UNIVERSITY OF NAIROBI

THE INFLUENCE OF SOCIO-CULTURAL AND ECONOMIC FACTORS ON THE ADOPTION OF ECOLOGICAL SANITATION FACILITIY: A CASE STUDY OF MATHARE SLUM OF NGONG TOWN, KAJIADO COUNTY, KENYA

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DECLARATION

This project is my original work and has not been presented for the award of degree in this or any other university.

Signature: ---------- ----------

Candidate Gichigo Mercy Wangui DATE

This project has been submitted for examination with our approval as university supervisors.

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Supervisor: Mr. John. Wakajummah DATE

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Supervisor: Mr.Lincoln Karingi DATE

DEDICATION

This work is dedicated to my parents Charles Gichigo, Margret Gichigo and my siblings.

ACKNOWLEDGEMENTS

My most sincere gratitude to the almighty God for the gift of life and strength to pursue this course to the completion stage.

I wish to thank my supervisors, Mr. John Wakajummah and Mr. Lincoln Karingi for having whole heartedly and enthusiastically guided me through this work and having sacrificed their time and energy during this study.

ABSTRACT

The provision of conventional sanitation facilities are not sustainable options due to contamination of both surface and underground water sources. Ecological sanitation facilities are therefore seen as a viable option. Ecological sanitation, or ecosan, refers to a range of sanitation technologies in which human excreta is recovered and retained on-site and eventually reused as fertilizer or biogas. These ecological sanitation (ECOSAN) technologies include: skyloo or urine diversion toilets, arboloo, fossa alterna and biogas latrines. The main objective of this study was to assess the influence of socio-cultural and economic factors on the adoption of ecological sanitation facility (skyloo toilet) in Mathare Slum of Ngong town. The study specifically focused on the following objectives: to find out the challenges associated with the current sanitation facilities; to find out the influence of socio-cultural factors on the adoption of ecological sanitation facility; to find out the influence of economic factors on the adoption ecological sanitation facility. Socio-cultural factors variables included cultural beliefs, gender and religion. The economic variables were level of income and occupational status.

The literature review provided a global and regional view of ecological sanitation and explained the extent to which socio-cultural and economic factors influence the adoption of ecological sanitation facilities. The units for analysis were households in Mathare slum of Ngong town. The study used systematic sampling to select ninety respondents. Every third household was selected until a sample size of ninety respondents was achieved. Data was collected by administering questionnaires and observation schedule was enhanced by use of photography. The collected data from the questionnaires was analyzed using descriptive and inferential statistics. The statistical tool used for testing hypothesis was chi-square. A hypothesis highlighting the relationship between current usage of sanitation facilities and diseases affecting residents of Mathare slum of Ngong town was tested. Other hypothesis tested focused on the effect of socio cultural and economic factors on the adoption of ecological sanitation facility in Mathare slum of Ngong town. The study found out that majority of the respondents had access to sanitation facilities. However, most of them were shared and respondents had challenges with the existing sanitation facilities. The study found out that the type of toilet used significantly contributed to the diseases being experienced in Mathare slum of Ngong town .The diseases included diarrhoea, amoebic dysentery and malaria.

The study established that cultural beliefs, gender and religion were not statistically significant in influencing the willingness to adopt skyloo toilets or urine diversion toilets. However some respondents associated faecal matter and urine with dirt, witchcraft and therefore had a negative view on its use as fertilizer. The study found out that occupational status did not significantly influence the willingness to adopt skyloo toilet. The study also established that the level of income was statistically significant in influencing the willingness to adopt the skyloo toilet or urine diversion toilet. The study recommends that information package and marketing strategies are needed to increase the adoption of ecological sanitation facilities and behavioural change. For instance, environmental advantages, nutrient reuse and health conditions should be the core of information. The study also recommends that government institutions should consider forming guidelines for ecological sanitation at a national or municipal level. This is because ecological sanitation works towards achieving sustainable development goals as set forth by the United Nations. This is by providing sanitation coverage in areas where low tech sanitation options are not feasible. Universal access to clean water and sanitation is one of the 17 Global Goals that make up the 2030 agenda for sustainable development.

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LIST OF ACRONYMS AND ABBREVIATION

ECOSAN	Ecological Sanitation
WHO	World Health Organization
UNICEF	United Nations Children's Fund
NEMA	National Environment Management Authority
UDDT	Urine Diversion Toilet
SUDEA	Society for Urban Development in East Africa
NGO	Non-governmental Organization
WECF	Women in Europe for a Common Future
VIP	Ventilated Pit Latrine
KNBS	Kenya National Bureau of Statistics
UNCHS	United Nations Commission on Human Settlement
WIPO	World Intellectual Property Organization

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The conventional approach to sanitation is based on systems that collect and store human excreta, called “drop and store systems”, or collect and transport excreta away from households, called “flush and discharge” systems (WHO & UNICEF, 2008). However, this conventional sanitation approach is not always applicable, particularly in developing countries. One important reason for this is the lack of necessary infrastructure for wastewater containment, treatment and safe disposal. Moreover, many developing countries suffer from water scarcity and “flush and discharge” systems use large amounts of water as a carrier for transportation of human excreta (Drweko, 2013).

In developing countries, about 90% of the sewage in cities is discharged untreated, polluting rivers, lakes and coastal areas (Winblad, 2009). With increasing population density and the resultant groundwater pollution, conventional decentralized disposal systems such as latrines are not a viable alternative either. With the growing need to save water and recycle nutrients, an alternative approach to sanitation has gained importance. This alternative approach to sanitation is commonly referred to as ecological sanitation (ecosan) or sustainable sanitation. By definition, a sustainable sanitation system needs to be “economically viable, socially acceptable, and technically and institutionally appropriate, it should also protect the environment and the natural resources” (Sustainable Sanitation Alliance, 2008**)**.

Currently, ecological sanitation (ecosan) is recommended for its recognized sustainability. It is an ecosystem based approach (closing the loop) that reduces environmental pollution, human health risks and enables recirculation of nutrients in the fields or gardens and at

the same time saves financial costs (Esrey et al., 1998; Esrey et al., 2001). In addition, in areas with hard rocks, unstable soils, high water table and congested housing structures, ecosan would be a better sanitation option.

Ecological sanitation systems are widely promoted and previous studies carried out on ecosan experiences in various areas show a considerable acceptance e.g. Mexico, Central America, Kerala-India, Yemen, South Africa among others (Esrey.,2001).In other areas the adoption of ecological sanitation (ecosan toilets) have not yet attained considerable socio-cultural acceptance to conventional sanitation systems, despite the associated potential benefits and cost saving to both the environment protection and human health (Esrey et al., 2001 & Drangert, 2004). Technology concerns like urine diversion toilet seats and squatting slabs, relates to the cultural setup and influence the adoption of ecosan (Esrey et al, 1998). In addition, the professional and political pressure in some instances may contribute to non-acceptance of ecological sanitation options due to the rigid adherence to higher definitions of level of service (SIWI, 2004).

Ecological sanitation facilities have been deployed in developing and developed countries. In Africa, Eco Sanitation Limited, produces, distributes, and markets the EcoSan waterless toilet, a sanitation system that converts human waste into dehydrated, compostable material. The waste can then be used as compost or disposed of at a traditional waste management facility. Currently, all parts of the EcoSan are manufactured only by Eco Sanitation limited partner, JoJo Tanks, in South Africa. The product is exported throughout Africa, the Caribbean, South America, Australia, and Europe (WIPO, 2014).

In Malawi, the Central Church of Africa Presbyterian (CCAP) in partnership with Water Aid developed eco san latrine building programme at Embangweni in the Northern region of Malawi. Rather than viewing excreta as a waste product, the communities in Embangweni linked

it to fertilizer and income generation. This has added a much needed, direct and easily recognized benefit to building and using a latrine and has allowed the social marketing of latrines, using small scale private sector organizations as providers and promoters, to flourish (Water Aid, 2003).

In Kenya, the Water Act of 2002 was created to help achieve the Millennium Development Goals (MDGs), focusing in particular**,** on goal 7. Goal 7 deals with access to safe water and sanitation. While there is some on-going progress, the Joint Monitoring Programme Report indicated that Kenya was not on track to achieve the Millennium Development Goal target for sanitation. The report estimated that about 6 million Kenyans still defecate in the open which results in prevalence of diseases such as diarrhoea, amoeba, typhoid and cholera (Ondieki & Mbegera, 2009). Universal access to clean water and sanitation is one of the 17 Global Goals that make up the 2030 agenda for sustainable development. The 2030 agenda comprises 17 new sustainable development goals (SDG_S) or Global Goals which Kenya and other countries have signed to. Vision 2030 focuses on correcting Kenya's economic inequity thus bringing adequate sanitation to those residing in urban slums is one of the important tasks that lies ahead for city councils and planners.

Sanitation coverage in slums is a major investment that only becomes cost effective when using ecosan. Ecosan is an innovative, reliable and sustainable alternative to out-dated conventional sanitation systems (Onyango et al., 2013).Given all the potential benefits of utilizing ecosan toilets, there are variations in the adoption rates depending on the local conditions in some areas. Adoption of ecosan sanitation facilities is largely likely to be influenced by socio-cultural aspects. Thus more studies are needed on the norms, practices and attitude towards ecosan toilets (Drewko, 2013).

1.2 Statement of the Problem

Through urban sprawl, numerous townships that provide cheaper housing and more economic opportunities have emerged at the outskirts of Nairobi city. Ngong town which is in Kajiado County is one of such towns. The population of Ngong town is of diverse ethnic groups and religious affiliations (Kajiado District Environment Action Plan 2009-2013). This town is experiencing urbanization leading to an increase in population thus rapid development of Mathare slum of Ngong town. This settlement has the lowest basic service levels of sanitation (Gottero, 2013).

Most of the residents use simple pit latrines which are less satisfactory when it comes to health aspects. Pit latrines also contaminate the underground water through seepage and flooding during rainy seasons (Rockström et al., 2005). Due to unsustainable pit latrines, the surrounding sewage from the slum flows to the nearby vegetable and maize fields which are used for human consumption in the area (Gottero, 2013).Ecological sanitation facilities are a viable option as they address a number of problems such as outbreak of infectious disease, pollution as well preventing environmental degradation by containing, sanitizing and recycling urine and faeces as fertilizer. In the late nineties, non-governmental organization introduced ecological sanitation in Kenya.

The ecosan-type technologies introduced included the urine-diversion dehydration toilets (UDDTs) or Skyloo, Arboloos and Fossa Alternas (Onyango et al., 2013. Despite its considerable potential advantages, ecological sanitation has not gained wide-spread acceptance. This is attributed to inadequate awareness creation, economic factors and cultural barricades on the handling of human waste (Otieno et al., 2010). The few cases tried are confined to small areas within some towns such as Mathare slum of Ngong town. Little research has been done on

the social-cultural acceptability of ecological sanitation (ecosan toilets).The current study therefore aims at examining the influence of socio-cultural and economic factors on the adoption of ecological sanitation facilities in Mathare slum of Ngong town.

1.3 Research Questions

This study seeks to answer the following questions:

a) What are the challenges associated with the current sanitation facilities in Mathare slum of Ngong town?

b) What are the socio-cultural factors that influence the adoption of ecological sanitation facility in Mathare slum of Ngong town?

c) What are the economic factors that influence the adoption of ecological sanitation facility in Mathare slum of Ngong town?

1.4 Objectives of the Study

The overall objective of the study was to examine the influence of social cultural and economic factors on the adoption of ecological sanitation facility in Mathare slum of Ngong town.

The specific objectives of the study were:

a) To establish the challenges associated with the current sanitation facilities in Mathare slum of Ngong town.

b) To analyze the social-cultural factors that influence the adoption of ecological sanitation facility in Mathare slum of Ngong town.

c) To analyze the economic factors that influence the adoption of ecological sanitation facility in Mathare slum of Ngong town.

1.5 Research Hypotheses

This study formulated the following null hypotheses.

1. **Ho:** There is no significant relationship between current usage of sanitation facilities and diseases affecting residents of Mathare slum of Ngong town.

2. **Ho:** There is no significant relationship between socio-cultural factors (cultural beliefs, gender and religion) of the slum residents and the adoption of ecological sanitation facility in Mathare slum of Ngong town.

3. **Ho:** There is no significant relationship between level of income and the adoption of ecological sanitation facility in Mathare slum of Ngong town.

4. **Ho** There is no significant relationship between willingness to adopt ecological sanitation facility and occupational status of residents of Mathare slum of Ngong town.

1.6 Justification of the Study

Ecological sanitation offers a potential for human waste disposal in urban areas. It also has a potential to improve food production through nutrition recycling. The findings of the study will be useful to civil societies by providing information on urban residents' perception towards ecological sanitation facilities and also recommend strategies towards improved awareness of ecological sanitation facilities.

Many practitioners have reported that most ecosan systems are not used for agricultural benefits but as sanitation facilities. This research therefore will help identify some of the reasons for this and also provide recommendations.

The findings will contribute to providing the basis for policy makers to make informed decisions on which type of ecological sanitation systems can accommodate people of various levels of income and religions. Mathare slum was selected because of the emerging sanitation

problems in the peri – urban settlements of Nairobi city. The slum was also selected because the researcher had prior knowledge of the administrative structure and location of the slum better than other slums in Kajiado County.

1.7 Scope and Limitations of the Study

The study was conducted in Mathare slum of Ngong town. The study dwelt on households that were in this area. The study was limited to economic and socio-cultural factors despite the fact that there were other factors that would influence the adoption of ecological sanitation facilities.

The variables for socio cultural factors were cultural beliefs, religious and gender influences. Variables for economic factors included level of income and occupational status.

This study was not a full analysis of the culture of the people but rather tried to identify how the socio cultural factors (cultural beliefs, religious and gender influences) influence the adoption of ecological sanitation facility.

Some of the problems experienced in this research were availability of time and financial constraints but the researcher budgeted to ensure effective management so as to complete the exercise within time.

Some of the alleys in Mathare slum of Ngong town were impassable due to poor drainage of household waste water and human waste that tampered all over. This made the researcher and her assistants to wear closed shoes to avoid contaminating with the waste.

1.8 Operational Definitions and Concepts

Access to sanitation: In this context this means households having access to excreta disposal facilities either in the dwelling or located within convenient distance of less than 100 meters from dwelling.

Beliefs: These are convictions that are held to be true by an individual or a group regarding concepts, events, people and thing.

Conventional Sanitation Facilities: The conventional approach to sanitation is based on systems that collect and store human excreta, called “drop and store systems”, or collect and transport excreta away from households, called “flush and discharge” systems.

Culture: Culture is the particular knowledge, beliefs, and understanding of art, law, morals, customs, and other skills and habits that a person acquires as a member of a given society.

Ecological Sanitation (EcoSan): These are sanitation technologies that involve excreta recovery and reuse of the nutrients found in the excreta these include skyloo or urine diversion toilets, arboloo and fossa alterna.

Flying toilets: They are polythene bags used for excreta disposal especially in slums.

Household: Refers to a person or group of persons who reside in the same homestead and normally share food and other amenities and are answerable to the same household head (KPHC, 2009).

Pour flush toilet: This is a type of toilet where water is poured by the user instead of coming from a cistern. This toilet has a water seal that reduces flies and odour from arising.

Slums: Slums are neglected parts of cities where housing and living conditions are appallingly poor. Slum households lack one or more of the following conditions: supply of clean water, reliable sanitation services, secured tenure and durability of housing.

Sanitation: Sanitation refers to the provision of facilities and services for the safe disposal of human urine and feaces.

Simple pit latrine: This is toilet consist of a square, rectangular or circular pit dug into the ground. This type of toilet attracts flies and odour.

Ventilated pit latrine: This is a pit latrine that has a ventilation pipe that improves airflow and decreases the smell of the toilet. It also reduces flies from arising when the top of the pipe is covered with a mesh (usually made of fiberglass).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section reviews literature on: sanitation in slums, impacts of poor sanitation, main criteria for ecological sanitation, adoption of ecological sanitation in the developed countries and developing countries then narrowing down to Africa. The extent to which socio cultural and economic factors influence the adoption of ecological sanitation facilities in Kenya also forms part of literature review. The chapter highlights the gaps existing in the reviewed literature and explains how the current study intends to fill those gaps.

2.2 Sanitation in Slums

Slums are informal, high density and low income settlements that are not included in the city planning for any kind of sewage, drainage or water services (Noved, 2014). According to UN-HABITAT (2007), the deprivation of water and sanitary facilities resulting in severe water-borne diseases is one main concern for slum dwellers.

According to Partha & Kishor (2012), slums are low-cost habitants of the marginalized people, mostly made up of make-shift shelters, in overcrowded and unhealthy conditions on land “encroached” upon and worsened further by the lack of basic civic amenities. Shah (2012) indicates that about 32 percent of the world's urban population lives in slums and this percentage is much higher, at 37 percent, for developing countries and highest in sub-Saharan Africa at 62 percent. The United Nations Commission on Human Settlement (UNCHS, 2003) states that the increasing growth of urban population especially in developing countries consequentially leads to the growth of slums. Majority of the slum dwellers depend on pit latrines because it’s relatively cheap compared to flush toilets. However, pit latrines are not a viable sanitation option

especially in areas with rocky or unstable soils. In areas with high water table and/or are flood prone, pit latrines are known to be the major source of ground water contamination (Esrey et al., 2001).

In Kenya, many people live in congested and resource-constrained urban informal settlements that lack access to sewer or water lines and improved sanitary conditions (Noved, 2014).The main challenges of providing access to safe and acceptable sanitation in urban areas with dense and generally poor population are lack of availability of space, financial constraints and the absence of an institutional infrastructure. In Kibera for example, majority of households pay between Ksh 3 and Ksh 5 per use to access communal pit latrines or rely on open defecation and 'flying toilets' especially during the night. Most of the pit latrines in Kibera are in unhygienic conditions, rarely cleaned, have unbearable smell, and attract insects and other disease vectors (Noved, 2014).

2.3 Impacts of Poor Sanitation

2.3.1 Health impacts

The lack of appropriate sanitation facilities, poor drainage and inadequate solid waste disposal combined with water shortages in poor urban areas result in dangerous living conditions which result in a heavy disease burden (Mulenga, 2011). Diseases related to contaminated drinking-water, unimproved excreta disposal and unclean household environments constitute a major burden on the health of peoples in the developing world (UNICEF, 2012).

Acheampon & Dinye (2013) conducted a study on challenges facing slum dwellers in Ghana: A case study of Ayigga, Kumasi. On access to sanitation services, the study found out that, out of the ninety nine respondents' malaria was the most prevalent disease as 71.7 % of the respondents admitted to this fact. This was followed by cholera which accounted for 14.2% of

the top 5 diseases recorded in Ayigya. This was followed by amoebic dysentery, rashes and Cholera which accounted for 8.1%, and 3% respectively. It was realized that all the diseases recorded are as a result of poor environmental conditions and poor solid waste disposal and management.

Corburn & Hildebrand (2015) conducted a study to find out the relationship between environmental sanitation and the social determinants of women and girls' health in the Mathare slum in Nairobi. They used household survey data to report on self-rated health and socio-demographic, housing, and infrastructure conditions in the Mathare informal. They also combined quantitative survey and mapping data with qualitative focus group information. The study found out that eighty-five households in Mathare shared one toilet, only 15% of households had access to a private toilet, and the average distance to a public toilet was over 52 meters. Eighty-three percent of households without a private toilet reported poor health. Mathare women reported violence (68%), respiratory illness/cough (46%), diabetes (33%), and diarrhea (30%) as the most frequent physical burdens. They concluded that inadequate, unsafe, and unhygienic sanitation resulted in multiple and overlapping health, economic, and social impacts that disproportionately affected women and girls living in urban informal settlements.

2.3.2 Pollution of Water Resources

Improved and hygienic sanitation facilities aim to solve problems related to contamination of the household and local environment. However, also such installations are often the source of pollution, due to poor treatment of the effluent and residues. Proper disposal of human waste remains a challenge even in the "developed" countries of Europe and North America. Wastewater treatment in all parts of Europe has improved significantly since the 1980. However

there remain many inefficiencies and treatment levels which vary greatly between regions (Luthi et al., 2011).

Poor sanitation is a serious threat to the environment and the water resources used for the supply of drinking water both surface and groundwater. It is highly possible for untreated waste water to leach into soils thus reaching water tables and also polluting soils.

Ndambuki & Kiptum (2012) conducted a study that was carried out to determine the well water contamination by pit latrines in Langas which is peri-urban settlement of Eldoret town, Kenya. The study sought to establish the safety (quality) of water in wells located near pit latrines on individual plots of the settlement. The results show that most wells were contaminated and posed a health risk to the dwellers of the settlement. From the results it was recommended that a safe well-pit latrine separation distance of 48 meters be maintained which would prevent contamination of well water from pit latrines.

2.3.3 Economic Impacts

Illnesses related to poor sanitation have a direct impact on household finances in terms of the financial costs to pay for medicines as well as the loss of working days due to sickness. In addition, the ill-health of one-member of the family has repercussions on the others.

In the longer term, illnesses drain household savings, lower learning ability, reduce productivity and impacting upon development objectives. Contamination of the natural aquatic resources also has major economic implications, both directly in terms of the cost of having to treat water more extensively after pollution and indirectly in terms of the impact of the polluted waters on tourism (Luthi et al., 2011).

2.4 Main Criteria for Ecological Sanitation

There are five criteria that should be taken into account for sustainable sanitation systems in peri-urban areas and these are of environmental, health, economic, socio-cultural and technical character (Tornqvist, 2007).

2.4.1 Environmental Criteria

Geographic and topographic criteria are important when planning a sanitation system because it is crucial to know the ground slope and groundwater level. Local climate and precipitation are also considered because they determine if water scarcity or floods are threatening factors. (Luethi, et al., 2010).

In the majority of the peri-urban areas, human excreta and grey water are directly disposed into the environment. Without any sort of wastewater treatment the wastewater ends up in the rivers, streams, canals and ditches (Hogrewe, 2000).

2.4.2 Health Criteria

There are numerous diseases connected to insufficient and unsafe water supply and sanitation systems. Microorganisms in human excreta can contaminate drinking water due to inadequate sanitation whereas other diseases caused by bacteria or parasites can originate from lack of access to water for hygienic purposes (Tornqvist, 2007). UNCEF (2006) has shown strong correlations between improved water supply and sanitation and improved health. Another risk characteristic of the peri-urban settlements is the dense population pattern which can lead to rapid spread of diseases, often in the form of epidemics like cholera. In these areas the density is often greater than 400 people per hectare (Hogrewe, 2000). One of the most frequent sanitation linked infections is diarrhoea which mostly affects young children. Rahman (2006) found out that there was a strong relationship between environmental conditions and occurrence of

diarrhoea. The incidence of diarrhoea among urban poor of Aligarh city was reported to be 96% which was attributed to outdoor defecation, use of manual latrines, lack of sanitation, buying prepared cheap food items from vendors.

2.4.3 Economic Criteria

Economics matter because it represents the amount of money people can invest at different levels of sanitation. Purchasing power of potential users will determine which technology can be envisaged because most of the time people care about the price of the installation and not its environmental benefits. (Luethi et al., 2010).External costs, like environmental pollution or external benefits like employment creation and improved health, are also included (Sustainable sanitation alliance 2008).

Sesani (2005) conducted a study to investigate the level of sanitation in Bushbuckridge local municipality in South Africa with a sample size of 50 respondents. The research findings indicated that only 6% (3) of the sampled respondents had latrines while 94% (47) of the sampled respondents had no latrines at all. Seventy percent of the sampled respondents not owning a latrine indicated that they did not have money or building materials to erect their own latrines. The thirty percent of the other respondents indicated that the government did not provide latrines in their households.

2.4.4 Socio-Cultural Criteria

Fithriana (2008) notes that the prime objective of sanitation is to protect human health and the environment however, sustainability in sanitation cannot be based only on these objectives but needs to include social criteria as they are most crucial to sustainability in use and services provided by the system. Sanitation systems should be carefully evaluated with regard to: cultural acceptance, gender and perception on sanitation.

It is important that the sanitation systems are built with respect of social and cultural norms otherwise the residents of the community can simply reject using it. For example in Islam religion emphasizes on cleanliness and avoidance of contact with human excreta. This taboo makes it hard to talk about the issue especially for women (Nawab et al., 2006).

2.4.5 Technical Criteria

A sustainable sanitation system utilizes a technology and a mode of operation that are well adapted to local circumstances. This includes the system's functionality and the ease with which the entire system including the collection, transport, treatment and reuse and/or final disposal can be constructed, operated and monitored by the local community and/or the technical teams of the local utilities. A sanitation system must be robust enough to be easily maintained. (Tornqvist, 2007).

2.5 Ecological Sanitation in Developed and Developing Countries

Ecological sanitation (EcoSan) is defined as the sanitation technologies that involve excreta recovery and reuse of the nutrients found in the excreta (Hurtado, 2005). In short, these technologies "sanitize and recycle" while preventing pollution and aiding food production (Haq& Cambridge, 2012).

Ecological sanitation, or ecosan, also refers to decentralized sanitation technologies in which excreta is recovered and retained on-site, and eventually reused. Ecosan differs from other decentralized sanitation systems (such as a pit latrine) in that there is a deliberate focus on the reuse of excreted material as opposed to treating it as waste.

In continental Europe, and especially in the Schengen countries of Sweden, the Netherlands, Norway and Germany, an increasing number of research and demonstration projects for excreta reuse was carried out between 1980s to the early 21st century. These closed-loop sanitation

systems as shown in figure 1 placed emphasis on hygenisation of the contaminated flow streams, thus becoming popular under the name “ecosan”, “dewats” or “desar” (Esrey et al., 2001).

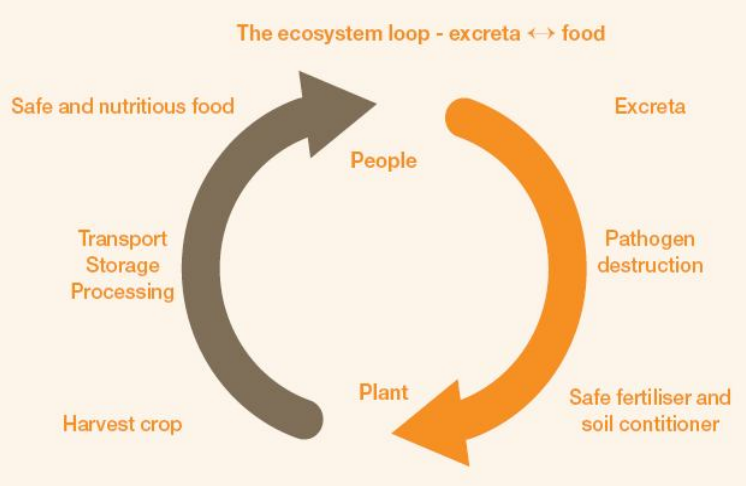

Figure 1: The closed loop for ecological sanitation

Source (Esrey, 2001).

In Asian countries, faecal matter is considered a valuable resource as it is used as fertilizer in gardens or fish ponds (Winblad et al., 2004). It is further argued that in the rural areas of China, it is normal for one to talk about faeces, smell and handle the feacal matter (Drangert, 2004). In Indonesia, untreated human excreta are used to fertilize fish ponds. To them it is believed that human faecal matter is diluted by the pond water as the water flows from one pond to another. Therefore the water is considered pure (tahur) and so the practice is religiously accepted (WHO, 2006).

Reuse of human excrement have for centuries been used as soil manure in some societies. In Asia, composting of human and animal excreta as fertilizer has been an old practice. In China, for example, it has been carried out for thousands of years. In Japan, reuse of urine and faecal matter started in the 12th century (Rockström et al., 2005). It is argued that use of human excreta

is in social accord with the traditions of frugality in China and Japan (WHO, 2006) and reflects a deep ecological as well as economic appreciation of soil fertility. But it is also argued that such practices were appreciated due to the need to feed a large populace living in the continent. In Europe reuse of urine and faecal matter started in 18th century (Höglund, 2001). In Sweden, a leading promoter of ecosan approaches, reuse of urine and faecal matter also started in 18th century, where latrine products were mixed with peat and used as fertilizer. By the 19th century, it is said that urine was stored and used as a detergent for washing clothes in Denmark (Drangert, 2004).

It is important to understand that although nutritional and environmental benefits are considered extremely important, the primary role of an eco-sanitation latrine is to improve hygiene and community health. Many cultures hold strong beliefs linking the use of sanitized faecel matter in food production and this has the potential to limit the acceptance of eco-sanitation technologies (Smet & Sugden, 2006). It has been documented by the World Bank Water and Sanitation Program that African families are unfamiliar with excreta reuse and hold strong negative sentiments and cultural resistance towards it's application to agriculture, and many implemented eco-sanitation latrines were being used only as a sanitation facilities rather than for agricultural benefits (World Bank, 2005). Importantly, it was also noted that users did not find management of these facilities easy. Despite this various eco-sanitation facilities have been successful throughout Africa. The benefits expressed towards eco-sanitation included the permanency of systems, the potential for agricultural productivity and improved hygiene (World Bank, 2005).

A variety of available technologies makes ecosan a very attractive solution, especially in the developing world, where the conventional approach to sanitation has often failed.

Technologies under the ecosan approach range from simple low-tech example urine diverting dry toilets or skyloo toilets, composting toilets to sophisticated high-tech solutions example vacuum toilets, membrane technology, with new approaches still evolving such as Terra Preta Sanitation – a combination of sanitation, bio-waste management and agriculture (Factura et al., 2010).

Using human excreta and urine can provide beneficial nutrients to plants and agricultural land (Schönning & Stenstr, 2004). However, to be able to use faecal waste as a soil conditioner or fertilizer the harmful pathogens must be destroyed and the process of destroying pathogens is called disinfection. Through proper treatment of faecal wastes it is anticipated that the occurrence of intestinal diseases in general would decrease (Vinneras et al., 2003).

There are several methods of disinfection which are useful in developing countries. One method is the application of wood ash to the waste to raise the pH of material and thus destroy faecal pathogens (Vinneras et al., 2003).

In South Africa, Thekwini Municipality provided environmentally friendly, urine diversion (UD) toilets, in some of the rural and peri-urban communities that were located outside the areas serviced by the waterborne sewerage reticulation system. These toilets were affordable as well as sustainable. The operation and maintenance of the urine diversion toilet prevented smell and fly nuisances from arising. A free bulk supply of 200 liters of water per day was provided to each household within the municipality together with appropriate health and hygiene education programmes (Devi, 2007). Excreta disposal facilities in slums include traditional pit latrines, flying toilets(polythene bags used for excreta disposal), open defecation and to a small extent ventilated improved pit latrines (VIP) and pour flush toilets by the few with a higher income (Kulabako et al., 2007). These excreta disposal systems in use are considered

unimproved because they are shared by many households and pollute the ground water (WHO & UNICEF, 2008).

Mosler et al., (2013) did a study on on user's satisfaction and dissatisfaction with sanitation facilities in Kampala. The study revealed that most respondents (67.9%) reported the use of shared sanitation facilities, followed by private (20.4%) and public (11.4%) facilities. Less than 1% of the respondents reported the use of flying toilets or open defecation. Evidence of the use of flying toilets was observed to be at 14.9% by the interviewers. Shared facilities were the most commonly used by both tenants and landlords. The use of private facilities was most common among landlords. Most sanitation facilities were traditional pit latrines with a slab (70%), followed by VIP latrines (21.6%) and flush toilets (8.3%). With regard to respondents' satisfaction with the sanitation facilities used, reasons for respondents' satisfaction with sanitation facilities included cleanliness and sanitation facilities lined from the bottom (VIP latrines). The main reasons for respondents' dissatisfaction were sharing sanitation facilities with too many users (36.7%) and facilities being dirty and smelly (28.5%). On cleanliness, only 1% of the respondents rated the toilets they used as clean.

Chenoweth et al., (2013) conducted a study to analyze challenges of achieving sustainable sanitation in informal settlements in Kigali Rwanda. The study was based on 1,883 target household and out of the 1,883 target household 1,794 households (95%) were interviewed giving a non-response rate of 5%.The study found out that 80% of respondents reported at least one problem, with the most frequently mentioned problem being shared usage (58.5%) followed by smell (38.7%). Other problems frequently reported were difficulty in cleaning (38%), insect attraction problems (32.4%), safety (30.1%), distance from the dwelling place (21.2%) and non-

availability of toilets (20.2%). They proposed sustainable sanitation technologies that matched with the requirements of study settlements of Kigali Rwanda.

2.6 The Extent to which Socio-cultural Factors Influence the Adoption Ecological Sanitation Facilities

Ngobi (2007) conducted a study to investigate attitudes towards urine diverting toilets in the peri urban areas of Kampala, Uganda: A case of Kamwokya II Parish. Data was collected from 40 household respondents using a semi structured questionnaires. The study revealed that majority (70 %) of the respondents indicated that there were not aware of cultural beliefs associated to reuse of urine and faecal matter. The study also revealed that there were arguments for and against use of urine diversion toilets. 25% of the respondents associated reuse of sanitized faecal matter with witchcraft and explained that it was believed that if the rival person mixed the faeces with ash could lead to stomach upset. 5% of the respondents indicated they were not sure whether cultural beliefs inhibited reuse of urine and faecal matter. Regarding religious beliefs,90 % of respondents reported that their religion was not against reuse of sanitized urine and faecal matter. A small fraction of those who adopted the urine diverting toilets realized the benefits (i.e. sale of urine, privacy, convenience) of the toilet and that raised interest in the facility. Even those people who had no urine diverting toilet preferred the facility. This is in contrast with findings based on the study in the south western towns of Uganda which revealed that the farmers were reluctant to use faecal matter to fertilize their crops due to cultural resistance and inadequate information about reuse of sanitized faecal matter (World Bank, 2005).

Jenssen et al., (2002) conducted a study on cultural preferences in designing ecological sanitation systems in North West Frontier Pakistan and found out that the village farmers were resistant to recycling of feacal matter and urine due to cultural barriers. Despite the fertilizer value of feacal matter and urine the psychological and religious concern about the impurity of feacal matter and urine overruled the fertilizer value for the villagers.

In a Study done by Wilbur (2014), socio-cultural factors were hypothesized to affect the adoption, operation, and maintenance of composting latrines. In the indigenous communities of rural Panama, the socio cultural factors (i.e., attitudes and perceptions) were thought to influence the success of composting latrine projects. When surveyed about the likes and dislikes of composting latrines, latrine owners responded with a variety of answers. The most frequent responses related to advantages of using a composting latrine, with greater than 40% mentioning the advantage, they included compost production, lack of mosquitoes or flies, and lack of smell. With respect to the disadvantages, the only dislike mentioned by over 40% of the participants was the need for water for washing purposes after defecation. Otherwise, obtaining dry material (i.e. sawdust or ash) and practicing daily maintenance were the other most frequently mentioned dislikes. These likes and dislikes reflect positive and negative attitudes that represent drivers and barriers for composting latrine adoption and sustained use, respectively. In addition, producing compost, avoiding mosquitoes and flies, and evading offensive smells were drivers for the adoption and use of composting latrines in lieu of adopting pit latrines or practicing open defecation.

Jenkins & Curtis (2005) conducted a case study of Tangkae in Benin to find out the factors influencing an individual's decision to adopt a latrine. They found out that past latrine exposures influenced the choice of latrine because certain beliefs and attitudes towards latrines were molded by these past experiences. They also noted several aspects which could be used as indicators of a community's past exposure and experiences relating to latrines which included:

a) Whether they have heard of a latrine before;

b) Used a latrine only once or twice, or for an extended period;

c) The age at first use;

d) Whether use occurred inside or outside the community setting; and

e) The attractiveness of the latrine encountered (smell and sight of faeces, construction quality or condition, novelty features, etc.

They further suggested that the age of first exposure to latrines influenced the attitude of an individual, where early age exposure promoted positive attitudes towards latrine adoption. These indicators were also important in aiding interpretation of cultural and social significance of latrines which influence the adoption of a system.

According to the Society for Urban Development in East Africa (SUDEA), "culture should not be taken as a hindrance to promote recycling of human excreta as fertilizer even though cultural sensitivity is important" (Terrefe & Edstrom, 2005). The cultural aspects had been discussed prior to the implementation of the SUDEA project in Ethiopia. SUDEA's experience in Ethiopia showed that the most difficult to convince were the groups of autocrats and medical personnel. The groups of agronomists, who were used to applying animal excreta as fertilizer, were easier to convince. The method that proved best showed how sanitized faeces and urine was applied. When people saw how the system worked and that it did not involve any odors, they were able to accept it.

Ngobi (2007) in his study on attitudes towards urine diverting toilets and reuse of nutrients in the peri urban areas of Kampala, Uganda found out that 85 % of respondents expressed their willingness to eat/buy food fertilized using urine or faecal matter. Out of the 40 household respondents, 65% (26) female and 35% (14) male respondents expressed their willingness to eat/buy food fertilized using sanitized urine or faecal matter. Those respondents who did not respond to this question argued that they were still in doubt if they would eat or buy the food fertilized by urine or faecal matter.

Hannan & Andersson (2002) note that women are actively involved in food crop production and food security in many parts of the world, and would be directly affected by increased soil nutrients provided through ecological sanitation, for their rural and urban agriculture. For example, the ecosan toilet in use in South India requires much less water than the water flush toilets favored by more well-off families. This reduces the work burden for women in providing water for the toilets. In Zimbabwe, women in some rural areas preferred the ecological sanitation alternative –the "arbor loo" - to the conventional pit latrines as they could be built closer to the house. Filled pits were used by women for planting fruit trees. And men expressed appreciation of the "arbor loo" because the pits were smaller and require less labour in building (Danklman et al., 2009).

2.7 The Extent to which Economic Factors Influences the Adoption of Ecological Sanitation Facilities

A study done by Jenkins and Scott (2007) on a sample size of 536 households in Ghana revealed the following reasons for building an improved household toilet: convenience (51.4 %), easy to keep clean (43.1 %), good health (41.9 %), general cleanliness (27.8 %). The same study revealed the following constraints on building an improved household toilet: limited space (48.4 %), high costs (33.6 %), no one to build (32.3 %), competing priorities (31.8 %), savings and credit issues (30.1 %).

In Garla Mare, Romanian villages of 3,500 citizens without a central water supply, ecosan school toilets (urine dry diverting) were introduced by Women in Europe for a Common Future (WECF) and Medium et Sanitas and Hamburg University of Technology, replacing the old school pit latrines, which were in an unacceptable state. The ecosan school toilets were built for demonstration and proved to be clean, and cheap, and produced excellent fertilizer, that was

used to grow corn and peppers. Both men and women contributed to the development of the toilets in their traditional roles, men were the builders and women were those teaching their children about how to use the toilets and hygiene. After a year of operation, a survey that was undertaken in the village among 40 respondents (21 women/19 men) showed the following results: 3% of the women respondents were willing to invest in a (new type of) toilet while 20% of men were willing to invest. 10% of the women were willing if it would fit into their budget (Danklman et al., 2009).This was understandable as the income level of most families was extremely low and they could hardly afford to buy enough food for themselves. But Danklman et al., (2009) suggested that more investigation was needed around the financial aspects to examine why men felt there were enough financial options, and women did not. 74% of women as opposed to 58% of men wanted dry urine diverting toilets for the school; whereas 32% of the men and 17% of the women would prefer a water flush toilet. The arguments women mentioned were that the toilets were good for children's health, the toilets had less odour and children were happy with them. More schoolgirls who were interviewed separately said that they would like to have such toilets at home.

Danklman et al., (2009) also noted that women's attitudes towards urine diverting dry (UDD) toilets seemed to be more positive than those of men. In Garla Mare women preferred the UDD toilets while men preferred water flush toilets. The study revealed that women wanted to have the toilets in the house as that would reduce walking distances especially during bad weather conditions. They were also more willing to use the fertilizer in their fields and gardens. Women and children (via schools) could therefore play an important role in motivating and educating others to use UDDT projects.

Niwagaba et al., (2010) did a study on the ecological sanitation coverage and factors affecting its uptake in Kabale municipality, western Uganda. A total of 806 respondents were interviewed, randomly selected from 32 of 77 (42%) villages in Kabale municipality. The findings from this study showed that education, occupation or level of income, religion and age were the most significant factors affecting ecological sanitation coverage in Kabale municipality. The study also found relatively high ecosan coverage in Kabale municipality compared to the targeted national coverage of 15% by 2018. They recommended that policy-makers and organizations in ecosan development ought to take into consideration the influence of education and socio-economic factors for successful uptake of ecological sanitation.

A study by Tsiagbey et al., (2005) on 60 households in Nima, a suburb of Accra in Ghana, revealed the following reasons why low and middle income households accepted urine diverting toilets (UDTs). The reasons were: convenience, affordability (in comparison to paid public toilets), hygiene, source of fertilizer, easiness of use and maintenance, safety, privacy, better than current facility, portability, and mobility. On the other hand, high income households perceived UDTs to be unhygienic due to the fact that they do not need water to clean and maintain the facility (Tsiagbey et al., 2005).

2.8 Socio-cultural and Economic Factors Influencing the Adoption of Ecological Sanitation Facilities in Kenya

Sanitation facilities development in the informal settlements in Kenya is inadequate and facing serious physical, socio-cultural and economic constraints, amidst the increasing population pressure being exerted on these facilities. It is estimated that 60 % of the residents in Kenya's urban areas live in these informal settlements and majority lack adequate access to these facilities (Gerryshom, 2012).

The slum settlements are growing by approximately 11% per year. The rapid growth of towns has led to the mushrooming of informal settlements devoid of basic infrastructure including water and sanitation. Informal settlements have developed haphazardly, without allowing adequate space for installing infrastructure network (Gerryshom, 2012).

Mugure & Mutua (2009) conducted a study in the peri urban areas of Nakuru, Kenya on norms, attitude and gender perspectives in ecological sanitation. Face to face interviews among 231 household respondents using a semi structured questionnaires, field observations, focus group discussions and key informant interviews were used. Most of the respondents reported that the ecosan toilets were a viable option due to congested housing pattern, desire to own a toilet (for those who never had a toilet before), geohydrological conditions, improved privacy, and convenience among other factors. Most respondents preferred squatting type of urine diverting toilet and were willing to reuse sanitized urine and feacal matter. Among the challenges noted include forgetfulness by some people to spray ash after defecating, misplaced water entering the toilet vault during cleaning and confusion in using the two holes. The study recommended more awareness campaigns through social marketing of urine diverting toilets.

Robinson, (2005) did a study on household adoption of ecological sanitation facilities: an assessment of agricultural value and user perspectives in Nyanza province, Kenya. The objective of this study was to investigate the motivation of household adoption of ecological sanitation facilities specifically skyloo toilet. The study revealed that users of skyloo toilet reported additional major benefits such as the absence of odour, inexpensive construction costs (partly due to a materials subsidy by the promoting NGO) and the aesthetic value/social status that the facility brings to the owners' homes. The major negative factors included problems with construction and design of the facility, training new users especially children on how to use the

toilet. The study also revealed that the local customs of the community influenced the community's perception of the user of skyloo toilet, and some of these customs were reported as a specific deterrent to the toilet's use. For example, in Luo custom, a man's mother-in-law cannot use the same toilet as he. It is also part of Luo folklore that pouring ash on a person's faeces is a way to curse the person with witchcraft. It certainly follows that any believer in this custom would not want to pour ash on their own faeces. Some Luo also believe that looking at faeces increases your chance of diseases of the eye. The study however concluded that positive factors outweighed community's negative perception example gaining status within their community for having such a nice, new, and sturdy structure in their home compound.

Muthoni, (2008) conducted a study to determine the most appropriate toilet technology that could be used to improve/upgrade sanitation in Soweto East, Kibera. The measure of determining how appropriate the technology was based on it's environmental, economic, social and technological sustainability. From her study she noted that the technology should not be expensive to maintain as the residents were not able to pay high prices to use them, she also noted that sanitation facilities should be very aerated and solidly constructed and environmentally sustainable. She also suggested that the toilet technology should consider women and children needs.

Thuita (2012) conducted a study in the Northern part of Kenya to investigate the beliefs, perceptions and practices of Somali women community in Kenya regarding sanitation and the barriers they face in adopting safe sanitation practices. The study found out that women's beliefs, perceptions and practices on sanitation were shaped by the environment they lived in, as well as social, cultural, religious and economic conditions. Somali women described considerable barriers to improving their sanitation situation. These barriers were lack of control over

resources, tedious domestic work, harmful societal practices such as female genital mutilation and early marriages, and the presence of gender norms and beliefs that acted against their well-being. Somali women were expected to perform numerous tasks that include cooking, fetching water and firewood, cleaning latrines, sweeping the compound, milking livestock (cows, goats, and camels), feeding their families, bearing and rearing children and constructing houses. The findings further indicated that men and women had different needs. This showed that men benefited more from sanitation projects, placing them on a higher scale to meet sanitation needs, secluding women who needed sanitation more.

2.8.1 Research Gaps

There are many gaps that exist between other similar studies done in Kenya and the current study. These gaps have been discussed as follows: Mugure & Mutua (2009) considered norms, attitudes and gender perspectives on ecological sanitation but did not consider religious and economic factors that may influence adoption of ecological sanitation facilities. Robinson, (2009) looked at ecological sanitation facilities adoption in Nyanza province. The current study therefore stands a better chance to fill the gap left by Robinson by segregating a slum as an area of study.

Muthoni (2008) conducted a study to determine the most appropriate toilet technology that could be used to improve/upgrade sanitation in Soweto East, Kibera while this study will consider economic and socio-cultural factors affecting the adoption of ecological sanitation facilities in Mathare slum of Ngong town.

Thuita (2012) study was similar with the current study but the only gaps were that he considered only the socio-cultural factors hindering women from adopting safe sanitation facilities in the northern part of Kenya and failed to consider economic factors. This study therefore stands a

better chance to fill the gap of the economic factors affecting the adoption of ecological sanitation facilities in Mathare slum of Ngong town and also by segregating slum as an area of study.

2.9 Theoretical Framework

A theoretical framework guides the researcher in determining things to measure and what statistical relationship to look for (Svinick, 2010). The researcher shows how the study in question is related to the theoretical background (Mugenda & Mugenda 2003). This study was based on behavioral change theories.

2.9.1 Behavioral Change Theories

For a household without adequate sanitation in a developing country, deciding to improve sanitation by installing a toilet for the first time, changing to a new toilet system, or connecting to a sewer, can be a complicated and lengthy process. To first contemplate this decision, a household must be aware of the personal benefits of the sanitation change and the availability of products and services.

Non-adopter households can be categorized by whether or not they have thought about making a change to home sanitation, and if so, how far they have taken such thinking. While some may have considered a change, for example, installing a latrine, others will have little awareness of options or meaningful benefits of having a latrine and therefore never considered adopting. Among those who have considered installing a latrine, intention to actually build it will vary with priority given to the outcome and with the time frame and level of planning and preparations (Jenkins & Scott, 2007).

2.9.1.1 Preference, Intention, and Choice stages

Drawing from behavior change models and cognitive theories of individual decision-making, particularly the theories of reasoned action and planned behavior, Jenkins and Scott (2007) developed three progressive stages of the decision to adopt a sanitation change. The study employed these stages to understand the decision to adopt a sanitation change. These stages are preference, intention, and choice.

Preference

The adoption decision starts with development of 'preference' for a sanitation improvement over one's present defecation practice. Preference captures purchase motivation and the expected relative advantages, benefits, and reasons (perceived utility gain) for wanting a sanitation improvement (Jenkins & Scott 2007). Motivation to change sanitation arises from dissatisfaction with current household defecation or excreta management practices coupled with sufficient awareness of advantages of new options (Jenkins & Curtis 2005). In this stage, households are interested in and have considered a sanitation change but have not necessarily begun to plan it.

Intention

Households in the intention stage have begun to plan a sanitation change, but vary in their degree of plan development. For many behavior changes, once awareness and motivation are sufficient, change is within the voluntary control of the individual or household. This is the case for example with hand washing, when soap, water, and technical knowledge usually exist within the household. However, changing sanitation infrastructure for the first time requires more than awareness and motivation, including new and unfamiliar materials, products/services, technical knowledge, and skills, much of which must be acquired outside the home. These less

controllable inputs often entail uncertainty and risks for households without prior sanitation experience (Jenkins & Scott, 2007).

Starting a plan to change home sanitation technology or practice depends directly on the availability, quality, and cost of opportunities to acquire materials, products, construction services, financing, skills, and knowledge, and on the personal resources, experience, and abilities of individual households to take advantage of these opportunities. If required abilities or opportunities are perceived to be lacking, or priority is low, a household is unlikely to form an intention to adopt a sanitation change (Ajzen & Madden, 2000).

Choice

This stage carries a very high likelihood of adopting a sanitation change within a short time. Choice requires a well-developed intention and concrete actions consistent with a strong imminent intention to change sanitation practice, including acquisition of relevant knowledge (e.g., cost), site and toilet technology or service provider selection. Perceived inabilities, inadequate resources, and lack of opportunities are different kinds of 'constraints' to adoption (Jenkins & Scott, 2007).

2.10 Conceptual Framework

In this study the independent variables were socio-cultural and economic factors, the dependent variable was current sanitation status in slums. Current sanitation status influences the level of adoption of ecological sanitation facility (skyloo) and other sanitation facilities such as simple pit latrines and pours flush toilets. Adoption of ecological sanitation facility is influenced by socio cultural and economic factors of the people.

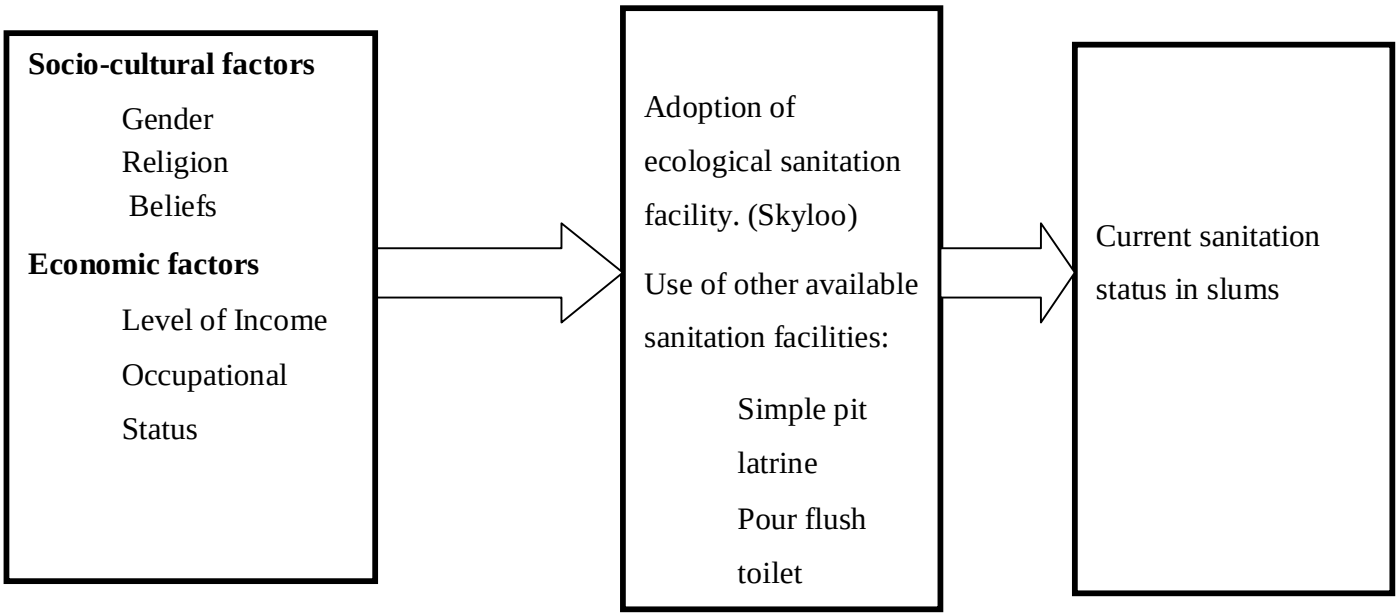

Figure 2: Conceptual Framework of the Study

Source: Researcher

2.11 Association between Socio cultural Factors, Economic Factors and Ecological Sanitation

According to Smith (2008) culture is understood as patterned spheres, beliefs, values, symbols, signs and discourses.

Socio cultural Factors and Ecological Sanitation

Santosh & Monti (2010) named two cultural aspects that have to be considered which are: psychological deterrents of handling human wastes and beliefs, social aspects such as gender issues and religious influences.

In the case of ecological sanitation these cultural and social aspects can be beneficial or form a barrier for acceptance of ecological sanitation facility. For ecological sanitation to be

successful, it needs to be socially acceptable. Research has showed that the UDDT technique in India is often considered as a toilet for the poor while the Western style flush toilet is seen as part of modern life by Indian inhabitants (Enssle, 2010). Cultural capacity is therefore needed to make the technique socially sustainable.

If sanitation systems are successful in several countries it does not mean that projects can be identically copied. Projects need to take the cultural context into consideration (Shanks, 2000; Thanansankit & Corbitt, 2002).

Economic Factors and Ecological Sanitation

Purchasing power of potential users is important to consider as this will determine whether they can afford the sustainable sanitation systems. The costs of a sanitation system need to be affordable at all levels of society. The adoption of ecological sanitation technologies among low-income communities requires appropriate application and support. Otherwise the intended outcome may not be realized, or could indeed be reversed by severe threats to public health. (Luthi et al., 2011).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents a geographical background of the study area as well as the methods used in data collection and analysis. The background aspects covered include: location of the study area, demographics, geology and soils, climate, socio –economic characteristics and water and sanitation. The methodology aspects, however, focuses on research design, data sources, sampling procedures, research instruments and methods of data collection and analysis.

3.2 Study Area

This sub section highlights the geographical study area and relates them to the study problem.

3.2.1 Location of the Study Area

The study area is located in Ngong town as shown in figure 3. Ngong is a town near the Ngong hills located in the south western direction of Nairobi city. Ngong town is situated at 1.37° South latitude, 36.65° East longitude. The word "Ngong" is a Maasai word meaning "knuckles" due to the four hill peaks of the ridge, which stands alone rising from the plain around Nairobi. Ngong town is a peri urban zone meaning it is neither in the city nor the rural zone.

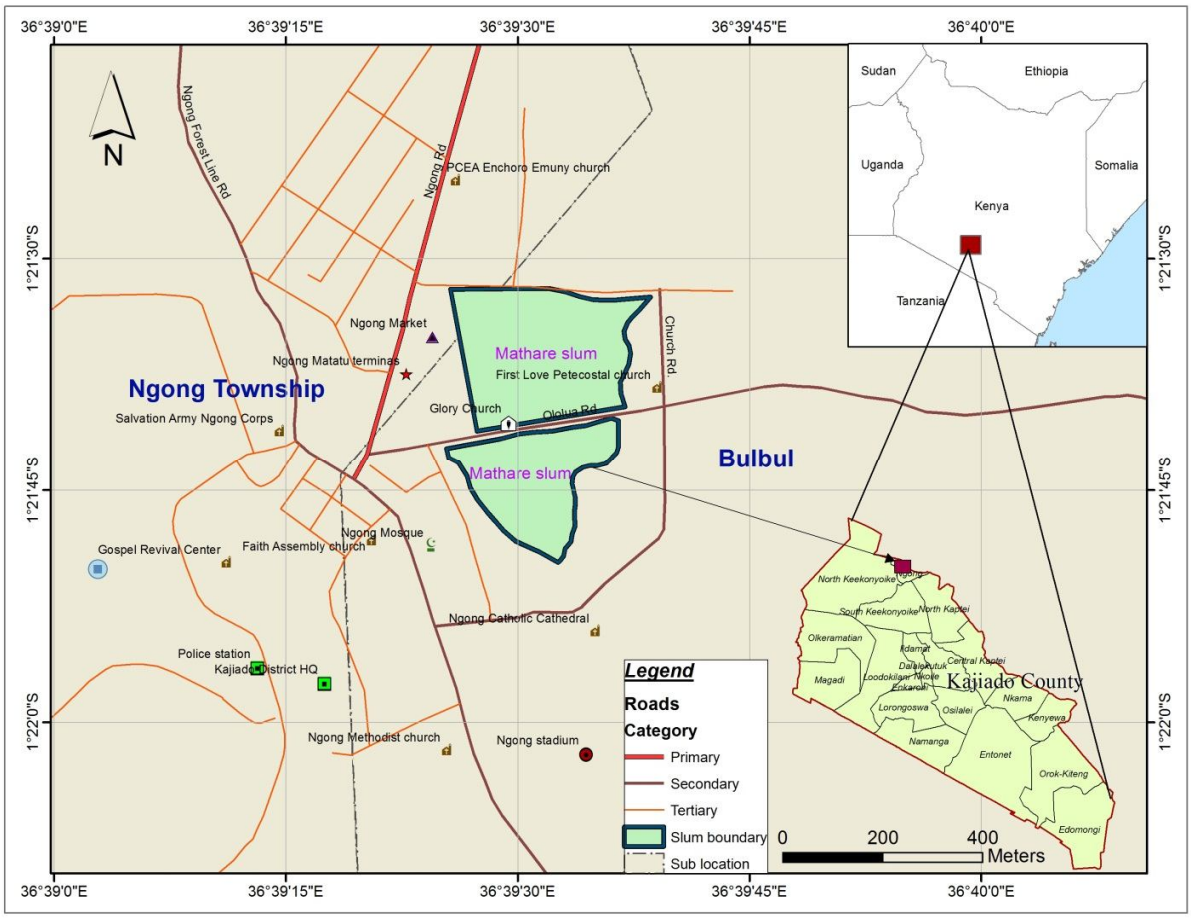

Figure 3: Location of the Study Area

Source: Researcher

3.2.2 Demographics

The population of Ngong sub location is 18,091 according to 2009 population census. The number of males in this sub location is 8910 and females 9181. The total number of households in this sub location is 5779 (KNBS, 2009). Ngong town was initially occupied by the Maasai people but today people from other tribes such as the Agikuyu, Luo, Luhya, Kisii, Ameru among other tribes have since moved in. Mathare slum came into existence in 1963 after Kenya's independence. Since then the population of Mathare slum has being rising especially after the political crises in 1982 and 2007-2008 which made the slum a safer place to settle (Gottero,

2013). The dense population pattern can lead to rapid spread of diseases, often in the form of epidemics like cholera. The most frequent sanitation linked infections in Mathare slum of Ngong town is diarrhoea which mostly affects young children.

3.2.3 Geology and Soils

The geology of an area gives rise to soil types. Mathare slum which is in Ngong area has tertiary volcanic soils. Ngong basement system rocks comprise of gneiss, schist, quartzite and crystalline limestone. The soils derived from these rocks include: ferrasols, luvisols, arena sols, regosols, leptosols, lixisols, cambisols and vertisols in the low-lying areas of Ngong. These soils have poor agricultural productivity unless high input levels are added (Kajiado District Environment Action Plan 2009-2013).

Toilet durability has been a challenge in Mathare slum of Ngong town due to unstable soils. These soils are particularly unstable during the rainy period leading to frequent collapse of pit latrines (Gottero, 2013). Pit latrines are therefore not a viable sanitation option especially in such areas. The high water table and collapse of pit latrines contaminate surface and ground water sources.

3.2.4 Climate

Ngong area has a bimodal rainfall pattern with the short rains falling between October and December while the long rains are experienced between March and May. During the heavy rainfall, toilets overflow and collapse. This poses a serious threat to the environment and contaminates both surface and groundwater sources. The rainfall pattern in the area is strongly influenced by altitude. Moisture deficit is also observed in the greater part of the year and this gives the area a dry season of between 7-9 month (Kajiado District Environment Action Plan 2009-2013).

3.2.5 Economic and Social Characteristics

Ngong town is a fast growing town where commodity trading is carried out in shops, supermarkets and in an open air market. The open air market in Ngong town opens on Wednesday and Saturday. Farm products such as vegetables, fruits and other commodities are sold in the market. Most of the residents in the surrounding areas of Ngong town practice farming. The main crops grown in these areas are maize and beans.

Dairy farming is also practiced by some of the residents in this area. Dairy farmers sell their milk to the neighbouring hotels and households in Ngong town. Some of the slum residents practice small scale farming where they grow vegetables in the nearby open spaces as shown in plate 2. During the rainy season the surrounding sewage from the slum mixes with the garbage and flows to the “Sukuma wiki” fields which are vegetables for human consumption in the area. These vegetables are then sold to the Ngong market (Gottero, 2013). Consumption of such vegetables can lead to health problems among the residents of Ngong town. Some households in the slum also rear chickens for consumption and commercial purposes.

Houses in Mathare slum are made of old iron sheet as shown in shown in plate 1. There are however newly made houses that are made of new iron sheets. Most toilets in the slum are made of old iron sheets, sacks and worn out materials. Regarding land ownership, the slum residents have experienced eviction threats. This is because some neighbouring plot owners claim that the land is theirs. There is an ongoing land case in court concerning this matter today. However no efforts to evict or demolish the settlement have being undertaken.

Plate 1: Houses made of Old Iron Sheets

Plate 2: Open Spaces used for Farming in Mathare Slum

3.2.6 Water and Sanitation

Due to uneven distribution of rainfall, the major source of water is piped water from boreholes, roof water harvesting is also popular in Mathare slum. Mathare slum lacks basic services of sanitation and is characterized by open sewers and uncontrolled dumping of waste which

pollutes the environment. The slum is located near a dumping site which can lead to health problems of the slum residents. The garbage comes from the whole area of Ngong and also from other places near the town.

Clean Kiserian initiative is a nongovernmental organization which was established in 2011 with an aim to improve sanitation by establishing ecological sanitation facilities to enhance the health of the community in Mathare slum of Ngong town. Other targeted areas to be provided with ecological sanitation facilities are Ongata Rongai, Kitengela and Isinya. The process of receiving an ecosan toilet begins when the residents are required to pay a subsidized fee then the organization sends a trained mason to construct the toilet. This study seeks to demonstrate that socio cultural and economic factors have a bearing on the adoption of ecological sanitation facilities in Mathare slum of Ngong town.

3.3 Research Methodology

This sub section highlights the research design used, data sources, the sampling procedures, research instruments, data collection techniques and data analysis procedures.

3.3.1 Research Design

Research design is defined as the plan and structure of investigation so conceived as to obtain answers to research questions. The research design used in the study was survey design which involved selecting a sample from the target population and administering questionnaires to the sampled respondents. The questions used in the study were based on research variables to illicit responses that could be analyzed to achieve the research objectives.

3.3.2 Data Source

Sources of data used were primary and secondary data. Primary data was generated as firsthand information from the field work. Primary data consisted of information on socio cultural and

economic factors that influence the adoption of ecological sanitation facility in Mathare slum. Such information was obtained through questionnaires administered to the sampled respondents. Secondary data was generated from the ministry of health records, journals, academic thesis, projects, books as well as relevant websites.

3.3.3 Target Population

The target population in this study were household residents of Mathare slum of Ngong town. The total number of households in Mathare slum was 812. The total population of Mathare slum was 3451(KNBS, 2009).

3.3.4 Sampling Procedure

Ngong slum was purposively sampled from other slums such as Gicagi and Ongata Rongai. This was because ecological sanitation facilities were not yet established in the other slums. Selection of respondents was done through systematic random sampling. Every nineth household was selected until a sample size of 90 was achieved.

To ensure that the results of the study could be used to make an accurate generalization at 95% confidence levels, the sample size was arrived by using Fisher et al., (1991) formulae of calculating the desired sample size as shown below:

$$\frac{n = Z^2 Pq}{d^2}$$

Where:

n - The desired sample size.

z - The standard normal deviation, set at 1.96, which corresponds to 95% confidence level.

p - The proportion in the target population estimated to have a particular characteristic. If there is no reasonable estimate, then use 50 percent (the study used 0.50).

q = 1.0 – p.

d = the degree of accuracy desired, here set at 0.05 corresponding to the *1.96*.

In substitution n =1.96^2 x 0.5x (1-0.5)/0.05 = 384.

The population in the slum = 3451

The number of households in the slum = 812

The household sample size was arrived by:

Household sample size = 812/3451 x 384 = 90±1

In this case, a sample size of households of 90 was considered statistically significant to yield fairly accurate results.

3.3.5 Data Collection Instruments

Primary data for this study was collected through administration of questionnaires to the respondents. Questionnaires had open and close ended questions. Open-ended questions allowed the respondents to give their responses without being constrained to a fixed set of responses. In close ended questions respondents answers were limited to a fixed set of responses. The questionnaires contained items linked to the variables under study as identified in the study questions. These variables were access to sanitation facilities, beliefs, gender and religious influences, level of income and occupational status. An observation guide was also used to reinforce data collected through questionnaires. The questions were structured to collect data on both social cultural factors influencing adoption of skyloo or urine diversion toilets which include: beliefs, gender and religious influences and economic determinants such as the level of income and occupational status of the respondents.

3.3.6 Data Analysis

Data was analyzed using descriptive statistics by use of percentages, tables and graphs. The purpose of descriptive statistics was to summarize set of scores so that features are understood

easily. Responses were recorded using a coded system that was entered into a database on the computer and analyzed using Statistical Package for Social Sciences (SPSS) version twenty. Data was first analyzed using descriptive statistics. Descriptive statistics of percentages and frequency tables were calculated for each variable in relation to the current sanitation facilities and willingness to adopt the skyloo toilet. Data was subjected to further analysis using chi-square statistics techniques. The chi-square technique was used to test the relationship between the independent variables and dependent variable. Data was put in the contingency tables to obtain the expected values and degrees of freedom. The chi-square analysis used the formulae of observed and expected values to arrive at the critical value of (X^2) as shown below.

$$X^2 = \Sigma \frac{(\text{Observed frequency} - \text{Expected frequency})^2}{\text{Expected frequency}}$$

The chi-square results were presented in the format of chi square values of (X^2), degrees of freedom (d) and statistical significance test (p). The chi square value and the degrees of freedom were used to decide the probability or p – value of independence. When the computed value of(x^2) statistic exceeded the critical value (table value), the null hypothesis was rejected. When the computed (x^2) statistic was less than the critical value (table value), the null hypothesis was adopted.

Two assumptions were made: one was that the data set was large enough to use chi square test. In cases where the sample size was small that is more than 20% of the contingency cells having expected values < 5, a general description was made. Secondly, the independence assumption was made i.e. data was not interrelated but rather categorical and independent from each other. Chi-square of independence showed that pairs of variables were related and whether there was any significant association to reject the null hypothesis. Failing to reject the null

hypothesis meant that the sample size could have being small or data could have being inadequate to reject the null hypothesis and therefore more research needed to be done to establish the cause of this relationship.

Chi-square tests statistics was adopted in this study because it is easier to compute than other statistics and can be used with data that has being measured at nominal (categorical) scale. Chi-square makes no assumption about the distribution of the population; other statistics make assumptions that the population should be normally distributed.

3.3.7 Ethical Considerations

The researcher sought consent from the participants before administering the questionnaires and did not subject them to any form of threat or undue influence. The researcher respected the respondents confidentiality and acknowledged all sources used in the study in order to avoid plagiarism.

3.3.8 Limitation of Data Analysis

Questionnaires were the only instruments used for primary data collection in this study. The researcher did not use focus group discussions and in depth interviews. Focus group discussions and in depth interviews could be used for further research in future. Variables where expected frequencies were less than five were not taken into consideration during data analysis. Some responses provided for some open ended questions were vague and were therefore omitted during data analysis.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the analysis and interpretation of the data collected based on the objectives of the study. The results discussed relate to the current sanitation status, the challenges associated with the current sanitation facilities and the social cultural and economic factors which influence the willingness to adopt ecological sanitation in the study area.

4.2 Current Sanitation Status of Mathare slum of Ngong town

The analysis and discussion on the current status of sanitation in the study area was grouped into the following categories: accessibility to sanitation facilities, type of sanitation facilities, level of adoption of the skyloo toilet and the reasons for non-adoption.

4.2.1 Access to Sanitation Facilities

Access to sanitation facilities was measured by asking the respondents whether they had toilets in their dwelling places. Figure 4 shows that majority of the respondents 88.9% (80) had toilets while only a few respondents 11.1 % (10) had no toilets.

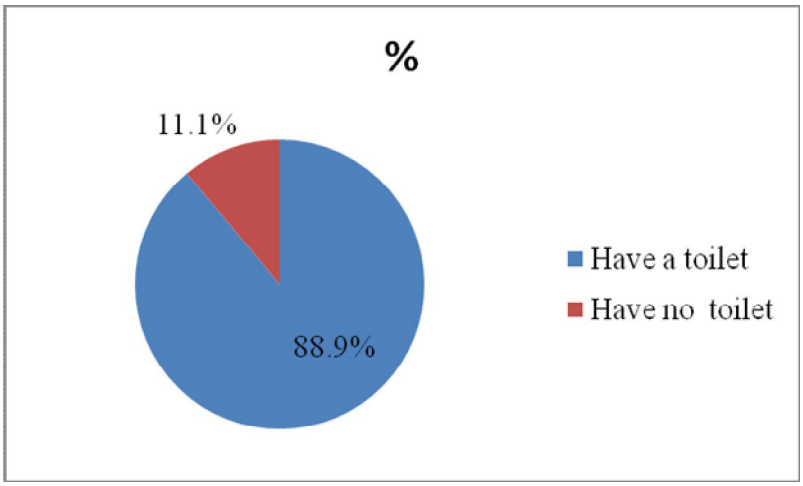

Figure 4: Access to Sanitation Facilities

Fieldwork: 2015

The respondents who did not have latrines were asked whether they had a latrine in the past. The study revealed that 20% (2) of the respondents indicated that they had no latrine in the past while the vast majority 80% (8) indicated they had a latrine in the past .Some of the reasons that they gave for not having a latrine were collapsing soil in the pit, financial constraints and lack of space. These research findings affirm that of a study conducted by Sesani (2005) in South Africa. Sesani's study revealed that most respondents had no latrine due to financial constraints. The current study also revealed that 60% (6) the respondents who did not have latrines used the neighbours toilet while 40% (4) others used public toilets.

4.2.2 Type of Toilet Facility

Type of toilets was categorized as simple pit latrine, skyloo toilet and pour flush toilet. Table 1shows that majority of the respondents used simple pit latrines. Few respondents used skyloo toilet as shown in plate 4followed by pour flush toilet. Most of the respondents used unimproved simple pit latrines which consisted of a hole in the ground with a wooden platform as shown in plate 3.

Mosler et al (2013) on their study on user's satisfaction and dissatisfaction with sanitation facilities in Kampala informal settlement had related findings and found out that the most frequently used sanitation facilities were unimproved pit latrines with a slab, followed by ventilated pit latrines and flush toilets. Pit latrines are the dominant sanitary facilities used in the slums, resulting in constant risk of faecal contamination of shallow ground water, which is used as a drinking water source by a large number of slum dwellers.

Table 1: Type of Toilet Facility

Type of Toilet Facility	**Frequency**	**%**
Simple pit latrine	51	63.75
Skyloo	15	18.75
Pour flush toilet	14	17.75
Total	**80**	**100**

Source: Fieldwork 2015

Plate 3: Simple Pit Latrine (Field Work 2015)

Plate 4: Skyloo Toilet (Field Work 2015)

4.2.3 Sharing of Sanitation Facilities

Sharing of sanitation facilities can lead to health risks if the toilets are not clean. Using dirty toilets exposes users to the risk of contracting diseases such as diarrhoea, intestinal and respiratory infections. The study revealed that 56.25% (45) of the respondents who had latrines shared the facility with their neighbours while 43.75% (35) indicated that neighbours did not use their latrine.

These findings were consistent with the findings from a study done in Kampala by (Mosler et al., 2013). The study found that sharing sanitation facilities is a preponderant practice in Kampala's low-income areas. In this study, the maximum number of households reported to share a toilet room was 92 households. The use of shared sanitation facilities by households was found to be almost three times greater than private usage (Mosler et al., 2013).

As shown in the table 2, the study revealed the reasons for sharing toilets which were: toilet overflow, walls and roofs collapsing and jointly constructed.

Table 2: Reasons for Sharing Toilets

Reasons for sharing toilets	**Frequency**	**%**
Toilet overflow	38	84.4
Walls and roofs collapsing	6	13.3
Jointly constructed	1	2.2
Total	**45**	**100**

Source: Fieldwork 2015

4.2.4 Respondents Level of Adoption of the Skyloo Toilet

The level of adoption was categorized into two; those who adopted and those who did not adopt the skyloo toilet. The study found out that majority of the respondents had not adopted the skyloo toilet 81.25% (65) while only a few 18.75% (15) had done so. The respondents indicated the following reasons for adopting the toilet: project subsidies (46.7%), the desire to have a toilet on their own (33.3%), and toilet durability compared to other pit latrines (20%).

4.2.5 Reasons for Non-adopting Skyloo Toilet

Reasons for non-adoption as shown in table 3 were financial constraints, religious influence, maintenance tasks and cultural beliefs.

Table 3: Reasons for not Adopting Skyloo Toilet

Reasons for not adopting skyloo toilet	Frequency	%
Financial constraints	18	27.69
Religious beliefs	20	30.77
Maintenance tasks	3	4.61
Cultural Beliefs	24	36.92
Total	**65**	**100**

Source: Field work 2015

Findings for reasons for non-adoption were in contrast with the findings of a study done by Ngobi (2007) who conducted a study to investigate attitudes towards urine diverting in the peri urban areas of Kampala, Uganda. The sample size used was fourty households. Those who did not adopt the urine diversion toilets indicated the following reasons for non adoption: they were tenants (46%), had little knowledge on how to use the toilet (27%), the urine diversion toilet was good for small households (18%) while other respondents indicated they had fear in regard to maintenance (9%). Ngobi's findings were similar to those of Wilbur (2014) who indicated that maintenance tasks of the compositing toilet such use of ash and dust were the major dislikes.

4.3 Challenges Related with the Existing Sanitation Facilities in Ngong Informal Settlement

4.3.1 Prevalent Diseases in Mathare Slum

Challenges related with the existing sanitation facilities included diseases, toilet overflow, odour and flies, distance, space and maintenance tasks. Figure 4 shows that out of the three diseases associated with the existing sanitation facilities in the last six months of 2015, diarrhoea was the most prevalent disease, 40% (32). This was followed by amoebic dysentery 27.5% (22) and

malaria 6.25% (5).Those who did not associate the disease with existing sanitation facility constituted 26.25% (21) of the respondents.

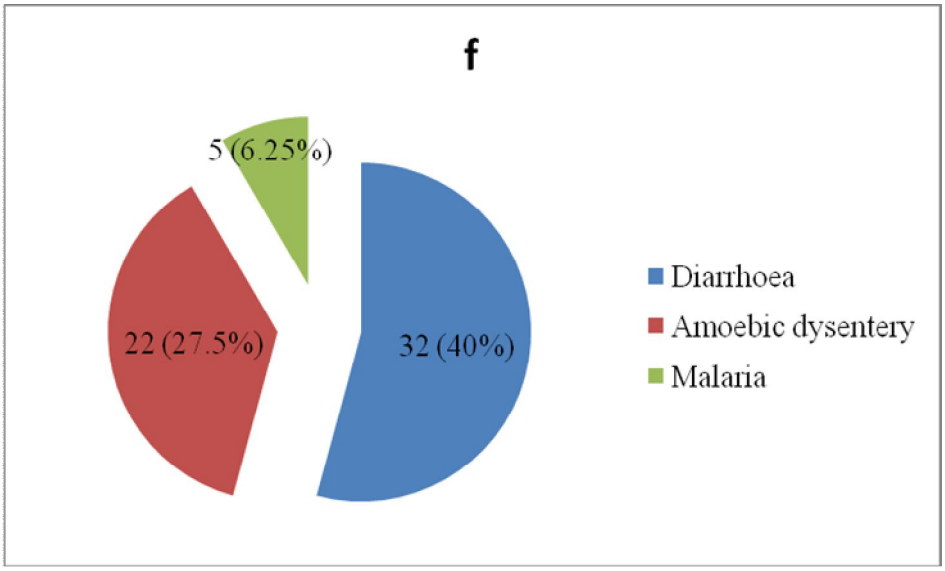

Figure 5: Diseases in Mathare Slum

Source: Fieldwork 2015

Data from Ngong District hospital also affirms the most prevalent sanitation related diseases in Ngong in the year 2014 and the last six months of 2015 as shown in table 4.

Table 4: Diseases Related to Sanitation Facilities in 2014 and January-July 2015

Disease occurence in 2014					Disease occurance from January - July 2015				
Diseases	**Under five yrs (f)**	**%**	**Over five yrs (f)**	**%**	**Diseases**	**Under five yrs(f)**	**%**	**Over five yrs (f)**	**%**
Diarrhoea	**1050**	**86.35**	**406**	**41.18**	**Diarrhoea**	**617**	**92.1**	**300**	**70.1**
Amoebic Dysentery	**29**	**2.38**	**59**	**5.98**	**Amoebic Dysentery**	**8**	**1.2**	**4**	**0.9**
Malaria	**136**	**11.18**	**447**	**43.34**	**Malaria**	**42**	**6.3**	**108**	**25.2**
Typhoid	**1**	**0.08**	**74**	**7.51**	**Typhoid**	**3**	**0.5**	**16**	**3.7**
Total	**1216**	**100**	**986**	**100**	**Total**	**670**	**100**		**100**

Source: Ministry of Health Ngong District Hospital 2015

The findings of diseases being experienced in Mathare slum of Ngong town are in contrast in terms of percentage with the findings from a study done by Acheampon and Dinye (2013) in Ghana. The study revealed that malaria was the most prevalent disease affecting 71.7 % of the respondents. This was followed by cholera which accounted for 14.2% of the top five diseases recorded in Ayigya Ghana. This was followed by amoebic dysentery, rashes and diarrhoea which accounted for 8.1%, 3% and 3% respectively. Flies and insects are usually responsible for the propagation of faecal-oral diseases, such as diarrhea or intestinal worms**.** Amoebic dysentery is caused by cysts. Cysts are closed capsule structures filled with liquid or gaseous material which occur in the body tissues. Cysts come out of the body in human faeces. In areas of poor sanitation, these cysts can contaminate food and water. Cysts can also linger in infected people's

hands after going to the toilet (WHO, 2008). Malaria is associated with stagnant water that provides ground for mosquito breeding as shown in the plate 5.

Plate 5: Water Contaminated with Toilet Overflow (Field Work 2015)

Source: Fieldwork 2015

When an improved sanitation facility is complemented with enhanced hygiene practices, such as proper usage, cleaning of the facility and washing of hands with soap, it leads to a greater effect in the prevention of sanitation- and hygiene-related disease outbreaks (Curtis et al., 2000). A significant association was noted between type of sanitation facilities and diseases affecting residents of Mathare slum of Ngong town.

The study also found out that 58.75% (47) of the respondents incurred hospital bills because of the above diseases while 41.25% (33) did not incur any hospital bill.

4.3.2 Other Challenges Associated with the Current Sanitation Facility

Apart from diseases, other challenges associated with the current sanitation facilities were also reported. The study revealed that 61.25% (49) of the respondents had other challenges related with the existing sanitation facilities while 38.75% (31) had no challenges with the existing sanitation facilities.

These challenges are shown in table 5and they include: walls and roofs collapsing, toilet overflow, flies and odour for those using simple pit latrines. Distance from the dwelling place, odour and flies were reported by those using pour flush toilet while maintenance task was mentioned by those using the skyloo toilet. Maintenance tasks involved spraying ash after every use and using the urine and faecal aperture carefully to make sure urine and faecal did not mix as shown in plate 6**.**

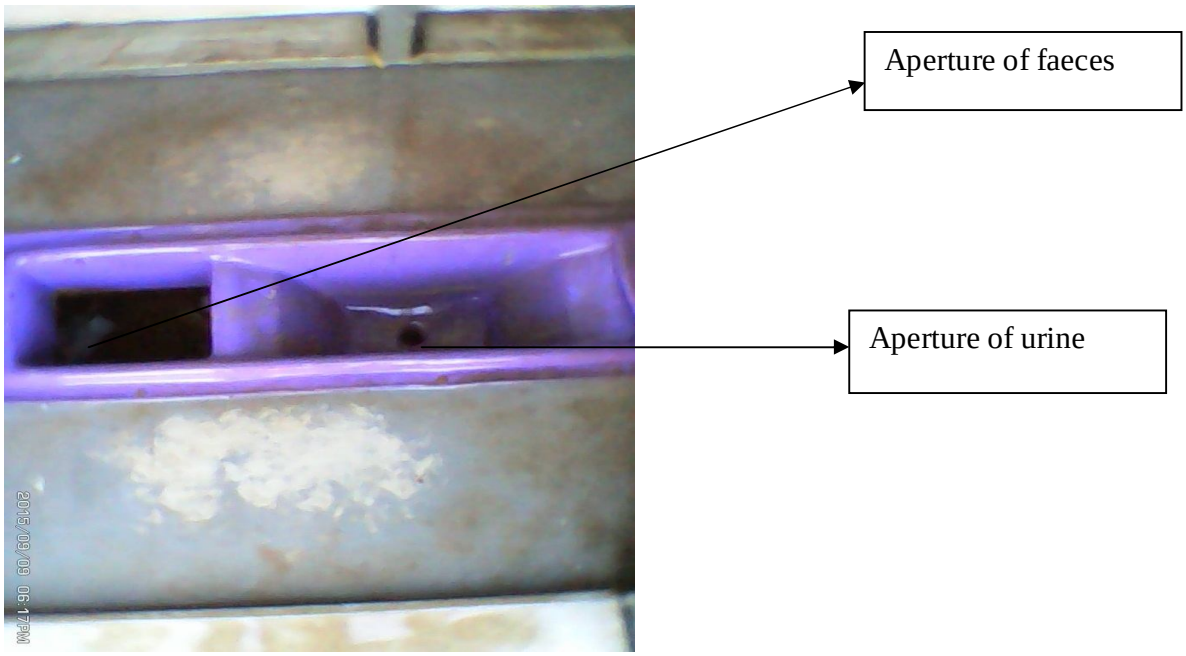

Plate 6: Aperture of Faeces and Urine

Source: Field work 2015

Table 5: Challenges with the Current Sanitation Facility

Type of toilets	Challenges	Frequency	%
Simple pit latrine	Walls and roofs collapsing, toilet overflow, odour and flies.	45	91.8
Pour flush toilet	Distance from the dwelling, odour and flies	1	2.04
Skyloo	Maintainance tasks.	3	6.12
Total		**49**	**100**

Source: Fieldwork 2015

Mosler et al., (2013) in their study had related findings with the current study and found out that the main reasons for respondents' dissatisfaction with the current sanitation facility were sharing sanitation facilities with too many users and that the facilities were dirty and smelly.

Chenoweth et al., (2013) on their study on challenges of achieving sustainable sanitation in informal settlements of Kigali Rwanda had related findings with the current study. Their study revealed that most respondents reported at least one problem, with the most frequently mentioned problem being shared usage followed by smell. Other problems frequently reported were difficulty in cleaning, insect attraction problems, safety, distance from the dwelling place and non-availability of toilets. Their findings also revealed that the unimproved simple pit latrines were the most common types of excreta management systems existing in Kigali. However, they recommended that such systems were not a sustainable sanitation option because they were vulnerable to leakages, collapsed during heavy rains and attracted flies. They proposed

sustainable sanitation technologies that matched with the requirements of study settlements of Kigali.

Mugure & Mutua (2009) in their study on norms, attitudes and gender perspectives on ecological sanitation in the peri urban areas of Nakuru, Kenya had similar findings with the current study. Their study found challenges in relation to ecological sanitation facilities which included forgetfulness by some people to spray ash after defecating, misplaced water entering the toilet vault during cleaning and confusion in using the two holes.

4.4 Relationship between Diseases and Current Sanitation Facilities

Diseases associated with households sanitation facilities and types of latrines were combined to form a contingency cell. Data from these variables were put in a contingency table as shown in the table 6 for the chi-square test.

Hypothesis 1: There is no significant relationship between current usage of sanitation facilities and diseases affecting residents of Mathare slum of Ngong town

Table 6: Contingency Table for Type of Latrines and Sanitation Related Diseases

Type of toilet used		Number of respondents not affected by sanitation diseases	Number of respondents affected by sanitation diseases	Total
Pour flush toilet	Count	9	5	14
Simple pit latrine	Count	10	41	51
Skyloo toilet	Count	11	4	15
Total Count		30	50	80

Table 7: Chi-square Tests for the Type of Latrines and Sanitation Related Diseases

O	E	$(O-E)^2$	$\frac{\sum(O-E)^2}{E}$
9	5.25	14.06	2.679
5	8.75	14.06	1.607
10	19.13	83.36	4.357
41	31.9	82.81	2.596
11	5.6	29.16	5.207
4	9.4	29.16	3.102
Total			19.548

Degree of freedom = 2

Chi-square value = 19.598

Critical value = 5.99

The information generated by table 7 showed that the calculated chi-square was $x^2 = 19.598$ which was greater than the critical value of 5.99 at 0.05 significance level. The null hypothesis that there was no significant relationship between current sanitation facilities and diseases affecting residents of Mathare slum of Ngong town was therefore rejected. This means that the type of sanitation facilities used in Mathare slum were to a large extent associated with diseases being experienced in Mathare slum of Ngong town. The association achieved at 0.05 significance level meant that the outbreak of diseases was not likely to have been contributed by chance of the random sample.

The findings of the current study were related with that of Rahman (2006). Rahman study found out that there was a strong relationship between environmental conditions and occurrence of diarrhoea. The incidence of diarrhoea among urban poor of Aligarh city was reported to be

96% which was attributed to outdoor defecation, use of manual latrines, lack of sanitation and buying of prepared cheap food items from vendors.

The findings of the current study were also related with the findings from a study done by Corburn & Hildebrand (2015). Their study found out that eighty-five households in Mathare of Nairobi city shared one toilet, only 15% of households had access to a private toilet, and the average distance to a public toilet was over 52 meters. Eighty-three percent of households without a private toilet reported poor health. Mathare women reported violence (68%), respiratory illness/cough (46%), diabetes (33%), and diarrhea (30%) as the most frequent physical burdens. They concluded that inadequate, unsafe, and unhygienic sanitation resulted in multiple and overlapping health, economic, and social impacts that disproportionately affected women and girls living in urban informal settlements.

4.5 Social cultural Factors Influencing the Adoption of Ecological Sanitation Facility (skyloo) in Mathare slum of Ngong town

4.5.1 Cultural Beliefs and Willingness to Adopt the Skyloo Toilet

It is important that sanitation facilities are built with respect to social and cultural norms of the local community. In the current study those who did not have the skyloo toilet (65) and those who did not have a toilet at all (10) were asked whether cultural beliefs influenced the willingness to adopt the skyloo toilet.

The cultural beliefs they cited are presented in table 8. Most of the respondents indicated that there were cultural beliefs that influenced reuse of sanitized faecal matter and urine as fertilizer. The remaining minority indicated that there were no were cultural beliefs that influenced reuse of sanitized faecal matter and urine as fertilizer.

Table 8: Cultural Beliefs and Willingness to Adopt Skyloo Toilet

Beliefs	**Frequency**	**%**
Handling faecal matter and urine is seen as dirt and therefore cannot be used as fertilizer.	16	21.33
Faecal matter is associated with witchcraft and therefore cannot be used as fertilizer.	18	24
Handling faecal matter is a taboo and therefore cannot be used as fertilizer.	15	20
No cultural beliefs	26	34.67
Total	**75**	**100**

Source: Fieldwork 2015

These findings were related with the findings of a study done by Robinson (2005) in Kenya. The study revealed that the local customs of the community in Nyanza influenced the community's perception to use skyloo toilet. Some of the customs were reported as a specific deterrent to the toilet's use. For example, in Luo custom, a man's mother-in-law cannot use the same toilet as he. It is also part of Luo folklore that pouring ash on a person's faeces is a way to curse the person with witchcraft. It certainly follows that any believer in this custom would not want to pour ash on their own faeces. Some Luo also believe that looking at faeces increases your chance of diseases of the eye.

The findings of the current study were also related with the findings from a study done by Ngobi (2007) which revealed that majority (70 %) of the respondents indicated that there were not aware of cultural beliefs associated to reuse of urine and faecal matter. The study however revealed that there were arguments for and against use of urine diversion toilets. 25% of the respondents associated reuse of sanitized faecal matter with witchcraft and explained that it was believed that if the rival person mixed the faeces with ash it could lead to stomach upset. 5% of the respondents indicated that they were not sure whether cultural beliefs inhibited reuse of urine and faecal matter.

Relationship between Cultural Beliefs and Willingness to Adopt the Skyloo Toilet

Skyloo toilet is one of the ecological sanitation facilities that involve reuse of nutrients found in faecal matter and urine. Respondents in this case were asked to indicate whether cultural beliefs influenced the willingness to adopt the skyloo toilet. Data for these variables were put in contingency table as shown table 9.

Hypothesis 2: There is no significant relationship between social cultural factors and the adoption of skyloo toilet in Mathare slum of Ngong town

Table 9: Contingency Table for Cultural Beliefs and Willingness to Adopt the Skyloo Toilet

Cultural beliefs		Not willing to adopt skyloo toilet	Willing to adopt skyloo toilet	Total
Associate faeces and urine with dirt	Count	7	9	16
Associate faeces and urine with witchcraft	Count	6	12	18
Handling faeces and urine is a taboo	Count	7	8	15
No cultural beliefs	Count	6	20	26
Total Count		26	49	75

Table 10: Chi-square Tests for Cultural Beliefs and Willingness to Adopt Skyloo Toilet

O	E	$(O-E)^2$	$\frac{\sum(O-E)^2}{E}$
7	5.55	2.1025	0.3788
9	10.45	2.1025	0.2012
6	6.24	0.058	0.0092
12	11.76	0.058	0.0049
7	5.2	3.24	0.6231
8	9.8	3.24	0.3306
6	9.01	9.06	1.0055
20	16.99	9.06	0.5533
Total			3.0866

Degree of freedom = 3

Chi-square value = 3.0866

Critical value = 7.82

From table10, information generated by the Pearson chi square showed that the chi square value was $x^2 = 3.0866$ which was smaller than the critical value of 7.82 at 0.05 significance level. The null hypothesis was therefore adopted. This could be interpreted that cultural beliefs did not influence willingness to adopt the skyloo toilet. The willingness to adopt skyloo toilet could be attributed to other factors other than cultural beliefs.

The findings of the current study were in contrast with the findings of the study done by Jenssen et al., (2002).They conducted a study on cultural preferences in designing ecological sanitation systems in North West Frontier Pakistan and found out that the village farmers were resistant to recycling of feacal matter and urine due to cultural barriers. Despite the fertilizer value of feacal matter and urine, the psychological and religious concern about the impurity of feacal matter and urine overruled the fertilizer value for the villagers.

The findings from a study done by Wilbur (2014) are related with the findings of the current study. In Wilbur's study, socio-cultural factors were hypothesized to affect the adoption, operation, and maintenance of composting latrines. In the indigenous communities of rural Panama, the socio cultural factors (i.e., attitudes and perceptions) were thought to influence the success of composting latrine projects. When surveyed about the likes and dislikes of composting latrines, latrine owners responded with a variety of answers. Most respondents indicated the advantages of compositing latrine which included: compost production, lack of mosquitoes or flies and lack of smell. With respect to the disadvantages, the only dislike mentioned by the respondents was the need for water for washing purposes after defecation. Otherwise, obtaining dry material (i.e. sawdust or ash) and practicing daily maintenance were the other most frequently mentioned dislikes.

4.5.2 Religious Beliefs and Willingness to Adopt the Skyloo Toilet

Regarding religious influence, 73.3% (55) of the Christian respondents indicated that religion did not influence their willingness to adopt skyloo toilet while 26.7% (20) of the Muslims respondents indicated that religion influenced their willingness to adopt the skyloo toilet because recycling of sanitized human waste and urine as fertilizer is viewed as impure.

Relationship between Religion and Willingness to Adopt the Skyloo Toilet

The respondents were asked whether religion influenced the adoption of skyloo toilet which involves reuse of sanitized faecal matter and urine as fertilizer. Data for these variables were put in contingency table as shown in table 11.

Table11: Contingency Table for Religion and Reuse of Sanitized Faecal Matter and Urine

Religion		Willing to adopt skyloo toilet	Not willing to adopt skyloo toilet	Total
Christian	Count	32	23	55
Muslim	Count	16	4	20
Total Count		48	27	75

Table 12: Chi-square Tests for Religion and Willingness to Adopt Skyloo Toilet

O	E	$(O-E)^2$	$\frac{\sum(O-E)^2}{E}$
32	35.2	10.24	0.2909
16	12.8	10.24	0.8
23	19.8	10.24	0.5172
4	7.2	10.24	1.4222
Total		40.98	3.0303

Degree of freedom = 1
Chi-square value = 3.030
Critical value = 3.84

From table12, information generated by the Pearson chi square showed that the chi square value was $x^2 = 3.030$ which was smaller than the critical value of 3.84 at 0.05 significance level therefore there was no adequate evidence to reject the null hypothesis. This implies that this relationship of association was likely to have happened by chance. This also meant that the sample size could have being small to reject the null hypothesis therefore more research needs to be done.

The findings of the current study were related with the findings of Ngobi (2007) who found out that 90 % of respondents reported that their religion was not against reuse of sanitized urine and faecal. This is in contrast with findings based on the study in the south western towns of Uganda which revealed that the farmers were reluctant to use faecal matter to fertilize their crops due to cultural resistance and inadequate information about reuse of sanitized faecal matter (WSP, 2005).

Niwagaba et al., (2010) on their study on the ecological sanitation coverage and factors affecting its uptake in Kabale municipality, western Uganda had related findings with the findings of the current study and found out that education, occupation or level of income, religion and age were the most significant factors affecting ecological sanitation coverage in Kabale municipality.

4.5.3 Gender and Willingness to Adopt the Skyloo Toilet

Table 13 shows that most male and female respondents did not find reuse of sanitized faecal matter and urine as fertilizer offensive. Some of the respondents in favour of this indicated that some crops in the area were grown using raw sewage. They also indicated that reuse of sanitized faecal matter and urine could reduce toilet overflow thereby improving the health of the community. Few female and male respondents viewed reuse of sanitized faecal matter and urine as fertilizer offensive.

Table 13: Respondents View about Reuse of Sanitized Faecal Matter and Urine as Fertilizer in Terms of Gender

Not offensive	**Frequency**	**%**	**Offensive**	**Frequency**	**%**
Female	22	45.8	Female	20	74.07
Male	26	54.2	Male	7	25.92
Total	**48**	**100**	**Total**	**27**	**100**

Source: Fieldwork 2015

Relationship between gender and willingness to adopt skyloo toilet

Gender was categorized in terms of males and females. This was to find out whether their views on reuse of sanitized faecal matter and urine as fertilizer influenced their willingness to adopt the skyloo toilet. Since the expected values for each cell were more than five, chi square was used to

test for the significance of the relationship. Data for these variables were put in contingency table as shown in table 14.

Table14: Contingency Table between Gender and Willingness to Adopt Skyloo Toilet

Gender		Willing to adopt skyloo toilet	Not willing to adopt skyloo toilet	Total
Female	Count	23	19	42
Male	Count	25	8	33
Total Count		48	27	75

Table 15: Chi-square Tests for Gender and Willingness to Adopt Skyloo Toilet

O	E	$(O-E)^2$	$\frac{\sum(O-E)^2}{E}$
23	26.88	15.05	0.56
25	21.12	15.05	0.71
19	15.12	15.05	1.00
8	11.88	15.05	1.27
Total			3.54

Degree of freedom = 1

Chi-square value = 3.54

Critical value = 3.84

From table 15, information generated by the Pearson chi square showed that the chi-square value was $x^2 = 3.54$ which was smaller than the critical value of 3.84 at 0.05 significance level

therefore there was no adequate evidence to reject the null hypothesis. This implies that this relationship of association was likely to have happened by chance.

The findings of the current study were in contrast in terms of preference with the findings from the study done by Danklman et al., (2009) in Romanian villages among fourty respondents. The study revealed that women's attitudes towards urine diverting dry (UDD) toilets seemed to be more positive than those of men. In Garla Mare, women preferred the UDD toilets while men preferred water flush toilets. The study revealed that women wanted to have the toilets in the house, as that would reduce walking distances during bad weather conditions. They were also more willing to use the fertilizer in their fields and gardens. Women and children (via schools) could therefore play an important role in motivating and educating others to use UDDT projects.

The findings of the current study relate with findings from a study done by Ngobi (2007) which revealed that out of the 40 household respondents, 65% of the female and 35% male respondents expressed their willingness to eat/buy food fertilized using sanitized urine or faecal matter. Those respondents who did not respond to this question argued that they were still in doubt if they would eat or buy the food fertilized by urine or faecal matter. The current study found out that occupational status did not influence the willingness to adopt skyloo toilet. The null hypothesis that there was no significant relationship between occupational status and willingness to adopt the skyloo toilet was therefore adopted.

4.6 Economic Factors Influencing the Adoption of Ecological Sanitation Facility (Skyloo) in Mathare Slum of Ngong Town

4.6.1 Level of Income and Willingness to Adopt the Skyloo toilet

The study sought to find out whether the level of income influenced the willingness to adopt the skyloo toilet. Table16 shows that out of the seventy five respondents who did not have the

skyloo toilet, most of them earned less than Ksh 4000 while few earned above Ksh 4000. Some of the respondents did not have any income.

Table 16: Level of Income

Level of income	**Frequency**	**%**
Ksh0 – 2000	20	26.7
Ksh2000 – 4000	24	32
Above Ksh4000	16	21.3
None	15	20
Total	**75**	**100**

Source: Fieldwork 2015

Relationship between level of income and willingness to adopt the skyloo toilet

Level of income influences the amount of money people are willing to invest in sanitation facilities. Level of income was classified from the lowest to the highest. Since the expected values for each cell were more than five, chi-square was used to analyze data. Data for these variables were put in contingency table as shown in table 19.

Hypothesis 3: There is no significant relationship between the level of income and the adoption of skyloo toilet in Mathare slum in Ngong town.

Table17: Contingency Table for the Level of Income and Willingness to Adopt the Skyloo Toilet

Level of Income		Willing to adopt skyloo toilet	Not willing to adopt skyloo toilet	Total
Ksh 0 - 2000	Count	10	10	20
Ksh 2000 - 4000	Count	16	8	24
Above Ksh 4000	Count	15	1	16
No income	Count	7	8	15
Total Count		48	27	75

Table 18: Chi-square Tests for Level of Income and Willingness to Adopt Skyloo Toilet

O	E	$(O-E)^2$	$\frac{\sum(O-E)^2}{E}$
10	12.8	7.84	0.6125
16	15.36	0.4096	0.03
15	10.24	22.66	2.21
7	9.6	6.76	0.70
10	7.2	7.84	1.09
8	8.64	0.4096	0.05
1	5.76	22.66	3.93
8	5.4	6.76	1.25
Total			9.87

Degree of freedom = 3

Chi-square value = 9.87

Critical value = 7.82

From table 18, information generated by the Pearson chi square showed that the chi-square value was $x^2 = 9.87$ which was greater than the critical value of 7.82 at 0.05 significance level therefore the null hypothesis was rejected. This relationship could be interpreted that income influenced the adoption of skyloo toilet.

The findings of the current study were related with the findings from a study done by Muthoni (2008). She conducted a study to determine the most appropriate toilet technology that could be used to improve/upgrade sanitation in Soweto East, Kibera. She established that appropriate toilet technology should be based on environmental, economic, social and technological sustainability. From her study she noted that the technology should not be

expensive to maintain as the residents were not able to pay high prices to use them, she also noted that sanitation facilities should be very aerated and solidly constructed and be environmentally sustainable. She also suggested that the toilet technology should consider women and children needs.

The findings of the current study were related with the findings from a study done by Danklman et al., (2009). Danklman's findings revealed that 3% of the women respondents were willing to invest in a (new type of) toilet while 20% of men were willing to invest. 10% of the women were willing if it would fit into their budget (Danklman et al., 2009). This was understandable as the income level of most families was extremely low and they could hardly afford to buy enough food for themselves. But Danklman et al., (2009) suggested that more investigation was needed around the financial aspects to examine why men felt there were enough financial options, and women did not.

4.6.2 Occupational Status and Willingness to Adopt Ecological Sanitation Facility

Occupational status among the respondents was categorized as self-employed (small scale businesses), employed and non- employed as shown in table 19.

Table 19: Occupational Status of the Respondents

Occupational Status	**Frequency**	**%**
Self employed	20	26.67
Employed	23	30.67
Non employed	32	42.67
Total	**75**	**100**

Source: Field work 2015

Relationship between Occupational Status and Willingness to Adopt Ecological Sanitation Facility

Occupational status of the respondents was classified into three categories: self employed (small scale business), employed and non-employed. Since the expected values were more than five, chi square test was used to analyze data. Data for these variables were put in the contingency table as shown in table 20.

Hypothesis 4: There is no significant relationship between occupational status and the adoption of skyloo toilet

Table 20: Contingency Table for Occupational Status and Willingness to Adopt the Skyloo Toilet

Occupational Status		Not willing to adopt skyloo	Willing to adopt skyoo toilet	Total
Employed	Count	8	12	20
Non employed	Count	7	16	23
Self employed	Count	7	25	32
Total Count		22	53	75

Table 21: Chi-square Tests for Occupational Status and Willingness to Adopt Skyloo Toilet

O	E	$(O-E)^2$	$\frac{\sum(O-E)^2}{E}$
8	5.87	4.54	0.773
12	14.13	4.54	0.321
7	6.75	0.06	0.009
16	16.25	0.06	0.004
7	9.39	5.71	0.608
25	22.61	5.71	0.253
Total			1.968

Degree of freedom = 2

Chi-square value = 1.968

Critical value = 5.99

The chi-square analysis for this variable X^2 = 1.968 revealed that there was no significant relationship between occupational status and willingness to adopt the skyloo toilet. This could further be interpreted that occupational status did not influence willingness to adopt the skyloo toilet in Mathare slum of Ngong town. The null hypothesis that there was no significant relationship between occupational status and willingness to adopt the skyloo toilet was adopted.

Households' income influences the capacity to build an eco san toilet. The findings of the current study revealed that many respondents earned less than Ksh 4000 this means that availability of income could be one of the reasons why people did not have eco san facilities as there was a significant relationship between level of income and willingness to adopt a skyloo toilet. These findings correspond with the findings of Niwagaba et al., (2010) in their study on

ecological sanitation coverage and factors affecting its uptake in Kabale municipality, western Uganda which reveal that some respondents reported that eco san toilets were expensive to build (ranging between Uganda shillings 500,000 [US $244] to 1,500,000 [US $731]), thus households with higher incomes were more likely to have eco san toilets.

Tsiagbey et al., (2005) in their study in Accra Ghana revealed the following reasons why the low and middle income households accepted the urine diverting toilets (UDTs). The reasons were: convenience, affordability (in comparison to paid public toilets), hygiene, source of fertilizer, easiness of use and maintenance, safety, privacy, better than current facility, portability, and mobility. On the other hand, high income households perceived UDTs to be unhygienic due to the fact that they did not need water to clean and maintain the facility. These findings were in contrast with the findings of the current study because one of the reasons for low adoption of the skyloo toilet was affordability.

Sanitation facilities are less prioritized because of the other household competing needs and the meager finances available. Increase in households' incomes combined with relatively cheap cost-effective eco san toilets could therefore lead to an increase in the building and use of eco san toilets (Esrey et al., 2001).

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION ANDRECOMMENDATIONS

5.1 Introduction

This chapter summarizes the findings of the study and presents conclusions, recommendations and suggestions for further research. The purpose of this study was to assess the influence of socio cultural and economic factors on the adoption of ecological sanitation facility in Ngong informal settlement.

5.2 Summary of findings

The findings of the study revealed that unimproved simple pit latrines were the most commonly used type of sanitation facility in Mathare slum of Ngong town. These latrines were generally not lined with bricks and therefore they would collapse as reported by most respondents. This made children to be at risk and most households discouraged children from using latrines for fear that they might fall in.

The study established that diseases, toilet overflow, odour, flies, collapsing of walls and roofs, distance and lack of space were the major problems associated with simple pit latrines and pour flush toilets in Mathare slum of Ngong town. Toilet overflow contaminated the environment with harmful pathogens causing offensive smells and flies. Flies were responsible for the propagation of faecal-oral diseases, such as diarrhoea or intestinal worms.

The study also revealed that the respondents using the skyloo toilet had a challenge of maintaining the toilet. This is because it involved spraying ash after every use so as to kill the pathogens in the faecal matter. Another challenge was using the urine and faecal aperture carefully so as not to mix urine with faecal matter. However the respondents indicated that skyloo toilet reduced odour and minimized fly infestation. The reasons for non-adoption of the

skyloo toilet were; cultural beliefs, religious influence, financial constraints and maintenance tasks.

The study found out that the most prevalent diseases associated with the existing sanitation facilities in Mathare slum were diarrhoea, amoebic dysentery and malaria. Data obtained from Ngong district hospital confirmed that most people in Ngong area suffered from diarrhoea, typhoid, amoebic dysentery and malaria all which were sanitation related.

The study revealed that most respondents had a positive view about reuse of sanitized faecal matter and urine as fertilizer. Those who responded positively on faecal compost reuse said that reuse of sanitized faecal matter and urine was important to keep the farms fertile and could improve the health of the community. Those who responded negatively found it offensive.

The study established that some respondents of Mathare slum who had not adopted the skyloo toilet had cultural or religious beliefs that hindered adoption of the skyloo toilet. In this case, reuse of sanitized faecal matter and urine was associated with dirt, impurity, taboo and witchcraft. The study found out that occupational status did not influence the willingness to adopt skyloo toilet. The study results also revealed that the level of income influenced the willingness to adopt the skyloo toilet as majority of the respondents in Mathare slum of Ngong town earned less than Ksh 4000 per month.

5.3 Conclusion

An analysis on the challenges associated with the current sanitation facilities showed that the issue was not only about the availability of the facilities. Factors such as the nature and type of sanitation facilities used the number of families sharing a toilet facility and the cleanliness of the facilities significantly contributed to users' satisfaction.

The study concluded that unimproved simple pit latrines were the most common types of excreta management systems that existed in Mathare slum of Ngong of town. However, such systems were not a sustainable sanitation option because they were vulnerable to leakages, collapsed during heavy rains, emitted odour and attracted flies. In addition, these facilities filled up quickly due to small volumetric capacity, high number of users (because of sharing), and were not easily or regularly emptied. Also, as a result of the steady increase in the population of the slum dwellers together with the construction of unplanned structures, the space available for constructing new simple pit latrines was continually decreasing. This implies that more sustainable sanitation facilities such as eco san toilets are needed.

While ecological sanitation toilet facilities contribute to safe excreta disposal to improve human health, safeguard surface and underground water from pollution and enrich soil productivity, there is a need to promote affordable and cost effective eco san designs to cater for all the different categories of people based on their income levels and religion.

On the reuse aspect, the study revealed that most of the respondents did not consider reuse of sanitized urine and faecal matter as fertilizer offensive. The study also concludes that religion and gender did not influence the willingness to adopt the skyloo toilet in Mathare slum of Ngong town.

Occupational status did not influence the willingness to adopt the skyloo toilet but the level of income influenced the willingness to adopt the skyloo toilet. Low income was therefore one of the factors that hindered the adoption of skyloo toilet among the residents of Mathare slum of town. The situation might be improved if financial support from local and national governments was available by either providing lower subsidies in the construction of ecological sanitation facilities.

5.4 Recommendations

Information package and marketing strategies are needed to increase the adoption and behavioural change. For instance environmental advantages, nutrient reuse, their hygiene and health conditions should be the core of information.

There is need to raise awareness through for example organizing seminars and workshops so as to encourage more residents to adopt the toilets. This will not only increase adoption rate but also ensure massive acceptance and replication of the facilities even in the neighbouring areas around Ngong where farming is usually done.

In order to improve ecological sanitation adoption and usage by communities, there is a need for continued sensitization of the local people on the value of ecosan facilities, putting emphasis on affordable toilet designs and on how to use and manage them appropriately. While maintaining the standard construction materials required (that is cement and bricks) there is need to improvise the locally available materials for the construction of ecological sanitation facilities so that the poor people with no project subsidies can be able to afford and also replicate after expiry of the project. Provision of locally available materials can include papyrus materials, timber, used/old iron sheets to construct the superstructure. This would substantially reduce costs for the poor as well provide a wide range of technologies on the market that suit the different classes of people depending on their ability to pay.

Ecological sanitation technology appears to be a good sanitation option that governments should support. Government institutions should consider forming guidelines for ecological sanitation at a national or municipal level. This is because ecological sanitation works towards achieving sustainable development goals or Global goals as set forth by the United Nations. This is by providing sanitation coverage in areas where low tech sanitation options are not feasible.

Universal access to clean water and sanitation is one of the 17 Global Goals that make up the 2030 agenda for sustainable development.

Governments and municipalities should frame legislation that allow experimentation of alternative ecological sanitation technologies and also manage the associated risks.

5.5 Suggestions for Further Research

From the study findings, it is clear that the residents of Mathare slum have positive view on reuse of sanitized faecal matter and urine but more research is needed to investigate the perception of different ecological sanitation technologies that can accommodate people of various religion and levels of income. Further research may also be carried out to determine the influence of skyloo toilets or urine diversion toilets on the improvement of health status of people living in Mathare slum of Ngong town.

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APPENDICES

APPENDIX I: QUESTIONNAIRE

THE INFLUENCE OF CULTURAL AND ECONOMIC FACTORS ON THE ADOPTION OF ECOLOGICAL SANIATION FACILITIES

Introduction

I am a student at the University of Nairobi pursuing Master of Arts Degree in Environmental planning and Management. I am carrying out a research on the influence of socio- cultural and economic factors on the adoption of ecological sanitation facilities. A case study of Mathare slum of Ngong town. The research is purely for academic purposes. Any information given to me will be treated with utmost confidentiality.

Demographic Data

1) Age:

18-30 ( ) 31-55 ( ) 56-80 ( )

2) Gender: a) Male b) Female

3) Marital status a) Single b) Married c) Widow

4) Level of education attained?

a) No education

b) Primary education

c) Secondary education

d) Tertiary education

5) What is your occupation, that is, what kind of work do you mainly do?

……..

…….

6) Are you paid in cash for this work or are you not paid at all?

a) Paid in cash b) Not paid

7) How much are you paid (per month or daily)?

a) Ksh 0 - 2000

b) Ksh 2000 - 4000

c) Above Ksh 4000

d) None

8) Religion: a) Christian b) Muslim c) Other specify…….

9) How many years have you lived in this area?

a) Less than one year.

b) Between five and 10 years.

c) More than 10 years.

10) a)Do you live with other people in this household?

a) Yes b) No

b) How many people including yourself live in this household?

i) Males ---------- ii) Females ------

The Current Sanitation Status in the Slum

11) Do you have a latrine?

a) Yes b) No

If yes skip to question 16and proceed

If no answer question 12, 13, 14, 15 and then skip to question 32and proceed

12) Did you have one in the past?

a) Yes b) No

If no skip to 14and proceed

13) What happened to your last latrine?

……

……

14) What reasons do you give for not having a latrine now?

……

……..

15) So where do members of your family go for their sanitation needs?

a) Public toilet b) Neighbours toilet c) Other(s) specify

If yes answer the following questions and proceed

16) Who funded the construction of your toilet?

a) Self c) Government

b) Family Member d) Non-governmental organization (NGO)

e) Self-help group

17) Do you have any neighbors who use your toilet?

a) Yes b) No

If no skip to 19

18) Give reasons why they have to use your toilet.

a) Look good than theirs c) They do not have one.

b) Theirs is full d) Other reasons explain……

19) Do some people from this house use the neighbours toilet?

a) Yes b) No

If no skip to 21 and proceed

If yes answer 20 and proceed

20) If yes, why?.....

……...

21) Do you have a skyloo toilet?

a) Yes b) No

If yes answer question 24, and 25 and skip to 27 and proceed

If no answer question 22, 23 and skip to 26 and proceed

22) If no why? .....

……..

23) Would you prefer to use a skyloo toilet?

a) Yes b) No

24) In what ways have you benefited from the skyloo toilet?

……..

……

25) What reasons do you give for having this toilet?

…….

……..

26) Which other type of sanitation facilities does your household use?

a) Flush toilets c) Ventilated improved toilets.

b) Pit latrine d) Communal flush toilet

e) Bush f) Others…….

27) Are you satisfied with the toilet facility in your household?

a) Yes b) No

If no specify why? …….....

……

Problems Related with the Existing Sanitation Facilities

28) a) What are the most common diseases associated with the existing sanitation facility in this area?

i) Diarrhoea 1) yes 2) no

ii) Cholera 1) yes 2) no

iii) Dysentery 1) yes 2) no

iv) Worms 1) yes 2) no

v) Typhoid 1) yes 2) no

vi) None

b) Has any of the diseases indicated above affected you or any member of your household in the last six months?

a) Yes b) No

29) Have you incurred any hospital bill in treating yourself or any member of your family against sanitation related diseases in the last six months?

a) Yes b) No

30) Besides diseases, what are the other common challenges related to the sanitation facility currently affect your household?

……..

…….

31) What is the main source of water used by your household for purposes such as drinking, cooking and hand washing?

a) Piped water b) Dug well c) Surface water (rivers/ dams) e) Rain water

d) Others specify……..

Socio-cultural factors affecting the Adoption of Ecological Sanitation

32) Is it a taboo to reuse sanitized faecal matter and urine as fertilizer?

a)Yes b) No

33) Do you belief that faecal matter and urine is associated with witchcraft?

a)Yes b) No

34) Would you eat/ buy food from fertilized using manure processed from human waste and urine?

a) Yes b) No

35) Is using faecal matter and urine as fertilizer offensive?

a) Yes b) No

36) Does your religion hinder use of manure processed from human excreta and urine?

a) Yes b) No

If yes please explain…….....

…….