Alternative approaches to management of excreta: An assessment of the factors that have led to household choice and adoption of Ecological Sanitation (ECOSAN) in Wajir.

By

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DECLARATION

This project paper is my original work and has not been presented for a degree in any other university

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To my husband Voltaire Mulonga Kegode and our children Chogo and Ndenga.

ABSTRACT

Sanitation is important not only for its direct impacts on health, but also for its contribution to improved living environments, human dignity and to improved education outcomes. In spite of this, sanitation coverage is low especially in the developing countries. One way of increasing sanitation coverage is to consider new and holistic options with a focus on economically feasible and environmentally friendly systems to improve environmental sanitation and hygiene. One such option is Ecological sanitation (ECOSAN). However, there has been no documentation on the factors that have led to the choice of ECOSAN in different parts of Kenya such as Wajir in North Eastern Province. These factors can be taken into consideration before ECOSAN can be rolled out to many other parts of the country. This can contribute towards achievement of sustainable sanitation improvement.

The aim of this study was to identify factors that have led to households' choice and adoption of ECOSAN in Wajir. A sample of 48 households in Wajir Township that were piloting the toilets (adopters) were chosen through simple random sampling. The independent variables considered in the assessment were gender, age groups and factors of choice. Dependent variables considered included choice of or preference for ECOSAN by the household and use of ECOSAN by the household members. The data collection tools included household interviews using structured questionnaires, focus group discussions (FGDs) and observations to answer descriptive research questions. Hypotheses were tested using the Kruskal Wallis test.

The study found out that apart from health and hygiene considerations, people also seek other benefits when choosing ECOSAN. Important choice factors for men include prestige and the fact that the toilet is durable and permanent. For women important choice factors include privacy and the fact that the ECOSAN toilet is attractive. Availability of subsidies was found to have equal importance for all household members when choosing ECOSAN. The study also found that there are various factors that would hinder the adoption of the ECOSAN toilets, which include limited financial resources, lack of awareness, misunderstandings and socio cultural aspects. Although household members preferred the ECOSAN toilet to other modes of sanitation, it was only the adults that made full use of the toilet while children less than 3 years old, the disabled and the elderly did not make full use of it.

The study recommends that ECOSAN is a good sanitation option that governments should support but there is a need for guidelines for ECOSAN programs and updating of relevant policies and legislation. Social marketing can also be used to market the benefits of the ECOSAN toilet to allow for wider promotion of the ECOSAN technology. In addition, subsidies are important to attain increased coverage. The study recommends further research into variations within the present ECOSAN technology to ensure that there is a viable option for all with respect to affordability. Further research is also required on the possibility of re-use of the ECOSAN products in gardens and the determination of an appropriate storage time for the excreta before it is used.

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CBS	Central Bureau of Statistics
DDP	District Development Plan
DHS	Demographic and Health Survey
EC	European Commission
EU	European Union
GEO	Global Environmental Outlook
GoK	Government of Kenya
GTZ	German Technical Cooperation (Gesellschaft für Technische Zusammenarbeit)
IWRM	Integrated Water Resource Management
JMP	Joint Monitoring Programme for Water Supply and Sanitation
KEMRI	Kenya Medical Research Institute
Kshs.	Kenyan shillings
MDG	Millennium Development Goals
MICS	Multiple Indicator Cluster Survey
MoH	Ministry of Health
MoPND	Ministry of Planning and National Development
MWI	Ministry of Water and Irrigation
MWRMD	Ministry of Water Resources Management and Development
NEP	North Eastern Province
OoP	Office of the President
PHO	Public Health Officer
SSA	Sub Saharan Africa
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USD	United States Dollars
VHC	Village Health Committee
WB	World Bank
WCC	Wajir County Council
WELL	Water and Environmental Health at London and Loughborough
WHO	World Health Organisation
WSSD	World Summit on Sustainable Development
WSP	Water and Sanitation Program

CHAPTER 1

INTRODUCTION

1.1. Introduction

Improved sanitation facilities are those that are more likely to ensure privacy, hygienic use, human safety and health and include connection to a public sewer or septic system. These include pour-flush latrine, simple pit latrine and ventilated improved pit (VIP) latrine. Unimproved sanitation facilities include a public or shared latrine, open pit latrine and bucket latrine (WHO/UNICEF, 2004). Increasing access to improved sanitation facilities is a key component of development and poverty reduction, as it has major health benefits as well as associated social and environmental benefits. These positive impacts of improved sanitation on individual livelihoods and the environment are likely to trickle down to the wider economy (Kalbermatten *et. al.*, 1980; Cairncross, 2004). Sanitation is therefore a basic need and should be recognized as an important household requirement.

However, promoting improved sanitation especially in developing countries continues to be a challenge. Again, the current sanitation facilities do not meet the growing need for proper treatment of human waste around the world. Globally, although sanitation coverage rose from 49% in 1990 to 58% in 2002, more than 2.6 billion people do not have access to basic sanitation (Figure 1.1). Over half of those who do not have improved sanitation live in developing countries. In terms of global distribution about 1.93 billion people without proper sanitation (74 %) live in China and India, 0.48 billion (18%) live in Africa and 0.14 billion (5%) in Latin America and the Caribbean (LA&C). The remaining

0.07 billion people (only 3 %) without improved sanitation coverage live in the developed regions.

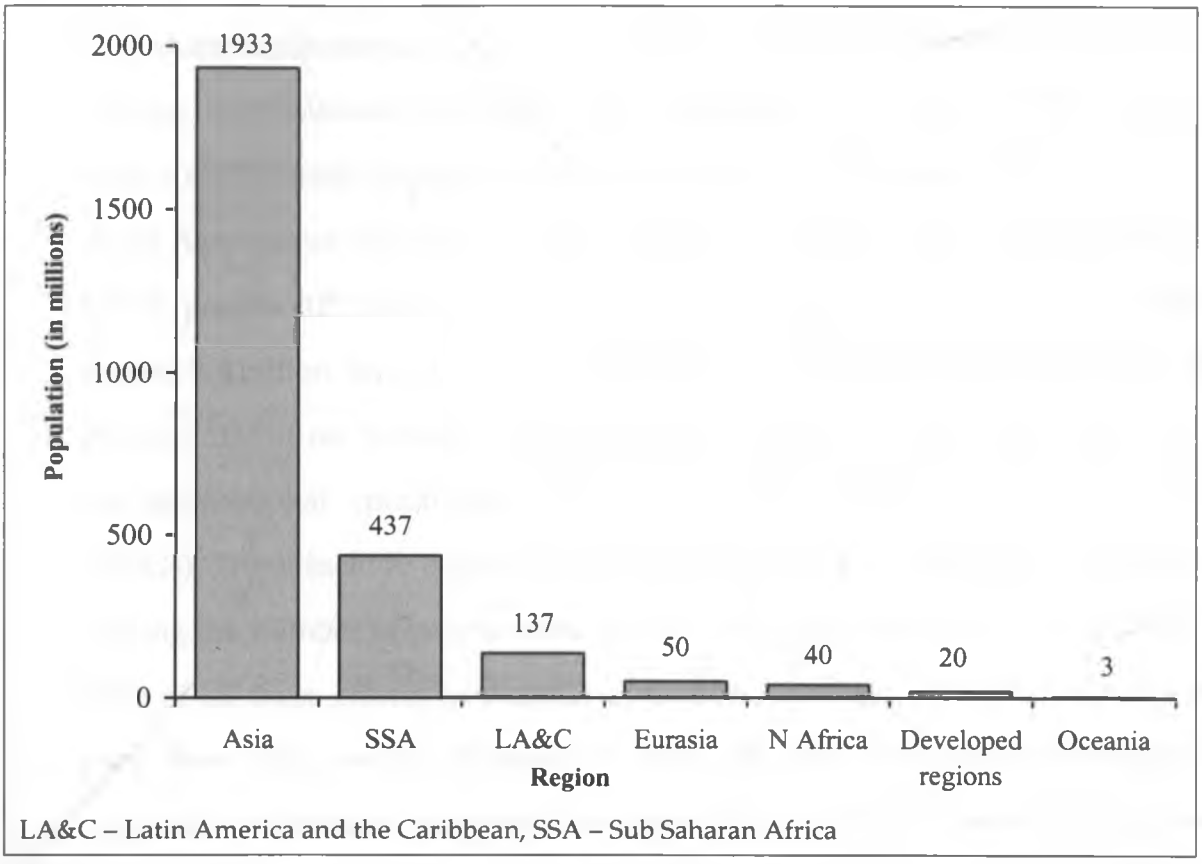

Figure 1.1: World population without improved sanitation by region in 2002 (WHO/UNICEF, 2004)

Although major progress was made in South Asia from 1990 to 2002, a little more than a third of its population are currently using improved sanitation (WHO/UNICEF, 2004). In Africa, the coverage varies among the different regions, from 73% in North Africa, to 62% in East Africa and 29% in Central Africa (Ibid, 2004). Statistics for individual countries show even greater variation. For example, in Kenya, the sanitation coverage in the year 2002 was only 56% in urban areas and 43% in rural areas. Of concern are the slums, remote rural areas and the nomadic pastoral areas where the sanitation coverage is very low. In an area like Wajir in North eastern Kenya where the population is mainly nomadic,

the percentage of people without a sanitation facility is as high as 80.9% (Ibid, 2004).

Inadequate sanitation is not a new concern – indeed, the 1980s was the United Nations International Drinking Water and Supply Decade (IDWSD). At that time, the international community set a target of achieving 100% coverage in water supply and sanitation by 1990. By the year 2000, WHO estimated that 1.1 billion people still lacked access to safe water supply, but over twice as many people, 2.4 billion, lacked access to basic sanitation (WHO/UNICEF, 2000). At the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002, the international community agreed to 7 Millennium Development Goals (MDGs). These include a new sanitation target of improving basic sanitation by halving the number of people without access to sanitation by 2015 (UN, 2002). In spite of all these efforts to increase sanitation coverage, progress has still been very slow. This can be attributed to various factors, which include neglect of consumer preferences, inappropriate approaches, ineffective promotion and low public awareness, lack of political will, poor policies and inadequate and poorly used resources (Simpson-Hebert and Wood, 1998).

This study addressed the issue of consumer preferences in sanitation services. It is important to consider what the people want and are willing to use and maintain, and which sanitation technologies are locally appropriate (Cotton and Saywell, 1998b; Obika 2003; Cairncross, 2004; Jackson, 2004). Studies have shown that knowing how consumers make sanitation choices and identifying the most important factors that contribute to demand can contribute to the success of a sanitation project (Cairncross, 2004). Additionally, individual users are the ones that are important for the success of a project since the value of an investment

depends not only on community support but more particularly on the consent of households and individual users (Cairncross, 2004). They need to be convinced that the benefits of improved sanitation and the new technology, with which it is associated, outweigh its costs. This knowledge is widely lacking especially for sanitation technologies like ECOSAN.

This study focused on why users would choose an ECOSAN toilet especially in the Kenyan context, and more specifically in Wajir, which is a pastoralist community with Islam as the predominant religion. It assessed the factors that have led to choice and adoption of ECOSAN in Wajir. Since the household is important in determining choice of ECOSAN, the focus was on the household. The study assessed the important choice factors for males and females and whether all household members used ECOSAN. This information is important if the ECOSAN program is to address the needs of all household members. The preference for different sanitation technologies and the factors that would hinder the choice of ECOSAN were also examined so as to determine any factors that would negatively affect promotion of ECOSAN.

1.2. Statement of the research problem

For the success of sanitation projects in general, studies show that it is important to understand what people want, what they are willing to use and maintain and which sanitation technologies are locally more appropriate (Jenkins, 2004). According to World Bank (2004), community "trends" commonly influence sanitation; hence, it is useful to learn about and compare the perceptions of sanitation in different communities. In the case of ECOSAN, community adoption has been mixed.

Communities can be categorized as faecophilic and faecophobic. A faecophilic community is one that has the tradition of reusing and recycling excreta and has no problem talking about it, handling it and smelling it. Examples of faecophilic communities include some East Asian communities like China. On the other hand, a faecophobic community is one that has no tradition of reusing or dealing with human excreta. In addition, general widespread cultural dislike for handling excreta is sometimes associated with taboo. Those who handle faeces in a community cause others to be unwilling to be associated with that stigma. Faecophobic attitudes are found in semi nomadic communities that do not have a tradition of building permanent wells and toilets. In such communities, a person's behaviour must change to adapt to the new technology and practice, which takes time (Feachem, 1983; Peasey, 2000). Additionally, in the case of the ECOSAN toilet, aspects such as reuse of excreta can only be considered and become obvious after using the ECOSAN toilet for some time.

Household adoption of sanitation is related to many factors. Many studies provide more details into why a household would or would not want to adopt a toilet. In modern times, communities are better educated and are increasingly aware of the relationship between good health, hygiene and sanitation practices. Sanitation leads to improved health, but people associate toilets with other benefits. According to Obika (2003), good toilets provide privacy and safety, particularly for women. They also provide comfort and convenience, dignity, less embarrassment for visitors, financial gains, they are easy to use and maintain. On the other hand, there are several reasons for non-adoption of latrines. The most common are related to financial factors, socio-cultural issues, and technical difficulties. Cotton and Saywell (1998a) notes that, often the reason for the lack of

a household toilet was the high cost, followed by use of public latrines, lack of space, difficulties in operating and managing.

In considering the reasons for choice, adoption or non-adoption, it is important to realize that communities are not uniform and not all of these issues are problematic in various communities. The goal of a successful promotion program is to identify the site-specific problems and work to overcome any barriers on accepted sanitation. In Kenya, until now, there has been no documentation on lessons learnt on implementation of ECOSAN technologies and the factors that have led to its choice and eventual adoption. Therefore, there was a need to undertake this assessment. Within the local context, a list of relevant factors that are specific to ECOSAN in Wajir were documented during this study. These factors have contributed towards the choice and adoption of ECOSAN by the households in Wajir. Promotion of ECOSAN can be based on these factors of choice for various household members.

1.3. Research objectives

The objectives of this study were:

- To establish whether all the family members in the households in Wajir with an ECOSAN toilet were making full use of it;

- To find out whether the households that use ECOSAN toilets prefer them to the other sanitation methods;

- To determine the different factors that have led to household choice of ECOSAN toilets in Wajir and whether they differ among males and females;

- To find out if there is a relationship between the choice of ECOSAN by households in Wajir and the availability of subsidies and finance;

- To determine the problems and barriers in the adoption of ECOSAN by households in Wajir.

1.4. Research hypothesis

The following hypotheses were formulated:

H_0 – There are no differences in use of ECOSAN among the different age groups in the households in Wajir;

H_1 – The alternative

H_0 – There are no gender differences in the factors that have led to the choice of ECOSAN in households in Wajir;

H_1- The alternative

H_0 – There are no differences in the personal, management and technical factors that have led to choice of ECOSAN in households in Wajir.

H_1- The alternative

1.5. Justification of study

In 2003, the Inter-Ministerial Task Force that was constituted to prepare a proposal on Wajir Town Water Supply and Sanitation recommended as a long-term solution, the construction of a sewerage system. The short-term measures suggested included: improvement of the bucket toilet system and wells; provision of regular or improved water treatment and a septic tank exhauster; and piloting of ECOSAN toilets. It was however suggested that ECOSAN would be explored as an alternative only after evaluation. This study was thus an important part of the larger project, whose aim is to assist in the evaluation of ECOSAN as an alternative sanitation method in Wajir. Again, the Wajir pilot ECOSAN project has thus far concentrated on the construction of ECOSAN toilets and education and awareness campaigns. It was also important to document lessons learnt, achievements to date and identify lessons learnt for future ECOSAN projects in the country.

It may be the responsibility of the Government to formulate and implement ECOSAN policies and regulations and enforce them to encourage ECOSAN adoption. However, the choice and eventual adoption of ECOSAN varies with different communities and in specific communities, various factors have contributed to its success or failure. Individual households are particularly important because they are the ones who end up choosing and using the ECOSAN toilet. They therefore need to be convinced that ECOSAN works and that there are benefits associated with its use. An investigation of the factors that influence the choice, adoption and non-adoption of ECOSAN can provide important information necessary in the creation and implementation of ECOSAN programs.

Further, the Agenda 21 document (which was a product of the Earth Summit in 1992), and the Kenya Water Act (2002) both stress on the need for an integrated approach to Water Resources Management (GoK, 2002a; UN, 1994). According to the Global Water Partnership, Integrated Water Resources Management (IWRM) is described as a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (GWP, 2000). This study addresses important issues in IWRM, which include proper wastewater management, minimization of water pollution and technology development. It is important to realize that ECOSAN is not a specific technology but is a philosophy based on containment, sanitisation and recycling of human excreta thus "closing the loop". It makes use of source separation and treats human excreta and wastewater such that they are considered not as wastes but as natural resources. Adequate treatment and disposal of wastewater contributes to better ecosystem conservation and less pressure on scarce freshwater resources. This ensures environmental sustainability.

Sanitation, especially in the least developed countries, has been overlooked for many years. It is only recently that it has featured prominently at major International conferences such as the World Summit on Sustainable Development (WSSD) in Johannesburg where the international community agreed to the 7 Millennium Development Goals (MDGs). The sanitation target includes halving the number of people without access to sanitation by 2015. Environmental health and improved sanitation are directly or indirectly linked to several of the MDGs and targets, therefore achieving the sanitation goals is a key factor in realizing many of the other International Development Targets (IDT).

Meeting the sanitation target also means that the current strategies need to be re-evaluated. One of the ways of doing this is by looking at other options such as ECOSAN, which are environmentally and economically sustainable. This study demonstrates ECOSAN toilets as an excreta management option and opens up a wider range of sanitation options than those currently considered. Currently, the cost for a sewer system is expected to be very expensive. In contrast, ECOSAN is expected to be cheaper; therefore, this evaluation can go a long way in influencing policy makers into recognising ECOSAN as a possible alternative sanitation technology in Kenya.

1.6. Theoretical framework

The Engel, Kollat, and Blackwell (EKB) model describes the decision process of consumers when making a choice between alternatives. The EKB model seeks to explain how a decision is reached. Five steps comprise the decision process (Engel et al. 1978). These steps include: 1) problem recognition (the state of arousal that activates the process); 2) search (sources and processing of information on alternatives); 3) alternative evaluation (criteria and rules for forming a preference); 4) choice; and 5) outcome (post-decision evaluation and action). Figure 1.2 shows a theoretical framework adapted from the EKB model to show the factors that can influence the eventual use and adoption of ECOSAN. The arrows simply represent inputs into the process and do not represent any cause and effect relationship. The dotted arrows represent a feedback.

The first step in a process that leads to choice and adoption is problem recognition. Problem recognition starts with dissatisfaction from a perceived difference between an ideal or desired state and the actual state. This provokes one to make a change. For example when one compares open defecation to

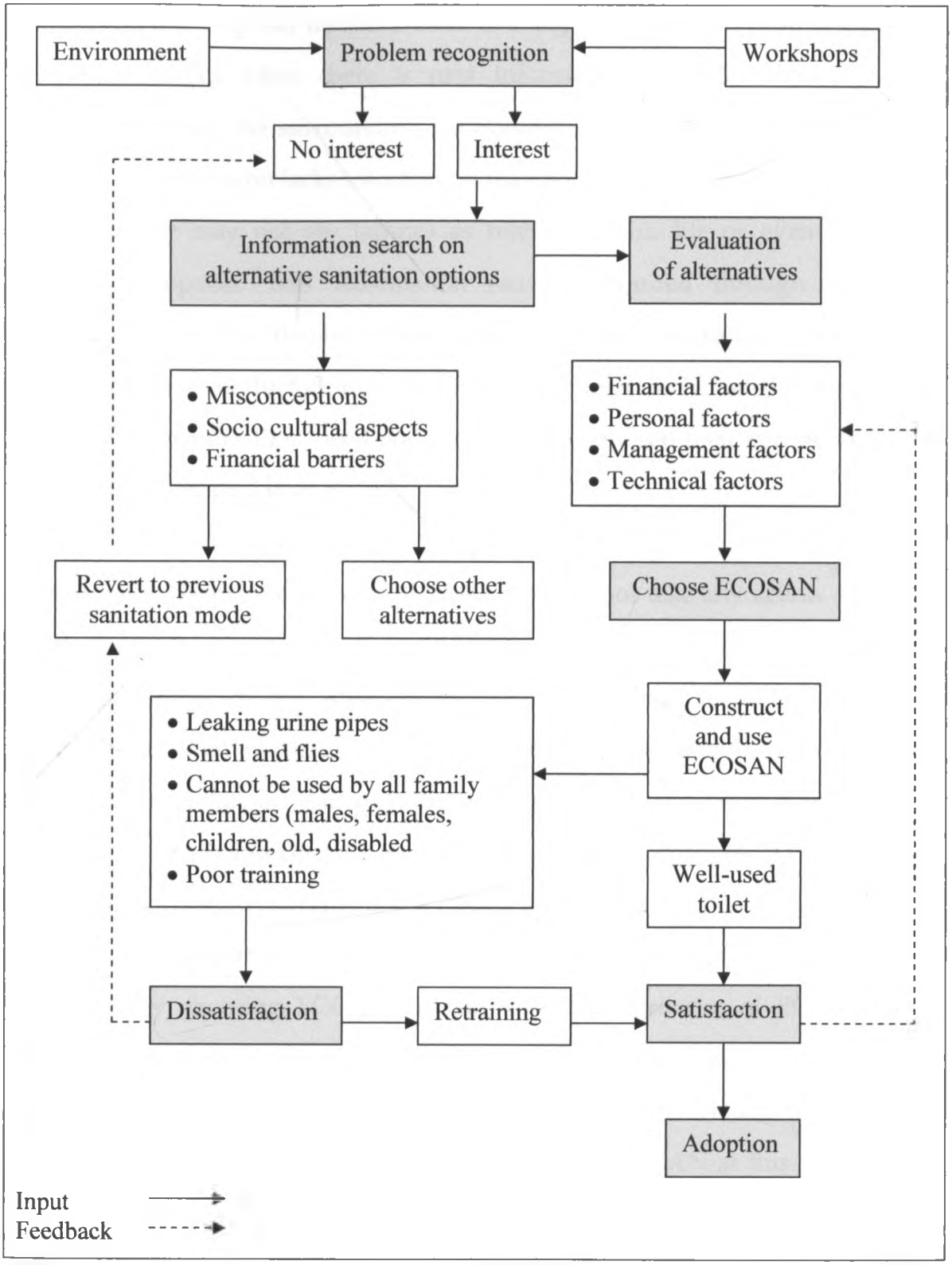

Figure 1.2: A theoretical framework of the decision process stages for the eventual adoption of ECOSAN (Modified from Engel, Kollat and Blackwell model, Engel *et. al.*, 1978)

proper excreta disposal method, there is a big difference. Problem recognition can come about when there is new information or when there are new experiences from the surrounding environment. Information is very important because a person who lacks information may not know what ECOSAN is or how it is used or may not see latrines as relevant to his life or even exist as a household option. This information can be acquired through awareness campaigns, visits to demonstration sites or through workshops. Most of the workshops are conducted in a participatory manner such that the participants are able to identify their need and differentiate between their current state and their desired or ideal state.

When some people recognize a problem, they do not take any action. For other individuals, the recognition of a problem triggers a search for information from various sources. In this situation, individuals are open to and actively seek information about alternatives. They pay particular attention to any information on alternatives that will satisfy their need, therefore at this point, it is important to have as much information available on all the alternatives. At some point, enough information is available to evaluate the alternatives that are identified for choice. The evaluative criterion includes factors such as the benefits that can be acquired by choosing ECOSAN or the different attributes of ECOSAN that satisfy an individuals needs (personal, technical and financial factors). The toilet that bears features that closely match an individual's evaluative criterion is chosen. There may arise barriers to the choice of ECOSAN at this stage, which may include financial factors, lack of awareness and misunderstandings, socio cultural factors, which may lead an individual to choose another sanitation method or revert to the previous mode of sanitation.

Once an individual chooses ECOSAN, they then go through the procedures of the construction of the toilet. Once construction is complete, the next stage is use. A household that uses the toilet well is satisfied with it. Satisfaction strengthens other prospective users' choices through confirmatory information and the experience of using and choosing an alternative. Further when the household realizes that the management of the ECOSAN toilet is at household level, operation of the toilet is easier and that the training and technical expertise is available, then they are encouraged to use the ECOSAN toilet. Dissatisfaction arises when the reality is not consistent with prior beliefs about ECOSAN or when the rejected alternatives have attributes that are more desirable.

1.7. Conceptual framework

Various factors can lead to choice of Ecosan at household level. These factors are the ones that contribute towards household preference of ECOSAN over other sanitation methods. They can thus be used as motivators for choice of ECOSAN and are thus important in designing ECOSAN programs. They fall into 4 main categories: personal/individual, operation/management, technical and financial factors (Figure 1.3).

These factors vary in importance among males and females. Female household members choose the ECOSAN toilet for factors such as privacy and the attractiveness of the toilet. Male household members choose the toilet for factors such as prestige and the fact the toilet is a durable and permanent structure. The use of the ECOSAN toilet also varies among the different groups that include the adults, elderly, children and the disabled.

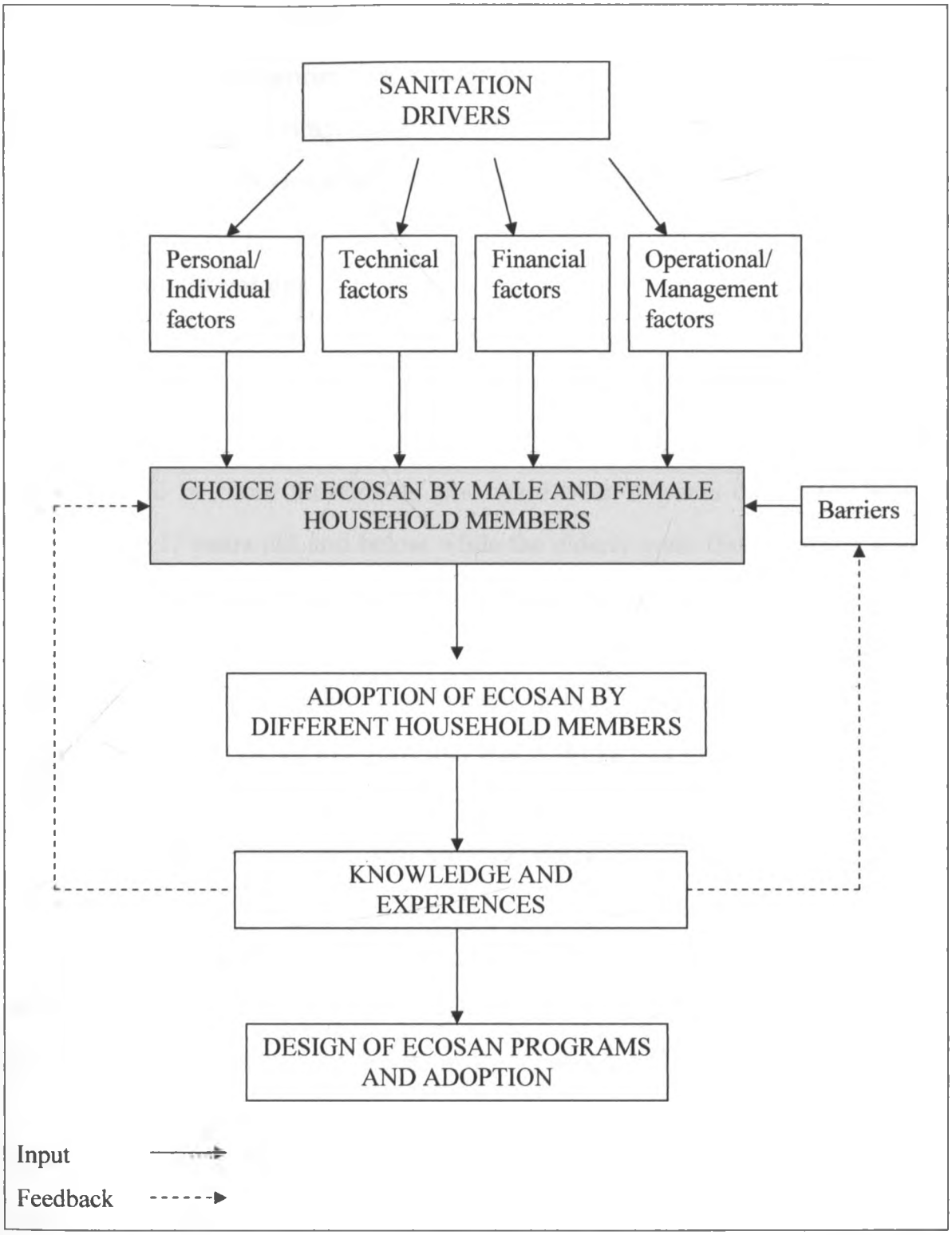

Figure 1.3: A conceptual framework of the factors that contribute to choice and eventual adoption of ECOSAN (Researcher, 2007)

As the households use and eventually adopt the toilets, they gain more knowledge and experiences, which contribute to the choice and adoption of ECOSAN and to the eventual design of ECOSAN programs. This knowledge and the experiences are also important in overcoming barriers to ECOSAN.

1.8. Scope and limitations

The study area was concentrated within Wajir Township. Data collection was limited to adult adopters in the households. The adopters consisted of those that had accepted the ECOSAN toilet and had been using it. The adults were considered to be those individuals who were over 18 years old, the children where those 17 years old and below while the elderly were those over 65 years old. The household was composed of one family living together in one plot. In Wajir, the households are big and are made up of an average of 10 members (grandparents, parents, children and extended family). A household ECOSAN toilet was thus considered to be one that was within a plot owned by one family. However, it served not only the family members but also the neighbours who did not have any toilets. Individual users are the ones that are important for the success of a project since the value of an investment depends not only on community support, but more particularly on the consent of households and individual users (Cairncross, 2004). They are the ones that need to be convinced that that ECOSAN works and that there are benefits associated with its use.

However, it might have been helpful to talk to other members of the community that were not already using the ECOSAN toilets (including those that do not know about ECOSAN, those opposed to it and those who are open to it but do not have one). This would have provided more information on the barriers and problems linked to ECOSAN, which are important in the promotion of ECOSAN.

This was not done because the sample size would have been bigger and this would have had a financial implication on the study. Further, the time allocated for the study was not sufficient to allow for further interviews with community members that were not using the ECOSAN toilet. It was therefore considered beyond the scope of this study.

There are many obstacles to improvement of sanitation coverage but this study focuses on the consumer preferences in sanitation services. The study considered the personal, management, financial and technical factors that were viewed as important in the choice of ECOSAN by the households in Wajir. The study looked at the relationship between gender and choice of ECOSAN. Other factors such as age, livelihood (family economic status) and education could have been important, but were not considered because of time and financial constraints.

Ecological sanitation is not a specific technology but is a philosophy based on containment, sanitisation and recycling not only of human excreta but also of wastewater thus closing the loop. This study did not focus on the ECOSAN concept as a whole but focused only on the ECOSAN toilets. Since only a few households had begun to use the second pit, this study therefore, did not address the impact of the ECOSAN toilets when the dried toilet contents were removed. However, any concerns expressed by the respondents regarding the dried toilet contents were noted.

The travel distance between Nairobi and Wajir was an important consideration. Wajir is about 800 km from Nairobi. The road from Nairobi to Garissa is an all weather one but the one from Garissa to Wajir is not. This made the journeys to Wajir very long and tiring. To counteract this, the data collection exercises were

well planned before proceeding to the field so as to collect the required data in as few trips as possible. Having some trained enumerators on the ground in Wajir assisted greatly in data collection. Additionally, they assisted in translation of the questionnaire to some of the local people who were not able to communicate in any other languages apart from the local languages.

CHAPTER 2

LITERATURE REVIEW

2.1. Sanitation coverage

According to the global statistics on sanitation coverage, 2.6 billion people globally still do not have access to basic sanitation; over half of these people live in the developing countries. According to the WHO/UNICEF (2004), it is apparent that sanitation coverage in developed regions (98%) is significantly higher than that in the developing regions (49%) (Figure 2.1).

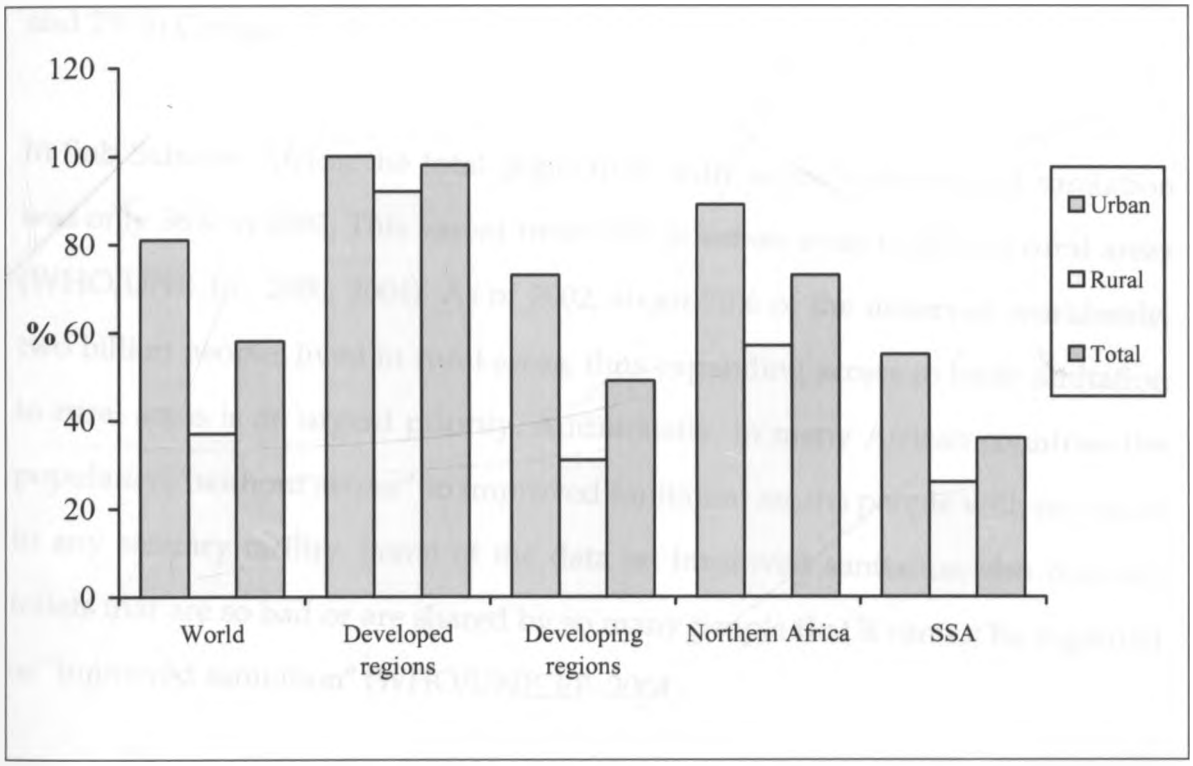

Figure 2.1: A comparison of the total, urban and rural sanitation coverage for different regions of the world in 2002 (WHO/UNICEF, 2004)

Within the developing countries, there is a big difference in sanitation coverage between the rural and urban areas. Only 31% of the rural inhabitants in

developing regions have access to any type of improved sanitation as opposed to 73% of urban dwellers (Figure 2.1). This difference between the rural and urban sanitation services continues to contribute to the burden of life in the rural areas.

An inter regional analysis for Africa shows that the sanitation coverage in West Africa is 48%, Central Africa has the worst (29%), while North Africa has the best (73%) and East Africa (62%). In global terms, Africa contains 18% of the world's population without access to improved sanitation worldwide (WHO/UNICEF, 2004). However, in terms of specific countries in Africa, urban sanitation coverage varies from 100% in Mauritius, 99% in Algeria to 14% in Congo. In contrast, in rural areas this varies from 82% in Algeria, to as low as 4% in Niger and 2% in Congo.

In Sub Saharan Africa, the total population with access to improved sanitation was only 36% in 2002. This varied from 55% in urban areas to 26% in rural areas (WHO/UNICEF, 2000, 2004). As of 2002, about 70% of the unserved worldwide, two billion people, lived in rural areas, thus expanding access to basic sanitation in rural areas is an urgent priority. Additionally, in many African countries the population "without access" to improved sanitation means people with no access to any sanitary facility. Some of the data on improved sanitation also contains toilets that are so bad or are shared by so many people that it cannot be regarded as "improved sanitation" (WHO/UNICEF, 2004).

According to Mohammed *et. al.* (1993), only about 15% of Dar es Salaam residents are connected to the city sewer network that was build in the late 1950s. The city has 8 oxidation ponds, of which only 4 are in operation (University of Dar es Salaam, Kurasini, Mikocheni; and Vingunguti). Much of the sewage is

thus emptied untreated into the ocean. Over 80%, of the households in the city use pit latrines and septic tanks. These frequently overflow, especially during the rains, contaminating water sources and increasing health risks in the neighbourhoods. The Zanzibar sewerage system, which covers the old stone town and parts of the new town, dates back to the 1920s and serves only about 18% of the population. As in Dar es Salaam, waste from the town's residents is dumped untreated into the coastal water. The rest of Zanzibar town and its suburbs are served by pit latrines (78.5%), cesspits and soak pits. Sewage from septic tanks and pit latrines are collected using vacuum desludge trucks (Mohammed *et. al.*, 1993).

According to Table 2.1, sanitation coverage in Kenya in the year 2002 was 56% in the urban areas and 43% in rural areas.

Table 2.1: Sanitation coverage in Kenya in 1990 and 2002

Year	Population			Sanitation coverage		
	Total ('000s)	% Urban	% Rural	% Total	% Urban	% Rural
1990	23,585	25	75	42	49	40
2002	31,540	38	62	48	56	43

(WHO/UNICEF, 2004)

The figures for urban sanitation coverage also include those living in the urban slums like Kibera and Mathare. The statistics tend to mask the deprivation in these communities. These are the people who suffer most from the growing change in quality and quantity of water, which includes degraded water quality, burden of water related diseases and degraded and dangerous environment (WHO/UNICEF, 2004). Of concern are towns like Lamu that have no sewerage

system in place. New buildings in the town use septic tanks, which are emptied by a tractor and discharged, outside the town (UNESCO / WHC, 2004)

Apart from the families living in remote rural areas and urban slums, other people without improved sanitation are among those hardest to reach. This includes families displaced by war and famine, pastoralists and poor families. Districts with the above characteristics include Tana River, Marsabit, Garissa, Wajir, Narok, Samburu and Baringo, which have the worst access to sanitation (CBS/MoFP, 2002). Pastoralist lifestyles in particular create a challenge when it comes to provision of excreta disposal facilities because people are always moving with their animals in search of new pastures. Statistics show that nomadic pastoral areas like those in North eastern Kenya have very low sanitation coverage and the percentage of people without a sanitation facility is as high as 80.9% (CBS/MoH, 2004). In contrast, provinces with the highest sanitation coverage in Kenya include Nairobi, Central and Western (CBS/MoFP, 2002). These provinces are very different from North eastern province because they are more economically developed, highly populated and the lifestyles are not sedentary.

2.2. Sanitation methods in Kenya

There are different sanitation methods in Kenya, which vary a lot among the different provinces in Kenya (Table 2.2). In the rural areas and in the poor urban areas especially in the urban slums, pit latrines (whether improved or not), are the most widely used sanitary means of excreta disposal. 77.6% of the population in rural areas and 55.9% in urban areas of Kenya use pit latrines (CBS/MoH, 2004).

Table 2.2: Types of sanitation methods used by households in different provinces in Kenya (%)

	Kenya		Nairobi	Central	Eastern	Western	Rift Valley	Nyanza	Coast	North-eastern
	U	R								
Flush toilet	39.0	1.7	66.5	9.5	4.9	1.9	3.4	2.1	12.3	0.3
VIP Latrine	11.7	7.3	2.2	5.5	8.9	7.9	13.2	5.6	14.6	1.4
Traditional Pit latrine	44.2	70.3	26.5	84.3	74.2	87.3	58.8	66.1	39.2	14.3
Bush/No facilities	3.7	20.4	2.7	0.2	11.8	2.8	0.4	26.2	33.5	80.9
Other	1.2	0.1	1.6	0.2	0.1	0.0	0.1	0.1	0.4	2.7
Missing	0.2	0.2	0.4	0.3	0.2	0.1	0.0	0.0	0.0	0.4

U - Urban areas, R - Rural areas (CBS/MoH, 2004)

A traditional or simple pit latrine consists of a simple wooden or concrete slab that is installed over a pit that is 2 meters or more in depth, depending on the soils and groundwater conditions. Excreta fall directly into the pit (it can be square, rectangular or circular) through a drop hole or a seat. A superstructure is necessary to provide privacy and protection (Brikke and Bredero, 2003). According to Esrey *et. al.*, (2001), pit latrines have been used for centuries, because they are simple and easy to manage. The simple pit latrine was introduced in Kenya by the colonial administration and the missionaries more than 60 years ago. The main purpose was to prevent outbreaks of diseases such as cholera and their construction was enforced through the chief's authority. This was reinforced by the missionaries who preached to their congregations that hygiene was Godly.

A Ventilated Improved Pit (VIP) latrine is intended to cancel or reduce the harmful side effects (smells and flies) related to the traditional pit latrines by

providing a vent pipe that is higher that the superstructure. The vent pipe is fitted at the end by a mesh that stops flies from entering. It also allows for circulation of air and for the evacuation of smells. There are different types of VIP latrines: one-pit latrines and double or multiple pit latrines (Brikke and Bredero, 2003). Flush toilets with sewerage connections are mostly found in the urban areas. Septic tanks are found in urban areas and in the rural areas where there is no sewerage connection. A study by Jackson (2004) notes that in the absence of the above sanitation methods, some communities (especially the poor) rely on what is available; dilapidated pit latrines, bucket latrines or open defecation in the bush. A recent study conducted in the Arid and Semi Arid Lands (ASALs) of Laikipia District showed that over 90% of the pastoral communities in Il Ngwesi in Mukogodo Division use open defecation in the bush (Mwaura, 2007).

A bucket toilet consists of a raised toilet pedestal with a bucket under it to collect all human excreta. The bucket toilets usually have buckets of 15 litres capacity. The buckets are regularly removed through a small door at the back of the toilet after which the contents (referred to as night soil) are emptied into bigger containers and transported to sites where the waste is further processed (Pickford, 1995). It is apparent that North-eastern Province has the greatest percentage of people in Kenya using the bucket toilets (8.4%). This is followed by Nairobi province with 0.7%, Nyanza and Coast provinces with 0.5% and Rift Valley and Eastern provinces with 0.3% (CBS, 2003).

2.2.1 Problems associated with different sanitation methods

Environmentally friendly sanitation methods are sustainable because the cost of repairing or preventing the environmental damage they cause makes them more

affordable especially in developing countries. There are many environmental problems associated with the various sanitation methods that are described above. Open defecation for example causes pollution of the environment and possible contamination of groundwater. It also encourages flies, which spread faeces-related diseases. In moist ground, the larvae of intestinal worms develop, and people and animals may carry faeces and larvae (Pickford, 1995). Surface water run-off from places where people have defecated results in water pollution. In the study by Mwaura (2007) in Laikipia District where open defecation was common, both diarrhoea and intestinal worms were common problems in the Il Ngwesi area.

The bucket toilet also has some problems associated with it. It is not considered improved sanitation because it is a hazard not only to human health but also to nature itself. The removal of the night soil is unpleasant and exposes the collectors to disease. Additionally, during removal and transportation, the night soil is often spilled leading to fly and smell nuisance (Pickford, 1995). The biggest environmental concern is associated with the pollution of groundwater. In an area like Wajir, since most shallow wells are located near the bucket toilets, pollution of the groundwater is unavoidable. The water is polluted not only by human excreta from bucket toilets and by other forms of waste disposal including the dumping site, but also by livestock waste and wastewater from bathrooms and urinals. Furthermore, when the bucket latrines urine soak pits are not well built, they are good breeding grounds for mosquitoes and flies. The bucket toilet is also uncomfortable to use (Ibid, 1995). All these factors make the bucket toilet use and disposal extremely unhygienic and dangerous not only for the health of the people but also for the environment. This eventually results in

high infant mortality rates, lowering the quality of life, increased burden on social services and vast pollution of water resources.

In the case of septic tanks, they have to be emptied once they are full and then subjected to further treatment. There are areas where the residents cannot afford to hire exhauster trucks to empty septic tanks or there is no exhauster available. In such cases, the effluent is left to run along the access roads or the septic tanks are emptied manually with buckets. This can be a health and environmental hazard. Another disadvantage of septic tanks is that some pollutants, especially sulphates, under the anaerobic conditions of septic tanks, are reduced to hydrogen sulphide, a pungent and toxic gas. Likewise, nitrates and organic nitrogen compounds are reduced to ammonia. Because of the anaerobic conditions, ultimately the fermentation processes generate carbon dioxide and methane, both of which are known greenhouse gases (Pickford 1995; GTZ, 2003).

The flush toilets or waterborne systems ("flush and forget") and pit latrines ("drop and store") while performing their primary objective of curbing health risks and pollution of the environment, have their own challenges (Winblad and Simpson-Hebert, 2004). In the case of flush toilets, they have first to be connected to a sewer line. Sometimes the drainage channels and sewer lines block resulting in overflow, which can be a menace and a health hazard. Eventually the human excreta together with grey water and storm water are transported to a wastewater treatment plant, using clean drinking water for transportation. This system therefore mixes comparatively small amounts of potentially harmful substances (500 litres of urine and 35 kgs. of faeces) with large amounts of treated and safe drinking water. This multiplies the amount of wastewater that needs to

be treated (GTZ, 2003). These systems are also difficult to apply in regions with water scarcity such as arid zones in poor countries.

The wastewater treatment plant also uses large amounts of energy to treat the wastewaters and excreta (ibid, 2003). The energy needed in some countries is supplied by fossil fuels, which compound the problems, considering the effects that fossil fuels have on the environment (Esrey *et. al.*, 2001). Burning of fossil fuels results in the emission of carbon dioxide, which is one of the greenhouse gases that contribute to global warming. In comparison, the renewable energy sources are more environmental friendly. These technologies are also expensive in investment, maintenance and operation. The annual investment for modern water and sewerage systems have been estimated to be about USD 30 billion and by 2025 the cost may rise up to USD 75 billion (Cosgrove and Rijsberman, 2000). This excludes the cost of maintenance. This is generally not affordable to the majority of the population especially in developing countries. They also place a significant challenge on the local authorities that are responsible for their regular maintenance.

There are cases where the wastewater treatment plants discharge partially treated sewage into water bodies. Of the 6 billion people in the world today only about 300 million people, have their sewerage treated in an environmentally acceptable manner (Matsui, 2002). This means that a lot of excreta is discharged directly into rivers, lakes and oceans with little or no treatment. In the developing regions of the world, treatment is applied only in a few systems (Figure 2.2).

Even in the industrialized countries, sewage is not universally treated. For example, in the EU, some 37 of the 527 cities with more than 150,000 inhabitants discharge their sewerage without adequate treatment. Brussels is a well-known example (EC, 2004).

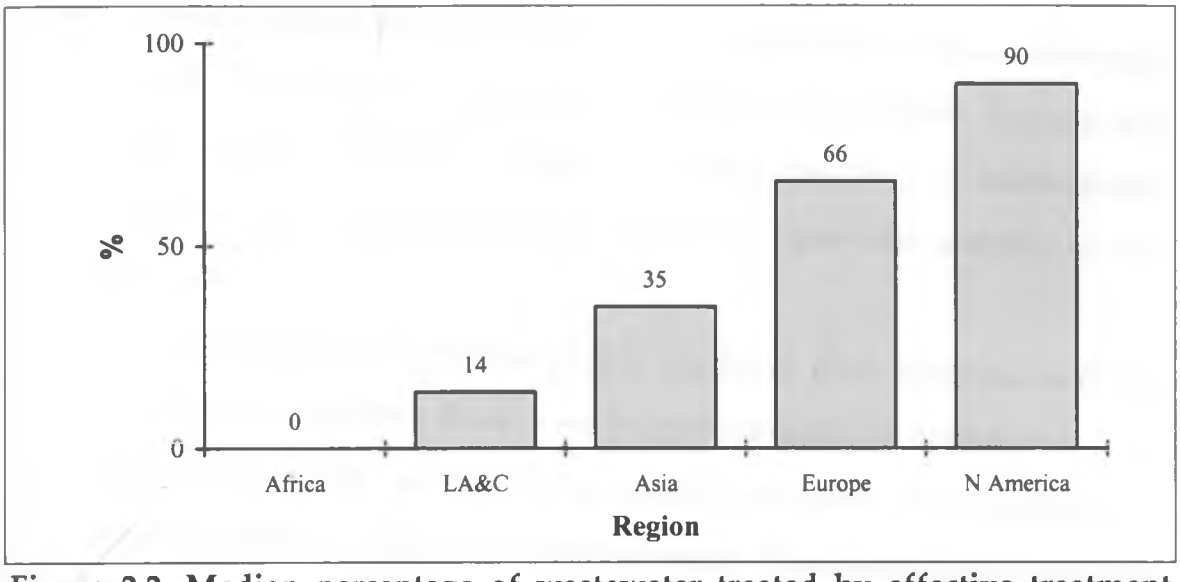

Figure 2.2: Median percentage of wastewater treated by effective treatment plant (WHO/UNICEF, 2000)

Untreated excreta and wastewaters contain organic matters, nutrients, trace elements, pathogenic bacteria, viruses, helminths, medical residues, hormones and hazardous substances. One gram of faeces contains 10,000,000 viruses, 1,000,000 bacteria, 1000 parasite cysts and 100 parasite eggs (GTZ, 2003). Untreated wastewater and excreta thus need to be well managed to prevent spread of diseases and various environmental problems.

Poor water supply and poor sanitation lead to high rates of water and sanitation related diseases such as ascariasis, cholera, diarrhoea, dracunculiasis (guinea worm disease), dysentery, eye infections, hookworm, scabies, schistosomiasis

(bilharzia) and trachoma. There are also various health hazards associated with these conditions. These include,

- Approximately 4 billion cases of diarrhoea each year cause 2.2 million deaths, mostly among children under the age of five.
- Intestinal worms infect about 10% of the population of the developing world. These can be controlled through better sanitation, hygiene and water supply. Intestinal parasitic infections can lead to malnutrition, anaemia and retarded growth, depending upon the severity of the infection.
- It is estimated that 6 million people are blind from trachoma and the population at risk from this disease is approximately 500 million.
- 200 million people in the world are infected with schistosomiasis, of whom 20 million suffer severe consequences. The disease is still found in 74 countries of the world (WHO/UNICEF, 2000)

In Africa, about 3 million people die annually as a result of water and sanitation related diseases (Lake and Souré, 1997). Furthermore, according to UNEP (2002), in 1998, 72% of all reported cholera cases in the world were found in Africa.

Environmental problems associated with untreated excreta and wastewater include the pollution of surface and ground water, which leads to problems such as the nutrient overload in water bodies and Harmful Algal Blooms (HABs). HABs occur when certain types of microscopic algae grow quickly in water and can deplete the oxygen and block the sunlight that other organisms need to live. Harmful marine algae such as those associated with red tides, release toxins into the oceans. HABs may thus harm the health of the environment, plants, or

animals. Reversing the damage is very expensive. In Malawi, for example, the total cost associated with water degradation was estimated at USD 2.1 million in 1994 (DREA Malawi, 1994). These costs included the need for water treatment, the development of human resources and reduced labour productivity (UNEP, 2002).

The search for appropriate solutions is important. With increasing population and the resultant groundwater pollution, conventional decentralized disposal systems may actually not be a viable alternative. If effective treatment were available at household level, prior to discharge into the environment or use, the health of downstream users would be better protected. In many densely populated areas, contamination of groundwater by nitrates for example exceeds the maximum level recommended by the WHO for drinking water and represents a serious danger to babies (GTZ, 2003). Shallow groundwater is still a major source for local and reliable water supply for many communities.

Pit latrines also have their own limitations. The pits are usually about two meters or more in depth. The design of the pit latrines means that they retain only the solids and infiltrate as much of the liquids into the subsoil as possible. The liquids contain all the soluble elements of the excreta and as well as viruses and pathogens. This type of sanitation if not well constructed can be considered as a way of polluting groundwater. Once pit latrines are full, they are abandoned, a banana tree is planted on them or they are emptied manually. Most people prefer to abandon them and dig new pit latrines because emptying them can be unpleasant. However digging new pit latrines can be expensive and is difficult in densely populated areas where plots are small. Digging pit latrines can also be hard in areas where there is flooding, the water table is high, the soils are sandy,

the ground is hard or the rock is fissured since this can cause pollution of the groundwater (Esrey *et. al.*, 2001). The other disadvantage of pit latrines is that they often smell and are areas for insects (such as flies and mosquitoes) and other disease vectors to breed, which leads to diseases such as filiariasis, yellow fever and malaria (Ibid, 2001). The VIP latrine was introduced to counteract problems of smell and insect breeding. However, construction of the VIP latrine is not practical where there is no space like in the informal settlements. In such cases where there is no space or there is a concern about the smell emanating from the pit latrine, unless the latrine is sited far from the house. This can be inconvenient especially for children, women and girls who have safety concerns.

In fact, the conventional wastewater systems are largely linear end-of-pipe systems (Figure 2.3) where drinking water is misused and small amounts of dangerous materials pollute huge amounts of water. This causes environmental damage and hygienic hazards (GTZ, 2003). Both this linearity and the resource intensity mean that these systems shift the burden onto another actor or on to the

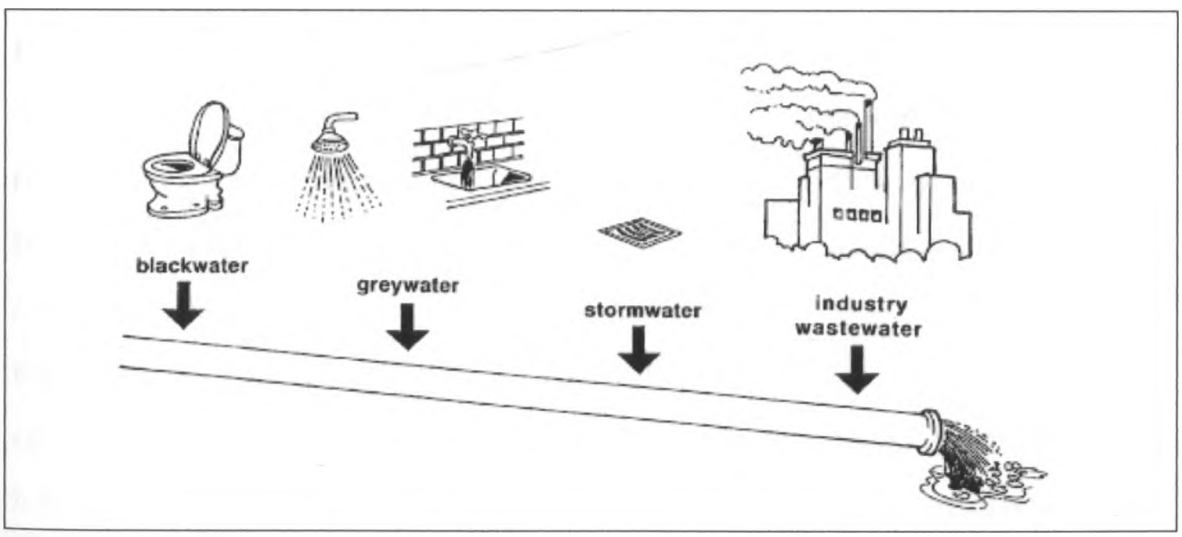

Figure 2.3: Linear flows in conventional sanitation systems (Winblad and Simpson-Hebert, 2004)

environment. This creates another problem rather than solving the problem in totality. In reality, more people need to gain access to effective and sustainable sanitation (WHO/UNICEF, 2004).

Unless sanitation systems are environmentally friendly, they will not be sustainable because the cost of repairing or preventing the environmental problems they cause will make them unaffordable. All the above problems have given a drive towards developing technological options that are ecologically sustainable and close the sanitation loop. The dissemination of Ecological Sanitation (ECOSAN) around the globe is at the forefront of achieving this objective (GTZ, 2003).

2.3. Ecological sanitation

ECOSAN takes environmental sanitation a step further. Environmental sanitation means preventing and controlling diseases by keeping the environment clean, safe and preventing pollution. It includes wastewater treatment, wastewater disposal, and other disease prevention activities. ECOSAN is a method of excreta management that includes environmental concerns, conserves and protects freshwater, promotes healthy living, and recycles nutrients from human excreta. ECOSAN does this by separating and treating faeces, urine and greywater and focuses on an on-site approach to sanitation. No water is used for flushing and natural processes are used to treat the wastewater and excreta (GTZ, 2003). ECOSAN thus appreciates the fact that clean water is a scarce commodity and good quality drinking water can no longer be used for transporting human excreta from residential areas only to end up polluting the same water bodies from which we get our drinking water.

ECOSAN ranges from simply planting a tree on a disused toilet pit to composting human excreta and reusing the products in agriculture, thereby "closing the loop" (Morgan, 1999, 2000, 2001). ECOSAN can be applied both in the third world countries and in the developed countries (Esrey *et. al.*, 2001 and Winblad and Simpson-Hebert, 2004).

There are two types of ECOSAN toilets that are based on two pathogen destruction processes: composting or dehydration.

- The *decomposition process* involves a biological process in which bacteria and worms break down the organic material (urine and faeces) under controlled conditions (temperature, moisture and airflow) to make humus. If this process is properly controlled, the humus is free of human pathogens and is an excellent soil conditioner. However, the decomposition process is harder to manage and requires more time to kill pathogens; therefore, dehydration is preferred (Winblad and Simpson-Hebert, 2004).
- In the *dehydration process*, the toilets are built above the ground in such a way that the excreta (faeces and urine) are separated at source – it is thus also referred to as the urine diversion toilet. They are then processed on site in the toilets to destroy the pathogenic organisms. Processing of urine takes place by storing to allow the pathogens to die. Processing of faeces takes place by addition of ash and by drying them using the sun so as to kill pathogens. The urine is used as a fertilizer since it contains most of the nutrients (Nitrogen, Potassium and Phosphorus) and the pathogens risks are relatively lower. The dried faeces can be used as soil conditioner. This study focused on toilets using the dehydration process.

Composting / Non-urine diversion toilets: In Africa, the *Arborloo* and *Fossa Alterna* are composting toilets and are also referred to as non-urine diversion toilets (Jackson, 2004; Morgan, 1999, 2000, 2001; Esrey *et. al.*, 2001). The *Arborloo* consists of a portable super-structure that covers a shallow pit. There is no urine diversion. When the pit is full, which can be after one year of use, the superstructure is moved and a tree is planted in the filled pit. Another pit is dug and used until it is full and the cycle continues. The *Fossa Alterna* consists of two permanent pits and a portable superstructure so that when one pit is full, the superstructure is moved on top of the other pit. The digested contents of the pit that is not in use can be safely emptied after one year (Morgan, 1999, 2000, 2001).

Dehydration or Urine diversion toilets: An example of a dehydration toilet in Africa is the *Skyloo* (Jackson, 2004; Morgan, 1999, 2000, 2001; Esrey et. al., 2001). It consists of a raised toilet with a pedestal for separate collection of urine and faeces.

ECOSAN is not new and in some cultures, for example in China, ECOSAN systems have been in use for thousands of years. Globally most of the ECOSAN pilot projects that have been carried out have focused on countries in Europe (Germany, Sweden and Austria) and Asia (China). Over the past 15 years, some projects have also been started in Africa (South Africa, Zimbabwe, Uganda, Ethiopia, Tanzania, Mozambique and Kenya). In Kenya, the ECOSAN technology was first introduced in the late nineties (Jackson, 2004). Though it has not been widely tested, ECOSAN projects can be found in Wajir, Kisumu, Kibera and Mombasa. The Wajir ECOSAN Project is an ongoing pilot project. About 60 ECOSAN toilets have been constructed in Wajir, most of which are at household level, only 2 are at institutional level. This study is part of a wider project that has

been funded by the Water Trust Fund, the financing arm of the Ministry of Water and Irrigation (MWI).

2.4. Adoption of ecological sanitation in Africa

One of the largest ECOSAN projects in Africa has been set up in South Africa in the Northern Cape Province. This was done to replace 25,000 bucket toilets in the poor and remote small towns of the arid province of South Africa. A study that was conducted by Mvula Trust showed that communities preferred the ECOSAN toilets because of various factors, which included privacy and convenience; little labour, ease to construct and maintain; provision of manure and health reasons. (Ibid, 2004). A report on the acceptance of ECOSAN suggests that the large-scale success of the toilet has been achieved by marketing it around social factors rather than the benefits of excreta reuse. In another study, it is documented how one project in a South African school failed despite careful preparation and intensive training. The failure was because of the fact that the teachers were not committed to ensuring that the pupils used the facilities well. According to Austin (2003), the project was fully subsidised and therefore the aspect of ownership could have been fully compromised. In Zimbabwe, about 1800 ECOSAN toilets (38 *Arborloos*, 27 Composting, 295 *Skyloos*, and 1487 *Fossa Alternas*) have been constructed by the Mvuramanzi Trust (Jackson, 2004). In a study carried out in a peri-urban informal settlement, ECOSAN was introduced mainly for technological convenience. The peri-urban settlements in Zimbabwe did not have any other form of sanitation whatsoever or a water supply system to facilitate water borne sewerage (Guzha, 2001).

Another ECOSAN project is found in Niassa Province, Mozambique (sparsely populated and with poor infrastructure, a weak cash-based economy and

political and social isolation). In this area, ECOSAN has been introduced with considerable success. Part of the ECOSAN project has been in the town of Lichinga in the north western part of Niassa Province. The town has approximately 85,000 inhabitants. A piped water supply system serves a small number of families in part of the town and water- borne sanitation, where it exists, is limited to septic tanks. The Municipality does not have the capacity to desludge septic tanks and private sector desludging capacity is hard to find (Breslin, 2003). Lichinga has many of the characteristics that are common to small towns throughout the developing world. Infrastructure is poor and unable to meet the needs of the local residents. Families live close to one another, and water and sanitation problems are acute. Economies are weak and dependent on agriculture with government agenda heavily relying on donors. In this situation, flush toilets make little sense. When people in Lichinga were given a range of options - VIP latrines and ECOSAN toilets - people consistently preferred ECOSAN toilets (Ibid, 2003). The toilets built in Lichinga and the surrounding rural areas are *Fossa Alterna* and *Arborloos*. This Mozambique example shows that it is possible to provide affordable ECOSAN toilets even to a population that is amongst the poorest and that these toilets are accepted and used correctly.

In West Africa, ECOSAN has been introduced in Koulikoro Mali. Despite the community being a Muslim community, various solutions have been adapted to meet the needs of the community without them having to make essential changes in their culture. In this community, there is separate collection of faeces and urine, which are then sanitized and reused in agriculture. According to Bark *et. al.* (2003), Grey water is treated through gravel filters then used to water gardens and plants.

In the Eastern Africa region, Uganda has made the biggest advances in ECOSAN. By May 2003, about 550 ECOSAN facilities had been introduced in south western Uganda (Kisoro, Kabale, Bushenyi), of these 437 are household, 36 are institutional and 33 are public facilities. The *Skyloo* is the most widely promoted. Up to 52 privately financed ECOSAN toilets have been constructed in south western Uganda. In a study by Jackson (2004), some households indicated that they built the ECOSAN toilets primarily as a sanitation facility and not for supporting agriculture. However, other households that had built the ECOSAN toilets were using the products in agriculture. A study showed that people chose ECOSAN because it is hygienic; requires minimal maintenance; is convenient (in or near the house); cheap in the long run; there are no water bills and there is no need for replacement (Nalubega, 2004).

In Tanzania, the biggest project consists of 275 urine diversion toilets in an unplanned settlement, Majumbasita, which is in peri-urban Dar es Salaam. The ECOSAN pilot project in Majumbasita, Tanzania constructed *Skyloos* because this area has a high water table. The project initially provided subsidies for construction of about 75 toilets, but when it stopped providing them in 2002, trained local artisans continued to promote ECOSAN and have built an additional 200 ECOSAN toilets directly contracted by households (Chaggu and John, 2002). The substructures were built with concrete blocks while the superstructures were built with a variety of local materials according to choice. Additionally, local artisans offer toilet-emptying services for a small fee. In this area, the reuse of excreta is also limited. Most people welcomed ECOSAN because it was promoted as permanent, simple, durable, environmentally friendly and hygienically safe relative to the traditional pit latrine (Jackson, 2004).

ECOSAN technology was introduced in Kenya in the late nineties (Ibid, 2004). There are now a number of projects in the country in areas, which include Mombasa, Kisumu, Makueni, Kibera and Wajir (ITDG, 2005; Jackson, 2004). The primary push for ECOSAN in Kenya comes from international organisations, international development donors and NGOs. The actual implementation work on the ground is mainly due to the work from NGOs such as Regional Land Management Unit (RELMA), Osienala (Friends of Lake Victoria), CARE International, Merlin, the Intermediate Technology Development Group (ITDG), the Kenya Water for Health Organisations (KWAHO) and ALDEF. However, the extent of implementation of ECOSAN is still very limited.

In Kisumu, ECOSAN pilot projects have been started to counteract the high pollution of the lake due to lack of proper sanitation. The water table is high in this area and communities rely on shallow water. The Kisumu ECOSAN toilets have been constructed in schools and in public places especially at the fish landing places near the lake. A study in Kusa, Nyando district, showed that the adoption of the *Skyloo* has been difficult due to cultural issues associated with the handling of faeces and urine diversion. However, the *Fossa Alterna* has been widely accepted in and around Kisumu and 45 have been constructed in and around schools (Jackson, 2004).

The Makueni ECOSAN project is an example of a project in a semi arid area that is rocky. In this area, 57 *Arborloo* toilets were constructed in the year 2003 (Jackson, 2004). In Kibera, the biggest informal settlement in Africa, the NGO ITDG, put up a pilot ECOSAN project in one of the villages. The reason for the ECOSAN project in Kibera was to reverse the acute problems associated with the

pollution of Nairobi River arising from inadequate sanitation facilities. The ITDG ECOSAN project in Kibera consists of an ablution blocks system with three different blocks. One block consists of a water kiosk; children's, ladies and gent's toilets; and a community resource centre. Another block consists of showers, bathrooms, and an area for washing. The third block consists of a bio-digester that recycles waste to produce energy. The biogas is used to heat water for bathing. Residents are charged for use of these facilities and the funds help in paying the caretakers and maintaining the facilities (ITDG, 2005).

With the Wajir Pilot ECOSAN Project, it is anticipated that by the end of 2 years (2004 to 2006), 100 ECOSAN toilets will have been constructed (ALDEF, 2005). So far, most of the toilets are at household level. Apart from this project, preliminary work on ECOSAN and environmental sanitation had also been carried out by other NGOs. Their work in Wajir initially involved working with the Wajir County Council in optimising the collection of buckets used in bucket toilets. In late 2002, an international NGO and the Ministry of Health were actually involved in introducing ECOSAN to Wajir when they piloted 9 plastic ECOSAN Kentainer toilets at institutional and household level (Merlin, 2003). However, most of those toilets have since been abandoned. There were various reasons for this. Some of the community members noted that the toilets were not only small but they were also made from plastic materials; this made them very hot and uncomfortable inside. The buckets that were used inside the toilets were also very small and filled up very fact; this was not practical for the families that were large. Other community members also felt that they were too expensive and were not locally available but had to be brought in all the way from Nairobi. Additionally there had also been limited follow up to determine if the toilets

were still being used and the perceptions and attitudes of the community members towards them.

2.5. Obstacles to improving sanitation coverage

There are many obstacles to improving sanitation coverage, which include neglect of consumer preferences in sanitation, inadequate or poorly used resources, increased population growth, ineffective promotion or low public awareness, lack of political will, weak institutional frameworks to support infrastructural development, poor policies, neglect of the importance of public health, cultural beliefs and technical inefficiency of the current solutions. The obstacles to progress are many and require different approaches to mobilize all the resources within a society. One concern is that sanitation is not normally considered a priority in development projects (WHO/UNICEF, 2000). A comparison of the differences in investment in water supply and sanitation for various regions in the world shows that investment in sanitation is much lower than in water supply (Figure 2.4).

In Kenya, the internal development budget for water and sanitation for the financial year 2003 and 2004 was estimated at Kshs. 2.1 billion. Only Kshs. 54 million out of Kshs. 2.1 billion was earmarked for sewerage development, which constitutes only 2.6% of the total internal investment for water and sanitation in Kenya. This has been the situation over many years, hence inadequate funding for rehabilitation, upgrading and expansion of sewerage facilities. The existing sewerage collection, treatment and disposal systems were built 20 to 40 years ago and they need to be maintained, this has not been the case.

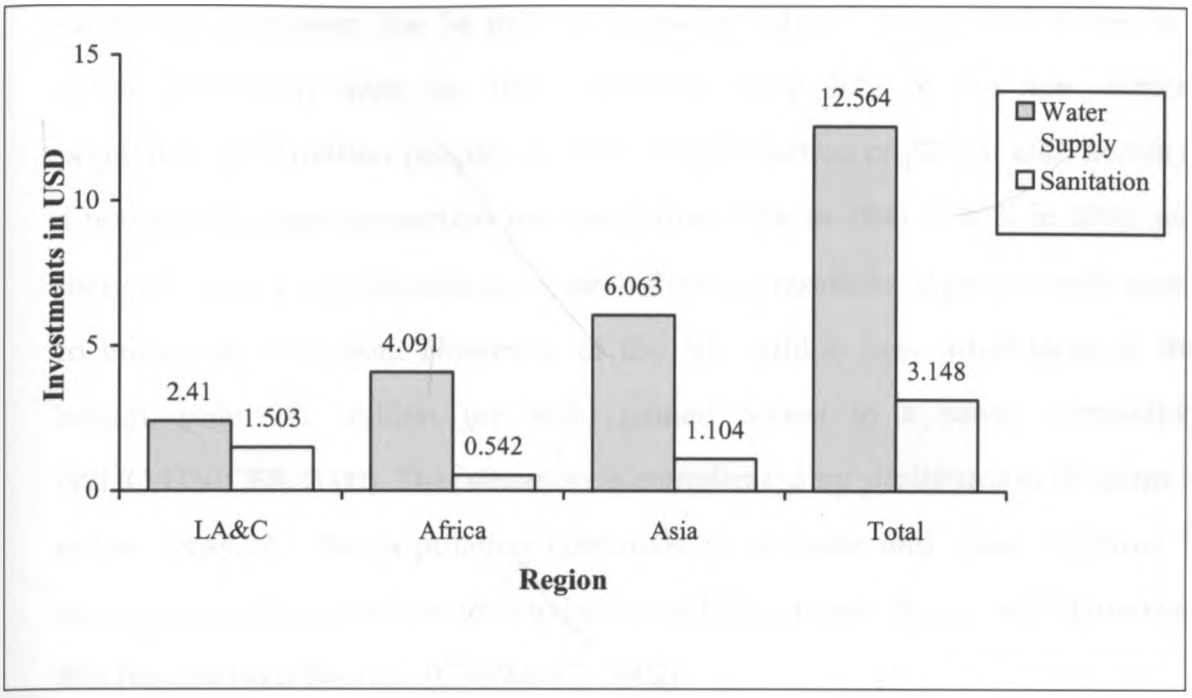

Figure 2.4: Differences in investment in water supply and sanitation (WHO/UNICEF, 2000)

A report published by GoK-MoPND/UNDP (2005), further confirms that the allocations for the government sewerage have been declining yet the cost of water supply and sanitation are high. In Nigeria, a recent study estimates the future cost of water supply and environmental sanitation to be US$9.12 billion during 2001–10 (Adedipe, *et. al.*, 2000). Most developing countries cannot afford to make these high investments and the urgent need is not for the technologies that are found in the developed countries.

Another area of concern is the fast growing population especially in urban areas. Statistics show that the current urban population of 2.8 billion will increase to 3.8 billion in 2015 and to 4.5 billion in 2025 (WHO/UNICEF, 2000). In Africa, the proportion of people who have access to a flush toilet connected to a sewer system increased slightly from 11% to 13%. However, there has been no progress in terms of the percentage of the population with access to any type of improved

sanitation. Moreover, the 34 million people in Africa who gained access to a sewer connection over the 1990s represent only 20% of the new African population (169 million people). In Asia, the proportion of people with access to a household sewer connection increased from 13% in 1990 to 18% in 2000, and there has been a considerable increase in the total numbers of people with access to improved sanitation. However, of the 502 million new inhabitants of this region, only 241 million (or 48%) gained access to a sewer connection. (WHO/UNICEF, 2000). This situation is complicated by proliferation of slums in urban areas. As the population continues to increase and cities continue to expand, sanitation services need to be expanded to match this growth. However, this has not been the case (CBS/MoFP, 2002).

A big part of the problem lies in the lack of consideration of what the people want and are willing to use and maintain, and which sanitation technologies are locally appropriate (Cotton and Saywell, 1998b; Obika, 2003; Cairncross, 2004; Jackson, 2004). According to Cairncross (2004), the last few decades have seen hundreds of thousands of toilets built in the developing world with considerable subsidy by governments and NGOs and the impacts of such programs has been very limited. One of the reasons for this low impact is low demand towards improved sanitation (Jenkins, 2004). In other words, to identify a demand for improved sanitation is more positive than to initiate a supply of technology that is deemed to be good. To be able to identify the most important factors that contribute to demand, it is important know how consumers make sanitation choices (Cairncross, 2004). This knowledge is widely lacking because there have been few studies on why users would choose an ECOSAN toilet especially in the Kenyan context, and more specifically in Wajir, which is a pastoralist community with Islam as the predominant religion. The few studies that are available are

limited to surveys on the health and agricultural reuse aspects of the ECOSAN toilets. This study therefore focused on Wajir and assessed the factors that have led to household choice and adoption of ECOSAN in Wajir. These choice factors can thus be used to increase the demand for sanitation.

CHAPTER 3

STUDY AREA

3.0. Introduction

Wajir district is located in the North eastern part of Kenya. It is the largest district in North-eastern Province (Figure 3.1). The district covers an area of 56,500 sq. km and bordering it are: the Republic of Ethiopia to the north, Mandera District to the northeast, the Republic of Somali to the east, Garissa District to the south, Isiolo District to the southwest Marsabit District to the west and Moyale District to the northwest. The district is divided into 13 administrative divisions, which include Bute, Gurar, Buna, Tarbaj, Elda, Griftu, Kotulo, Wajir-Bor, Central, Hadado, Diff, Habaswein and Sebule (Figure 3.2). It is divided further into 74 locations and 102 sub-locations. Wajir County Council, which has 75 wards, is the only local authority in the district. All the wards coincide with locational boundaries except one, which coincides with sub-location boundary. There are four constituencies in the district: Wajir North, Wajir West, Wajir South and Wajir East (GoK, 2002b).

3.1. Physical and climatic features

Wajir District is a featureless plain, which is prone to flooding during the rainy seasons. The northern side is characterised by scattered hills. The district is mostly covered with young sedimentary rocks with loamy soils towards the north at the footsteps of Ethiopian Highlands. The soils are mainly sandy. It lies within the Sahelian climatic regions with long dry spells and a short rainy season. The temperatures range between 30 - 42 degrees centigrade (maximum)

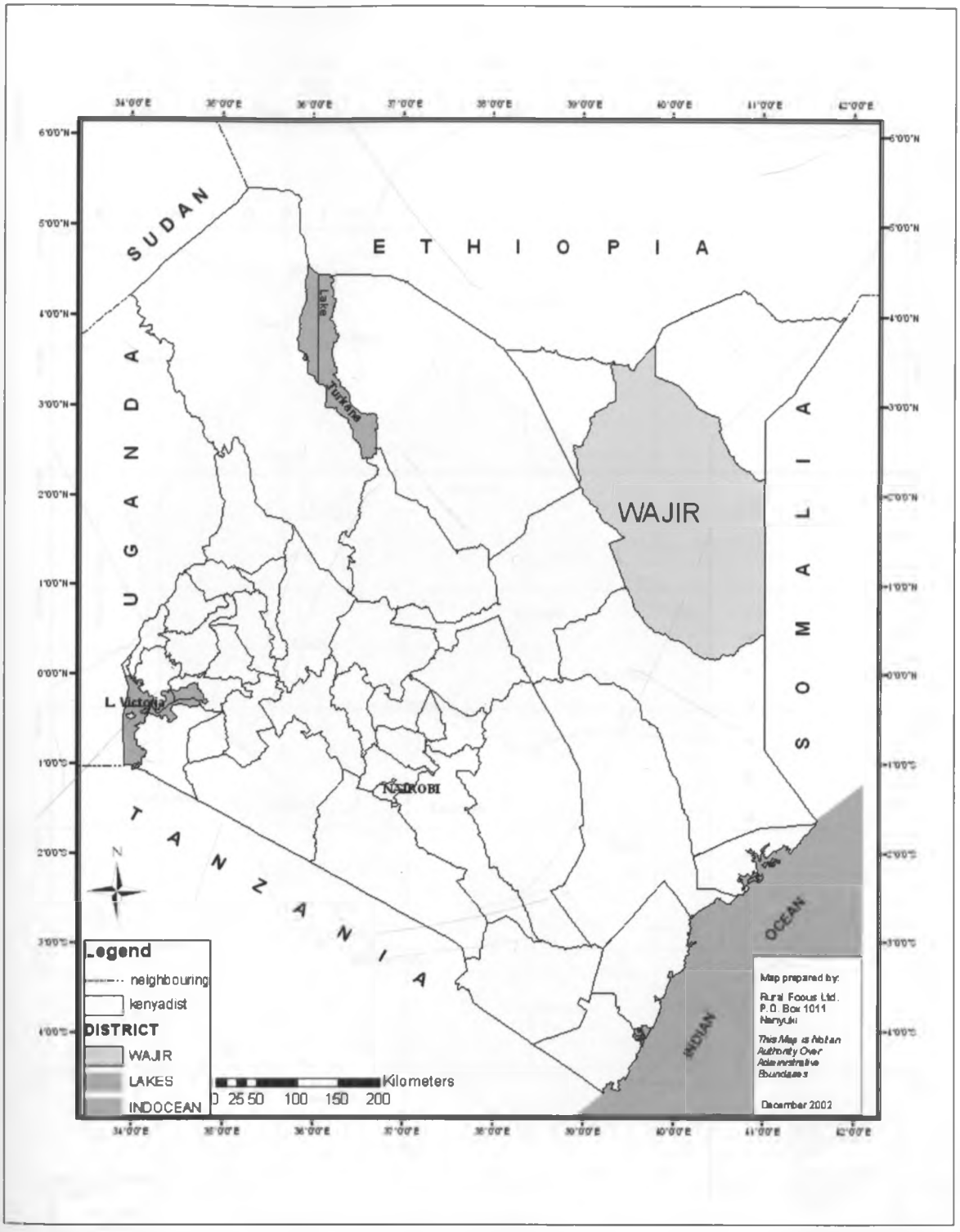

Figure 3.1: Map showing the Location of Wajir District in Kenya (Rural Focus Ltd., Nanyuki)

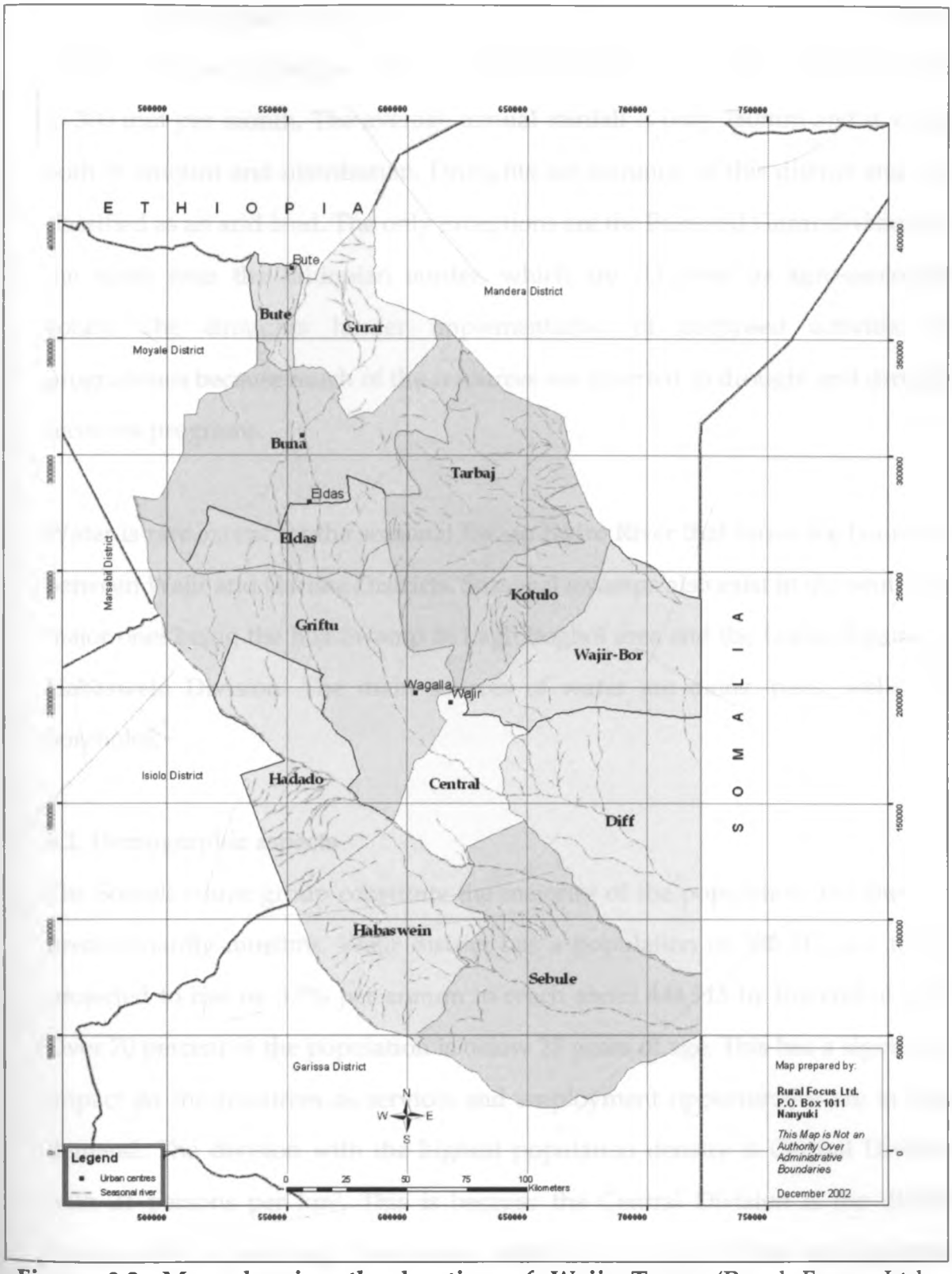

Figure 3.2: Map showing the location of Wajir Town (Rural Focus Ltd., Nanyuki)

and 18 - 24 degrees centigrade (minimum). These high temperatures can be partly attributed to the low altitudes. Evaporation is high and averages 200mm to 300 mm per month. The average annual rainfall is only 280mm and it varies both in amount and distribution. Droughts are common in this district and it is classified as an arid land. The only exceptions are the Bute and Gurar divisions in the north near the Ethiopian border, which are classified as agro-ecological zones. The droughts hinder implementation of proposed activities or programmes because much of the resources are diverted to drought and drought recovery programs.

Water is rare except for the seasonal Ewaso Nyiro River that forms the boundary between Wajir and Garissa Districts. Seasonal swamps also exist in the south, the major ones being the Boji Swamp in Lagh Boghol area and the Lorian Swamp in Habaswein Division. The main sources of water are dams, pans, wells and boreholes.

3.2. Demographic aspects

The Somali ethnic group constitute the majority of the population and they are predominantly muslims. Wajir district has a population of 356,340 and this is projected to rise by 3.7% per annum to reach about 444,915 by the end of 2008. Over 70 percent of the population is below 25 years of age. This has a significant impact on the resources as services and employment opportunities are in high demand. The division with the highest population density is Central Division with 21 persons per km^2. This is because the Central Division is the district headquarters where large businesses, employment opportunities and informal sector income generating activities are concentrated (GoK, 2002b).Most of the settlements are found in the divisional headquarters, which serve as market

centres and watering points. Over 70% of the population in Wajir District are pastoralists and their homesteads are found in the grazing reserves, which sometimes also act as administrative locations and sub locations. Pockets of poor people are found in all the locations with higher concentrations in the peri urban areas. These people are poor due to loss of livestock during droughts, famine, crop failure and cattle rustling. Poverty is high in Wajir District and it is estimated that about 65% of the population live below the poverty line. Wajir District is underdeveloped and lags behind in social infrastructure (health, education, water).

Wajir Township is the administrative headquarters of Wajir District. It has a population of about 51,199 people. The town covers an area of about 28.3 km^2 and has an average altitude of 150 m above sea level. Wajir Township is located in Central Division and comprises five of the six Locations in Central Division. The distribution of Locations and Sub locations in Wajir Township are as follows (Table 3.1):

Table 3.1: Location and Sub locations of Wajir Township

Location	**Sub-location**	**Population**
Township	Township	10,480
Jogbar	Makoror (inhabited by displaced people)	17,676
Wagberi	Wagberi	11,613
Barwaqo	Barwaqo	5,573
Hodhan	Hodhan	5,857
Total		**51,199**

(MWRMD, 2003; Merlin, 2003)

3.3. Ecological and land use aspects

Wajir District is currently under threat of desertification. The high dependence on fuel wood for almost all energy requirements has resulted in clearing of woody plants around settlement areas; this has exacerbated the already fragile ecosystem. Additionally, uncontrolled permanent settlements and indiscriminate grazing have also contributed to the worsening trend. Pastoralists feel that the land is free for all. Most land is trust land though within Wajir Township, the land is owned by people. The high risk of environmental degradation underscores the need to ensure that livestock and crop production are practised in a sustainable manner. The district is also endowed with a lot of wildlife especially gazelles.

3.4. Water sources

Wajir overlies an aquifer and despite its aridity, it has a high water table and an abundance of water. One aquifer is shallow and is encountered in most of the shallow wells. It forms the main source of water supply for livestock and domestic purposes. The second aquifer is at a depth of 30 m and is pumped into the boreholes (MWRMD, 2003). The residents of Wajir rely on shallow wells for their source of water. There are about 5000 shallow wells in Wajir, but only about 100 wells are protected with the rest exposed to contamination (Ibid, 2003). Most of Wajir wells have saline water, which is hard, highly mineralised and rich in nitrates due to the effects of geology and subsurface seepage (MWRMD, 2003; Merlin, 2003). Biological studies from local wells by KEMRI also indicated that the water is highly contaminated and has high levels of *E. coli*. Out of 164 wells sampled, 10 tested nil for *E.coli*, 24 wells had acceptable *E. coli* levels (<10/100 mls of water), while 117 (71.4%) were highly contaminated (>10/100 mls of water) of which 66% had unacceptably high *E. coli* counts (Said, 2003). Additionally, there

are no water treatment plants to disinfect the water for human consumption. This has led to incidents of water borne diseases like cholera and typhoid. This is therefore a public health and environmental concern.

3.5. Sanitation

There are different sanitation methods used within Wajir District (Table 3.2).

Table 3.2: Different methods of sanitation in Wajir District

Sanitation method	Flush toilet	Septic Tank	Pit latrine	Bush/No facilities	Bucket Latrine	Other
Percent of population (%)	0.4	0.2	7.3	84.7	6.8	0.6

(CBS/ MoFP, 2002)

Within Wajir town, the high water table and sandy soils preclude the use of conventional forms of sanitation like the pit latrine and the flush toilet. According to statistics, in Wajir Town the majority of the people (about 75%) in the *bullas* (small communities) defecate in the open (cat style). About 5% of the community members, who are mostly government employees, use the septic tanks. The remaining 20% of the population (12,000 people) use bucket toilets while a very small number of people use vault latrines (MWRMD, 2003).

The colonial government initially started the bucket toilet system as a temporary measure for excreta disposal. The population of Wajir was low during the colonial era. However, over the past years the population both in the urban and peri urban areas has greatly increased. This has been brought about by people leaving their nomadic lifestyles to settle in the *bullas* (GoK, 2002b; MWRMD, 2003). According to Merlin (2003), out of 2310 toilets in Central Division, 2155

(93.3%) are bucket toilets. The WCC is responsible for management of the bucket toilets and has employed 34 "night soil men" to empty the bucket toilets. The "night soil men" collect about 1184 buckets per day using two tractors and two night soil tanks (Ibid, 2003). Due to religious factors, water is used for anal cleansing and thus the amount of night soil is high. A study published by the MWRMD (2003), shows that 96.254 tonnes of faecal matter is produced annually in Wajir Township and the bucket toilets are estimated to collect only 1.93 tonnes of this matter.

With the capacity and resource constraints that the Council currently operates under, it is unlikely that they can be able to cater for the additional requirements of the present population of Wajir, which has an annual growth rate projected at 3.7% (Ibid, 2003). The "night soil men" go unpaid for long periods and this means that the buckets are not collected for weeks. They overflow, are unsightly and produce unpleasant odours. Illegal "night soil men" sometimes collect the buckets and empty them anywhere, thus risking pollution of the shallow aquifer with pathogens such as *E.coli* and increasing the risk of diseases.

Under normal circumstances, the waste from the bucket toilets is disposed off about 6 km from Wajir town in an unlined dumping site. There is a high degree of spillage during removal and transport. The unlined dumping site is not safe either and this increases the risk of ground water pollution. The pollution of groundwater is an environmental concern. This alone can justify the need for proper wastewater management disposal practices. Without the necessary resources such as water, money and institutional capacity, flush toilets, sewers and conventional wastewater treatment plants cannot solve the immediate problems related to sanitation in Wajir. For the waterborne systems, a huge

financial investment is required and water is necessary to transport the wastes as is evident from the feasibility studies that have been carried out by the MWI (Ibid, 2003). Additionally, a large number of poor people still need to be served. Other options need to be considered. Further, the smaller communities, establishments and industries need affordable alternatives that are sustainable and easy to maintain.

According to Fankey (2003), Wajir is the only town in Kenya that is still using the bucket toilets on a large scale. It is therefore, not surprising to note that Wajir District is the most underserved district in Kenya and only a minority of the population is able to access improved sanitation (GoK-MoPND/UNDP, 2005). One Wajir resident described the situation as "dehumanising" and felt that the bucket toilets are old-fashioned and obsolete (Merlin, 2003).

CHAPTER 4

METHODOLOGY

This section describes in detail the methods that were used in carrying out the study. It describes the sampling methods, data collection methods and instruments and the data processing and analysis.

4.1. Sample design

The sampled population consisted of 60 households within Wajir Township, which had an ECOSAN toilet and were using it. The sampling unit was taken as an individual household. The selected respondents from the households were adult persons who were actually using the ECOSAN toilets and had been trained on the use of the toilet, and were present during its construction. This helped us capitalize on genuine experiences.

The data collection approaches adopted probability sampling. The sample size was determined using the following formula:

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

Where:

- n - The desired sample size
- Z - The standard normal deviate at the required confidence level
- p - The proportion of the target population that was estimated to have the characteristics being measured
- q - 1-p
- d - The level of statistical significance (α)

The value of Z was found in the statistical tables. It was assumed that the estimated proportion of the attributes that were present in the population was 80% (as the population is homogenous), p was taken as 0.8 and q as 0.2 and at 95% confidence or risk level and ± 5% level of precision, the sample size was calculated as follows:

$$n = \frac{(1.96)^2 (0.8) (0.2)}{(0.05)^2} = 246 \text{ sampling units}$$

Because the population was small, the sample size was reduced slightly because a given sample provides more information for a small population then for a large population. It was adjusted using the equation below:

$$n_f = \frac{n}{1+n/N}$$

Where:

- n_f - The desired sample size, when the population is less than 10,000
- n - The desired sample size, when the population is more than 10,000
- N - The estimate of the population size

$$n_f = \frac{246}{1+ (246/60)}$$

This worked out to 48.2 sampling units, 48 sampling units were therefore taken for the study.

Simple random sampling was then used to select a sample, whereby a number was assigned to all the 60 households on a list. The numbers were then placed in

a container and numbers picked at random. The households corresponding to the 48 numbers that were picked were included in the sample.

4.2. Data collection

Primary data collection was done using various tools. These included household interviews using a structured questionnaire (Appendix 2), focus group discussion (FGDs) and interviews with key informants. The questionnaires were administered to all 48 households and the response rate was 100%. The FGDs included 1 mixed gender group and 2 women groups of about 25 people each. Other informants included the government officials, the NGO and local leaders. Data on the conditions of the toilets was collected through observations and by photography.

This study also built on the data collected during the regular monitoring and evaluation of the ECOSAN toilets in Wajir. This included the interviews that were carried out on the various households that were using the ECOSAN toilets, photographs that were taken during the various stages of construction and any other observations.

4.3. Data processing and analysis

The raw data that was obtained from the field was entered into a Microsoft Excel spreadsheet. The data was then exported to Statistical Package for Social Sciences (SPSS) software for processing and analysis. This data was then summarized using descriptive and inferential statistics.

The *independent variables* that were considered included:

- Gender

- Age groups
- Personal/Individual, Technical, Management and Financial factors of choice

The *dependent variables* included:

- Choice of ECOSAN by households was studied by considering: the preference for ECOSAN toilets, the use of ECOSAN toilets by household members and the use of the previous mode of sanitation by household members

The statistical test that was used was the Kruskal Wallis, which is a non-parametric alternative to the Analysis of Variance – ANOVA. This test was used because the data was mainly ordinal and categorical data. It was used to test whether 2 or more data sets from different groups of individuals differed from each other significantly. For example:

- The differences in use of ECOSAN among the different age groups
- The differences in use of ECOSAN for the different factors of choice
- The difference in choice factors for males and females

The test was carried out as follows:

The measurement observations were converted to their ranks in the overall data set. Tied observations were given average ranks (thus if there were four identical values occupying the fifth, sixth, seventh and eighth smallest places, all would get a rank of 6.5). The sum of the ranks was calculated, and then a test statistic (H) was calculated.

H is given by the following formula:

$$H = \frac{12}{N(N+1)} \sum \frac{R^2}{n_c} - 3(N+1)$$

Where:

R - The rank for each group (for example age group, gender or choice factors)

n - The number of observations in each group

N - The total sample size

H has a known probability associated with its values. It was therefore compared with a critical value from the Kruskal Wallis tables, considering the degrees of freedom (which is the number of groups minus 1) and the level of statistical significance of the test (which is 0.05). The null hypothesis was not rejected when the calculated H was greater than the critical H, which meant that there was not enough confidence to reject it. The null hypothesis was rejected when the calculated H was less than the critical H.

SPSS gave the value of the chi square statistic together with its degrees of freedom and the probability value of the test. The null hypothesis was rejected when the probability value was below the level of statistical significance of 0.05 and the null hypothesis was not rejected when the probability value was above 0.05.

CHAPTER FIVE

RESULTS AND DISCUSSION

This chapter presents results of the study based on data that was collected in the field to assess the factors that have led to the household choice and adoption of ECOSAN in Wajir. The analytical framework used is descriptive and quantitative and is based on statistical significance of study results. The variables that were considered included factors that have led to choice of ECOSAN by households, preference of ECOSAN over other sanitation modes, usability of ECOSAN toilets by households and expected problems in the use and adoption of ECOSAN toilets by households.

5.1. Descriptive statistics

5.1.1. Use of the ECOSAN toilet by households

All of the 48 households interviewed had an ECOSAN toilet within their compounds and were using it at the time of the interview. The construction of the ECOSAN toilets under study had started in 2004. At the time of the study, 37% of the respondents had used the toilet for over 1 year while 63% had used the toilet for less than one year (Figure 5.1).

The ECOSAN toilet adoption had been slow during the first year but had doubled during the first part of the second year of project implementation. The first year had mainly involved education and awareness raising campaigns with limited toilet construction focusing mainly on demonstration toilets. The toilets that had been used for over 15 months were the demonstration units that had

been constructed by the early adopters. The construction of toilets had geared up in the second year.

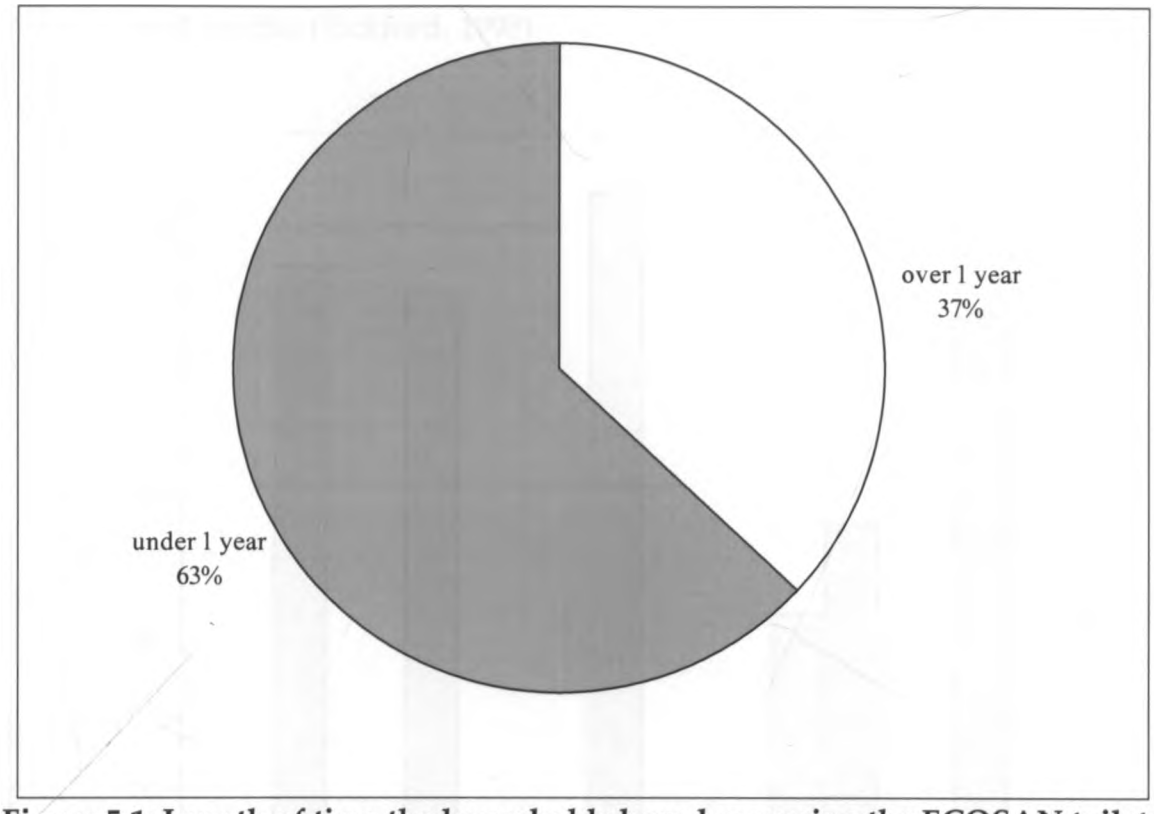

Figure 5.1: Length of time the households have been using the ECOSAN toilets

Not all the household members (that is adults, children, elderly and disabled) were using the ECOSAN toilet at the time of this study (Figure 5.2). In 9 out of ten of the households with children under 3 years old, the toilets were not used by children while in 1 out of 10 of the households with children over 3 years old (but below 18 years of age); the toilets were not used by these children. One of the reasons for this may have been that ECOSAN was viewed by many as something modern and prestigious therefore families wanted to show off their toilets, and wanted them to be clean. If children were going to use the ECOSAN toilet, they would end up spoiling it by urinating or pouring water in the faeces chamber, or playing with the ashes. Alternatively, children under 3 years in the

community generally do not use toilets especially in the communities that live outside the town. In a similar study in Yemen where the children do not use toilets at all, fear of the dark inside the toilet and fear of falling into the pit were reasons cited for this (Pickford, 1995).

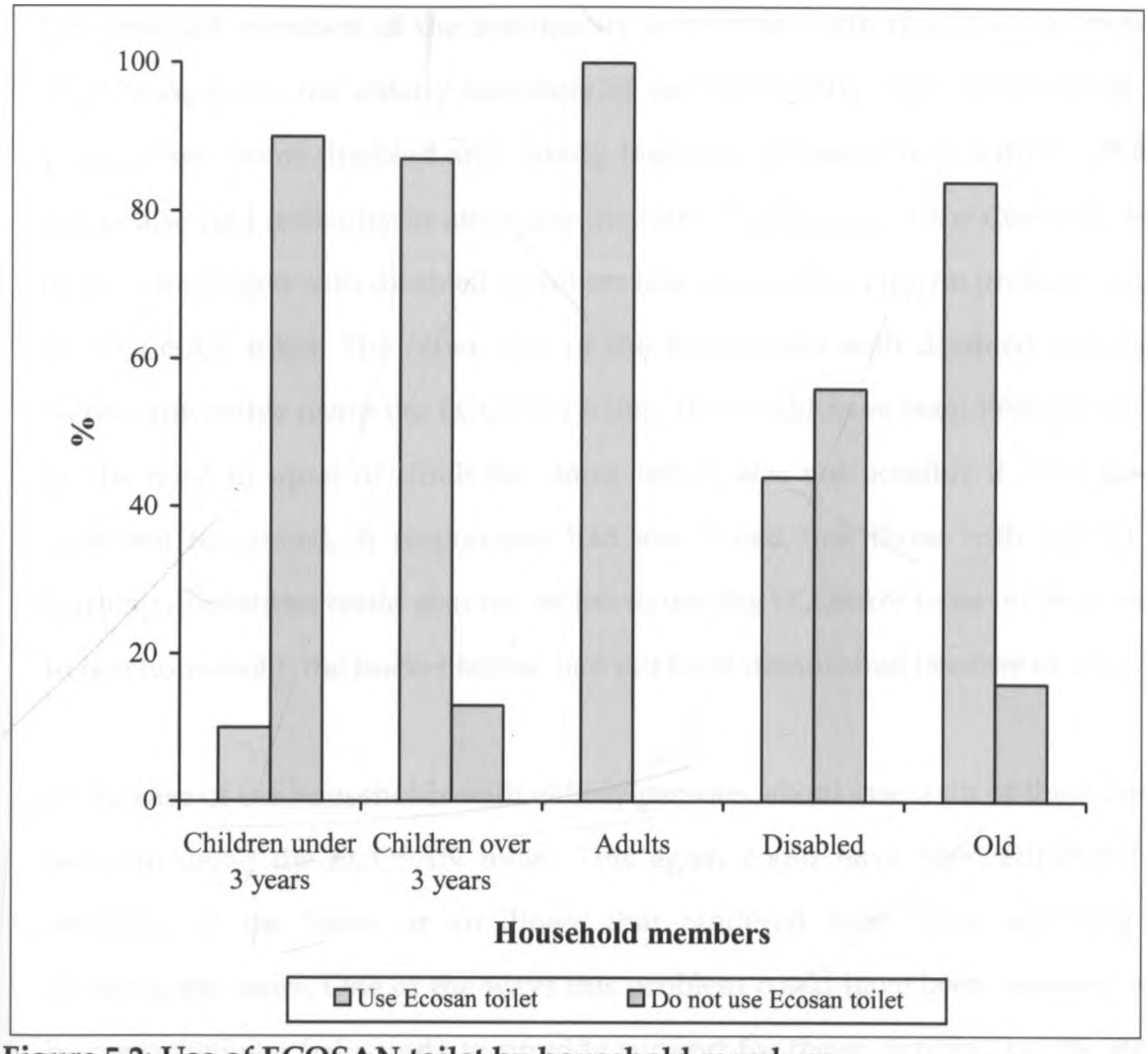

Figure 5.2: Use of ECOSAN toilet by household members.

Additionally, young children's faeces were not considered dangerous. The practice in this area was therefore for children under 3 years to defecate on the floor outside the toilet or in the open. Their faeces were then picked up and thrown into the toilet. These were practices that could be overcome gradually by

educating the community members. It would be important not only for the children to use the ECOSAN toilet but also to teach children especially those less than 3 years to use the toilet well. A health and hygiene programme targeted at parents and children could help alleviate this problem over time.

The disabled members of the community were those with physical and mental disabilities while the elderly members of the community were those above 65 years of age. Some disabled and elderly members of households with ECOSAN toilets also had difficulty in accessing the toilet. In the case of the disabled, 44% of the households with disabled members had reported having no problem using the ECOSAN toilet. The other 56% of the households with disabled members were comfortable using the ECOSAN toilet. This could have been brought about by the need to squat or climb the stairs, which was not possible if one's limbs were not functional. A respondent had also noted that those with mental or learning disabilities could also not be left to use the ECOSAN toilet on their own. In one household, the bucket latrine had not been demolished because of this.

In the case of the households with elderly persons, about one sixth of them had a problem using the ECOSAN toilet. This again could have been attributed to problems of the limbs or an illness that hindered them from squatting or climbing the stairs. One of the ways this problem could have been resolved was by constructing a balustrade to provide support for those climbing up the stairs or supports inside the toilet to aid squatting. The squatting plate can also be modified so that one can sit on it. On the other hand, socio-cultural factors could also have contributed to this, some respondents noted that they were not comfortable using the toilet with their in-laws.

5.1.2. Preference of ECOSAN over the previous method of sanitation and to other sanitation methods

Before they got the ECOSAN toilet, over one half of the respondents had been using the bucket toilet, 4% had been using the septic tank while 43% had no toilet and had either been using the bush or had been sharing a toilet with neighbours (Figure 5.3). These statistics from the field confirm that sanitation in Wajir is very poor. Since the WHO describes improved sanitation as a flush toilet, septic tank or VIP toilet, in the case of Wajir, the percentage of people who have access to improved sanitation is very low.

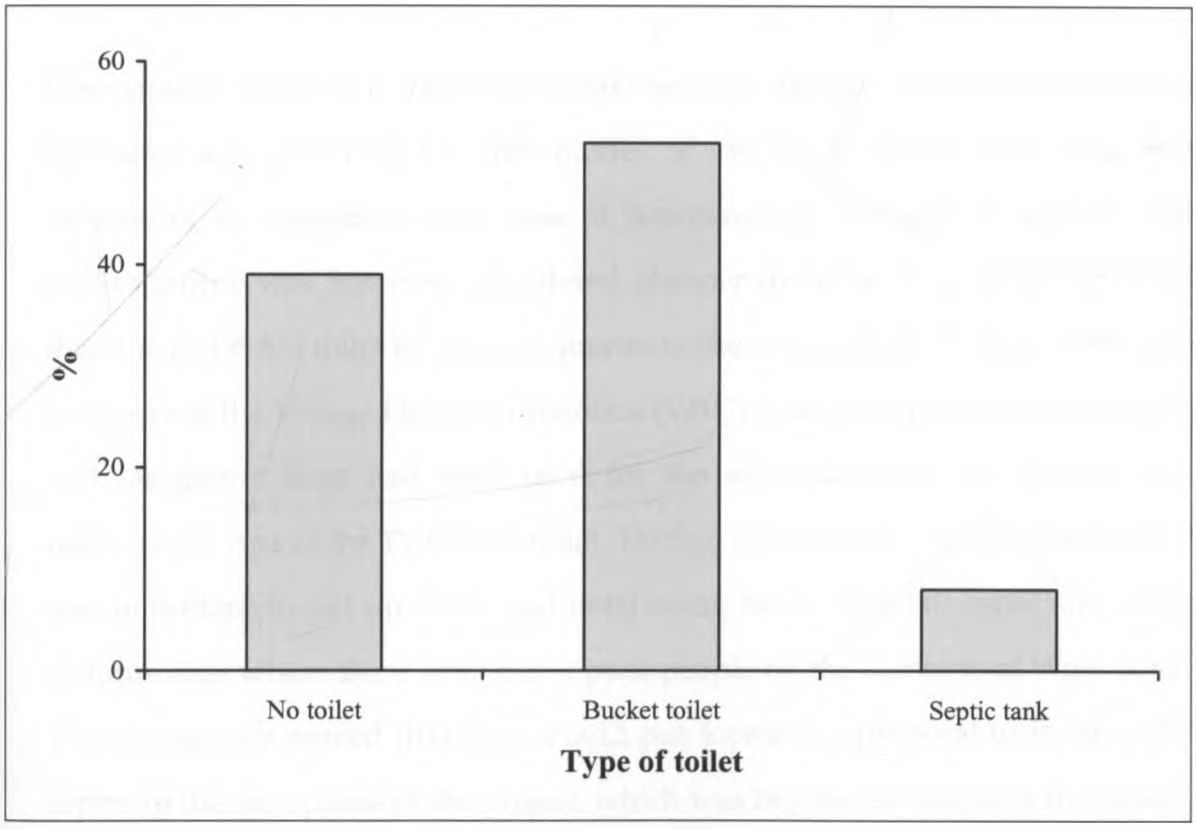

Figure 5.3: Methods of sanitation the respondents were using before ECOSAN

In 11% of the households, the previous mode of sanitation (the bucket latrine in this case) had not yet been closed down. It was still in use, despite the household

members' knowledge of the hazards that it posed. One respondent noted that he had retained this toilet for visitors from out of town and for his in-laws. The presence of some bucket latrines in the households with the ECOSAN toilet was indicative of the fact that changing one's customs and habits is often difficult. There are many taboos that are still engrained in this community and these can only be overcome gradually. Another respondent noted that the bucket latrine was for the elderly and for the disabled. However it was encouraging to note that 89% of the households had demolished or stopped using the previous method of sanitation altogether. This included the households that had been using the septic tank.

Comparative analysis of other sanitation systems against ECOSAN shows that the latter was preferred to other modes of sanitation (Figure 5.4). This was because of its operation costs, ease of maintenance and hygiene aspects. The bucket latrine was however considered cheaper in terms of construction costs than the ECOSAN toilet by about a quarter of the respondents. Village elders and members of the Village Health Committee (VHC) noted that if different materials such as gunny bags had been used for the superstructure this would have reduced the cost of the ECOSAN toilet. During discussions, it was agreed that it was important to put up some trial units using these materials especially in the communities where there were many poor people on the outskirts of Wajir town. The community agreed that they would put forward a proposal to include this aspect in the next phase of the project, which was beyond the scope of this study.

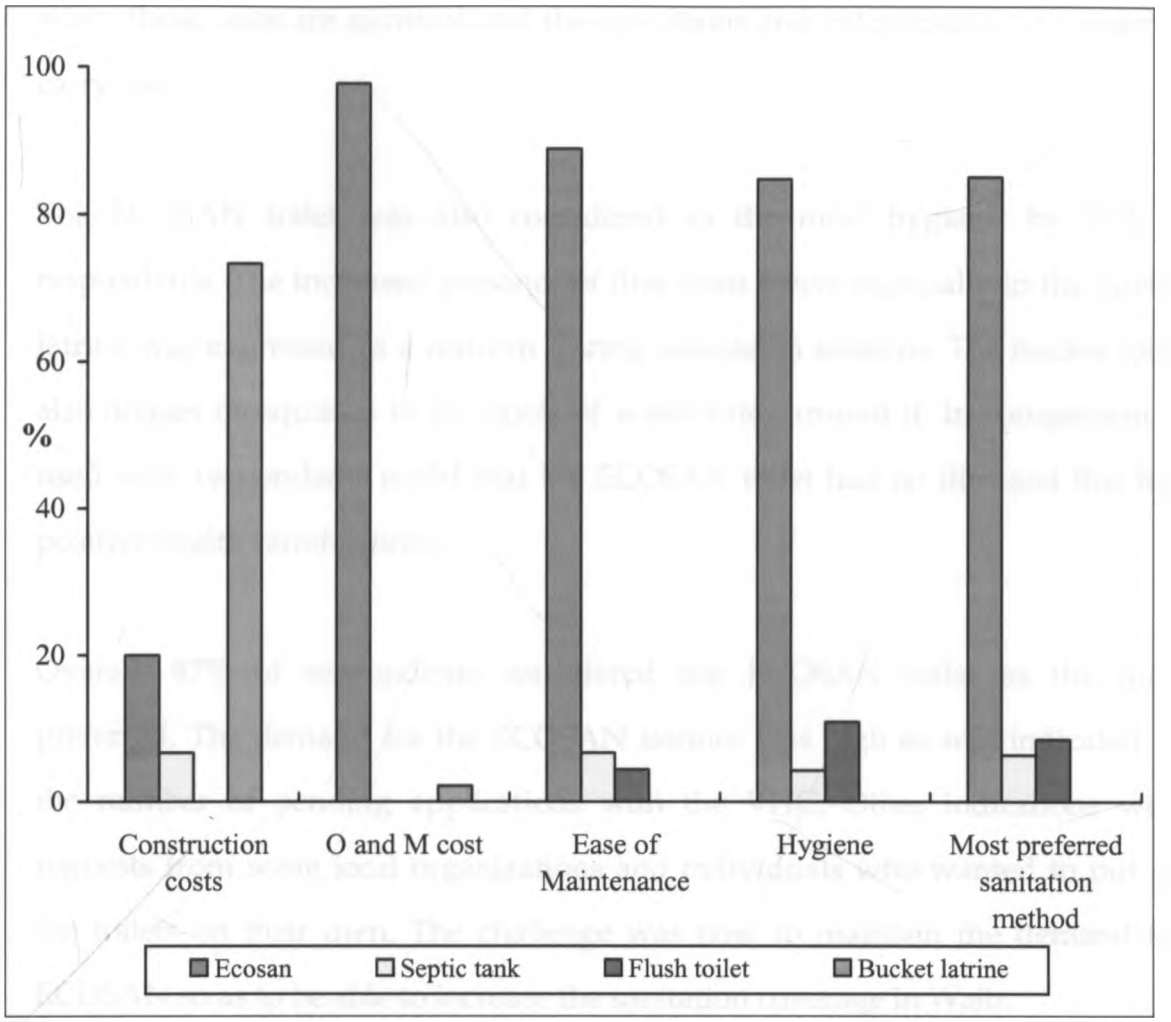

Figure 5.4: A comparison of the ECOSAN toilet with other sanitation methods

About 9 out of 10 respondents reported that the operation and maintenance of the ECOSAN toilet was much simpler than the bucket latrine and septic tank. Almost all of the respondents noted that the costs of operating and maintaining the ECOSAN toilets were the lowest. Indeed, reports do confirm that with the flush toilets and septic tanks, there are various operation and maintenance considerations and costs. These include availability and costs of consumables needed for operations, spare parts, equipment and technical expertise for preventive maintenance and repairs (GTZ, 2003). According to Schuringa (2001) operation and maintenance costs are to be born by users, therefore it is better

when these costs are minimal and the operations and maintenance are easier to carry out.

The ECOSAN toilet was also considered as the most hygienic by 85% of respondents. The increased presence of flies from faeces especially in the bucket latrine was expressed as a concern during discussion sessions. The bucket toilet also houses mosquitoes in the pools of wastewater around it. In comparison, if used well, respondents noted that the ECOSAN toilet had no flies and this had positive health ramifications.

Overall, 87% of respondents considered the ECOSAN toilet as the most preferred. The demand for the ECOSAN latrines was high as was indicated by the number of pending applications with the VHC. Other indications were requests from some local organizations and individuals who wanted to put up the toilets on their own. The challenge was now to maintain the demand for ECOSAN so as to be able to increase the sanitation coverage in Wajir.

5.1.3. Factors that have influenced household choice of ECOSAN

Responses regarding why households chose ECOSAN toilets over other sanitation modes were grouped into different categories (Table 5.1). All household responses generally fell into four categories:

Table 5.1: Factors that have influenced the household choice of the ECOSAN toilet

Personal/ Individual factors	Operational and management factors	Technical factors	Financial factors
1.Sociocultural aspects, privacy, convenience, health and hygiene, prestige and safety	1.Operation and maintenance issues 2.Availability of training and technical expertise	1.The physical structure (design, durability, construction) 2.The external structure (aesthetics)	Provision of subsidies

a. Personal factors

Personal factors included responses on how an individual related to their toilet. These responses ranged from issues like the convenience, safety or privacy provided by the ECOSAN toilet, to the health, hygiene and prestige that households attached to ownership of the ECOSAN toilet. The most reported personal factor was the desire for privacy with slightly more than a quarter of respondents indicating this as a factor of choice (Figure 5.5). Defecation is considered a private affair. Respondents that did not have any toilet before and had been defecating in the open spoke about their problems and expressed their need for privacy since the bush is open. It was also important to avoid being seen uncovered or defecating especially for women by the opposite sex as has been confirmed by studies published by Schuringa (2000). The study further notes that

the need for privacy may vary according to sex, age and social status and but generally, women also have more need for privacy than men do.

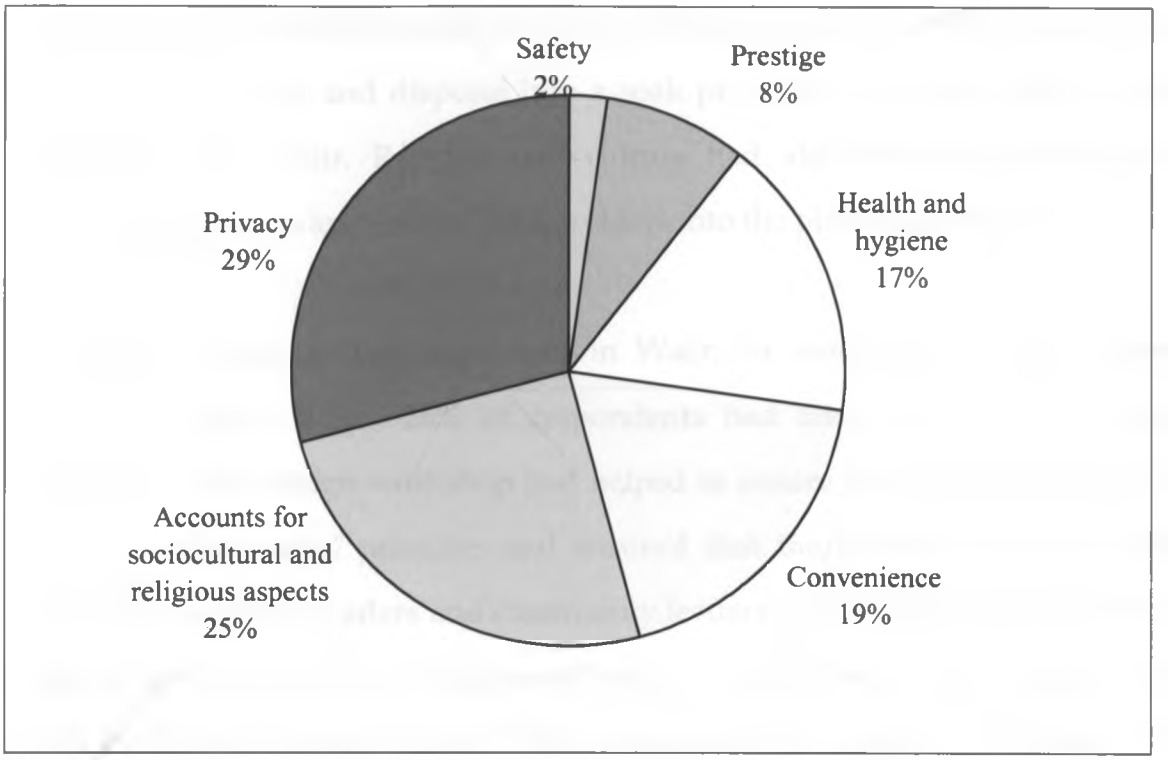

Figure 5.5: Personal factors that have influenced choice of ECOSAN toilets by households

The fact that ECOSAN incorporated cultural and religious practices was another important choice factor. Initial concerns that ECOSAN would be culturally unacceptable seemed to have eroded. The Wajir Township consists of the Somali community who are low to middle class and are predominantly Muslims. The Muslim religion and Somali culture have a strong influential impact on the sanitation practices. This setting is very different from a high-density low-income urban environment, which has mixed cultures, like Nairobi, where it may be difficult to maintain social norms and taboos (Schuringa, 2000).

Cultural and religious factors that influence sanitation behaviour were taken into consideration before the implementation of the project in Wajir. For example, urine is considered unclean; reuse of urine had not been stressed despite the importance of recycling urine in ECOSAN. The initial focus had thus been on the separation of urine and disposal into a soak pit, which was acceptable for the community in Wajir. Religion and culture had also been incorporated by including religious leaders and village elders into the planning process.

A design workshop had been held in Wajir, to come up with the current ECOSAN toilet design; 26% of respondents had taken part in this design workshop. The design workshop had helped to ensure that the ECOSAN toilet was based on users' priorities and ensured that the households, community members, religious leaders and community leaders were sufficiently involved in the design of the toilets. Adjustments had thus been made on the design of the ECOSAN toilet to cater for the Wajir community for example, cleansing with water. This contributed to project ownership and thus project sustainability.

19 % of respondents noted that convenience was a factor of choice. The ECOSAN toilet did not smell like the bucket latrine and it had thus been constructed nearer to the house. It was more convenient to go to a latrine near a house especially at night. Discussants also noted that it was good to have a reliable, close and easy place to go to especially when one was aged or had diarrhoea or other illnesses. A similar study carried out in the rural areas in Zimbabwe reported that the users of the ECOSAN toilet, preferred it to the conventional pit latrines as it was built closer to the house and thus offered them privacy and convenience (Morgan, 1999, 2000, 2001).

17% of the households chose the ECOSAN toilet because of health and hygiene reasons. A major objective of sanitation is to promote health. Adult faeces and wet faeces are considered very dirty and sometimes dangerous especially when they are still recognizable. Flies observed in relation to faeces are thus also considered dirty. With the ECOSAN toilet, there was no handling of the wet faeces, only dry products that have less pathogens. Additionally, because of the way, the toilet was built and ashes were used to cover the faeces, users could not see any faeces. ECOSAN toilets if used well are very effective in the elimination of pathogens and they sanitize excreta on the spot. Their effect can thus be felt not only in the households but also in the surrounding areas. Interest in ECOSAN has grown as people in Wajir have seen that the contents of the pit do in fact transform and fears about excavating unprocessed faeces have diminished considerably. If used well the ECOSAN toilet can thus contribute positively to health and hygiene.

For the remaining one tenth of households, important personal factors that had influenced choice of ECOSAN toilets included status, prestige and safety. ECOSAN latrines were new, and to some degree exciting in comparison with the bucket latrine and septic tanks. Many users referred to it as a modern toilet and this had contributed to the acceptance and increasing demand for ECOSAN. For the respondents that were educated, salaried or retired and were building permanent houses, they wanted to be associated with the elite or modern way of life and had opted for the ECOSAN toilet because it symbolized this new way of life to them. However, if status and prestige alone were motivating factors then people did not need to use the latrine. This was evident in some households where the latrine had only been reserved for certain members of the family. On the other hand, the safety aspect was not prominent in the Wajir community

although this was a concern especially for the young girls and women. Other studies note that safety may be more of a concern in the urban areas, where social control is low (Schuringa, 2000).

b. Operational and management factors

Operational and management factors consisted of any issues that were related to operation and maintenance of the ECOSAN toilet and availability of training and technical expertise. These issues were important because proper management, operation and maintenance practices ensured the sustainability of the toilet. Of importance to 42% of the households was that the management of the ECOSAN toilet was at household level (Figure 5.6), while with the bucket toilet and the septic tank, the respondents had to rely on the Wajir County Council whose services were described as poor.

The fact that the residents in the study area had large families meant that the bucket latrine and septic tanks filled faster. Without a proper mechanism for their removal, (tractors and labour for the bucket latrines or exhausters for septic tanks), there were various negative consequences, which included overflowing buckets or septic tanks and offensive odours from the faeces.

One in every three households had chosen the ECOSAN toilet because they felt that they had access to the ECOSAN technology in terms of sufficient information and training on the ECOSAN concept, the utilisation, operation and maintenance of the ECOSAN toilet and health and hygiene issues. Technical expertise was and still is available locally. The early adopters were a group of 18 Wajir residents that had some technical expertise having received the necessary training in Uganda.

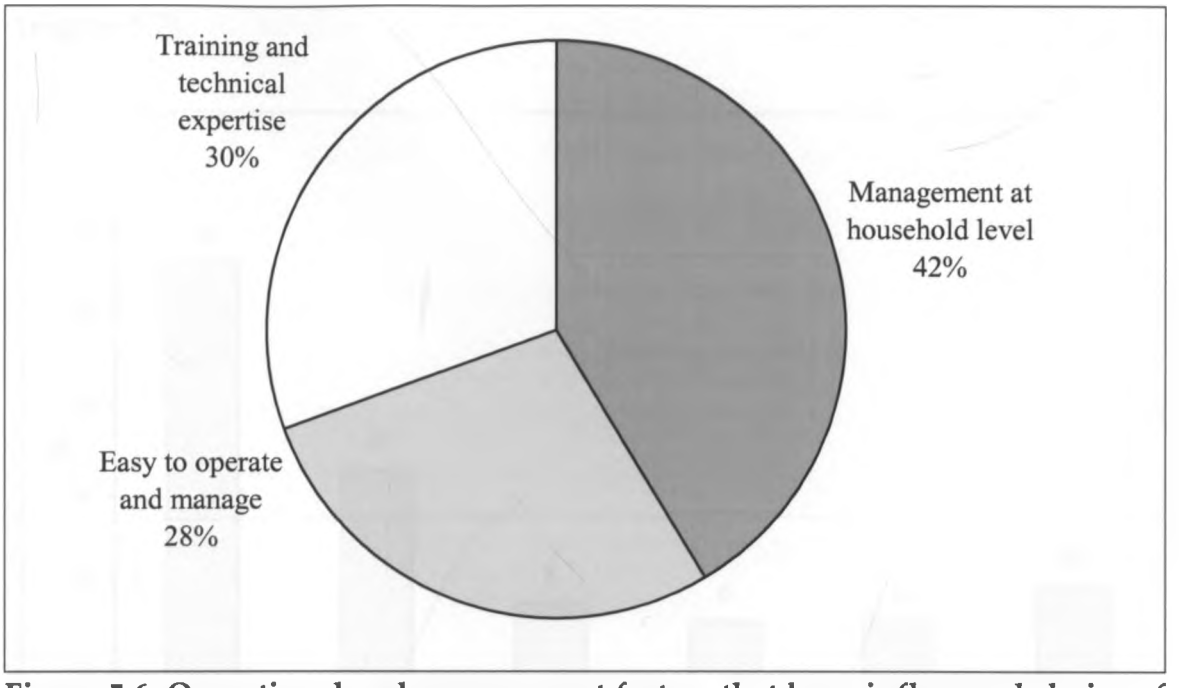

Figure 5.6: Operational and management factors that have influenced choice of ECOSAN toilets by households

Masons from within the Wajir community and a project officer who was in charge of the ECOSAN project had also been trained on the technical aspects of the ECOSAN toilet. There was therefore the necessary technical assistance before, during and after construction of the ECOSAN toilets. Studies have found that projects where provision of technical expertise is not taken into consideration have consistently failed (Kaggwa *et. al.*, 2003). It is important to render technical expertise from time to time so as to take care of any problems that may arise or any design errors and thus for project sustainability.

Training on use of ECOSAN toilets is an important issue. One needed to know how to use and care for the toilet in ways that are different from the ways one cared for and used other locally available sanitation options (such as the bucket latrine, septic tanks). Improper use of the ECOSAN toilets had hygienic

consequences. Sources of information and training on ECOSAN were varied (Figure 5.7).

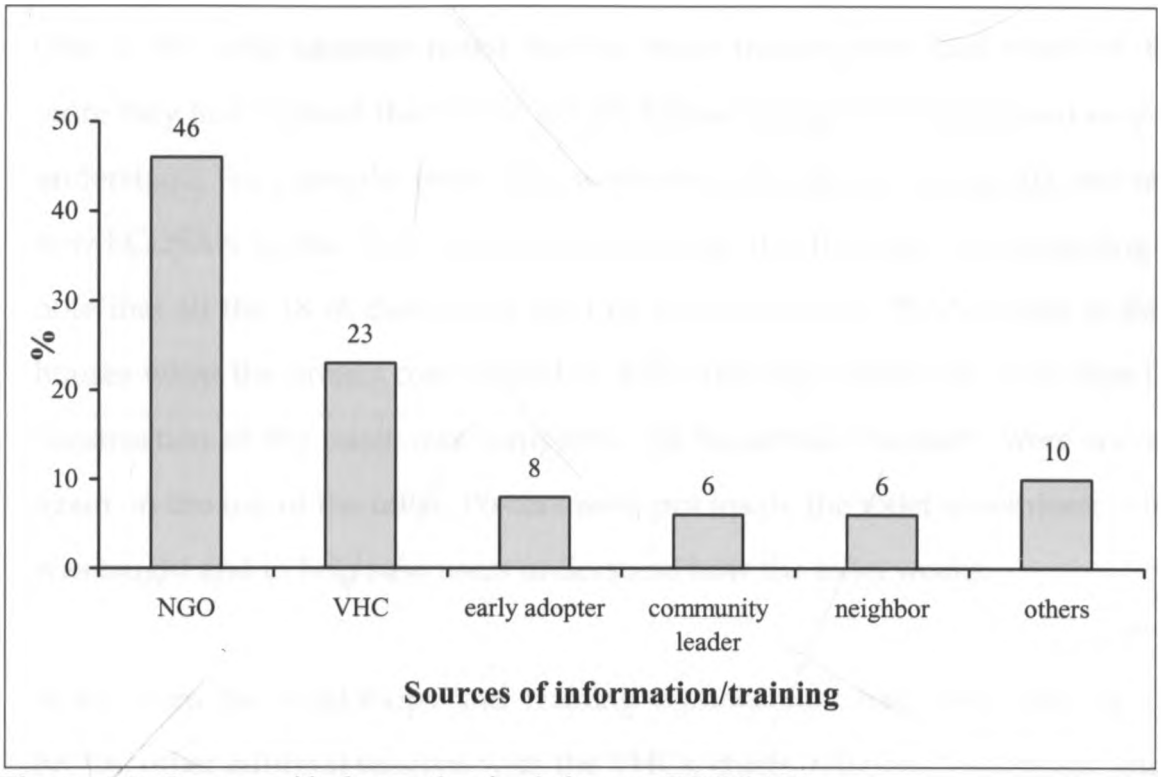

Figure 5.7: Source of information/training on ECOSAN

Information was disseminated through workshops, training sessions or visits to demonstration sites. Facilitators from within Wajir and from outside Wajir, who were trained in ECOSAN, conducted the training sessions and workshops. Participatory methods were used, whereby the local residents were assisted to analyse their own situation and come up with solutions. This ensured that community members were involved in the project cycle from the initial phase of project identification. According to the monitoring reports on the project, various groups had benefited from the workshops and training sessions. These included women group leaders, County Council employees and VHC leaders.

Respondents reported that the training and workshops were very useful because they made them more aware of environmental sanitation issues.

One of the early adopters noted that the more training they had received, the more they had realized that the ECOSAN toilets concept was simple and easy to understand. For example, when they went on a training trip to Uganda and saw how ECOSAN works, their reservations reduced. It is therefore not surprising to note that all the 18 of them were the first to construct ECOSAN toilets at their houses when the project commenced in 2002. Training continued, even after the construction of the toilet was completed; all household members were trained again on the use of the toilet. Posters were put inside the toilet to reinforce what was taught and to help new users understand how the toilet works.

Apart from the workshops and training sessions that had been held by the NGOs, other informal sessions with the VHCs, chiefs, religious leaders and early adopters had also helped in the dissemination of information on ECOSAN. The traditional and religious leaders had also played an important role. Government workers whose roles included sanitation provision and promotion like the Public Health Workers in the MoH/PHD and sanitation inspectors from MWI could also have played a larger role, but the responses in Figure 5.7 shows that their participation had been minimal at this stage. This can be partially attributed to that fact that there are no clear policies or guidelines for in the field of sanitation. However, the Ministry of Health together with other stakeholders is in the final stages of developing an Environmental Sanitation and Hygiene (ESH) Policy, which will go a long way in providing guidance in the field of sanitation and defining specific roles for various players.

Sharing of the ECOSAN toilet with neighbours and visitors had also been a useful way of transmitting information on ECOSAN. 6% of respondents reported that they had acquired information on ECOSAN from neighbours. At the time of the study, only 20% of the households were not sharing their toilets with neighbours and visitors. In the case of new users (neighbours and visitors), the household members trained them on how to use the toilet and ensured that they used it well.

Concerning other management factors about a quarter of the respondents noted that they had chosen ECOSAN because the operation and maintenance of the ECOSAN toilets was easier than their previous mode of sanitation (septic tank, bucket toilet and open defecation). Within this group are also those who had chosen the ECOSAN toilet because the operation and maintenance costs were expected to be minimal. For example, in cases where respondents' toilets were smelly, the solution was to add more ash to ensure that the contents of the chambers were dry. Over time, people saw the value of putting sufficient ash because their toilets did not smell, thus no flies were attracted, and the low humidity did not attract mosquitoes. They thus became more comfortable with maintenance of their ECOSAN toilets.

c. Technical factors

Technical factors refer to the design, construction of the toilet and its aesthetics. 40% of respondents had chosen the ECOSAN toilet because they saw it as durable and permanent structure that could be considered as a long-term household investment (Figure 5.8). Similar responses were noted in a study in an ECOSAN project in Kisumu where respondents compared it to their previous mode of sanitation, the pit latrine. The study noted that unlike the pit latrine, the

ECOSAN toilet did not have to be rebuilt once it was full and thus saved space in the homesteads and money in terms of labour that was needed to build another pit and the finances needed to pay for costs associated with a new toilet.

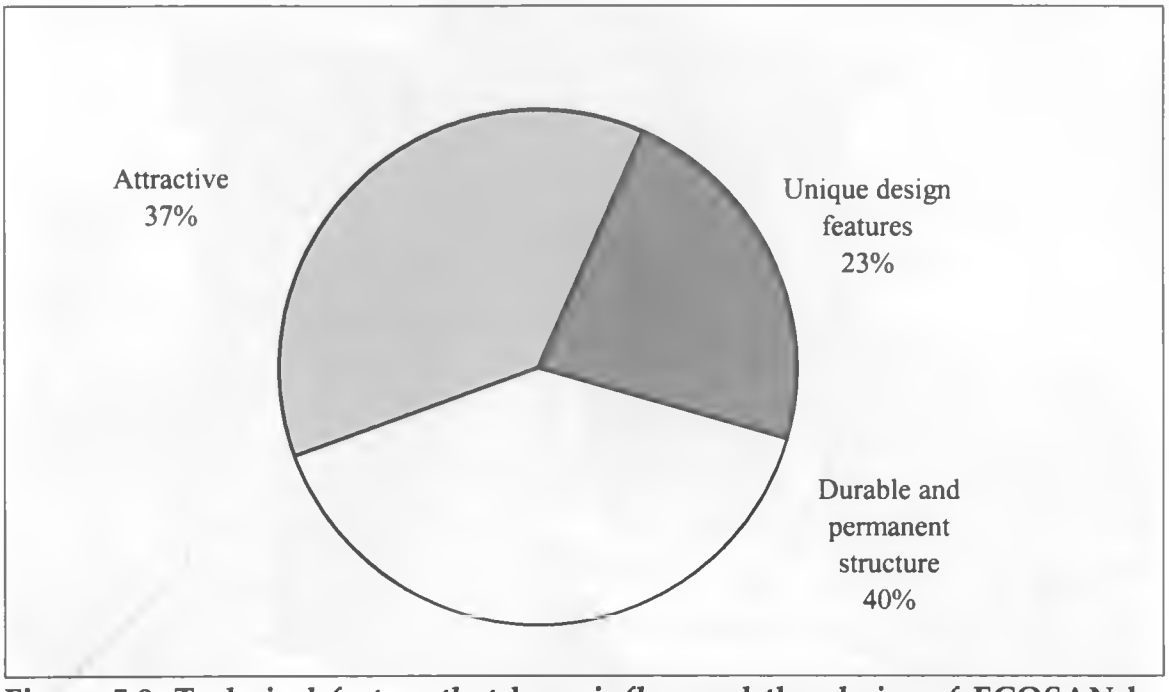

Figure 5.8: Technical factors that have influenced the choice of ECOSAN by households

Attachments to the physical structure were to be seen in sentiments such as aesthetic appreciation for the structure or pride in ownership, as was expressed by 37% of the users. One respondent noted that the toilet had added beauty to his homestead. In comparison to the bucket latrines, the ECOSAN toilets had been well built and were pleasing to the eye. Another respondent had even painted his toilet and added a bathroom next to it (Plate 5.1). This upgrading was as a good indicator that the toilet was highly valued and that the system responded well to changes and could thus be adapted to fit consumer preferences. His toilet pulled neighbours and they also wished to have one.

Another respondent had even painted the floor of his toilet with kerosene to keep away any flies or crawling insects.

Plate 5.1: An owner of an ECOSAN toilet (Mr. Abdi Yusuf, a PHO) proudly shows of his toilet in Wagberi

There are design aspects unique to the ECOSAN toilet such as the double chambers and the separation plates, which 23% of the respondents noted, had influenced their choice of the ECOSAN toilet. For example, the separation plates (Plate 5.2) separated the urine and faeces and treated each separately.

Plate 5.2: The substructure with the urine separation plates of a toilet in Wajir town under construction

The double chambers retained the faeces until they were dry. The double chambers were covered by 2 black metallic sheets know as solar heaters (Plate 5.3). These helped in the pathogen die-off. They were fixed tightly to prevent entry of water into the chambers and to keep children or animals out of the chamber. This was different from the bucket latrine where the excreta was handled while it was still wet. It was also not separated from the urine and wastewater and this meant that the bucket filled faster.

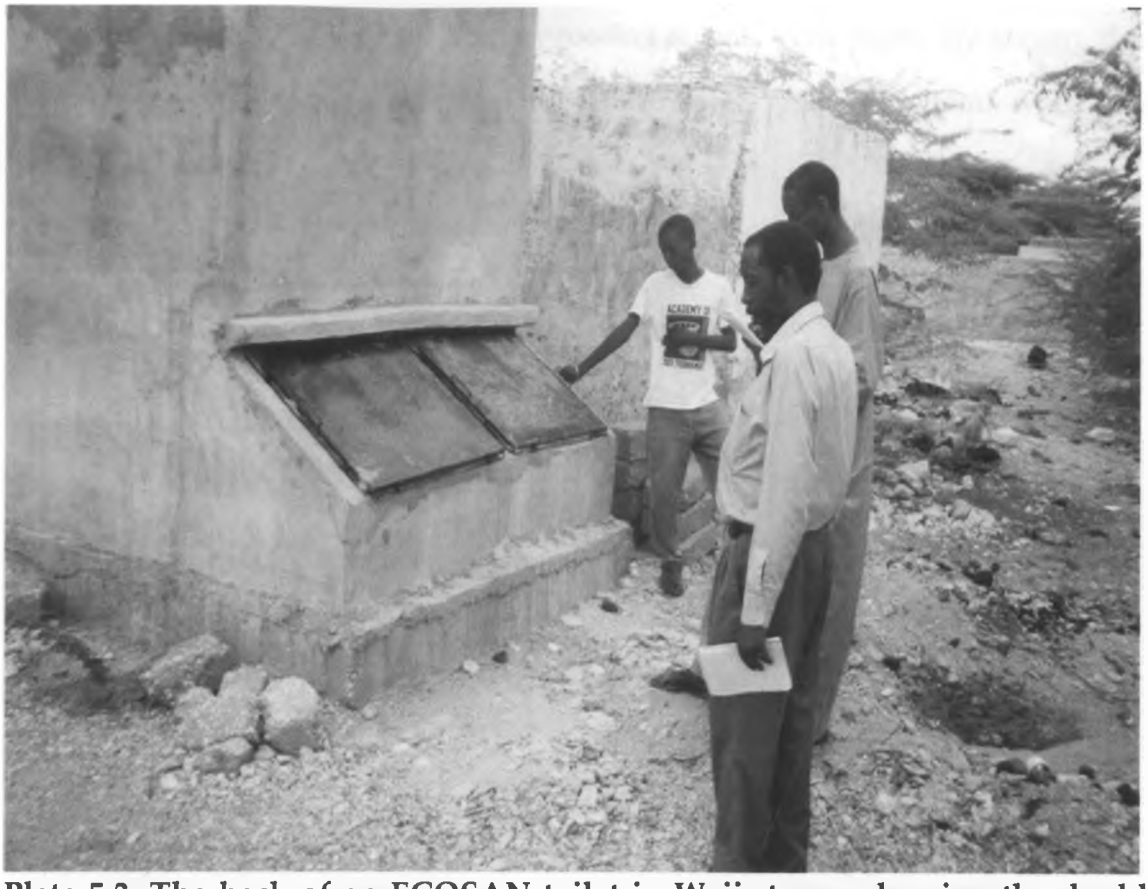

Plate 5.3: The back of an ECOSAN toilet in Wajir town, showing the double chambers.

5.1.4. Financial factors and availability of subsidies

The total cost for the construction of one ECOSAN toilet was Kshs. 99,542 with a community contribution of Kshs. 11,486 as itemized in Appendix 1. Indeed, 81% of households felt that they would not have built the toilet without any subsidies while 19% of the respondents noted that they would have built the toilets whether they had received the subsidies or not (Figure 5.9).

All households had contributed for toilet construction, which included sand, stones and water. For example, about 9 out of ten households contributed sand, stones, water and provided unskilled labour, while only half of the households made monetary contributions. The materials that were provided by the NGO

included cement, wire mesh, timber, roofing sheets, vent pipes, fly screen, door, plumbing fittings, squatting pans and solar heaters. All these items were either not locally available or expensive.

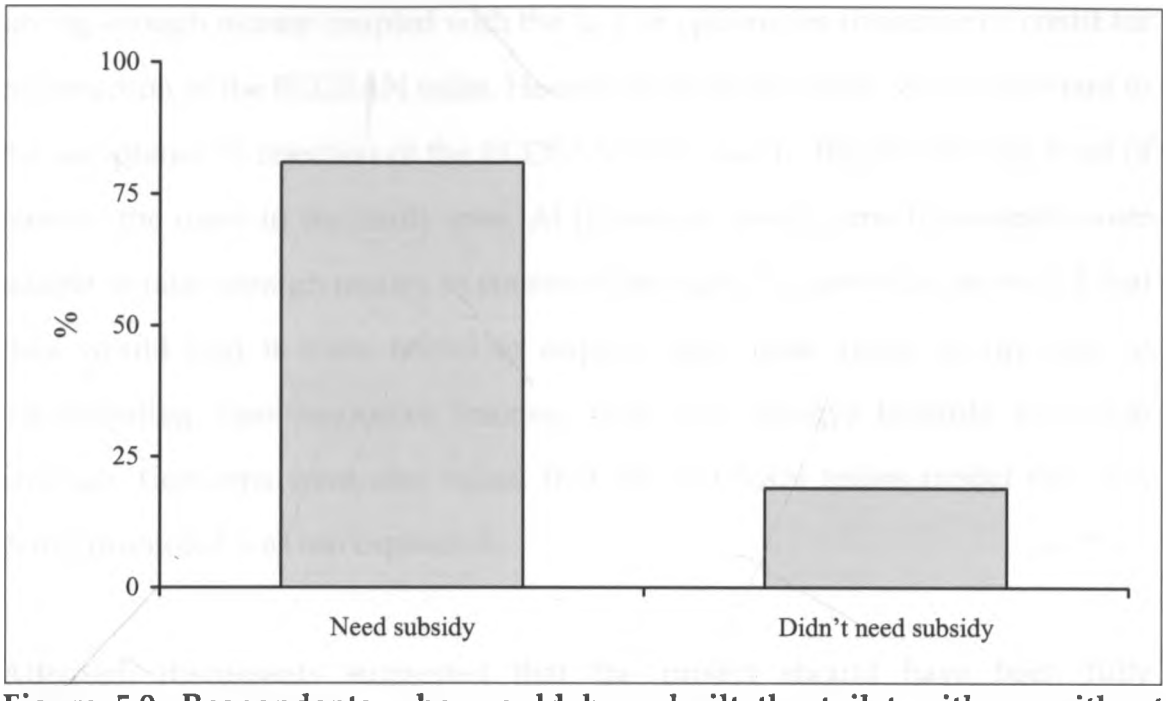

Figure 5.9: Respondents who would have built the toilet with or without subsidies

All the respondents had been subsidized in the construction of their ECOSAN latrines. The NGO noted that this had been provided as an incentive for the users to try out the toilets. Subsidies were needed especially for the poor who could not afford the cost of the ECOSAN toilet. However, developing low cost options and increasing access to credit and other financial packages for the households could have reduced subsidies. The subsidies should also have been dependent on the family financial situation.

5.1.5. Problems and barriers experienced in use of the ECOSAN toilet

Most of the users noted an overall satisfaction with their ECOSAN toilets, however during discussions and interviews, some problems were noted. The main problem was lack of financing. Respondents noted some difficulties in saving enough money coupled with the lack of options for financing or credit for construction of the ECOSAN toilet. Household financial issues were important to the acceptance or rejection of the ECOSAN toilet due to the low-income level of most of the users in the study area. At household level, some households were unable to raise enough money to construct the toilet. Households also noted that they would find it more useful to acquire other basic needs as opposed to concentrating their resources (money, time and energy) towards sanitation facilities. Concerns were also raised that the ECOSAN toilets model that was being promoted was too expensive.

Although discussants suggested that the project should have been fully subsidised, Schuringa (2000) notes that it is important to ensure that the users contribute something towards the toilets, whether it is cash or in kind. The problem of ownership will always occur when something is given for nothing or the contribution made is small compared to the household's economic status. During the monitoring exercise, one household had not been using their ECOSAN toilet despite the fact that the construction of the toilet had been completed. One of the reasons that they had cited for this was that the urine pipe had leaked the first few times they had used the toilet. The family had thus simply stopped using the ECOSAN toilet and reverted to using the bucket toilet. Further investigations had also shown that this was a relatively high-income household that had contributed only 10% of the funding, which may not have been much to them. They had simply given in the money and household

members had taken minimal or no part in the construction process. Studies show that taking part in the construction and supervision of the ECOSAN toilet ensured that the toilet had fewer operational errors and thus made it more convenient to use (Schuringa, 2000). Another important point that was noted from this example is that when subsidies are given then this has to be done according to the financial status of the family.

Another problem was the lack of awareness and misunderstandings about how ECOSAN latrines function. Despite the efforts to educate the residents in the study area on ECOSAN, there were still those with little or distorted knowledge about ECOSAN toilets, their operation, how they are built, or their attributes. These misunderstandings or wrong conceptions were negative towards the ECOSAN toilet and led some household members to reject the ECOSAN toilet in various ways. For example, in one household it was noted that only the father had initially used the toilet, because the other household members including the mother of the house and children feared using the toilet. Such problems can be overcome by wider information dissemination through community meetings, training sessions for all household members, and visits to the pilot structures or posters in the toilets. Winblad and Simpson-Hebert, (2004), stress that, any attempt to introduce an ECOSAN system must be accompanied by a substantial amount of social marketing, instruction of builders, users and operators and follow-up.

Socio cultural aspects were also cited as another problem in the adoption of ECOSAN. Though culture and religious aspects were considered in implementation of the project, there were still some problems. Some traditional beliefs discouraged the use of toilet facilities. The same was observed in the Terai

communities in Nepal where the communities do not want to "defecate in the same place as Rhino and Blue Cow does" and they believe that only sick people or those with broken legs defecate at the same place repeatedly (Bolt, 2003).

The concern over the disposal of dried faeces was also expressed as a problem that needed to be addressed. In Wajir, the perception and attitude towards use of urine collected and dried faeces were a very negative issue since the community is faecophobic. The locals did not even want to consider the benefits of such waste. About a quarter of the respondents noted that they would have no problem with emptying the faeces once they were dry. However, in three quarters of the households, no one wanted to deal with even the dry faeces and felt once they were dry, they would probably pay someone to come and remove them. They considered the handling of faeces a taboo. According to Salifu (2001), this is not a barrier to ECOSAN but rather as a demand driver. He noted that small-scale operators could be developed or encouraged to provide handling services in a safe and professional manner at a reasonable cost. The small-scale operators can also be involved in the transportation and processing services that are needed for the marketing of manure.

The other factors cited related to the physical structure of the ECOSAN toilet such as the steps. Some users felt that the steps were too many and there was no balustrade to allow for easier climbing of the steps especially for the elderly and the disabled. Another complaint involved the separation plate. Some users felt that there was a need for a sieve in the urine plate to prevent the blockage of the urine pipe by foreign materials. Concerns were also raised regarding the construction of the urine pipes inside the separation chambers as shown in Plate 5.4.

Plate 5.4: The inside of the chambers of an ECOSAN toilet in Wajir town

Other users felt that the size of the squat hole was too small. The lack of a window for ventilation was also another issue. There was a need for a window to allow for ventilation and some light into the toilet. Other complaints regarded the iron sheets used for the door, which the respondents felt were not very strong and there was a need for stronger material for the door. However all these construction issues are not major and many of them can be easily dealt with locally. For example, in some of the ECOSAN toilets, the households had asked the masons to make some custom modifications to their toilets.

5.2. Inferential statistics

The formulated hypotheses for the study were tested to determine whether there were any statistically significant differences. The data sets that were considered were the different age groups, the genders and the factors of choice.

H_0 – There are no differences in use of ECOSAN among the different age groups in the households in Wajir

H_1 – The alternative

Descriptive statistics (Figure 5.2) show that in the households that have the ECOSAN toilet, not all household members used the ECOSAN toilet. It is only in one third of the households that all the family members used the ECOSAN toilet.

Table 5.2: Kruskal Wallis Test, whether all household members use ECOSAN

Ranks			
	Whether ECOSAN is used by all household members	**N**	**Mean Rank**
Children over 3 years using ECOSAN toilet	Yes	14	20.50
	No	32	24.81
	Total	46	
Children under 3 years using ECOSAN toilet	Yes	4	5.75
	No	26	17.00
	Total	30	
Adults using ECOSAN toilet	Yes	14	23.50
	No	32	23.50
	Total	46	

Test Statistics			
	Children over 3 years using ECOSAN toilet	**Children under 3 years using ECOSAN toilet**	**Adults using ECOSAN toilet**
Chi-Square	2.953	20.944	.000
Df	1	1	1
Asymp. Sig.	.086	.000	1.000

There are significant differences in the use of the ECOSAN toilet by the children under 3 years old as shown by the test results $\chi^2 = 20.944$ and $p = 0.000$, this means they are not making full use of it (Table 5.2). However, for the children over 3 years old and the adults there was no significant differences in the use of the ECOSAN toilet, which means that they are making full use of it. Thus, the null hypothesis that there are no differences in use of ECOSAN among the different age groups in the households in Wajir is thus not adopted.

H_0 – There are no gender differences in the factors that have led to the choice of ECOSAN in households in Wajir.

H_1- The alternative

According to Tables 5.3 and 5.4, there is a difference in the factors that have led to choice of ECOSAN by males and females in households in Wajir

Table 5.3: A cross tabulation of gender and factors of choice

		Gender		Total
		Female	Male	
All personal factors	Health and hygiene	6	2	8
	Convenience	5	4	9
	Privacy	11	3	14
	Safety	1	0	1
	Prestige	0	4	4
	Considers religion and culture	4	8	12
	Total	27	21	48
All management factors	Training and technical expertise available	3	11	14
	Management at household level	15	3	18
	Easy to operate and manage	7	6	13
	Total	25	20	45
All technical factors	Durable and permanent	4	9	13
	Unique design features	4	4	8
	Attractive	11	1	12
	Total	19	14	33
All financial factors	Subsidies received	24	16	40
	Total	24	16	40

Table 5.4: Kruskal Wallis Test, whether there is a difference in factors that have led to choice of ECOSAN by male and female household members in Wajir

Ranks				Test statistics		
Dependent variable	**Gender (Independent variable)**	**N**	**Mean Rank**	**Chi-Square**	**Df**	**Asymp. Sig.**
All personal factors	Female	27	20.87	4.375	1	.036
	Male	21	29.17			
	Total	48				
All technical factors	Female	19	21.08	9.084	1	.003
	Male	14	11.46			
	Total	33				
All management factors	Female	25	25.92	3.152	1	.076
	Male	20	19.35			
	Total	45				
Subsidies received	Female	27	23.98	.000	1	.986
	Male	20	24.03			
	Total	47				

The results show statistically significant differences, Kruskal Wallis $\chi^2 = 4.375$ and $p = 0.036$, $\chi^2 = 9.084$ and $p = 0.003$, for personal factors and for technical factors respectively. The null hypothesis is therefore not adopted. Female household members chose the ECOSAN toilet for factors such as health and hygiene, convenience, safety, privacy and the fact that it is attractive. Male household members chose the ECOSAN toilet for factors such as prestige, religious and cultural factors and durable and permanent structure.

In the case of the management factors, Kruskal Wallis $\chi^2 = 3.152$ and $p = 0.076$, which is close to 0.05. However, in the case of the financial factors Kruskal Wallis $\chi^2 = 0$ and $p = 0.986$, this means that there are no statistically significant differences in the choice factors for males and females. For all household members, whether male or female, the availability of subsidies was an important choice factor. Thus, the null hypothesis is adopted.

H_0 – There are no differences in the personal, management and technical factors that have led to choice of ECOSAN in households in Wajir.

H_1 – The alternative

The independent variables are the factors of choice (personal, management and technical) and the dependent variable is the use of ECOSAN by households.

For all the factors of choice above, the test (Table 5.5) provided a probability value, which was above 0.05. The null hypothesis that states that use of ECOSAN by households is the same for the personal, management and technical factors of choice is therefore adopted. Families that choose ECOSAN for the personal, technical and management factors actually end up using the ECOSAN toilet and pulling down the previous mode of sanitation. This may be because most of the factors that are found in the ECOSAN toilet are not found in the others.

Table 5.5: Kruskal Wallis Test, whether the use of ECOSAN is the same for personal, management and technical factors of choice

Ranks				Test Statistics		
	Whether using only ECOSAN	N	Mean Rank	Chi-Square	Df	Asymp. Sig.
Personal factors general	Using ECOSAN only	42	24.00	.000	1	1.000
	Using ECOSAN and previous mode of sanitation	5	24.00			
	Total	47				
Management factors general	Using ECOSAN only	42	24.18	.373	1	.541
	Using ECOSAN and previous mode of sanitation	5	22.50			
	Total	47				
Technical factors general	Using ECOSAN only	40	23.25	.212	1	.646
	Using ECOSAN and previous mode of sanitation	5	21.00			
	Total	45				

5.3. Conclusion

This study assessed the factors that are important in the choice of ECOSAN by households in Wajir. For the male household members, these factors were found to be prestige, religious and cultural factors and that fact that the toilet is durable and permanent. On the other hand, female household members chose the toilet because it offers them privacy, convenience, health and hygiene, safety and privacy and it is an attractive structure. Financial factors (availability of subsidies) were an important choice factor for both male and female household members. Apart from the factors of choice, there are also other factors that could act as barriers in the adoption of ECOSAN. These include lack of finances, socio cultural aspects, lack of awareness and misunderstandings.

These findings show that not all household members use the ECOSAN toilet. In some households, the children less than 3 years of age, disabled and elderly, were not using the toilet. Despite this, comparative analysis shows that the ECOSAN toilets were preferred to the most used method that is the bucket latrine.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1. Summary of findings

- All ECOSAN toilets were in use at the time of this study. All adult household members were using the ECOSAN toilet. However, in some households the children (especially those less than 3 years old), disabled and elderly were either not using the ECOSAN toilet at all or were uncomfortable using it. Children may not have had the necessary training to operate the toilet correctly while elderly and disabled persons had difficulty squatting in the toilet and or climbing the stairs to get to the facility.

- ECOSAN owners reported an overall satisfaction with their latrines and that the toilets worked well when used properly. They preferred the ECOSAN toilet to most other used methods, which include the bucket latrine. This was because the ECOSAN toilet was easier to manage and the cost of operating and maintaining it were lower and it was more hygienic. The fact that the management of ECOSAN is at household level was a choice factor shows a need to move away from the bucket latrine and the septic tank, which are not well managed by the Wajir County Council. Respondents also reported that they would recommend the toilet to others.

- Health reasons are important because improved sanitation acts as a barrier, keeping excreta away from people who, if exposed to the pathogens in faeces, become ill. However, these are not the only considerations in choice of ECOSAN by households. Male household members based their choice of the

ECOSAN toilet on such factors as prestige, religious and cultural factors and the fact that the toilet is durable and permanent. On the other hand, the female household members chose the ECOSAN toilet for factors such as health and hygiene, convenience, safety, privacy and the fact that it is an attractive structure. These can be seen as important motivators to get a toilet as well as valued benefits once people get the toilet and start using it. Financial factors were an important motivator for choice of ECOSAN. The subsidies had a very high impact on the household desire to own and use a latrine.

- There were however various problems, which could act as barriers in the adoption of ECOSAN. These included lack of finances, socio cultural aspects and lack of awareness and misunderstandings. Financial barriers were of concern since the community is composed of a large percentage of poor people. Subsidies should therefore be made available, but they should be targeted such that the very poor also benefit from them. Those that can put up the ECOSAN toilet without subsidies should be encouraged to do so.

- Sensitivity of a toilet design to social or religious factors was also very important when a household was choosing an ECOSAN toilet. It was therefore important to appreciate the social and cultural context within which individual decisions are made.

- When designing ECOSAN systems (or sanitation systems in general), it is important not only to use what is available, but to also have various options available for various people (for example the poor, children under 3 years old, elderly and disabled).

- There were also comments on the construction issues, which for the most part were problems that could be corrected by the households themselves in conjunction with the Masons.

6.2. Conclusions

This study sought to document factors that contribute to household choice and adoption of the ECOSAN toilets in Wajir, therefore this data is important so as to determine strategies that can help in the generation of demand for ECOSAN. The following conclusions were made from the study:

- Messages that can arouse an interest in ECOSAN should take into consideration the factors that contribute to choice of ECOSAN for example the personal factors like convenience, privacy and prestige. This can attract attention and interest and stimulate households to consider change. Care should be taken that the messages do not clash with values and beliefs of the communities.

- It is important to adapt the ECOSAN toilet to different social groups, as well as children, the old and the disabled. The different designs should be affordable and can be made from materials that are not only cheaper but also locally available.

- Awareness and understanding on the various aspects of ECOSAN should be raised, while specific misunderstandings that may cause a negative attitude towards ECOSAN should be corrected. This can be done through education and awareness campaigns. These should be at household level.

- It is also important to address environmental issues. Environmental factors were not a factor of choice for ECOSAN toilets because the knowledge on the environment may be limited. When faeces contaminate the environment, the vicious cycle of people contaminating the environment and becoming infected by the contaminated environment continues and enhances poverty.

- In ECOSAN projects, it is important to identify an entry point. In Wajir, the geo-hydrological conditions (high water table and soil conditions) together with the lack of a proper sanitation technology provided a smooth entry point for ECOSAN into the community.

- Contrary to popular belief ECOSAN is a viable option that can be considered in faecophobic communities such as Muslim communities like the one in Wajir. ECOSAN can thus fill a special niche as a method of sanitation provision in developing countries such as Kenya and thus help in increasing sanitation coverage.

6.3. Recommendations

To improve sanitation in Wajir, the following recommendations are thus made. These will go a long way in the promotion of ECOSAN as an alternative sanitation option.

Government/ Policy makers

- They should consider forming guidelines for ECOSAN at national and municipal level. Many sanitation policies have been developed, which includes the Environmental Sanitation and Hygiene Policy that is

currently being developed. However, there are no sanitation policies specific to ECOSAN that have been developed. Formulations of by-laws that encourage the use of ECOSAN are also important.

- ECOSAN can play a valuable role in the regional integrated water resources management plans (IWRM). It can address important issues, which include water pollution, wastewater management and technology development. It is an alternative and cheap excreta management option that contributes to ecosystem conservation and thus puts less pressure on scarce water resources.

- ECOSAN programs should start with the factors that influence sanitation choice. Marketing messages should feature the fact that the ECOSAN toilet comes with convenience, privacy, prestige and safety. It can also be managed at household level, is an attractive and durable structure. Social marketing would thus play an important role here.

- Subsidising hardware is important to attaining increased coverage. Financial mechanisms should therefore be put in place for households that cannot afford the building costs of ECOSAN. Access to credit and payment by instalments is important. The technical expertise and hardware should also be made available to the consumers.

NGOs

- Information on appropriate technologies should be made available so that the appropriate selections can be made, bearing in mind the local situation as well as the technical and institutional capacity to deliver.

- Some ECOSAN units should be constructed in market places, clinics and other public places. In areas like Wajir, the night soil men can be trained to manage them and thus collect revenue for the County Council.

Recommendations for further research

- There is a need for further research into a range of affordable ECOSAN designs that are suitable for a wide range of users like the children, the physically challenged and the poor.

- It is also important to determine if there is any adverse effect of the urine from the urine diversion soak pits on the quality of ground water. If there is any effect then it would be important to look into alternative ways of handling the urine.

- There is need for field experiment on the possibility of the reuse of the ECOSAN products and their impacts on growth of various food crops such as vegetables and maize. Other considerations may include appropriate storage time for the products for safety reasons.

- Establishing the impact of ECOSAN on human health especially in terms of disease prevalence especially diarrhoea and intestinal worms.

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APPENDICES

Appendix 1: Requirements and costing for ECOSAN Toilet in Wajir

	Item description	Unit	Qty	Rate	NGO	Community (Kshs.)	Total (Kshs.)
1	Site clearance and excavation of top soil	Sm.	3.6	760		2736	2736
	Foundation						
2	Hardcore	cm.	3	500		1500	1500
3	Sand	cm.	1	500		500	500
4	Cement	bags	2	650	1300		1300
5	Aggregates	cm.	1	900		900	900
6	Damp proof membrane	Rm.	26.4	50	1320		1320
	Substructure (including plastering of walls)						
1	Bricks (230x100x75mm.)	No.	320	40	12800		12800
2	Sand	cm.	1	500		500	500
3	Cement	bags	7	650	4550		4550
4	Aggregates	cm.	0.5	450		225	225
5	10 mm. Reinforcement bars	Pc.	4	500	2000		2000
6	Binding wire	Kg.	1	100	100		100
7	Timber 12x1 ft. (for shuttering)	Rm.	5	100	500		500
	Superstructure						
1	Bricks (230x100x75mm.)	No.	630	40	25200		25200
2	Sand	cm.	1	500		500	500
3	Cement	bags	2	650	1300		1300
4	Nails						
	Stairs/Ramp						
1	Bricks (230x100x75mm.)	No.	100	40	4000		4000
2	Sand	cm.	0.5	500		250	250
3	Cement	bags	1	650	650		650
4	Aggregates	cm.	0.5	450		225	225
5	Hardcore	cm.	1	500		500	500
6	Murram	cm.	0.6	250		150	150
	Roofing						
1	Wall plate (100x50 mm.)	Rm.	8	99	792		792
2	Hoop iron	Kg.	2	200	400		400
3	Rafters (100x50 mm.)	Rm.	6	99	594		594
4	Corrugated Iron sheets	No.	2	500	1000		1000
5	Roofing nails	Kg.	2	120	240		240
	Plastering						
1	Cement	Bags	12	650	7800		7800
2	Sand	cm	2	500		1000	1000
	Fittings						
1	Door (800x21mm.)	No.	1	1800	1800		1800
2	Solar Heaters (800x800mm.)	No.	2	1500	3000		3000
3	100 mm. diameter PVC Vent pipe with rain stopper	Pc.	1	1200	1200		1200

	Plumbing						
1	1 1/4" PVC pipe	No.	1	500	500		500
2	1 1/4" PVC tee	No.	3	450	1350		1350
3	1 1/4" PVC elbows	No.	1	450	450		450
4	1 1/4"PVC plug	No.	2	450	900		900
5	PVC cement	tin	1	400	400		400
6	Squatting pan	No.	2	2000	4000		4000
	Evapotranspiration bed						
1	Excavate top soil	item	1	1500		1500	1500
2	Hardcore	cm.	2	500		1000	1000
3	Polythene sheets	Rm.	2	120	240		240
4	Labour	Man days	1	10000	10000		10000
					88466	**11486**	**99542**

Appendix 2: Questionnaire

Alternative approaches to management of excreta: An assessment of the factors that have led to household choice and adoption of Ecological Sanitation (ECOSAN) in Wajir.

Household Questionnaire for Adopters of ECOSAN in Wajir

My name is Julie Mulonga a student at the University of Nairobi. Today we are visiting your household to understand the choice and adoption of you and your family members of the ECOSAN toilets. If you do not mind, please spare a few minutes to answer some questions.

Please note that you are under no obligation to answer the questions and you are free to terminate this interview should you deem so. Any information you provide us will be treated with strict confidence and will only be used for research purposes.

Thank you.

Questionnaire no. ……..

1. Sex of respondent	*Male*	…….
	Female	…….
2. Age of respondent (years)		…….
3. Education level	*1. None*	…….
	2.Primary	…….
	3.Secondary	…….
	4.Higher	…….
4. Source of livelihood		
	1.*Self-employment*	…….
	2.Wage employment	…….
	3.Unemployed	…….
	4.Other/Agriculture/Livestock……	
5. How many people currently live in the household?		
	Children under 3 years	…….
	Children over 3 years	…….
	Adults	…….

6. Where did you first hear about ECOSAN?

1. Early adopter ……
2.NGOs (ALDEF/MERLIN) ……
3.Neighbour ……
4.Community leader ……
5.VHC ……
6.Govt (MWI/MoH/MoA) ……
Other ……

7. Are you currently using the ECOSAN toilet? Yes …… *No* ……

8. How long have you been using the ECOSAN toilet?

0 to 3 months ……
3 to 6 months ……
6 to 12 months ……
12 to 18 months ……
over 18 months ……

9. What were you using before the ECOSAN toilet? *1.Bucket toilet* ……
2.Septic tank ……
3.No toilet/Bush ……
4.Neighbours toilet ……

10. Are you or any member of your household still using the previous method of sanitation? *Yes* …… *No* ……

11. How does your ECOSAN toilet compare with the previous method of sanitation?

	Construction Cost			***O & M and replacement costs***			***Hygiene***			***Ease to maintain***			***Most desired in future***		
	1	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*
Septic tank															
Bucket latrine															
Bush/No toilet															
Other ……..															

1 = Better than ECOSAN, 2 = Same as ECOSAN, 3 = Worse than ECOSAN.

12. Would you prefer ECOSAN to other methods of sanitation?

Prefer ECOSAN ……
No preference ……
Prefer other methods ……

13. How many households (including yours) currently use your ECOSAN toilet?

1 …… *2* …… *3* …… *3+* ……

14. Does everyone in your household use the toilet with ease?

Males		*Females*	
Children under 3 years	*Yes/No*	*Children under 3 years*	*Yes/No*
Children over 3 years	*Yes/No*	*Children over 3 years*	*Yes/No*
Adults	*Yes/No*	*Adults*	*Yes/No*
Disabled	*Yes/No*		
Old	*Yes/No*		

15. What was important to you when you were choosing the ECOSAN toilet?

Technical factor
Durable and permanent structure .....
Attractive structure .....

Personal or individual factor
Convenience .....
Privacy .....
Health and hygiene .....

Management factor
Availability of training and technical expertise .....
Management at household level .....
Easy to operate and maintain .....
Financial factors .....
Other .....

16. What assistance did you receive in construction of the toilet?

Construction advice .....
Skilled labour .....
Unskilled labour .....
Construction materials .....
Other .....
None of the above .....

17. What did you contribute in construction of the toilet?

Skilled labour .....
Unskilled labour .....
Construction material .....
Money .....
Construction advice .....
Other .....
None of the above .....

18. Would you have built the toilet if you had received no assistance?

Yes ..... *No* .....

19. Did you participate in the ECOSAN toilet design workshop?

Yes ..... *No* .....

20. Are you satisfied with the ECOSAN toilet design?

Yes ..... *No* .....

21. Have you had any problems in using ECOSAN? *Yes* ..... *No* .....

If yes? Which problems?.....

22. Whom do you consult in case of any queries or problems with the toilet?

1.Mason .....
2.NGO .....
3.Other .....
4.No one .....

23. Would you have a problem emptying the chamber once it was full and the faeces had completely dried up? *Yes* ..... *No* .....

24. Would you recommend the toilet to others? *Yes* ..... *No* .....