ADOPTION AND USE OF SELF SANITIZING BIODEGRADABLE TOILET BAGS IN KIBERA SLUMS, NAIROBI COUNTY, KENYA

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University or any other award.

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DEDICATION

This work is dedicated to my parents Aaron Nderitu Wambugu and Miriam Wambugu for their support towards my education.

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ABBREVIATION AND ACRONYMS

CBOS	Community Based Organizations
EKC	Environmental Kuznets Curve
GDP	Gross Domestic Product
IBRD	International Bank for Reconstruction and Development
MDGS	Millennium Development goals
NGO	Non-Governmental Organization
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organization

ABSTRACT

The problem of how to dispose human waste has remained a global challenge in a world that is increasingly bound by constraints of resources population growth, rapid urbanization and corresponding levels of poverty and disease, the pressure for appropriate and sustainable solutions is mounting. Despite continued efforts to promote sanitation, a significant number of the world's population is still without basic sanitation. Kibera slums suffer from lack of improved sanitation facilities, including toilet, showers and sewage disposal. With few toilets and pit latrines, this has resulted in growth of "flying toilets" due to inaccessibility of toilet facilities during late hours owing to lack of even distribution and lack of convenience unresolved to insecurity. The purpose of this study was to investigate the adoption and use of self- sanitizing biodegradable toilet bags in Kibera slums, Nairobi County. Specific objectives focused on: community perception on adoption; level of awareness of the use and socio-economic and environment impact of adopting single use self-sanitizing biodegradable toilet bags. The findings may provide information to national policy makers, civil society and research organization in making informed decisions on relevant interventions on sanitation to communities living in informal settlements. The study adopted a descriptive research design using survey criteria. The study focused on the descriptions, which had a capacity to gather more information. The study was carried out in Kibera Slums, Nairobi County in two villages Silanga and Laini Saba. The study employed a number of sampling techniques including simple random and purposive sampling targeting key informants. The target population comprised 7363 and 8182 community residents' in both Silanga and Laini Saba respectively. Determination of the sample size was done using Fischer *et al.,* (1998) formula. A sample of 376 was considered appropriate for the study as supported by Cresswell (2005). Data was collected by use of questionnaires, observation list and focus group discussions. The data collected in this study was entered, edited and analyzed by use of descriptive statistics. The study found that people are not entirely comfortable being seen handling the bags. Educating the community, advertising the toilet bags more aggressively, door to door campaigns among other strategies can help inform more people and encourage others to begin using the bags. The study revealed that users had to contend with poor hygiene, insecurity especially at night for women and girls, overcrowding in public toilets, inaccessibility of toilets, the high cost of using toilets and difficulty disposing human waste. The study concluded that toilet bags indeed have a positive socioeconomic and environmental impact on the community; evidenced by new sustainable ways to handle waste. The study identified gaps in community level of awareness of the use of single use self-sanitizing biodegradable toilet bags. The study recommended the Peepoo management in partnership with the government and other NGOs to enhance continuous community hygiene education awareness programs along with physical access to water supply and sanitation to positively influence change in hygiene behaviour and decrease the prevalence of risks associated with poor hygiene conditions. The study recommended an investigation on gender and sanitation programs in order to evaluate integrating gender into community sanitation programs and the perception challenges.

CHAPTER 1

INTRODUCTION

1.1 Background of the study

The problem of how to dispose human waste has remained a global challenge in a world that is increasingly bound by constraints of resources and population growth, rapid urbanization and corresponding levels of poverty and disease while the pressure for appropriate and sustainable solutions is mounting. Diarrheal disease resulting from poor sanitation and hygiene is the leading cause of child morbidity and mortality in the world, resulting in the death of 1.5 million children a year (WHO, 2013). In addition, the world's 1.1 billion people who practice open defecation (WHO, 2010) are daily faced with threats to their privacy, health and safety. As a result, improvement in sanitation coverage has been targeted by the United Nations Millennium Development Goals (United Nations, 2005) because of its strong link to issues of environmental and public health, economy, and human dignity.

An estimated 1.6 billion people must be able to access improved sanitation services before 2015 in order to meet the Millennium Development target of halving the percentage of people without access to improved sanitation (WHO, 2011). However, much of the world is not on track to meet these goals (UNICEF, 2010) and there is general agreement within the field of sanitation that the sector has failed to deliver substantial improvements to the most needy. Despite the efforts made to reach the

United Nations Millennium Development Goals, the world will meet only 43% of the target of halving the percentage of people without access to improved sanitation in 2015, leaving over 2.7 billion people underserved (WHO, 2013).

Despite continued efforts to promote sanitation, a significant number of the world's population is still without basic sanitation. This number does not tell the whole story, sanitation coverage is often much lower in rural areas than in urban areas. In many cases, improving sanitation can be as simple as installing a well-designed ventilated improved pit latrine (VIP) or composting latrine. However, in other cases, improving sanitation will be more challenging, particularly in rapidly growing urban slums (Prüss and Mariotti, 2010). Moreover, while building improved sanitation facilities is a crucial health intervention, the full health benefits will not be realized without proper use and maintenance of the facilities and good personal and domestic hygiene (Carr and Strauss, 2001).

In Nairobi informal settlements, like many other cities in developing countries, the most widely used sanitary facilities in the poor neighborhoods are pit latrines, occasionally supplemented with flushing toilets and septic tanks. Conventional pit latrines provide a cheap way to handle human waste and require little maintenance; however, they provide limited comfort, attract flies and spread diseases such as diarrhoea and dysentery through contamination of the environment. Rapid population growth and urbanization associated with the proliferation of informal settlements are often accompanied by environmental degradation. The problem of informal settlements remains one of the greatest challenges for city managers (UN-HABITAT, 2010).

Sanitation facilities interrupt the transmission of faecal-oral disease at its most important source by preventing human faecal contamination of water and soil. Poor waste disposal practices are responsible for a significant proportion of the world's infectious disease burden. Diseases due to poor water supply, sanitation, and personal and domestic hygiene cause 4.0% of all deaths and 5.7% of all disability or ill health in the world (Thye and Templeton, 2009).

This burden is not distributed equally; waterborne illnesses predominantly affect the poor and the young. However, when basic water, sanitation, and hygiene interventions are applied, waterborne illnesses can be effectively reduced. Low cost interventions such as composting latrines can be used to reduce the transmission of many diseases.

Municipal sewage is a mixture of human excreta and household wastewater that is transported via pipes to a treatment or disposal point. In many areas, municipal sewage is often mixed with industrial waste. Sewerage systems are common in industrialized countries and often occur in urban areas of less-industrialized countries. In some regions very little wastewater receives treatment before it is discharged into the environment.

According to Karmal (2008), Community Led Total Sanitation (CLTS) is an innovative participatory approach that facilitates a process of empowering local communities to stop open defecation (OD) and encourages them to dispose of excreta in a safe and hygienic way. CLTS is meant to trigger collective local action, at village level, through hands-on field practice by successfully generating enthusiasm among communities.

Like most cities in developing countries, Nairobi is experiencing rapid urbanization leading to an increase in the urban population and rapid growth in the size and number of informal settlements (UN-HABITAT, 2010).

Although it is known that well-managed systems for piped water, sanitation, drainage, and garbage removal would improve the health of city residents, introducing and maintaining centralized systems in developing cities have been hampered by political, economic, ecological and social instabilities. This leads to poor environmental performances and perpetual breakdowns, due to lack of proper maintenance or timely investments (Parkinson, 2008). This raises a pressing need to understand the nature and magnitude of the issues affecting sanitation provision in order to find more cost-efficient and sustainable sanitation alternatives to address them. It is against this background that this study sought to investigate factors influencing the adoption and use of single use self-sanitizing biodegradable toilet bags in Kibera slums.

1.2 Statement of the problem

Kibera slums suffer from lack of improved sanitation facilities, including toilet, showers and sewage disposal. Ninety four percent of the informal population does not have access to adequate sanitation facility (Chepchirchir *et al.,* 2009). Up to sixty percent of the population must share pit latrines with approximately fifty others. Even when toilet facilities are available, people complain that they are not conveniently located, they are unclean, or that using them at night poses security risk. Children are vulnerable especially because they lack access to household keys that unlock community toilets. The toilets are built by NGOS and managed by CBO's (Chepchirchir *et al.,* 2009).

With few toilets and pit latrines, this has resulted in growth of "flying toilets" owing to inaccessibility of toilet facilities during late hours due to lack of even distribution and lack of convenience payable to insecurity. Most toilets are owned by community groups and individual business men who charge Kshs.5 per person per every visit (Vinneras *et al*., 2009).

Peepoople, a well-established Swedish NGO is working in different parts of Kibera informal settlement to improve sanitation by introduction of single use self-sanitizing bio-degradable toilet bags which are also sources of fertilizer. Hence the community is able to dispose human waste properly and at the same time reduce environmental degradation by providing collections points of used bags and also by assigning collectors from the houses for individuals that are shy.

1.3 Research questions

i. What is the community perception on adoption of the single use self-sanitizing biodegradable toilet bags in Kibera slums?
ii. What is the community level of awareness of the use and benefits of single use self-sanitizing biodegradable toilet bags?
iii. What is the socio-economic and environment impact of adopting single use self-sanitizing biodegradable toilet bags?

1.4 Objectives

1.4.1 General objective

To investigate factors influencing the adoption and use of single use self-sanitizing biodegradable toilet bags in Kibera slums.

1.4.2 Specific objectives

i. Investigate perception on adoption of the single use self-sanitizing biodegradable toilet bags in Kibera slums.
ii. Assess the community level of awareness of the use and benefits of single use self-sanitizing biodegradable toilet bags.
iii. Assess the socio-economic and environment impact of adopting single use self-sanitizing biodegradable toilet bags.

1.5 Hypotheses

1. There is a relationship between community perception and adoption of self-sanitizing biodegradable toilet bags.
2. There is a relationship between community awareness and the extent of use of the single use self-sanitizing biodegradable toilet bags.
3. There is a relationship between socio-economic status of households and the adoption and use of single use self-sanitizing biodegradable toilet bags.

1.6 Significance of the study

The study is an important eye opener for policy makers to explore innovative systems of toilet facility management and adoption of self-sanitizing biodegradable toilet bags a

sustainable option in urban slums. Moreover, the study has offered key recommendations that may help the government and stakeholders to create long-term solution that will produce the most attractive, sustainable and hygienic alternatives to open defecation for slum residents. In the long run, results may enable policy makers design programs by raising awareness of hygiene practices, and advocacy to the government for replication and scale up of successful practices and pilot projects. The study has provided a good opportunity to make long lasting changes in the way hygiene and sanitation is perceived in slums.

It is expected that the study may contribute to existing body of knowledge on sanitation in urban informal settlements. It may highlight the socio-economic factors influencing the adoption and use of new technology. The findings may provide information to national policy makers, civil society and research organization in making informed decisions on relevant interventions on sanitation to communities living in informal settlements. Findings from this study can be used by the city authorities in the planning of effective sanitation intervention strategies for communities in informal settlements. In addition, this study reflects a continuing evolution in methods, scope and evidence base on sanitation aspects and proposes alternative methods of sanitation in urban slums; and the need to ensure that policy on interventions such as water and sanitation be grounded on methods that are transparent.

1.7 The scope of the study

A variety of strategies have been used in waste disposal amongst slum dwellers. This study only focused on the adoption and use of self-sanitizing biodegradable toilet bags

in Kibera slums; and thus left out other emerging or past methods. The study geographically focused on Kibera in Nairobi County.

1.8 Limitation of the study

While there are various factors that may influence adoption and use of self-sanitizing biodegradable toilet bags; this study limited itself to three key aspects including: perception, community level of awareness, socio-economic and environment impact of adopting single use self-sanitizing biodegradable toilet bags. Moreover, the study adopted a survey research and utilized questionnaires, observation check list and focus group discussions only. Although there are a number of informal settlements in Nairobi, the study was limited to Kibera Slums as a case study. A major limitation is that study may not be applicable to other regions and countries owing to local socio-economic differences and hence results will be in the context of a developing country such as Kenya.

1.9 Conceptual framework

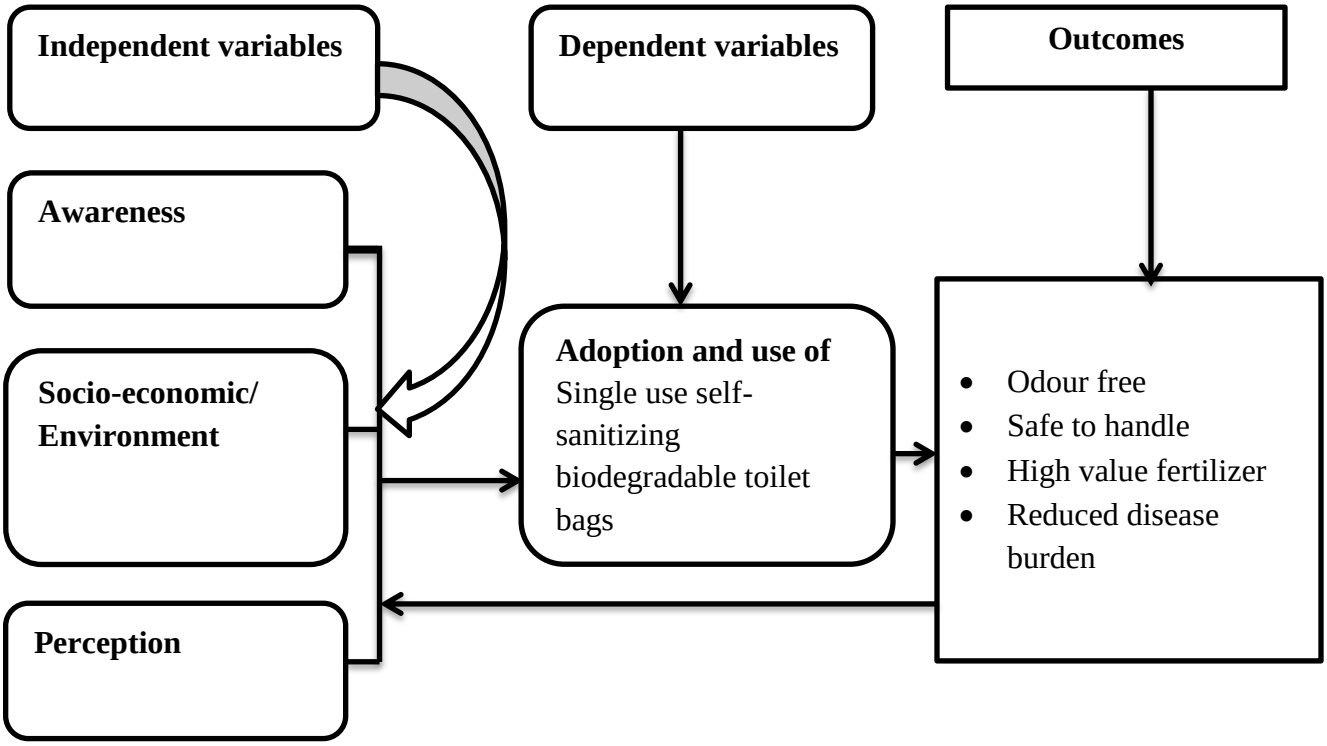

Figure 2.1 Conceptual framework-adoption and use

Source: Author

The study examined two categories of variables namely the independent and dependent variables. The independent variable include; perception, awareness and socioeconomic and environmental impact of single use self-sanitizing biodegradable toilet bag whereas the dependent variable of this study was adoption and use of single use self-sanitizing biodegradable toilet bag .

The framework is based on the key variables based on the research objectives which include; perception, community level of awareness, perception and socio-economic status; impact of adopting single use self-sanitizing biodegradable toilet bags. The

framework with the findings of this research resonates that the factors influencing adoption and use of self-sanitizing biodegradable toilet bags relate to awareness, socio-economic status and perception. Community level awareness may result in community ability to utilize the self-sanitizing biodegradable toilet bags. At a household level, factors such as socio-economic status and perception towards change may result to behaviour towards change thus ultimately affecting the livelihoods of the residents. At the lowest level which is the individual level, factors such as sociocultural and economic factors may also result to outcomes such as behaviour change and therefore affecting the livelihood of the residents. The knowledge of the presence and benefits of peepoo toilets can positively influence the community to embrace the new innovation which will result in adoption. In addition, when individuals have a source of income, this translates to change of lifestyle and hence they have the capacity to buy the bags.

Community perceptions and attitude towards a new innovation could impact on either adopting or rejecting change. If members of a community have the perception that the self-sanitizing bio degradable toilet bags are for children; this will slow down the adoption process. Adoption and use of self-sanitizing bio degradable toilet bags means that the population will reap the benefits of using the sanitized toilet bags. Awareness is a critical component in the combination of internal and external conditions that comprise organizational support and social mobilization. It also consists of the public awareness and participation, formation of user committees and definition of specific roles for stakeholders. The socio-economic impact is critical. For example, lack of access to sanitation and safe drinking water has multiple ramifications on people's

finances (WHO, 2011). When they are infected with waterborne ailments, they need to spend their hard-earned money on medicine. Similarly, the illness keeps them from going to work and stifles their income. Basic hygiene, as they perceive it enhance self-esteem. Those who are tidy, clean and healthy are respected in society. They have further said that those who do not have toilets at home feel inferior to those who have toilets at home. Yet still, some may view the adoption of self- sanitizing biodegradable toilet bags as something humiliating when outsiders come to their homes (Vallabhaneni, 2012).

All these factors are crucial in influencing adoption and use of self-sanitizing biodegradable toilet bags in informal settlement. Contrary to this, the failure to identify local people's needs and mobilization renders an intervention unsuccessful. Different stakeholders need to become aware, committed and actively engaged if the critical constraints necessary for scaling up sanitation chain services, in particular for the poor, are to be overcome. Households need to willingly invest in available, affordable, quality and friendly sanitation services; offered by entrepreneurs who are capable of offering such services. Scalable innovation which addresses the changing needs of the sanitation chain services everywhere needs to be promoted. It is also vital to strengthen policies and regulations which stimulate entrepreneurship and private sector involvement in different aspects of sanitation chain services, and to monitor the quality of the services they provide. Moreover, a systems-based approach that combines technical ingenuity and innovative business models to engage the local communities and build out the entire sanitation value chain is critical. The adoption of self-sanitizing

biodegradable toilet bags; coupled with community members who possess knowledge about sanitation and put their knowledge into practice may ensure an odour- free environment and reduced disease burden as shown in Figure 2.1 on page 8 (Parkinson, 2008).

1.10 Definition of operational terms

A flying toilet: is a method whereby the user defecates into a paper or a plastic bag, which is then sealed and thrown away. Since their lack proper waste management system such as litter drop points and collections in the informal settlement, disposing of the bag normally means throwing it through the air as far from your residence as possible. The bags are seen sitting on roof tops, in piles of rubbish and the open sewers which are prevalent in the settlements. This has contributed to significant environmental degradation and the open trenches stagnant polluted water has led to high incidence of disease (Buttenheim, 2008).

Biodegradable: is matter which can be broken down, in a reasonable amount of time, into its base compounds by micro-organisms and other living things, regardless of what those compounds may be (Ikada and Tsuji, 2000).

Millennium Development Goals (**MDGs**): are eight international development goals that were officially established following the Millennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration(United Nations, 2006).

Peepoo: is a self-sanitizing single use completely biodegradable toilet that can safely be disposed of in soil and converted into compost formation. It is plastic bag containing

urea crystals that serves as a single-use disposable ‘toilet’ for people that lack access to regular toilets. The urea crystals kill the harmful bacteria in the excrement that would ordinarily end up contaminating water supplies and spreading very preventable diseases (Patel *et al*, 2011)**.** Peepoo is essentially a slim biodegradable plastic bag (14 x 38cm) with separate, green gauze lining (26 x 24 cm), similar in shape to a single wine bottle bag. It weighs less than 10 grams and odour free up to 24hours after use (Vinneras *et al*., 2009).

Waste Management: encompasses management of all processes and resources for proper handling of waste materials, from maintenance of waste transport trucks and dumping facilities to compliance with health codes and environmental regulations (Nordin, 2010).

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Flying toilets are a common problem in urban areas like slums. To provide access to safe and acceptable toilet system in urban areas with a dense and generally poor population, one has to face the challenges of the lack of availability of space, willingness to pay and the absence of an institutional infrastructure. The Peepoo toilet could be an alternative solution. It is a personal, biodegradable toilet for single-use. It can be used either sitting or standing, where and whenever the user wants and it is easy to carry around. After use it can be stored odour free up to 12 to 24 hours until it is handed over to the collection system and finally buried in the soil, where it serves as fertiliser. Another option is for people in urban slums to use it in their home gardens, so called vertical gardens. The big advantage is that no fix infrastructure and thus no space and no investment costs are needed as it can be distributed very quickly and easily. However, in order to get the full value from the Peepoo solution, using it as a high value fertiliser for local farmers and other agriculture businesses, a logistical infrastructure is required for the collection of used Peepoo's. This also helps in avoiding accumulation in people's backyard. Moreover, no water is needed which makes this technology suitable for water scarce areas. Wirseen and Palmklint (2011).

2.1 Peepoople organization

Peepoople is a registered Swedish Non-governmental organization based in Kibera slum, in Kenya. The first Peepoo urban slum project was launched in Kibera in 2010. Peepoople's organization mission is to provide hygienic and dignified sanitation for all. In the process Peepoople is also empowering communities with a necessary resource, fertilizer (Nordin, 2010). Two to four weeks after use, the remnants of the Peepoo self-sanitizing biodegradable bag deposit become a fertilizer filled with soil nutrients and nitrogen, improving agricultural production and livelihoods. Using the Peepoo bag is simple and is designed for total hand protection, but it is recommended to wash hands after use (Patel *et al*., 2011).

Engineers, researchers, public health professionals and aid workers have studied the connection between sanitation, human security, disease, gender roles and social development. The World Health Organization (WHO) points out that Cholera remains a global threat to public health and one of the key indicators of social development and it remains a threat in almost every developing country. The Peepoo toilet was launched to the market in Kenya in 2010. Individuals can now purchase them in markets where the Peepoo solution was launched. The Peepoo is sold to poor people in urban slums cheaply and typically distributed by women micro entrepreneurs, by landlords or through retailers such as small kiosks or water sales points. In emergencies, refugee camps, schools and hospitals, Peepoo is typically handed out for free via aid organizations and governments. Peepoo is described as the ideal system, the ideal product for the biggest problem facing the world (Bennett and Elser, 2011).

2.2 Peepoo

The peepoo toilet is compact in size and weighing 10 grams, Peepoo is designed to provide maximum hygiene and convenience using minimum material. Peepoo is in the form of a slim biodegradable bag, with an inner layer that unfolds to form a wide funnel. It is easy to store, handle and use. Peepoo is intended to be used a single time, by one person, whenever and wherever needed. Unlike traditional toilets or latrines, Peepoo is never occupied by anyone else. It is always clean and can be used in complete privacy. Recognizing consumer needs, Peepoo is formulated from a bottom-up perspective that puts the user's need first. Ergonomically designed to be easy and hygienic to use, simple to produce, and thus possible to be sold to groups with the weakest purchasing power, Peepoo offers a sanitation choice for both individuals and society at large.

Peepoo works as an every-day toilet and can also be used as a complementary sanitation system at night, at work, or at school. Due to its low price, it can be used regularly at home or only when ill. After use, even if no collection or disposal services are available nearby, Peepoo does not contaminate the environment once the top of Peepoo has been tied into a knot. The urea inside Peepoo inactivates harmful pathogens (bacteria, viruses and parasites) within four weeks.

Photo 1: Demonstration on use of peepoo bag

Due to its self-sanitizing attributes, Peepoo remains safe to hold and carry after use. Because scarce and valuable water resources are not required to use or dispose of Peepoo, the traditional link between water and sanitation is cut. In fact, water is only needed when the user washes his or her hands after defecating or urinating.

Peepoo remains odour-free for at least 24 hours after use and can be stored in the immediate environment. This makes Peepoo easy to use, either day or night in a household, which increases safety – especially for woman and children. Peepoo offers a sanitation solution adapted to the needs of the user without endangering the environment.

Peepoo is made of a bio-plastic that meets EU standard EN13432. This means the plastic not only disintegrates, the molecules break down into carbon dioxide, water and biomass. Combined with the sanitization process that urea initiates and completes,

Peepoo completely transforms over a short period of time into high-value fertiliser which enables collection and disposal systems to arise, informally or formally, private or public, small scale or large scale. The design of the toilet offers a clean and hygienic way of excreta management, helping to cut the stigma normally connected with this service. Peepoo thus has the capacity to work as a development strategy on different levels.

Peepoo is designed to be used once, while sitting, squatting or standing. For more convenience, Peepoo can also be placed on the Peepoo Kiti or on a small bucket and used as a chamber pot. Because Peepoo is small, lightweight and not fixed in place, it can easily be used indoors or carried to a secluded spot for use as a private toilet. After defecating or urinating, the user can securely contain the contents inside Peepoo by sliding the outer layer up over the inner layer and tying it into a knot Wirseen and Palmklint (2011).

2.3. Perception on adoption of new methods

Perception is an important component of behavior change and plays a major role in public response to environmental exposures. Therefore, increasing people's perception and knowledge is a cornerstone for interventions promoting protective behavior (Thye and Templeton, 2009).

Research on environmental risk assessment has established a relationship between exposure and health risks. However, little attention has been paid to understanding community perceptions of environmental risk particularly in sub-Saharan Africa (Kim,

2012). Consequently, governments are grappling with how to empower citizens to be involved in various aspects of environmental management to increase action and local participation in interventions.

As such, assessing the community level of awareness of the use and benefits of single use self-sanitizing biodegradable toilet bags is of critical importance. Furthermore, community and individual level interventions for reducing exposure to health hazards and environmental safety in slum areas are important means for improving public health and citizen participation. However, the effectiveness of these programs depends mainly on peoples' perceptions of exposure and risk for individual acceptance and action. Studies on risk perception have revealed it to be multi-dimensional with demographic, cultural and political characteristics playing a role in observed differences in perception. On the other hand, interventions directed at individuals have also been suggested to lower baseline health risks and overall burden of diseases associated with fecal waste disposal (Pope, 2006).

2.4 Socio-economic and environment impact

Health ultimately depends on the ability to manage successfully the interaction between the physical, biological and economic/social environment. Sound development is not possible without a healthy population; yet most developmental activities affect the environment to some degree, which in turn causes or exacerbates many health problems. Conversely, it is the very lack of development that adversely affects the health condition of many people, which can be alleviated only through development.

The health sector cannot meet basic needs and objectives on its own; it is dependent on social, economic and spiritual development, while directly contributing to such development. It is also dependent on a healthy environment, including the provision of a safe water supply and sanitation and the promotion of a safe food supply and proper nutrition (Yongsi *et al.*, 2008).

Specific socio-economic conditions prevail in many economically developing countries including India, that also include rapid population growth, migration to urban areas, lack of sufficient funds and affordable services and generally a low-skilled labour force. In such circumstances, all the economically valuable resources become a trade even if they are waste of primary or other levels. Although somewhat old but highly relevant, according to a United Nations Development Programme survey of 151 mayors of cities from around the world, the second most serious problem that city dwellers face (after unemployment) is insufficient solid waste disposal (UNDP, 1997). Bad waste collection practices and improper solid waste disposal contribute to local episodes of disease, regional water resource pollution, and global greenhouse gases (Apata, 2011).

Poor, inaccessible, and marginal urban areas suffer most from deficiencies in service and infrastructure, thus worsening poverty, ill health, and social marginalization. In low-income or squatter settlements, waste collection is often nonexistent, either because the settlements are informal, unplanned, and possibly unauthorized or because the strategies and technologies adopted for service provision are inappropriate for operating in settlements with narrow and unpaved streets and lanes (Yahaya, *et al*, 2011).

Theoretically, three features are typical in the waste management situation in developing cities; first, the municipalities in developing countries have insufficient means to manage the growing burden of solid waste, second, the informal sector plays an important role in recovering large quantities of solid waste at a zero cost to the public and third, despite the efforts of the formal and informal sectors, significant quantities of waste remain uncollected (Aluko and Sridhar, 2005).

Poverty is said to be both cause and effect of environmental degradation. The circular link between poverty and environment is an extremely complex phenomenon. Inequality may foster unsustainability because the poor, who rely on natural resources more than the rich, deplete natural resources faster as they have no real prospects of gaining access to other types of resources. Moreover, degraded environment can accelerate the process of impoverishment, again because the poor depend directly on natural assets (Gouveia and Ruscitto do Prado, 2010).

2.5 Waste management practices

The cities of third world countries are growing at very rapid rates compared to those in the developed nations. For instance, a UN-Habitat report observed that Africa is the fastest urbanizing continent having cities like Cairo, Lagos, Nairobi, Kinshasa among others growing at fast rates that would make them triple their current sizes by the year 2050 (UN-Habitat, 2010). Such high rate of growth of cities has implications for the provision of urban infrastructural services to prevent the proliferation of urban slum. The increasing growth of cities, therefore, has implications for municipal waste

management among other social services required in the urban communities. Data from many of the cities show inadequacy in urban social services like shelter, provision of safe drinking water and efficient management of solid wastes. The cities are therefore littered with 'mountains' of rubbish in landfills and open (in most cases illegal) waste dumps which are covered with flies and thus serve as breeding grounds for rodents and mosquitoes which are carriers of diseases (Yongsi *et al.,* 2008).

In a bid to examine the link between environmental pollution arising from waste dumps and public health, the United Nations Environment Programme (UNEP, 2010) conducted a pilot study of the Dandora Waste Dump in Kenya. The study, as tentative as it was, showed that a link exists between the two. The conclusion from this and other studies has led to an increasing interest of researchers in the studies relating to several aspects of municipal solid waste management in urban cities of many nations (Yongsi, *et al*, 2008). Though some studies conducted by social scientists have examined the social consequences of the present urban waste management issues, yet, few of these studies examined the health implications of community level of awareness and the use and benefits of single use self-sanitizing biodegradable toilet bags (Cronin, 2013).

2.6 Environmental Kuznets Curve (EKC)

The Environmental Kuznets curve is a hypothesized relationship between various indicators of environmental degradation and income per capita. In the early stages of economic growth degradation and pollution increase, but beyond some level of income

per capita the trend reverses, so that at high-income levels economic growth leads to environmental improvement.

Many studies on waste management and its implications for the city dwellers take their theoretical root in the conventional wisdom regarding the trade-off between industrial growth and income inequality among the citizenry. Given that high level of savings is a pre-requisite for investment and rapid growth, Kaldor (2008) believes that an income distribution skewed towards the entrepreneurial class, who are believed to be having high marginal propensity to save, is good for growth.

The Kaldor's (2008) hypothesis has been adapted by scholars in the environmental studies to explain the relationship between the growth in income per capita and various indicators of environmental degradation, and it is popularly referred to as Environmental Kuznets Curve (EKC). The main argument of Environmental Kuznets Curve (EKC) is that the level of environmental degradation (as a result of pollution from industrial and domestic activities) first rises, gets to a peak and later declines as income per head increases in the economy.

The EKC proposition was brought into prominence by the World Bank in 1992 which argued that "as incomes rise, the demand for improvement in environmental quality will increase, as will the resources available for investment" (IBRD, 1992:39). Following the World Bank's study, Grossman and Krueger (2005) estimated an econometric model where the level of pollution per capita was made a quadratic function of real GDP using a panel regression approach. The pollution variables used are the quality of water and ambient air in cities worldwide. The resulting scatter plot of pollution-income

relationships appear as an inverted U-shape, but with the peaks of predicted pollution-income paths varying across pollutants but in most cases they come before a country reaches per capita income of kshs.680,000 in 1985 (Grossman and Krueger, 2005).

The identified weaknesses of EKC hypothesis notwithstanding, evidence abound in the literature that the level of solid waste generation and the resulting environmental pollution is high in developing countries of Africa, Asia and Latin America as compared to the developed nations. This can be linked to the rural-urban migration and urbanization phenomena as well as externality effect of solid waste generation in production and consumption activities as the economy develops industrially (Grossman and Krueger, 2005).

When individual's income in the slums increases their get the purchasing power in this case they are able to adopt the biodegradable toilet bags which will help curb the "flying toilet" menace that has continually caused environmental degradation.

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CHAPTER 3

METHODOLOGY

This chapter presents the various steps that facilitated the execution of the study to satisfy its objectives. This section covers the research design, the study area, target population, sampling techniques, sample size, research instruments, pre-testing of the instruments, validity, reliability, data collection techniques, data analysis, logistical and ethical considerations.

3.1 Research design

A research design is a plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variance. Green and Tull (2002) describe research design as an overall operational pattern or framework of a project that stipulates the source and procedures of how information is to be collected. The research design of this study was a survey. The study focused on the descriptions, which had a capacity to gather more information. According to Ngau and Kumssa (2004), descriptive surveys are useful in describing the characteristics of a large population. Moreover, very large samples are feasible, making the results statistically significant even when analyzing multiple variables. The researcher collected information from community on their perception, awareness and valuation of the single use biodegradable toilet bags against the “flying toilets” in Kibera slums.

3.2 Study area

The study was carried out in Kibera Slums, Nairobi County. It has an estimated population of one million inhabitants of mixed ethnic descent (KNBS, 2010). It is situated South West of Nairobi and has a total of 13 villages which comprise of: Karanja, Soweto, Laini Saba, Gatwikira, Makina, Mashimoni, Kisumu Ndogo, Kianda, Lindi, Silanga, Raila, Mhuru and Kambi. This research was limited in two villages in Kibera slum namely; Silanga and Laini Saba, this is because the self-sanitizing biodegradable toilet bags were first introduced in the two villages before being replicated to other villages in Kibera.

3.3 Target population

The target population was both adopters and non-adopters of the biodegradable toilet bags. The researcher targeted household that had an indication of the presence of a residence (an open door). In addition, the researcher talked with an adult of age of 18years and above and made an appointment to come and meet with the head of the house in order to receive permission (in cases where the head of the house was present the structured interview took place on the spot).

3.4 Sampling procedure

The quality of any research is influenced by the appropriateness of methodology, instrumentation and suitability of the sampling strategy that has been adopted (Manion *et al*., 2001). An ideal sample should be large enough so that the researcher can be confident, within specified limits that a different sample of the same size if drawn using

same procedures can give approximately similar results (Wiersman, 1995). The study employed the following sampling techniques: simple random and purposive sampling from key informants.

Simple random sampling is that method of drawing a portion (sample) of a population so that each member of the population has equal chance of being selected (Kerlinger, 1964). Simple random sampling was employed to enable the researcher further narrow down in getting the specific respondents in the each of the village in Kibera with an objective of gathering highly representative information.

According to Wooldridge (2003), a purposive sample is a sample selected in a deliberative and non-random fashion to achieve a certain goal. The researcher deliberately sought out the first respondents from the targeted areas where adoption of the single use self-sanitizing biodegradable toilet bags has been reported.

The target population comprised 7363 and 8182 community residents' in both Silanga and Line Saba respectively. Simple random sampling was used to select the actual number of respondents, from the targeted households. Moreover, the study used purposive sampling procedure to gather information particularly from key informants. Moreover, convenience sampling was used based on respondent's ease of accessibility and willing to participate.

A total of 10 key informants were sampled to provide key information. The key informants interviewed comprised of four workers from the Peepoople and four shop attendants doing peepoo sale each from one of the villages in Kibera. The area chief

was interviewed based on his experience and knowledge about Kibera. In addition, one key informant from Peepoople was interviewed owing to their invaluable contribution to the development in Kibera.

3.5 Sample size

Determination of the sample size was done using Fischer *et al.,* (1998) formula recommended by Mugenda and Mugenda (1999) as effective for social sciences. The formula is as follows:

$n = z^2pq/d^2$

In this formula n=the desired sample size for target population <10,000, z=normal standard deviation corresponding to 95% confidence interval, that is 1.96, p= proportion of the population estimated to have desired characteristics, in this case residents in both Silanga and Laini Saba.

q=1-p those who do not have an idea about solid waste disposal methods.

Therefore q=1.0-0.57=0.43

d= the level of statistics significance set. In this case it is 0.05.

$$n = \frac{1.96^2 \times 0.57 \times 0.43}{\mathbf{0.5^2}}$$

=3.76x100

=376

Therefore the minimum sample required was 376 people.

In terms of the sample size, rather than selecting a large number of people or sites, the study identified a representative number that provided in-depth information on key issues regarding adoption the single use biodegradable toilet bags against the “flying toilets” in Kibera slums. The choice of the sample is seen appropriate as supported by Cresswell (2005) indicating that, sample sizes should not be too large. At the same time, the sample should not be too small that it is difficult to achieve data saturation, theoretical saturation or informational redundancy. On the other hand, the sample was large enough for statistical procedures to be used and hence made it possible for the researcher to draw inferences with some confidence that it reflected the characteristics of the entire population.

3.6 Data collection

Data was collected by use of questionnaires, observation list and focus group discussions. Three types of questionnaires were used targeting various groups of people. First a key informant question guide was used to collect data from school principals, health workers, area chief, school staff and teachers. A questionnaire designed for the user of the single use self-sanitizing toilet bag was used. Thirdly, an observation checklist was used by the researcher for making her own observations.

The researcher pre-tested the research instruments in two regions (Lindi and Mashimoni) in Kibera selected which was selected using simple random sampling. The pre-testing was meant to achieve precision, and to ensure that they measure what they were expected to measure. The regions selected were not included in the final study

sample. To enhance validity, the study pilot tested the instruments. This helped to make a comparative advantage to make sure the questions were accurate and indeed measured what they were intended to measure. Furthermore, the semi-structured standard questionnaires were adopted from an instrument validated by Kantis *et al*., (2002). The study adopted the internal consistency method which provided a unique estimate of reliability for the given test administration.

Key informants question guide and focus group discussions formed the main tool for collecting data which were administered to key informant; school principals, health workers, area chief, school staff and the residents (users). The questionnaire comprised four sections: general information; perception on adoption and use of single use self-sanitizing biodegradable toilet bags; level of awareness and socio-economic and environment impact of adopting and use of single use self-sanitizing biodegradable toilet bags.

3.7 Data analysis

The data collected in this study was entered, edited and analyzed by use of descriptive statistics. According to Babbie (2004) quantitative analysis is the numerical representation and manipulation of observations for the purpose of describing and explaining the phenomena that those observations reflect. According to Mugenda and Mugenda (1999), descriptive methods have the advantage of summarizing measures, which are used to condense raw data into forms that supply information efficiently.

Quantitative data collected using questionnaires was coded and entered and analyzed using a computer Statistical Package for Social Scientists (SPSS) program. In

presenting the study's findings, frequency tables and charts with varying percentages were used. As for the results of interviews and focused group discussions, qualitative techniques were used to present the findings. This involved a critical assessment of each response and examining it using thematic interpretation in accordance with the main objectives of the study and will then be presented in narrative excerpts within the report.

Data was analyzed by non-parametric means using SPSS (Statistical Package for the Social Sciences). First, the frequencies and percentages of respondents with various views on the use of use self-sanitizing biodegradable toilet bags were determined. The questionnaires data was subjected to Chi-square first to determine whether there was a significant relationship between the various variables. On the other hand, qualitative data was drawn from open-ended questions in the question guide and focus group discussions to present the findings. This involved a critical assessment of each response and examining it using thematic interpretation in accordance with the main objectives of the study, which was then presented in narrative excerpts within the report (Babbie, 2004).

3.8 Logistical and ethical considerations

The researcher received authorization from Graduate School, Kenyatta University allowing her to collect data. The letter enabled the researcher to apply for a research permit from the National Commission for Science, Technology and Innovation (NACOSTI). The permit was presented to the administration in Kibera to allow for data collection. The researcher took precaution to keep the data confidential and also helped explain to the respondents the purpose of the study.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.0 Introduction

The study was conducted to investigate factors influencing adoption and use of single use self-sanitizing biodegradable toilet bags in Kibera slums, Nairobi County. This chapter presents the findings of this study. The chapter is divided into two main sections. The first section will briefly address the respondents' characteristics while the second section will present and discuss the findings of the study.

4.1 Brief overview of the respondents

4.1.1 Response rate

The researcher aimed at using a representative sample of 376 respondents to represent the residents of Kibera slum. The researcher distributed 376 questionnaires and 316 were returned properly filled. Thus, the response rate was 84.2% which is more than adequate for analysis and reporting of results (Mugenda and Mugenda, 2003).

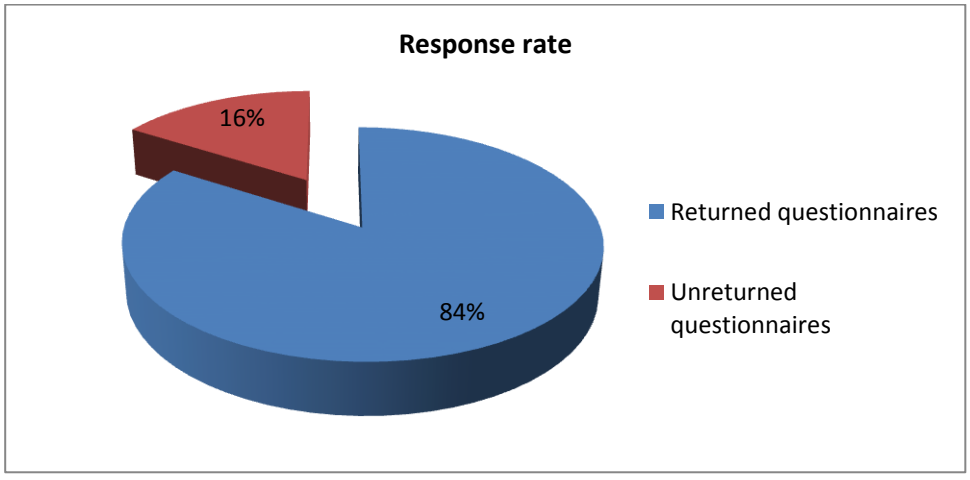

Figure 4.1: Questionnaire response rate

4.1.2 Respondents' gender

Both male and female residents of Kibera slum took part in the study. Table 4.1 shows the proportion of male to female respondents in the study

Table 4.1 Respondents' gender

	Frequency	**Percentage**
Male	115	36.6
Female	201	63.4
Total	**316**	**100.0**

As Table 4.1 shows, 63.4% of the respondents were female whereas 36.6% were male. Majority of the respondent were females. This gender disparity is also evident in other sectors as the ratio of male to female is not always the same. The gender aspect had a key implication on the study, given that case; perception and knowledge focus on the general aspects without an emphasis on gender aspect that can have an effect on adoption and use of self- sanitizing biodegradable toilet bags.

Gender issues may play a significant role in sanitation programs. Gender issues have only recently become the subject of detailed academic scrutiny under the new constitutional dispensation in Kenya. Within several of the city's informal settlements, women groups are involved in a number of programs of improving community environmental conditions and generating income.

Gender equality and equity are indispensable to realization of Millennium Development Goals especially relating to water and sanitation. Women's issues and concerns are important in all development planning and projects and the success of any initiative depends substantially on recognition of their different needs, concerns, perspectives and

contributions and also the gender relations. Gender mainstreaming not only seeks to ensure incorporation of women's and men's needs and perspectives but also sees their contribution to the efficiency and sustainability of the development initiatives themselves (UN-HABITAT, 2012). Gender-responsive programming promotes greater equity by ensuring that the overall needs and interests are met; effectively incorporating life skills-based strategies and closing potential achievement gaps between the sexes (Raghavan, 2009). Foregoing, the contribution of gender aspects when considering sanitation and adoption of new technologies is significant.

4.1.3 Respondents' age

Individuals of different ages were included in the sample of respondents which participated in the study. Table 4.2 shows the age distribution of the respondents

Table 4.2 Respondents' age

Ages	Frequency	Percent
18 and below	12	4.0
19 to 23	88	27.7
24 to 28	88	27.7
29 to 33	34	10.9
34 to 38	47	14.9
39 and above	47	14.9
Total	**316**	**100.0**

As Table 4.2 shows, more than half of the respondents (55.4%) were between 19 and 28 years old. This indicates that majority of residents of Kibera slum are relatively young. This finding is consistent with the fact that young people below 30 constitute the largest segment of Kenya's population. Hook and Spooner (2012) observed that increased adoption of new technologies was significantly associated with age, and work/life imbalance; adjusting for age, gender, health risks, and medical conditions. Reports such

as United Nations Population Fund (NFPA-Kenya, 2012) indicate that seventy-five per cent of Kenya's population is less than 30 years of age, and this may explain the age distribution.

4.1.4 Respondents' highest level of education

Respondents who took part in this study had varying levels of education as shown in Table 4.3.

Table 4.3 Respondents' highest levels of education

Education	Frequency	Percent
Primary	144	45.5
Secondary	128	40.6
Certificate	13	4.0
Diploma	28	8.9
Bachelors	3	1.0
Total	**316**	**100.0**

Table 4.3 reveals that a total of 86.1% of respondents only have primary or secondary level of education. Only nine respondents had diplomas and one had a bachelor's degree. These finding indicates that the level of education among residents of Kibera slum is very low which is not surprising considering that most people inhabiting poor slum areas do not have adequate access to formal education.

There has been an increasing number of public and private universities in Kenya, and many people are currently seeking to further their education. Local community at various stages of formulation, implementation, monitoring and evaluation of the programme and projects on sanitation; including participatory processes can be influenced by education background of the local population. As such, education

becomes critical in such a study where adoption of peepoo requires sensitization and participation.

4.1.5 Duration of stay in the area

Respondents were required to state how long they had lived in the slum prior to the date of the study. This information is summarized in Table 4.4.

Table 4.4 Duration of stay in the area

Duration	Frequency	Percent
5 years and below	106	33.7
6 to 10 years	38	11.9
11 to 15 years	28	8.9
Over 16 years	144	45.5
Total	**316**	**100.0**

The information in Table 4.4 indicates that more than a half (54.54%) of the respondents had lived in the area for more than ten years and only 33.7% had lived there for less than five years. This finding indicates that the respondents in this study are very familiar with the sanitation situation in the slum. A study by Lewis (1999) indicates that length of stay at a particular locale or station greatly determines the extent and nature of attitudes toward the various sub-components in organizations. Although training is critical, experience gained based on the number of years in a region may correlate with deeper understanding of community related issues.

4.1.6 Respondents monthly income

The respondents taking part in the study were asked to indicate their monthly incomes in Kenya shillings. Table 4.5 is a summary of the respondents' incomes.

Table 4.5 Respondents' monthly income in Kenya shillings

Income	Frequency	Percentage
No income	59	18.8
Less than 3000	81	25.7
3000 to 5000	81	25.7
6000 to 8000	35	10.9
8000 to 10000	25	7.9
More than 10000	35	10.9
Total	**316**	**100.0**

An examination of Table 4.5 reveals that people living in Kibera slum earn very little income. Table 4.5 shows that 18.8% of the respondents have no income while more than half of the respondents (51.4%) earn less than Ksh.5000 per month. This finding indicates that poverty is a major problem in Kibera slum and the residents hardly have any spare money. Income plays a critical role in household's sanitation aspects. It is evident that improved sanitation promotes improved health in areas where sanitation facilities exist but that community involvement and integration plays a significant role in providing acceptable, affordable and hygienic sanitation in urban slums.

4.1.7 Number of people in respondents' households

The researcher requested respondents to indicate the number of people in their households. Table 4.6 summarizes this information

Table 4.6 Number of people in respondents' households

No. of Residents	Frequency	Percentage
1 to 3 members	160	50.5
4 to 6 members	122	38.6
7 to 9 members	25	7.9
10 to 12 members	6	2.0
13 to 15 members	3	1.0
Total	**316**	**100.0**

Table 4.6 shows that one half of the respondents' households have between one and three members and 38.6% have between four and six members. In total, only 10.9% of respondents' households had seven or more members.

Population at household level ultimately dictates the number of people sharing a latrine. Due to poor construction, low coverage, poor maintenance, improper use and dilapidation, open defecation still happens; residents have problems disposing their waste. These conditions form the perfect environment for diseases and poverty to flourish. Adopting a community based approach, such as introducing peepoo approach to help trigger residents and landlords alike to take action, should consider household population. The ultimate aim is to create access to sanitation and hygiene facilities for all, and to ensure that everyone in the community effectively use and look after their toilets.

4.1.8 Methods of defecation used in Kibera slum

The researcher investigated the methods of defecation used in Kibera. Respondents who were not using the single use self-sanitizing biodegradable toilet bags were asked to state which methods they were using. Respondents using the bags were also required to indicate what methods they used prior to adopting the bags. Their responses are summarized in Table 4.7.

Table 4.7 Methods of defecation used in Kibera slum

	What respondents using the bag used before	What respondents not using the bags are using
Method	**%**	**%**
Community latrine	67.3	87.8
Flying toilet	21.2	2.0
Bucket	1.9	0.0
more than one method	1.9	6.1
magazines/newspapers	1.9	0.0
Potty	1.9	0.0
Outside in the open	0.0	4.1
Own toilet or latrine	0.0	2.0
Plot latrine	3.8	8.2
Total	**100.0**	**100.0**

Table 4.7 shows that community latrines and "flying toilets" are the two mostly used methods of defecation. Table 4.7 also shows that very few people have access to their own toilets or latrines located in the plots they live in. Although the County government has set by-laws requiring all landlords to provide on-site sanitation, there is little incentive for the landlords to invest in their properties because the tenants are very poor and can only afford low rents. One respondent noted that: "providing landlords with access to loans and toilets appropriate to this situation will enable them to meet the sanitation requirements whilst still keeping rents affordable."

4.2 Perception on adoption of self-sanitizing biodegradable toilet bags

The first objective of the study was to investigate perception on adoption of the single use self-sanitizing biodegradable toilet bags in Kibera slums. Studies have shown that a community's perception of a new innovation determines how readily they embrace it and consequently its success or failure (Kim, 2012). The single use self-sanitizing

biodegradable toilet bag is an example of an innovative solution to the problem of human waste disposal facing residents of Kibera Slums. On this basis, the researcher investigated how the residents of Kibera perceived the single use self-sanitizing biodegradable toilet bag.

4.2.1 Adoption and experience of using the bags vis-à-vis other methods

The respondents who used the single use self-sanitizing biodegradable toilet bags were asked to compare their experience while using the bags and their experience before adopting the bags or when using other methods. They were asked to indicate whether using the bag was worse than the other methods, there was no difference or the bag was better than the other methods. Figure 4.2 shows how respondents rated using the bags vis-à-vis other methods.

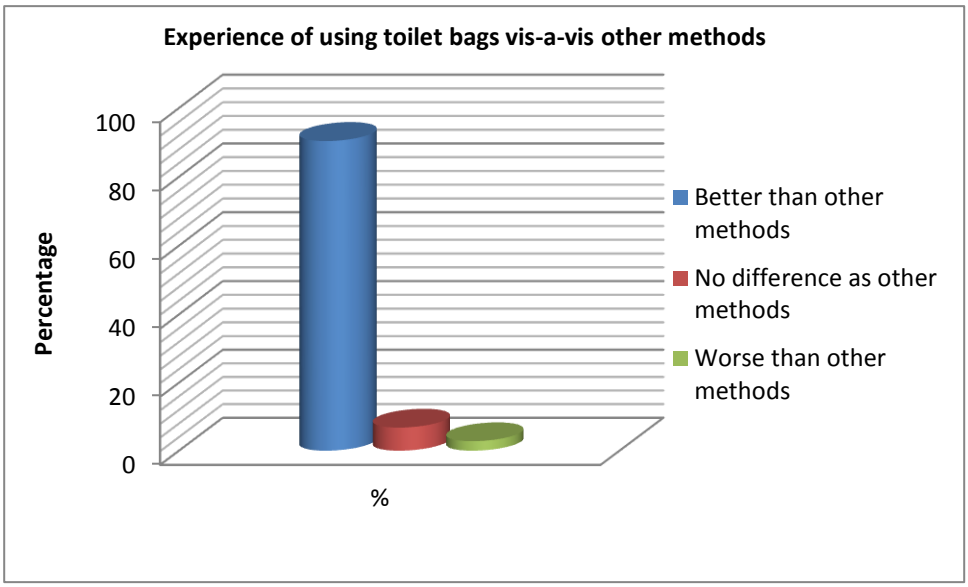

Figure 4.2 Respondents rating of toilet bags and other methods

An examination of Figure 4.2 shows that the majority of respondents who had used the single use self- sanitizing toilet bags that is 90.4% felt that using the bag was a better experience compared to using other methods of defecation. One respondent felt using the bag was worse and four respondents felt the bag made no difference. The conclusion that most of the respondents using the bags were satisfied with the experience could be made out of these findings. The introduction of new methods requires households' understanding issues across the entire sanitation service chain, including waste containment (toilets), emptying (of pits and septic tanks), transportation (to sewage treatment facilities), waste treatment, and disposal/reuse. These factors would mediate on the adoption and experience of using the bags vis-à-vis other methods.

4.2.2 Cause of satisfaction in using toilet bags

Having established that the respondents who had used the bags were pleased with them, the researcher investigated the cause of satisfaction with the bags. Figure 4.3 summarizes reasons respondents gave in favor of using the single use self-sanitizing biodegradable toilet bags.

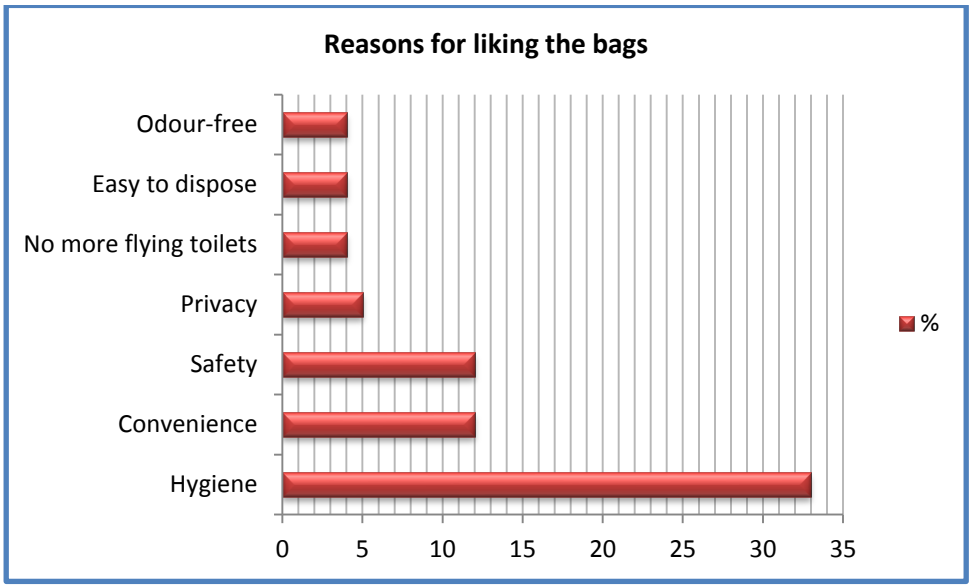

Figure 4.3 Satisfaction level of using toilet bags

Figure 4.3 reveals that hygiene, convenience and safety were the three main reasons users of the bags rated their use better than using other forms of defecation such as "flying toilets" and community latrines. In the slums, most households use either public toilets, which are meant for a rotating population in commercial areas, or communal toilets, which serve a fixed residential population. However, the condition of these facilities is very poor. Households who were dissatisfied with the cleanliness of their community's toilets were more likely to practice open defecation, and thus suggests that the toilet bags offer hygiene and safety for the households. Because the innovations support can be most immediately valuable in densely populated areas, the main focus of urban sanitation priorities, it appears, involves developing non-sewered sanitation approaches, identifying new delivery models, and advocating for public policies that support improved sanitation.

4.2.3 Stigma when using the bags

To investigate whether stigma was associated with using the toilet bags, respondents were asked to state which member of their households purchased the toilet bags and which members returned the used toilet bags. Figure 4.4 shows their responses.

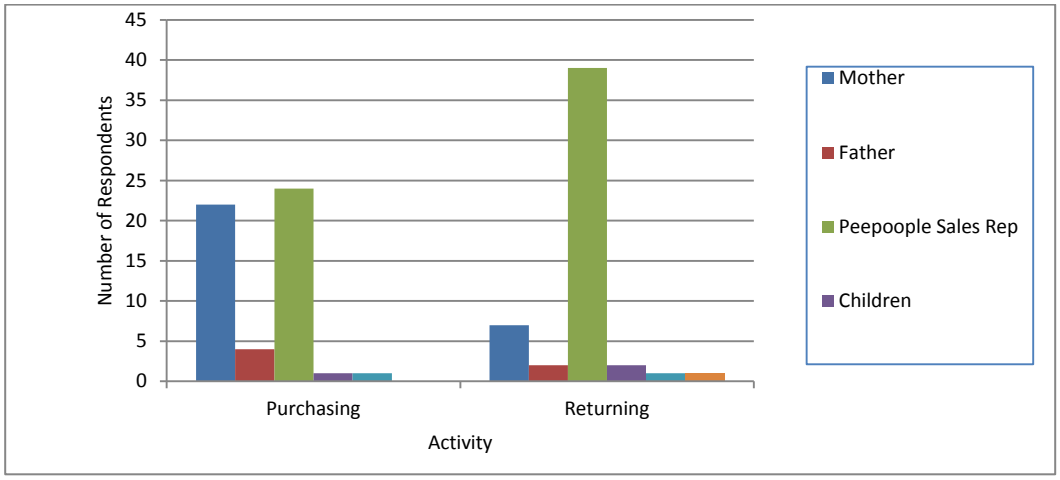

Figure 4.4 Individuals who purchased or returned the toilet bags

The findings presented in Figure 4.4 lead to several conclusions on the question of whether users of the bags experienced stigma. To start with, few men purchased or returned the bags. This is indicative of the fact that men feared being seen buying or returning the bags. More mothers purchased the bags but fewer returned them. From Figure 4.4, it is clear that sales representatives from Peepoople very actively involved in distributing and collecting the bags which also indicates a degree of reluctance by users to be seen buying or returning the bags. Comments from the focus group discussion corroborate these conclusions.

The researcher asked the participants of the focus group discussion to describe how the community perceived the single use self-sanitizing biodegradable toilet bag. The

participants' responses led the researcher to two conclusions. Firstly, the community was reluctant to adopt the toilet bag when it first arrived. This was because of the stigma people associated with using the bags. And one of the biggest hurdles facing the group is something else man-made: the stigma when feces, urine, and menstruation enter a conversation, "Evidently, food and clean water are easier to talk about than access to a decent hygienic toilet," Peepoople CEO Karin Ruiz told The Swedish Institute.

Secondly, the researcher concluded that after the stigma wore off, more people began adopting self- sanitizing biodegradable bag after seeing its positive impact in the lives of the users and the community in general. Consequently, approximately one half of the population to whom the bag has been marketed adopted it. On the issue of stigma, the focus group discussion revealed that men were the most embarrassed when using the bags even though women also expressed some fear of being seen with the bags. This explains the fact that sales representatives did most of the distribution and collection of used bags, even though one shilling was offered to anyone returning a used bag.

4.2.4 Reasons for failure to use the disposable toilet bags by residents

The study found that approximately one half of respondents did not use the single use self-sanitizing biodegradable toilet bags. The respondents gave several reasons for not using the toilet bags. These are summarized in Figure 4.5.

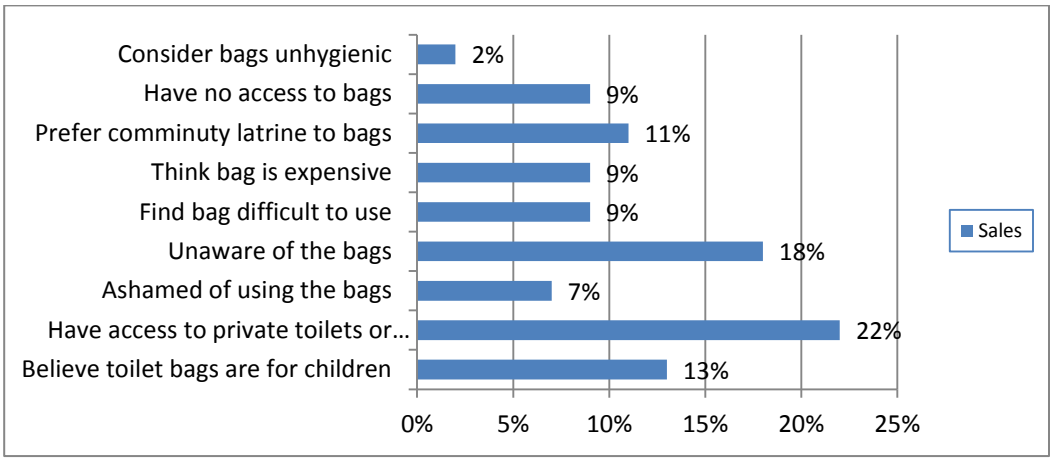

Figure 4.5 Reason for not using toilet bags

An examination of Figure 4.5 reveals that having easy access to a toilet or latrine and ignorance of the toilet bags are the two most significant reasons respondents gave for not using the toilet bags. Seven respondents thought the bags are only meant for children and four respondents felt ashamed of using the bags. From these findings, the conclusion that stigma associated with using the bags has diminished can be made. This is because only four respondents stated that they did not use the bags because of stigma. The discussion with the focus group had revealed that the initial embarrassment in using the toilet bags had greatly diminished when people saw the benefits of the bags. However, the results in Figure 4.4 show that inasmuch as people are embracing the bags, many people are still wary of being seen with them especially the used ones.

4.3 Awareness and benefits of self-sanitizing biodegradable toilet bags

The second objective assessed the community level of awareness of the use and benefits of single use self-sanitizing biodegradable toilet bags. The Peepoo single use self-sanitizing biodegradable toilet bag was launched in 2010 with the aim of combating

contagious diseases such as cholera that spread very easily in environments lacking proper solid waste disposal like Kibera Slums. It is essential that community members receive information about any new innovation including how to use it and its benefits in order to inspire them into adopting it (Kim 2012). Various aspects on awareness and benefits of self-sanitizing biodegradable toilet bags are discussed in the section below.

4.3.1 Knowledge and access to toilet bags

The study established that 51.5% of respondents had used the toilet bags therefore it is obvious they are aware of its availability, where to get it and how to use it. The researcher sought to find out whether those respondents who had not used the bags knew of its existence. Table 4.8.

Table 4.8 Knowledge on toilet bag

Knowledge	Frequency	Percentage
Yes	39	79.6
No	10	20.4
Total	**49**	**100.0**

A look at Table 4.8 shows that 79.6% of the respondents who did not use the toilet bag knew about it. When this number is added to that of people already using the bag, 90.1% of all respondents was found to know about the toilet bags.

The study further sought to establish respondents who knew about the bags if they knew where they could obtain them. Their responses are summarized in Table 4.9.

Table 4.9 Accessibility of toilet bags

	Frequency	Percent
Yes	74	81.3
No	17	18.7
Total	**91**	**100.0**

As shown in Table 4.9, 81.3% of the respondents who knew about the toilet bags knew where to get them from and only 17 respondents did not know where to get the bags from. The information in Table 4.8 and Table 4.9 shows that residents of the slum are well informed about the single use self-sanitizing toilet bags and many of them know where to get the bags.

4.3.2 Source of information on toilet bags

The Peepoople organization has endeavored to educate the people in Kibera about their innovative toilet bags. The researcher requested the participants in the study to state how they learnt about the toilet bags. Figure 4.6 shows the sources from which respondents learnt about the bags.

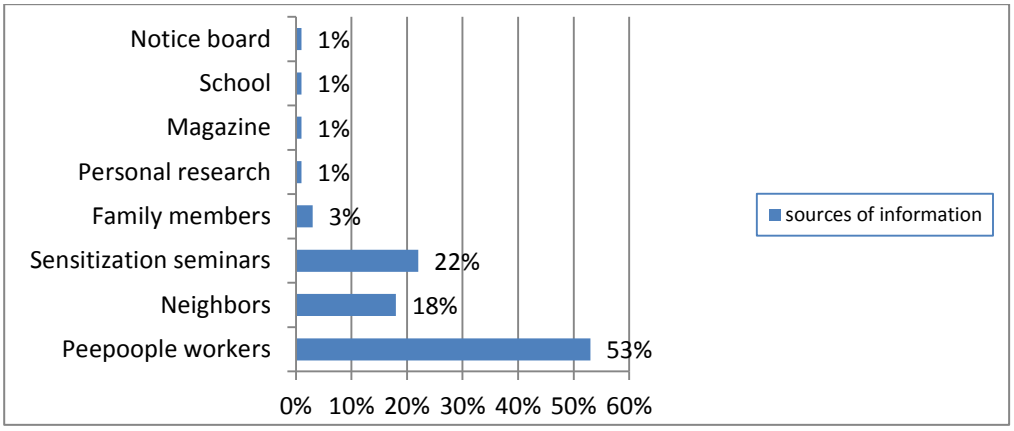

Figure 4.6 Respondents source of information on toilet bags

An examination of Figure 4.6 reveals that Peepoople workers, neighbors and sensitization seminars played a major role in spreading awareness about the toilet bags. Family members, schools, magazines and notice boards played a minimal role in spreading the awareness. In addition to investing in improved technologies and urban market conditions, organizations working within the slums provide initiatives that help stimulate user demand for improved sanitation. Part of this effort involves working with sanitation providers and partners to help them adopt more evidence-based practices so they can deliver sanitation services that meet people's needs. It also includes promoting incremental shifts in social norms around toilet use that will lead to higher demand for better sanitation products and services as they become available.

4.3.3 Knowledge on the value of toilet bags

The researcher investigated what the respondents knew about the toilet bags. Figure 4.7 presents a summary of the things respondents knew about the single use self-sanitizing biodegradable toilet bags

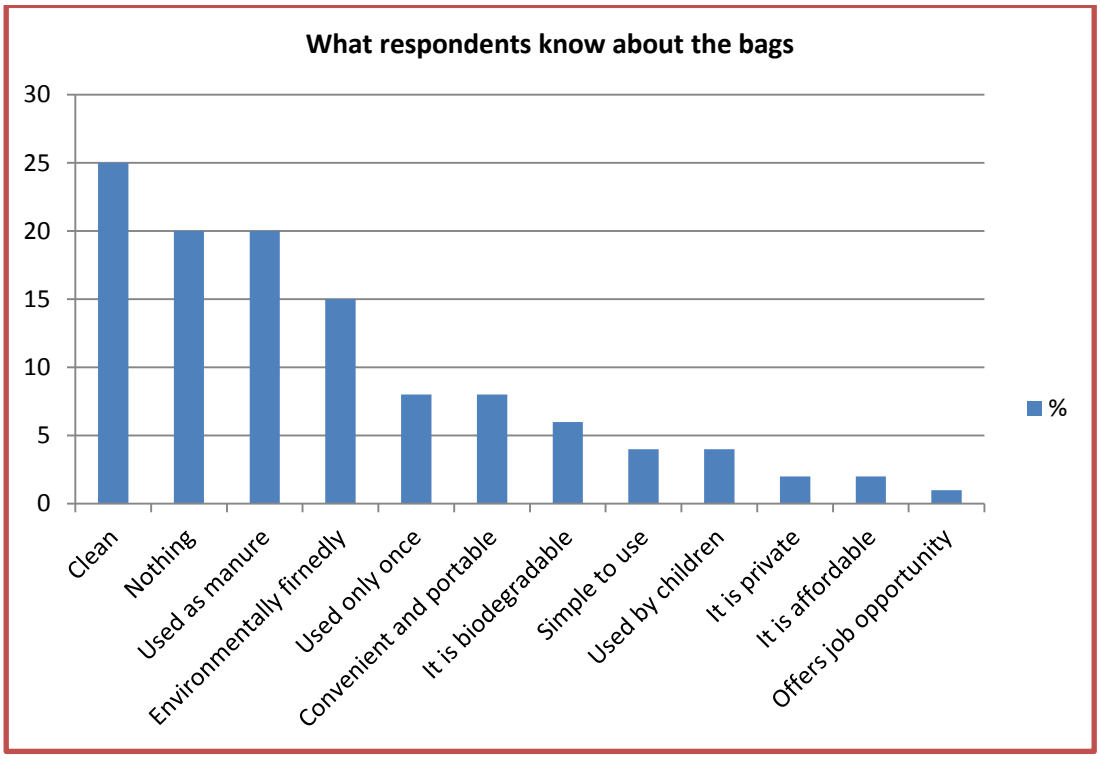

Figure 4.7 Respondents knowhow about toilet bags

A look at Figure 4.7 reveals that 20% respondents knew about the existence of the toilet bags but knew nothing about them. This was an indication of the gap existing in the level of awareness and education for these toilet bags, which meant that the respondent needed more information of this new technology, on the use and also the benefits of adoption of the same. Figure 4.6 also shows that cleanliness of the bags, the fact that the bags could be used to produce manure and that they are environmentally friendly were the three facts about the bags most respondents knew about. While Peepoo's business model is still unproven as a long-term, sustainable solution after all, it depends on the world's poorest people seeing a benefit in paying 200-Kenyan shillings (around USD $2) for something they used to do for free. The toilet bags are seen too improve the

physical infrastructure of community, as well as to improve the associated management systems in order to ensure long-term maintenance. From the results, it's clear that the toilet bags offer a solution that can produce the most attractive, sustainable and hygienic alternatives to open defecation for slum residents.

4.3.4 Suggestions on awareness creation on bags

The respondents were asked to state what they thought could be done in order to spread awareness of the toilet bags to even more people and encourage other people to use them. The respondents offered the suggestions summarized in Table 4.10.

Table 4.10 Suggestions to spread awareness about toilet bags

Spread awareness	Percentage
Educate people about the bags	41.6
Advertise the bags	19.8
Door to door campaign	14.9
Seminars	11.9
Mobilizing the community	5.9
Give them for free	3.9
Increase the sales and collection points	2.9
Engage parents and schools	1.9
Offer incentives like money	1.9

Table 4.10 shows that most of the respondents recommended that the community should be educated, the bags should be advertised, door-to-to door campaigns held and seminars conducted to sensitize more people about the use of the toilet bags. Educating households on new sanitation technologies scored high. Community sanitation programs in slums can provide a sustainable and cost-effective option, as it encompasses community involvement in the design, use of facilities rather than leaving it to municipal authorities.

4.3.5 Sources, sufficiency and quality of drinking water

The study established that clean water was not sufficient for the residents of the study area. The Nairobi City Council was the main source of water but the researcher observed that the water was not available on a continuous basis. Most of the residents purchased water from water selling points which cost them money. It was also observed that the water on sale was often contaminated with sewage water because the water pipes were close to burst sewer lines. The residents had to boil drinking water or use chemicals to disinfect it in order to avoid contracting waterborne diseases.

4.3.6 Availability and quality of toilets and bathrooms

The study established that that most residents had no access to clean toilets and bathrooms. Only a small number of residents had proper toilets and bathrooms in their houses. The rest of the population had to rely on shared facilities which the researcher observed to be very unhygienic. Residents were required to pay a fee of kshs.5 to use community latrines which were also crowded and in short supply. Residents reverted to using “flying toilets” when they could not afford to pay for community latrines or at night when it was too insecure to go to the shared facilities. These conditions form the perfect environment for diseases and poverty to flourish. Children have multiple illnesses which has a detrimental impact on their health, development and education. As noted by one respondent; “people do not like these conditions, but have become resigned to them because they can’t see how the situation can be improved. Indeed, this lack of sanitation has far-reaching effects: it imposes significant public health and environmental costs on urban areas. The numerous challenges facing sanitation providers attempting to serve the urban slum market in makes the task seem daunting. It

is essential that it goes hand-in-hand with spreading awareness about the significant health and hence related hazards that result from poor hygiene and inefficient waste management.

4.3.7 Drainage and waste disposal systems

It was observed that proper drainage and garbage disposal systems did not exist in the study area. Burst sewers and dirty stagnant water was observed. Residents have no reliable garbage disposal system so they throw litter along the streets. The researcher noted that some youth groups collected garbage in a few areas. Kimaro and Hatibu (2008) found that waste collection and transfer was done in a franchise type of privatization whereby the municipalities gave the contractors and community based organizations the authority to collect refuse as well as to collect refuse charges from households in particular locations where the service is provided. The study established that 48% of respondents reported the performance of waste collection being poor, with 32% of the respondents who noted it as average.

Photo 2: Drainage and waste disposal in Kibera slum

From observations made, the uncollected waste was illegally dumped in open spaces, water bodies or even burnt on the street and roadsides. The results agree with other findings; for example, a study by Konradsen (2000) reported that averagely waste collection percentages were observed to be below 50% in both Arusha and Dar es Salaam municipalities. This can partly be explained by the means and facilities used for waste transportation which give an indication on the limits of the amount of waste that can be transported to the dumpsites per day.

4.3.8 Extent of use of single use self- sanitizing toilet bags

The study investigated the adoption of the single use self-sanitizing biodegradable toilet bags therefore it was imperative to establish the number of respondents who had used the bag and for how they had used it. Figure 4.8 shows the proportion of respondents that had used the bag and the proportion that had not.

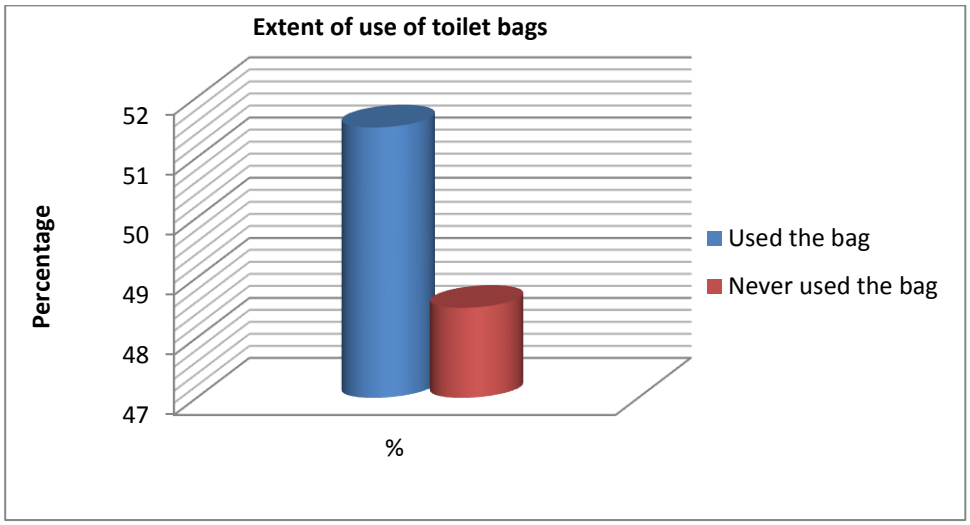

Figure 4.8 Proportion of respondents who had used the toilet bag

Figure 4.8 show that 51.5% had used the bag whereas 48.5% had never used the toilet bags. This finding shows that approximately one half of respondents had used the toilet bag. Respondents who had used the toilet bags were asked to state how long they had been using the bags. This information is presented in Figure 4.9

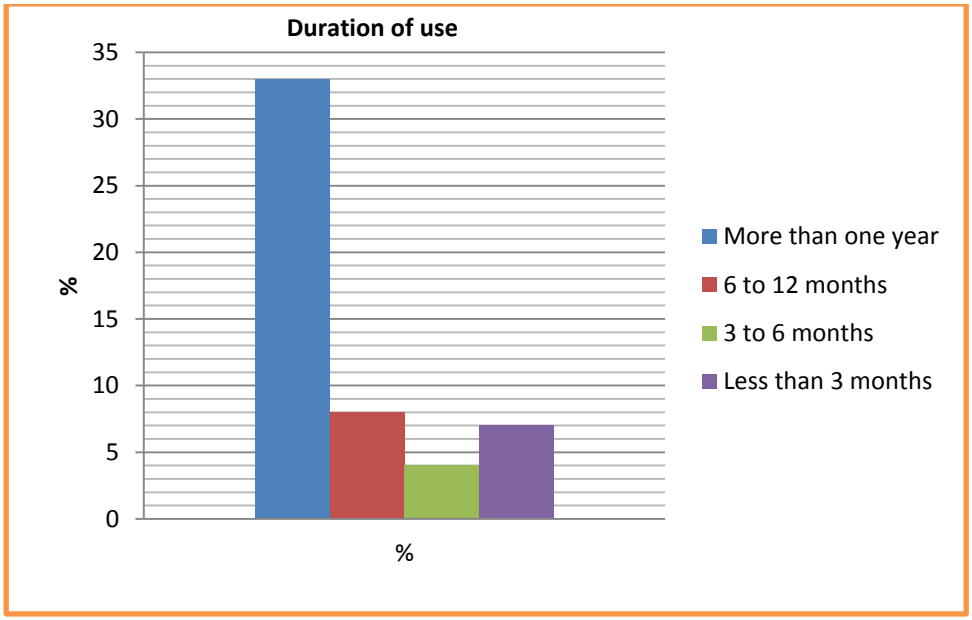

Figure 4.9 Duration of respondent's use of toilet bags

As Figure 4.9 shows, 64% of respondents had used them for more than one year. Only 36% of the respondents had used them for less than a year. This results show that most of the people who adopted the toilet did so roughly the same time after which few other people followed suit. Solving the sanitation challenge in the developing world will require radically new innovations that are deployable on a large scale. Innovation is especially needed in densely populated areas, where people are only capturing and storing their waste, with no sustainable way to handle it once their on-site storage such as a septic tank or latrine pit-fills up.

4.4 Socio-economic and environment impact of toilet bags

The third objective of the study sought to assess the socio-economic and environment impact of adopting single use self-sanitizing biodegradable toilet bags. Kibera slum is faced with the challenge of solid waste disposal common to fast growing cities in the developing countries (UNDP 1997) which contribute to spread of diseases (Apata 2011).

The waste disposal methods like “flying toilets” and community latrines residents of Kibera have to resort to are harmful to the environment as well (Aluko & Sridhar, 2005). The Peepoo single use self-sanitizing biodegradable toilet bag was introduced to assist the residents of Kibera slum deal with these problems. The study investigated whether the toilet bag had had any socioeconomic and environmental impacts in Kibera.

4.4.1. Challenges of using other methods

To begin with, respondents who were using the bags were asked to cite the challenges they encountered while using previous defecation methods which are summarized in Figure 4.10.

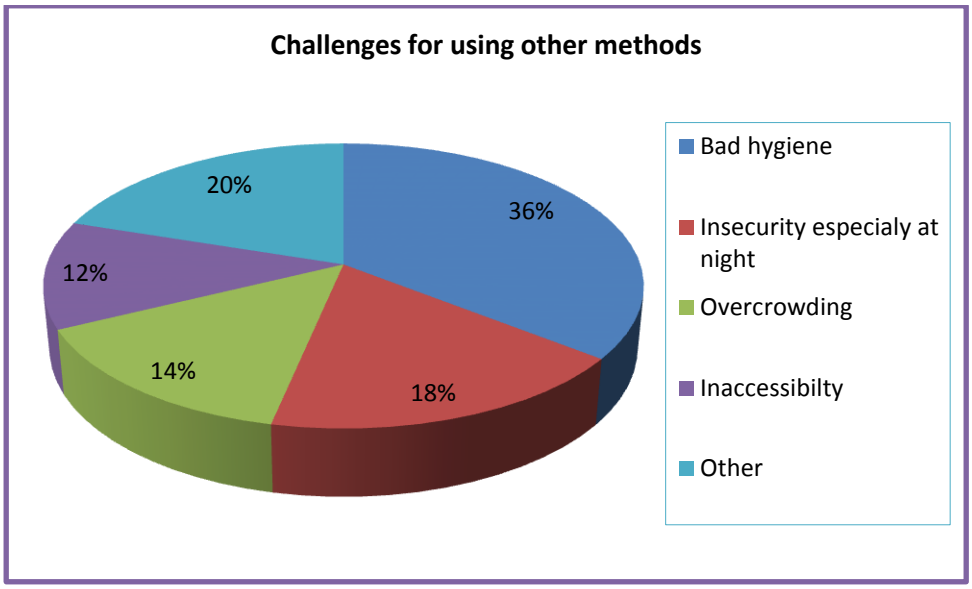

Figure 4.10 Challenges respondents faced before adopting toilet bags

Figure 4.10 shows that poor hygiene, insecurity especially at night for women and overcrowding were the three greatest problems respondents faced before they started using the toilet bags. The focus group discussion provided information backing up the respondents' answers. The researcher learned from the focus group that women feared going to the shared latrines at night because some men would waylay them and rape them. Even men were not very comfortable venturing outside at night for fear of criminals lurking around. People would revert to "flying toilets" which they would then toss outside their houses. The researcher learned from the focus group and by

observation that the community toilets available are few, overcrowded, far between and very dirty. The filthy state of these facilities discourages some people from using them.

4.4.2 Toilet bag use and lifestyle change

The study investigated whether any changes had occurred in the respondents' lifestyles since they started using the single use self-sanitizing biodegradable toilet bags. The researcher asked the respondents to state how using the toilet bag has changed their lifestyles. Their responses are presented in Figure 4.11.

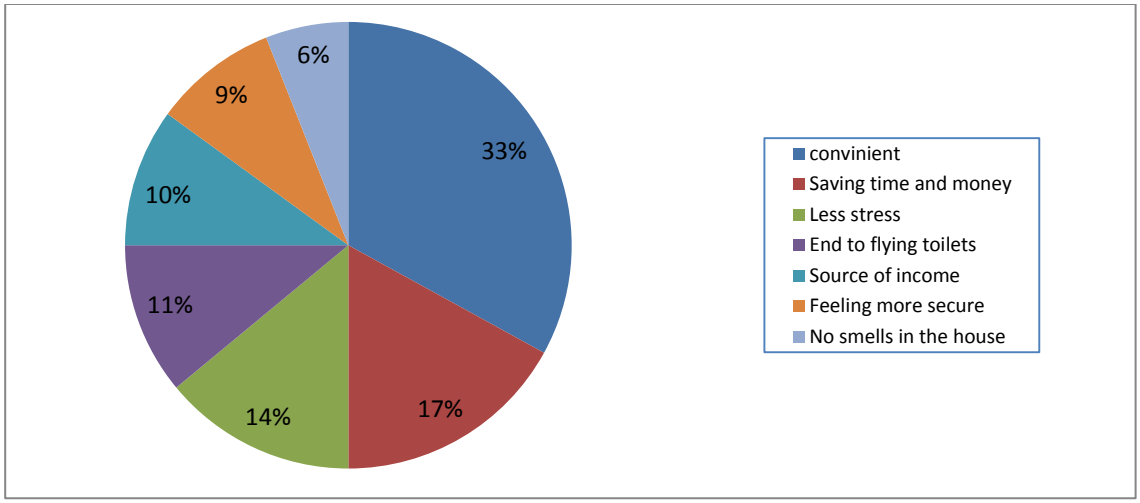

Figure 4.11 Toilet bags use and lifestyle change

Convenience is the greatest benefit of using the toilet bag according to Figure 4.10. This is due to the hygienic nature of the single use self-sanitizing biodegradable toilet bag and the fact that users no longer need to go to the dirty public toilets or use other unhygienic means like "flying toilets". In addition the fact that the used toilet bags are collected at the house level for users who are not able to get to the collection points.

Users also saved time and money since they no longer have to walk to public toilets and pay to use them. 14% of the respondents stated that they felt less stressed and 9% said they were more secure after adopting the bags. It is possible to conclude from the results in Figure 4.11 that using the bags has brought positive changes in the respondents' lives.

4.4.3 Toilet bag use and household changes

The researcher sought to find out whether respondents who used the bags have noticed any changes in their household they could attribute to the bags. Figure 4.12 shows some of the changes that have occurred in respondents' households.

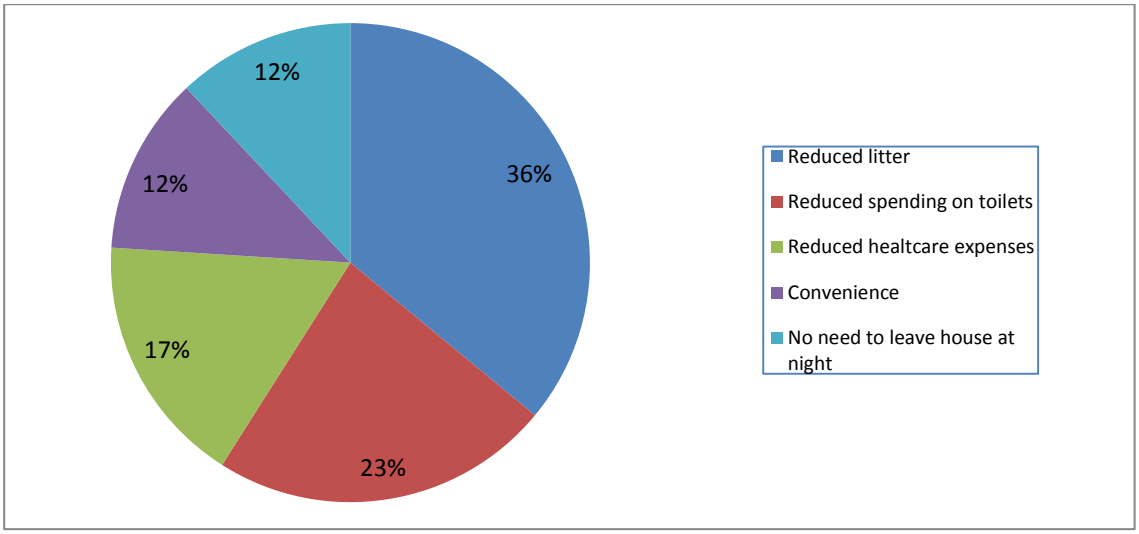

Figure 4.12 Toilet bag use and respondents' households change

An examination of Figure 4.12 shows that respondents who have adopted the toilet bags have seen changes in their households including more cleanliness, cost savings on healthcare and using toilets as well as convenience and not having to venture out of the house in the night to use a toilet. The study found from the focus group discussion that

the toilet bag has indeed changed the community. The focus group established that the toilet bags simplified people's lives. Women, children, the elderly and the sick who had trouble accessing public latrines now have a simpler solution at hand.

4.4.4 Economic impact of using the toilet bag

Information in Figure 4.11 and Figure 4.12 show that respondents using the bags are able to save money because the bags are cheaper than the cost of paying to use toilets and also because they spend less on healthcare now that the rate of illness has reduced.

The researcher observed from the focus group discussion that using the toilet bag brings economic advantages to the users. To begin with, some people earn an income from distributing the bags and collecting the used ones. Secondly, using the bags is cheaper for most people using community toilets that are paid for. For instance, a bag costs three shillings and a shilling is given back for each used bag returned. On the other hand, public toilets cost anything from five to ten shillings per person every time one uses them. In addition, the reduction in diseases has helped people save money they would use to seek medication and avoid loses they make on the days they cannot work either because they are ill or looking after ill family members.

4.4.5 Impact of using the toilet bag on the environment

To start with, there is reduced littering of environment because fewer people are using "flying toilets" or relieving themselves in the open (as shown in Figure 4.12). This has reduced the bad odors and inconveniences that arose from "flying toilets" and human waste lying on the ground

In summary, the findings presented in section 4.4.2 lead to the conclusion that the single use self-sanitizing biodegradable toilet bag has brought about socioeconomic and environmental benefits to the people of Kibera slum who are using it. Respondents faced major challenges before they had the toilet bags such as inaccessible public toilets. With the adoption of the bags, users have experienced changes in their lifestyles and their households as shown in Figure 4.11 and Figure 4.12. Among other benefits, respondents spend less money to relieve themselves and less money for healthcare because using the bag lowers the rate of sickness. Finally, the environment has improved because fewer people use "flying toilets" or relieve themselves in the open.

Hypothesis testing

Relationship between community perception and adoption of self-sanitizing biodegradable toilet bags

A Spearman Rank Order Correlation (r) was calculated to ascertain if there is a statistically significant ($p<0.05$) correlation in the responses. The following results were obtained:

$r = 1.039 \pm 0.09$; $P.E._r = 0.057$. The calculated value of r is less than the probable error. Therefore, the value of r is significantly ($p<0.01$) different from zero correlation coefficient. This indicates that a relationship exists between community perception and adoption of self-sanitizing biodegradable toilet bags.

Relationship between the level of community awareness and the extent of use of the single use self-sanitizing biodegradable toilet bags

A Spearman Rank Order Correlation (r) was calculated to ascertain if there is a statistically significant ($p<0.05$) correlation in the variables. The level of community awareness may be a significant factor in community adoption and the extent of use of the single use self-sanitizing biodegradable toilet bags. Correlations between level of community awareness and the extent of use were 4 to 5 times greater than the ratio or difference.

Relationship between socio-economic status of households and the adoption and use of single use self-sanitizing biodegradable toilet bags.

A Spearman Rank Order Correlation (r) was calculated to ascertain if there is a statistically significant ($p<0.05$) correlation in the variables.

The following results were obtained:

$r = 1.0621 \pm 0.09$; $P.E._r = 0.139$. The calculated value of r is less than the probable error. Therefore, the value of r is significantly ($p<0.01$) different from zero correlation coefficient. This indicates that a relationship exists between socio-economic status of households and the adoption and use of single use of self-sanitizing biodegradable toilet bags.

The results of the statistical analysis are as shown below.

Table 4.11 Correlation analysis

Spearman's rho	Socio-economic	Correlation Coefficient	1.000	-.410
		Sig. (2-tailed)	.	.493
		N	5	5
	Perception	Correlation Coefficient	.1039	1.000
		Sig. (2-tailed)	.057	.
		N	5	5

Spearman's rho	Socio-economic	Correlation Coefficient	1.000	-.410
		Sig. (2-tailed)	.	.493
		N	5	5
	Perception	Correlation Coefficient	.062	1.000
		Sig. (2-tailed)	.139	.
		N	5	5

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a summary, conclusions, recommendations and suggestions for further research based on the results of the study. The findings were thematically based on the objectives of the study.

5.1 Summary of findings

This chapter presents a summary of the main findings of the study, conclusions and recommendations for further research. The purpose for this study was to investigate factors influencing adoption and use of single use self-sanitizing biodegradable toilet bags in Kibera slums, Nairobi County. The summary of the study was informed by the objectives below:

i. Investigate perception on adoption of the single use self-sanitizing biodegradable toilet bags in Kibera slums.
ii. Assess the community level of awareness of the use and benefits of single use self-sanitizing biodegradable toilet bags.
iii. Assess the socio-economic and environment impact of adopting single use self-sanitizing biodegradable toilet bags.

The study findings discussed in the previous chapter can be summarized as follows:

Perception on adoption of the single toilet bags

The findings presented in subsection on the community's perception on the adoption of the biodegradable toilet bags have concurred with the prediction by Kim (2012) that a

community is more amenable to a new innovative technology if they have a positive perception of it. This study has established that approximately one half of people who have been exposed to the toilet bag have adopted it. The study established through focus groups discussions that stigma existed in the initial days when the bags were still new but that the apparent benefits of using the bags has helped erode the stigma. Still, the study has found that people are not entirely comfortable being seen handling the bags. Finally, it is apparent from the findings that stigma is not the main reason some people are not using the toilet bags. The study has found that some respondents have access to their own toilets or latrines, prefer community latrines or are unaware of the toilet bags.

Community level of awareness of the use and benefits of toilet bags

The findings presented on the level of community awareness about the use and benefits of the single use self-sanitizing biodegradable toilet bag lead to the conclusion that Peepoople's efforts to inform the community about the bags have been quite successful with 90.1% of the respondents knowing about the bags. This includes even those respondents not using the bags. According to Figure 4.8, respondents know several facts about the bags with most of them knowing that the bags are very clean, can be used to produce manure and are environmentally friendly.

The study established respondents know where they can find the bags. The study has also found that efforts by Peepoople staff, word of mouth from neighbor to neighbor and sensitization seminars (Figure 4.7) have been very successful in spreading information about the toilet bags. Respondents felt that educating the community,

advertising the toilet bags more aggressively, door to door campaigns among other strategies can help inform more people and encourage others to begin using the bags.

Socio-economic and environment impact of using toilet bags

To tell whether socioeconomic changes have resulted from using the bag, it is important to establish whether using the bag has brought about any changes in people's lives and their households. The study revealed that users had to contend with poor hygiene, insecurity especially at night for women and girls, overcrowding in public toilets, inaccessibility of toilets, the high cost of using toilets and difficulty disposing human waste. Respondents reported positive changes in their lives after they began using the bags. The key benefits of using the bags include reduction in diseases associated with poor hygiene, saving time and money and less stress associated with toilet use. Users of the bags also reported that they no longer used "flying toilets", felt more secure and did not have bad smell in their houses.

The study also found that users' households benefited as a result of adopting the bags. The benefits of using the bags in this reduction in "flying toilets", lower expenditure on toilets, lower healthcare expenses, convenience and no longer needing to leave the house at night to go to the latrines. The study also found that the environment has become cleaner since fewer people are using "flying toilets" or relieving themselves in the open. Children, old people, people with disabilities and the sick that had difficulty accessing toilets found a welcome solution in the single use self-sanitizing biodegradable toilet bags.

5.2 Conclusions

The implication of the present study should be a strengthened motivation for empirical focus and methodological developments in the general factors influencing adoption and use of new technologies for sanitation and toilet use in informal settlements; and especially within the context of single use self-sanitizing biodegradable toilet bags. A second implication should be a critical stand in relation to identifying a solution that will produce the most attractive, sustainable and hygienic alternatives to open defecation for slum residents; while putting perception, awareness and socio-economic factors into consideration.

From the summary, the study established the following conclusions**:**

- Ignorance about the bags, misperception about the bags, the notion that the bags were only meant for children and preference of using community latrines is critical factors that challenge adoption of toilet bags.
- Using the single self-sanitizing biodegradable toilet bag is better than using other methods available in the slum because if offers convenience, is safe and hygienic. The efforts by Peepoo to create awareness about the bag have largely succeeded considering that over ninety percent of respondents knew about them and that most of them knew about the bags were true. People learned about the bags through efforts by Peepoo staff as well as word of mouth from neighbors. The awareness campaign will benefit greatly by enlisting word of mouth as a strategy.

- The success of the project could only be judged after examining whether the bag has brought with it socio economic and environmental impacts.
- Toilet bags have indeed had a positive socioeconomic and environmental impact on the community. The more vulnerable members of the community have found a convenient solution for their difficulty accessing toilets. Finally, as fewer people use “flying toilets”, the environment is becoming cleaner.

5.3 Recommendations

Recommendations made in this section were derived from the conclusions about the study findings as presented in the previous section and focus on direct interventions. It is the view of the study that the recommended solutions could help address issues of factors influencing adoption and use of single use self-sanitizing biodegradable toilet bags in Kibera slums, Nairobi County.

5.3.1 Policy recommendations

First, health policy makers and the Ministry of health should create mechanisms that enhance cooperation with local NGOs and the community to deal with negative perception on use of toilet bags. The Peepoo organization should carry on with their sensitization campaigns to inform more people about the toilet bags. They should employ door to door campaigns, advertisements and education as recommended by the study respondents. The organization should educate people on the benefits of using the bags and dispel all misperceptions that could prevent some people from using the bags.

5.3.2 Recommendation to Peepoople Organization

The study identified gaps in community level of awareness of the use and benefits of single use self-sanitizing biodegradable toilet bags. The Peepoo management in partnership with the government and other NGOs should enhance continuous community hygiene education awareness programs along with physical access to water supply and sanitation to positively influence change in hygiene behaviour and decreases the prevalence of risks associated with poor hygiene conditions. Moreover, local NGOs

should consider community participation in the decision making process is the most important determinant for sustainable hygiene promotion as far as toilet bags adoption is concerned.

Critical factors associated with socio-economic and environment impact of adopting single use self-sanitizing biodegradable toilet bags was identified. The Peepoo organization should provide more incentives to encourage more people to adopt the bags. Such incentives might include giving more money to people returning used bags or giving them away for free. Moreover, there is need to increase distribution and collection points to make accessing the bags easier. They could also consider repackaging them so that people can carry them more discreetly. This will reduce the embarrassment some people feel when buying or returning the bags.

5.3.3 Recommendation for further research

The researcher recommends key areas as follow-ups to the current study. As a result of the study, the researcher identified certain areas that might require additional research. The following are the areas of study that the researcher recommends;

i. A study is needed to investigate gender and sanitation programs in order to evaluate integrating gender into community sanitation programs and the perception challenges.
ii. A study on participatory community hygiene education is recommended that can focus on Kibera slums and other informal settlements in other Counties in Kenya for comparison purposes.

iii. A study on household factors and challenges to sanitation programs is recommended that focuses on household hygiene and knowledge. More research is needed to identify the problems and opportunities of community-based waste management in major towns in Kenya.

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APPENDICES

APPENDIX I: QUESTIONNAIRES

Introduction

My name is Faith Wanjiku Nderitu, a Masters student at Kenyatta University. I am undertaking a study on "Adoption and use of self-sanitizing biodegradable toilet bags in Kibera Slums, Nairobi County." Kindly assist in the contribution of knowledge by answering the following questions. The information provided will be used for academic purposes only.

Please mark with an (**x**) or (tick) in the box with the appropriate response. Mark one box only.

SECTION A: General Information

1. Gender

   Male [ ]

   Female [ ]

2. Age

   18 and Below [ ]

   19 – 23[ ] 24 – 28[ ]

   29 – 33[ ] 34 – 38[ ] 39 and above [ ]

3. Highest level of education attained.

   Primary [ ] Secondary [ ] Certificate [ ] Diploma [ ]

   Bachelors [ ]

   Others (specify) _____

4. Duration of stay in the area-current residence

5 years and below [ ] 6 – 10 years [ ]

11– 15 years [ ] above 16years [ ]

5. What is your monthly income in Kenya Shillings?

   Less than 3000

   3000 to 5000 [ ] 5001 to 8000 [ ]

   8001to 10000 [ ] More than 10001 [ ]

6. How many people are in your household? (parents, children and relatives living in your home)_____

7. Have you ever used the self-sanitizing biodegradable toilet?

   Yes [ ]

   No [ ]

   If YES, how long have you been using it?

   Less than three months [ ]

   Three to six months [ ]

   Six to twelve moths [ ]

   More than one year [ ]

(*If your answer is YES go to section C and if your answer is NO, go to section B of the questionnaire)*

Section B: Perception on adoption of single use self-sanitizing biodegradable toilet

8. Are you aware of the self-sanitizing biodegradable toilet?

   Yes [ ]

   No [ ]

9. Which method of defecation do you use?

   Community latrine [ ]

   Flying toilet [ ]

   Outside in the open [ ]

   Bucket [ ]

   Combination of more than one [ ]

Any other methods _____

10. Indicate any challenges you face while using the defecation method (*You can tick more than one)*

    Insecurity [ ]

    Inaccessibility [ ]

    Overcrowding [ ]

    Unhygienic [ ]

    Any other _____

11. What are your reasons against using the self-sanitizing biodegradable toilet bags? _____ _

(*Please proceed to Section D of the questionnaire*)

12. If you have used the single use self-sanitizing biodegradable toilet bags, why did you choose to use it? _____ _____

13. Who in your household goes to purchase the single use biodegradable toilet bags?

    Mother [ ] father [ ] Sales Representatives from Peepoople [ ]

    Child [ ] grown up relative [ ]

    Everyone buys for him or herself [ ]

    Any family member can buy [ ]

14. Who in your household returns the used single use biodegradable toilet bags?

    Mother [ ] father [ ] Collectors from Peepoople [ ]

    Child [ ] grown up relative [ ]

Collection staff from Peepoople [ ]

Everyone returns own [ ]

Any family member returns [ ]

15. Which method of defecation did you use before you adopted the single use self-sanitizing biodegradable toilet bag?

    Community latrine [ ]

    Flying toilet [ ]

    Outside in the open [ ]

    Bucket [ ]

    Combination of more than one [ ]

    Any other methods _____

16. Indicate any challenges you encountered while using the previous defecation method (*You can tick more than one)*

    Insecurity [ ]

    Inaccessibility [ ]

    Overcrowding [ ]

    Unhygienic [ ]

    Any other _____

17. Can you compare the experience of using the single use self-sanitizing biodegradable toilet bag to the method you previously used on the following scale?

Worse than previous method [ ] No difference [ ] much better than previous method [ ]

18. Can you briefly explain your reasons for the choice you made in the question above

    _____

    _____

19. How many single use self-sanitizing biodegradable toilet bags does everyone in your household collectively use per day?

_____

_____

20. Does using single use self-sanitizing biodegradable toilet bags have any other benefits to you? If yes, name them

_____

_____

Section C: Socio-economic and environment impact of adopting single use self-sanitizing biodegradable toilet bags

21. Have any changes happened in your lifestyle as a result of using the single use self-sanitizing biodegradable toilet bags?

    Yes [ ]

    No [ ]

If YES, state the changes that have happened

_____

_____

22. Does using the single use self-sanitizing toilet bags have any impact on your household?

    Yes [ ]

    No [ ]

If yes, state the changes you have noticed since adopting the biodegradable toilet

_____

_____

(Please proceed to Section D of the questionnaire)

Section D: Community level of awareness

23. Where did you learn about the single use self- sanitizing biodegradable toilet bags?

    Peepoople workers [ ]

    Neighbors [ ]

    Sensitization seminars [ ]

    Family members [ ]

    Personal research [ ]

    Any other _____

24. Do you know where to obtain the single use self- sanitizing biodegradable toilet bags?

    Yes [ ]

    No [ ]

If YES, where can you find them in your locality? _____

25. What more do you think should be done to make more people aware of the single use self- sanitizing biodegradable toilet bags? _____ _____

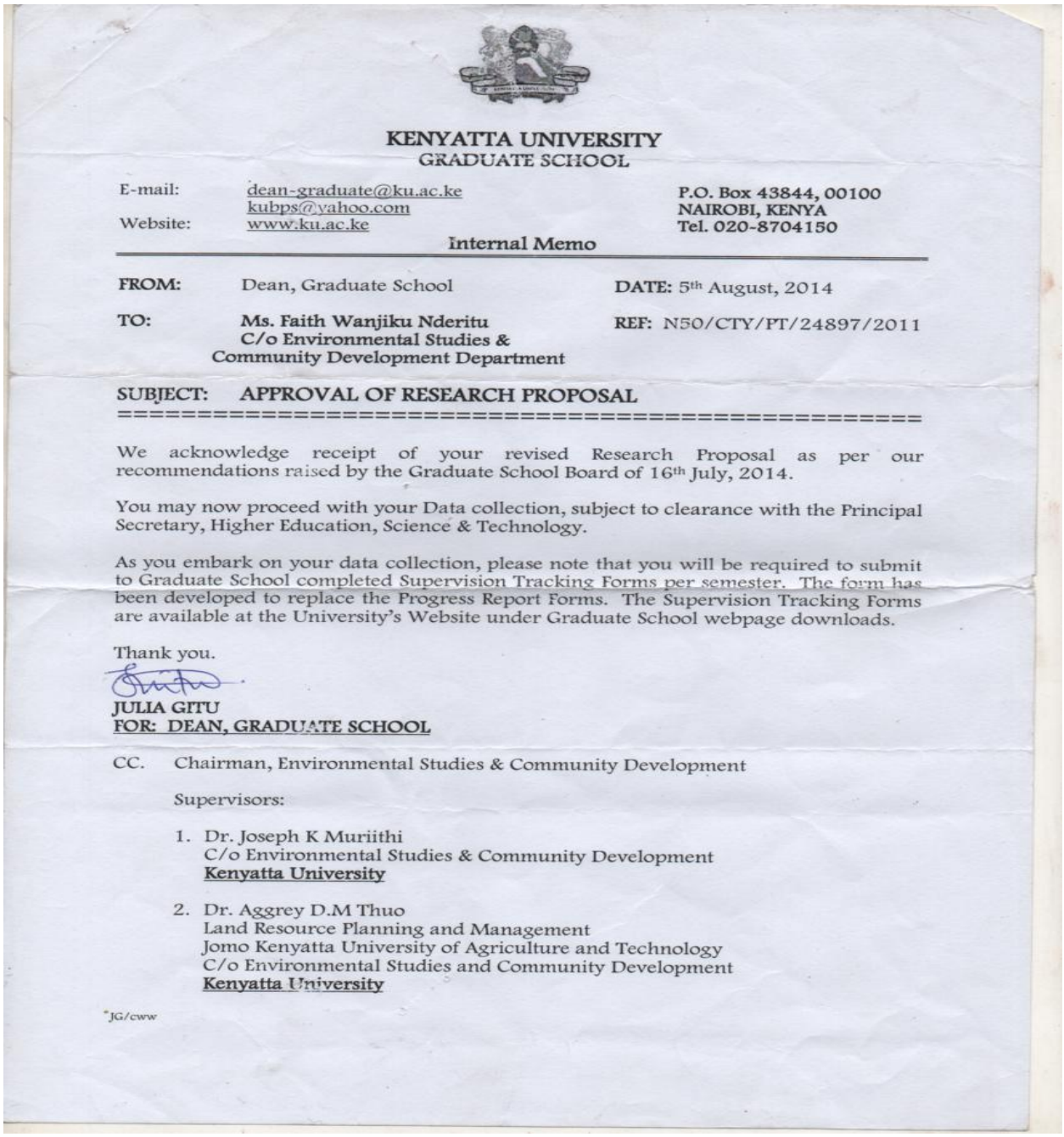
26. What do you know about the single use self -sanitizing biodegradable toilet bags? _____

APPENDIX II: FOCUS GROUP DISCUSSION GUIDE

1. Which methods of waste disposal are used in the community and what are the challenges associated with them?
2. How do these methods of waste disposal impact;
    a. The environment
    b. People's health
3. How did members of the community receive the single use self-sanitizing biodegradable toilet bags?
4. What differences can be noticed in your environment since people started using the single use self-sanitizing biodegradable toilet bags?
5. What differences have you noticed in people's health since people started using the single use self-sanitizing biodegradable toilet bags?
6. Do you think this product is cost effective?
7. Would you recommend that more people use the single use self-sanitizing biodegradable toilet bags? If so, what should be done to encourage more people to use it?
8. How are people using the single use self-sanitizing biodegradable toilet bags viewed by their neighbours? Have you noticed any stigma associated with the bags?

APPENDIX III: OBSERVATION LIST

1. Sources and sufficiency of drinking water
2. Quality of drinking water.
3. Availability of bathroom
4. Availability of latrine and its type
5. Garbage disposal
6. Drainage arrangement



KENYATTA UNIVERSITY
GRADUATE SCHOOL

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P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Internal Memo

FROM: Dean, Graduate School

DATE: 5th August, 2014

TO: **Ms. Faith Wanjiku Nderitu**
C/o Environmental Studies &
Community Development Department

REF: N50/CTY/PT/24897/2011

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

We acknowledge receipt of your revised Research Proposal as per our recommendations raised by the Graduate School Board of 16th July, 2014.

You may now proceed with your Data collection, subject to clearance with the Principal Secretary, Higher Education, Science & Technology.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking Forms per semester. The form has been developed to replace the Progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.

JULIA GITU
FOR: DEAN, GRADUATE SCHOOL

CC. Chairman, Environmental Studies & Community Development

Supervisors:

1. Dr. Joseph K Muriithi
   C/o Environmental Studies & Community Development
   Kenyatta University

2. Dr. Aggrey D.M Thuo
   Land Resource Planning and Management
   Jomo Kenyatta University of Agriculture and Technology
   C/o Environmental Studies and Community Development
   Kenyatta University

*JG/cww

OFFICE OF THE PRESIDENT
MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT
LANGATA SUB –COUNTY
LAINI SABA DIVISION

Telegram.....
Telephone:
When replying please quote

Ref. No.....

ASS. CHIEF'S OFFICE
Silanga Sub-LOCATION
LAINI SABA DIVISION
P.O.Box 20824-00100
NAIROBI
Date 19/9/2018

ASST. CHIEF
SILANGA SUB-LOC
LAINI LOC.
KIBERA DIV

RE: Faith Wanjiku Ndeviti
ID/No' 24540068.

You are hereby granted permission to carry out some ~~road~~ research as you requested. This office has no any objection to your request in doing research in Silanga Sub-location.

You are here been given a maximum support you may need from our office.

Do it without any fear.

Thank you,

Ass/chief Silanga Sub-Loc.

ASST. CHIEF
SILANGA SUB-LOC
LAINI LOC.
KIBERA DIV

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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When replying please quote

9th Floor, Utalii House
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P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:
10th September, 2014

NACOSTI/P/14/8014/3090

Faith Wanjiku Nderitu
Kenyatta University
P.O Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Adoption and use of self sanitizing biodegradable toilet bags in Kibera Slums, Nairobi County,"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for a period ending **31st August, 2015.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

SAID HUSSEIN
FOR: SECRETARY/CEO

Copy to:

The County Commissioner
The County Director of Education
Nairobi County.

COUNTY COMMISSIONER
NAIROBI COUNTY
P. O. Box 30124-00100, NBI
TEL: 341666

12 SEP 2014