LUND UNIVERSITY

MASTER PROGRAMME IN INTERNATIONAL DEVELOPMENT AND MANAGEMENT (LUMID) 2013-2015

Understanding Technology Adoption: The Case of Improved Cook Stoves in Bunga, Central Uganda

Author: Allen Tebugulwa

Supervisor: Elsa Coimbra

Abstract

Promoters of improved cook stove technologies (ICS) argue that the use of these technologies offers several benefits such as improved health, fuel saving, reduction in green house gases emissions among others. Many of the studies exploring the use of improved cook stoves reveal a strong pro-diffusion bias towards these benefits, and few studies have investigated the adoption and use of ICS from the adopter's point of view. This qualitative case study therefore attempted to understand the perceived factors that explicitly or implicitly influence the adoption (or not) of Improved cook stoves at household level by listening to potential ICS users. From the study, it was evident that adoption and sustained use of cook stoves is complex and it necessities consideration of a wide range of factors which mutually the influence house hold decision to adopt (or not) an improved cook stove. Consequently, this study emphasized the need for those promoting ICS to have a deeper understanding of the context in which potential adopters are part, and gain insight into the complex factors that govern behavior and provide a basis for doing things in a certain way, in order to ensure adoption and sustained use of ICSs and thereby realize it's associated long term benefits.

Key Words: Energy, Improved cook stoves, Adoption, Biomass fuel, Innovations, Diffusion of innovations.

Acknowledgement

This study would not have been a reality without the support and contributions from a number of people. In this light, I wish to extend my sincere gratitude to the Swedish institute that has sponsored my study at Lund University through their study scholarships. Many thanks go to the participants in this study who welcomed me into their homes and gave me a chance to peek through their reality by sharing their stories with me.

I would also like to thank my supervisor Elsa Coimbra for all the guidance and assistance offered during the planning, execution and writing of this thesis. In the same way special thanks go out to my peer reviewers and supervision group members for their great comments and all the suggestions you contributed during the journey of writing this thesis.

Last but not least, thanks to the almighty father for his grace during the course of my life and to all my friends and family for the support and love accorded to me during this phase of my life.

Acronyms

AGECC	Advisory Group on Energy and Climate Change
CREEC	Centre for renewable energy and Energy Conservation
GiZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Federal Enterprise for International Cooperation).
ICS	Improved Cook Stoves
IEA	International Energy Agency
JEEP	Joint Energy and Environment Projects
KCCA	Kampala City Council Authority
MEMD	Ministry of Energy and Mineral Development
MoFPED	Ministry of Finance, Planning and Economic Development
NGO	Non-Governmental Organisations
UBOS	Uganda Bureau of Statistics
UNDP	United Nations Development Programme
WHO	World Health Organisation

TABLE OF CONTENTS

1. Introduction

1.1. Setting the scene

Approximately 3 billion people worldwide rely on traditional biomass for cooking and heating (UNDP and WHO, 2009). In sub-Saharan Africa, close to 70 percent of the people depend on wood and its by-products as a primary source of cooking fuel (ibid). Many of these people cook on open fires which are not only inefficient in converting energy but give off high pollution emissions. The use of traditional biomass in form of solid fuel such as firewood, cow dung, crop residues and charcoal for cooking and heating is not without consequences. The world health organization (WHO) estimates that more than 1.5 million deaths are linked to indoor air pollution arising from inefficient combustion of solid fuels, of which majority of these deaths are women and young children (WHO, 2006). In many areas women are responsible for cooking as well as collecting the cooking fuel. As such women and girls are disproportionately affected in many developing countries, from the long hours spent on collecting fuel and from the smoke inhaled during cooking (AGECC, 2010:7). In addition, the inefficient use of biomass together with its increased demand levels results into fuel wastage and scarcity. In addition, the use of biomass for cooking is responsible for a significant share of emissions into the atmosphere (Martin et al., 2011, Shindell et al., 2012). More specifically, the non-sustainable burning of wood fuels contributes to climate change through carbon dioxide and methane emissions (Bailis et al., 2005). In addition some of the methods used in the production of charcoal emit significant amounts of greenhouse gases per unit of energy gained (ibid). Estimates from the international Energy Agency demonstrate that the number of people reliant on biomass globally will increase in the foreseeable future rather than decrease (OECD/IEA, 2006, OECD/IEA, 2011). Moreover recent efforts in electrification and subsidisation of LPG have not substantially affected the situation on a global scale (OECD/IEA, 2011). It is against such a background that the United Nations set out "*sustainable energy for all initiative*" with the ambitious goal of universal adoption of clean cooking stoves and electricity by 2030.

While 1.5 billion people lack access to electricity, a billion more people have access only to unreliable electricity network and majority of these people live in Sub-Saharan Africa (AGECC, 2010). Even though none of the MDGs explicitly related to Energy, not one of them could have been met without substantial improvement in the quality and quantity of energy services in developing countries (UNDP, 2014b). This was first officially recognized at the World summit for Sustainable development (WSSD) in Johannesburg in 2002 and recently the report published by the secretary-general's Advisory Group on Energy and Climate Change has awakened commitment to focus on the issue of energy access at the highest levels (UNDP, 2012).

Two major approaches may be used to address the challenges associated with cooking energy needs in developing countries; promotion of more efficient and suitable use of biomass, and encouragement to switch to other modern cooking fuels and technologies such as electricity or biogas (Urmee & Gyamfi, 2014). For many households switching from traditional biomass to modern fuels such as biogas, electricity may not be feasible in the short run due to high capital costs coupled with high poverty. Furthermore statistics show that the many households in the developing countries are unlikely to have access to these modern fuels for the near future and thus the number of people reliant on firewood and charcoal in sub-Saharan Africa is likely to double by 2050, posing future energy access challenges (Bailis et al., 2005). Therefore improving the way biomass is supplied and used for cooking is an important step in ensuring its sustainability and ensuring energy security in households. Against this background, the use of improved cook stoves (ICS) present an opportunity to address health, environment, and gender concerns at a wide scale.

1.2. Formulating the research problem

In the last 4 decades, the promotion and distribution of cook stoves with ”improved efficiency” in developing countries has been one of the most popular strategies to improve people’s living conditions. In many ways, policy makers and researchers have formulated a persuasive case for the use of improved cook stoves (ICS), as well as for allocating funding and expertise to ICS programs. These ICS have been the obvious tool for policy makers to counteract the negative impacts arising from the use of biomass resources associated with traditional cooking ways. Several stove programs have since been introduced in Africa, Asia and Latin America to disseminate improved cook stoves (ICS) to households. It is a paradox for development actors that despite all of the effort invested in dissemination of improved cook stoves, ICS have not yet achieved extensive use in households to the scale required to effectively address the problems associate with using traditional cooking technologies (Barnes et al., 2012). A recent review of energy access situation in developing countries conducted by UNDP and WHO reveals that approximately only 166 million households (or 828 million people) reliant on biomass use improved cook stoves (UNDP and WHO, 2009)[1]. It’s noteworthy that, this is less than a third of the estimated total of three billion people who depend on solid biomass fuels for cooking and heating worldwide. Considering that over 70 percent of the improved cook stoves in the field are in china alone, these figures are even less significant and the rate of uptake of improved cook stove has been generally low particularly in Africa (ibid).

[1] It is important to note that in the UNDP/WHO study cited here, data relating to ICS use was only found in 67 countries out of the 140 developing countries. However the populations that rely on biomass in these countries represent more than 90% of the total number of people dependant on biomass in all the 140 developing countries.

One of the many reasons for low uptake might be that the stoves have not delivered on their promises. Promoters of these improved cooking technologies claim that they bring about several benefits for the intended users. Besides saving firewood which results in reducing deforestation, it is said that the use of these stoves can lead to saving cooking time, reducing health impacts to the user through reduced emissions and smoke, and improving cooking satisfaction among many others (Barnes et al., 1994, Urmee & Gyamfi, 2014, World bank, 2011). Some of these benefits have consequent and spilling advantages, for example in the saving cooking time, the freed time increases time for education and income generating activities (Ibid).

However a comprehensive assessment of the improved cook stove itself and various ICS programs in the field gives a more ambiguous picture. Noticeably in academic literature there is promising support for the benefits of ICS (See for example Agurto-Adrianzén, 2013, Smith-Sivertsen et al., 2004, Bensch & Peters, 2013, Smith-Sivertsen et al., 2009, Smith et al., 2011), but there is also research that counters these inclinations with evidence which shows that we cannot suppose ICS will decrease fuel consumption and reduce the health burden significantly (e.g Burwen & Levine, 2012, Duflo et al., 2012, Nepal et al., 2011). In the same way there is evidence that some ICS programs have been successful and achieved their set objectives while others have rather failed. What is becoming apparent is that the success or failure of such programmes can be attributed to many factors. For instance in their assessment of several cook stove programmes in Africa, Asia and Latin America, Urmee & Gyamfi (2014) found that the success of the programmes can be attributed to compatibility of stove technical parameters with the local expectation, consistence with local needs and culture, stove cost, and users attitudes to the new technology. On the other hand poor implementation strategies, inappropriate technologies, lack of training and community participation led to a collapse of many programs as soon as donor funding was stopped (ibid).

In Uganda many national and international development agencies such as GiZ in collaboration with the government, JEEP Uganda and CREEC among many others have engaged in the promotion of improved cook stoves in various urban, peri urban and rural areas. However from the recent statistics, a low adoption rate can be observed despite the high potential demand for improved cook stoves. A study conducted by UNDP and WHO reveals that only five percent of the population relying on solid fuels were using ICS in 2007 (UNDP and WHO, 2009).The recently conducted National demographic survey 2009/10 indicates that only 8.5 percent of the population use improved cook stoves. These low adoption rates exhibit a gap between demand of improved cook stoves and available offer. If the benefits of improved cook stoves are as good as stove promoters portray them, then why is it that their demand is not skyrocketing?

1.3. Research question and Purpose

Following from the above statement, my main research question resolves around understanding the low adoption of improved cook stoves in Uganda through conducting a case study in an urban suburb. This questioning places particular emphasis in listening to potential and beneficial users, and from there to identify factors that explicitly and implicitly influence the adoption (or not) of improved stoves. I believe that listening to stove end users is paramount in the design of better interventions (programmes or policies) and technology solutions that are more efficient, potent and sustainable. To gain an insight in the perspective of potential and beneficial stove users, the study will investigate the cook stove adoption situation in Bunga trading centre in Makindye division in Uganda. By specifically analysing;

- What factors influence household decision to adopt (or not) improved cook stoves?

This study seeks to contribute to the existing knowledge on the diffusion and adoption of improved cook stoves. I also hope it can serve as an information base for policy makers and development agencies in Uganda to draw on, in relation to the topic of improved cook stoves. As such I will present it to my previous internship organisation Nordic folkecenter for renewable energy and seniors without boarders (Denmark), both involved in energy projects in Uganda. In addition I hope to share the study report with Joint energy and environment projects (JEEP) Uganda, which is a local non-governmental organisation working for a green Uganda ensuring an environmentally safe and clean habitat for present and future generations.

1.4. Thesis disposition

The introductory chapter is followed by second chapter which serves as a background to the study. It provides information on the Ugandan energy context, the specific study area, what improved cook stoves are and a brief overview of improved cook stove programmes over time. The third chapter discusses the methodology undertaken in conducting the study as well as the ethical considerations and the limitations of the study. The fourth chapter outlines theoretical framework that guided the study and also the model of analysis utilised in data analysis. The fifth chapter presents the empirical data and its analysis. The sixth chapter discusses these finding in relation to broad field of development. Finally, the seventh and the last chapter of this thesis concludes the study and emphasizes the need for those promoting ICS to have a deeper understanding of the context in which potential adopters are part, and gain insight into the complex factors that govern behavior and provide a basis for doing things in a certain way, in order to ensure adoption and sustained use of ICSs.

2. Study Background

2.1. A contextual overview of Uganda and the Ugandan energy sector

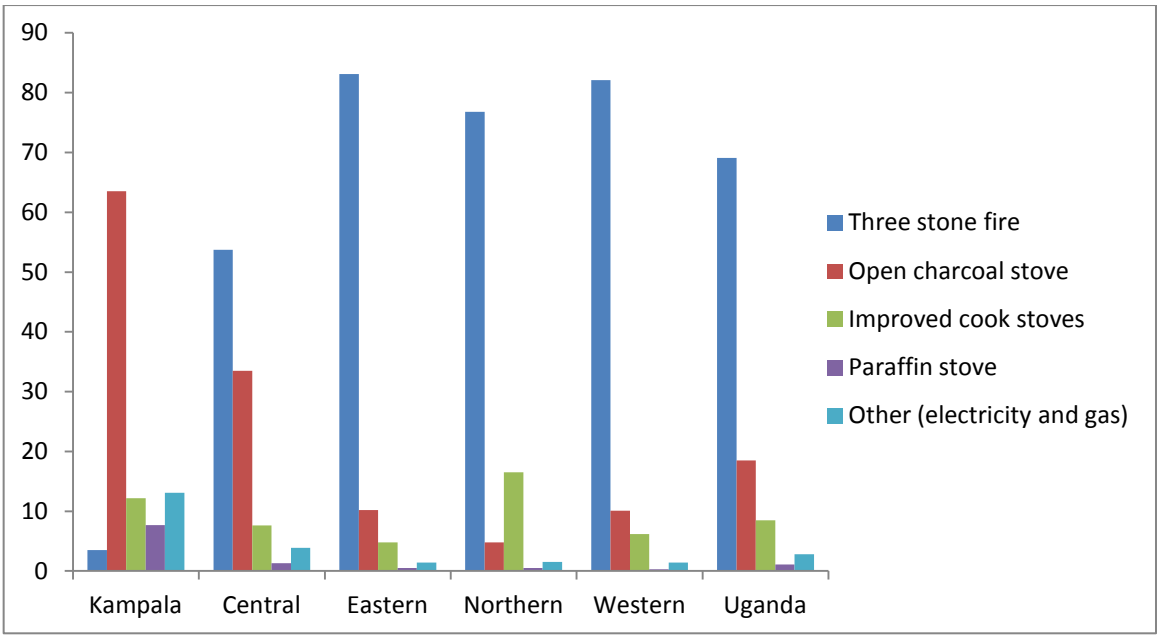
Uganda is a landlocked country located in East Africa, with an estimated population of 34 million in 2013 (UBOS, 2013). Ugandans are one of the youngest populations in the world with nearly 78 per cent of Ugandans under 30 years of age (MoFPED, 2013). Furthermore the country is ranked among the countries with the highest population growth rate in the world, with an estimated 3.4 per cent annual growth rate in 2012 (World Bank, 2015a). In terms of human development Uganda is among the countries with a low human development and was ranked 164th out of 187 countries as of 2013(UNDP, 2014a: 159-162). It's estimated that nearly 80 per cent of the Ugandan population lives in rural areas (UBOS, 2010). Majority of these people depend on agriculture for their livelihoods and it's also a primary source of their income (ibid). The national economy has been growing steadily and in the last two decades the country recorded robust economic growth, with the growth rate averaging at approximately 7 percent per annum in the 1990s and 2000s; until of recent when a downturn was experienced due to the global financial crisis and the rate of growth of the GDP reduced to an average of about 5 percent (World Bank, 2015b). Although the size of the Ugandan economy has quadrupled since the early 1990s, the real per capita incomes have only doubled in this same period and this may be attributed to the high population growth rate in the country (MoFPED, 2014). On the other hand poverty levels exhibit a declining trend. The recent Uganda poverty status report shows promising statistics, it reports that the national poverty rate reduced to 19.7 percent in the fiscal year 2012/2013 from 24.5 percent in 2009/2010 (MoFPED, 2014, See also World Bank, 2015b). Furthermore the inequality level in the country has also declined significantly to 0.395 from 0.426 in 2009/10 (MoFPED, 2014). Overall Uganda has made important progress towards achieving the millennium goals particularly in regards to reducing income poverty, promoting gender equality and women empowerment, reducing child mortality and ensuring environmental sustainability (World Bank, 2015b). Despite that the progress achieved is commendable, it should be recognized that there is still a lot of work to be done to improve the delivery of quality basic services to the Uganda populace, as well as improve income and secure livelihood of the many (roughly 43 percent) still vulnerable and are at a risk of falling back into poverty in an event of a shock (MoFPED, 2014). In addition the country is facing many major environmental problems such as deforestation, unprecedented errant rainfalls, relatively more floods, drought and landslides among others.

Uganda's primary energy supply and consumption is predominately biomass which constitutes 92% followed by petroleum 6% and electricity 2% (MEMD, 2007). The findings from the recent national household survey indicate that more than 95 percent of Ugandans rely on solid fuels for cooking,

particularly wood, charcoal or crop residues (UBOS, 2014a). Biomass fuels provides for all the basic energy needs of cooking and water heating in rural areas and for most urban households. It is also the main source of energy for many institutions such as schools, small and medium enterprises. The use of alternative sources of energy for cooking is still very low at country level. According to a study conducted by UNDP and WHO, less than 1 percent of the people in Uganda have access to modern fuels such as LPG and electricity for cooking (UNDP and WHO, 2009). A recently concluded national survey indicates that about 0.5% utilise electricity and approximately 3.7 percent of the households using fuels such as Kerosene, LPG and biogas for their cooking needs (UBOS, 2014a)[2]. The low electricity use is mainly due to low electrification levels and also due to the high tariffs per unit. The country's electrification rate is only 9% with large disparities between the urban and rural areas; in urban areas, 42% of the urban population accesses the national grid while it's only 4% in the rural areas by 2008 (UNDP and WHO, 2009). In many instances houses connected to the electricity grid rarely use electricity for cooking due to its higher cost compared to the use of biomass fuels particularly charcoal for cooking. However biomass fuels are also currently becoming expensive due to the increased pressure on the limited resources which can be attributed to the growing population. Moreover energy assessments by the World Bank demonstrate that the share of household expenditure on solid fuels for cooking in Uganda is one of the highest in sub-Saharan Africa (World Bank 2010).

National statisticians estimate that approximately 69 percent of the population utilize the traditional "three stone fire stoves" for cooking predominately in rural areas and that almost 19% use the traditional charcoal stoves known as "Sigiri" (UBOS, 2010). According to the 2010 national demographic survey, the traditional three stone open fire cooking technology was most commonly used in Eastern Uganda (83%) and western Uganda (82%). While the traditional charcoal stoves are prevalent in Kampala and improved cook stoves are mostly used in Northern Uganda. The graph below illustrates the share of the different cooking fuels at regional and country level.

[2] See Appendix 2 for trends in household cooking fuels over time in Uganda.



Source: Adapted from Uganda National Household survey report 2009/2010 (UBOS, 2010).

Fig 1: A graph illustrating the distribution of the various cooking fuels in Uganda

The cooking environment is also an important aspect when utilising biomass fuels as it has the potential to expose the users to smoke and other harmful emissions. In Uganda more than half the population utilise outside built kitchens and about 20 percent do their cooking in open spaces (UBOS, 2014a). The kitchens vary significantly according to residence, region and strata. The portion of the people utilising outside built kitchens is greater in the rural areas - 62% than in urban area -35% (ibid). Additionally statistics show that Kampala has the highest percentage of people cooking in open spaces – about 45 percent and it also exhibits the highest number of household with an indoor kitchen compared to other regions (ibid)[3].

The Ugandan cook stove sector

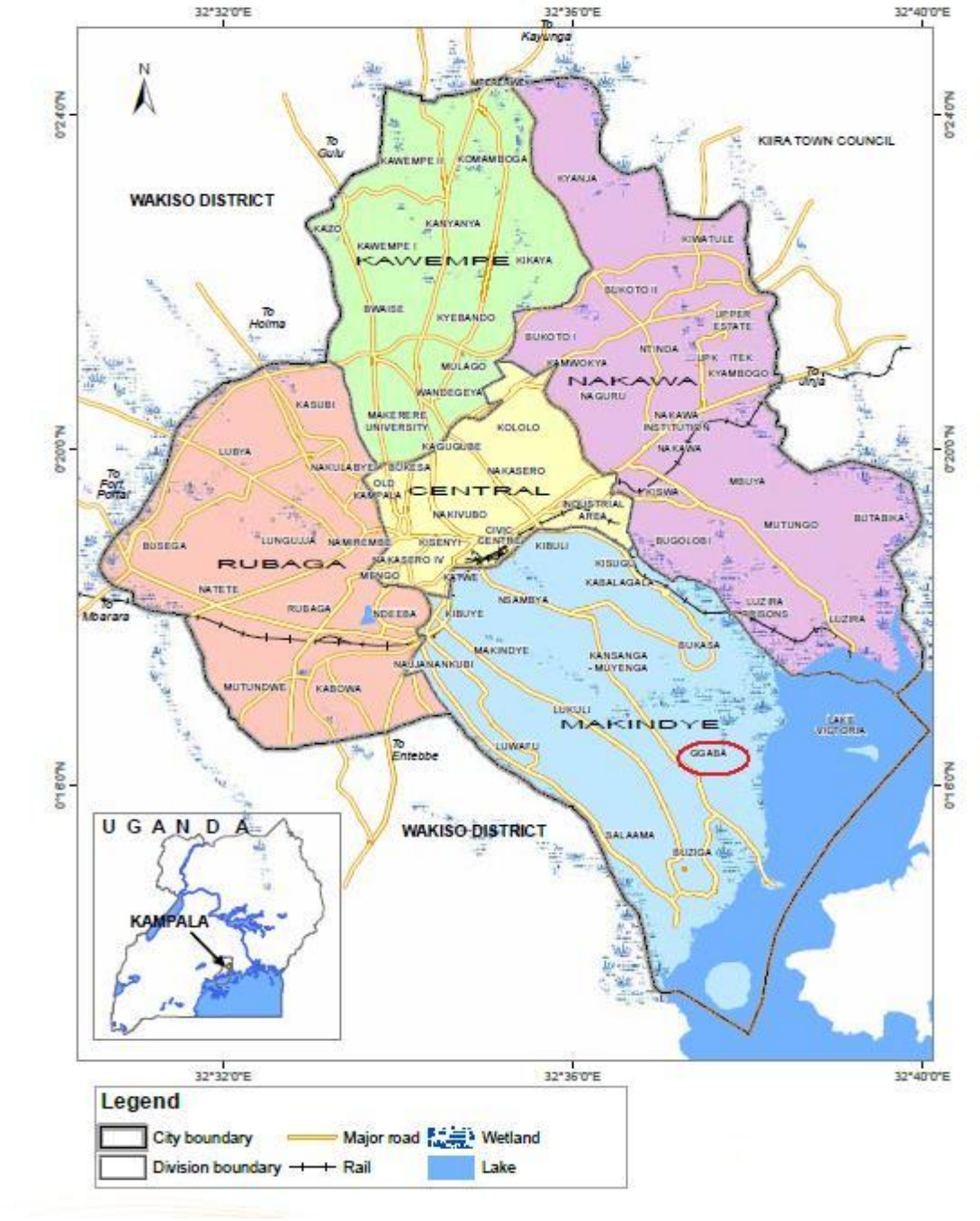
The Ugandan cook stove sector emerged in the 1980s due to concerns over deforestation and desertification. At the time, the newly established ministry of energy advanced the agenda of ICSs on the first national stove workshop in 1987 (Kammen, 1995). At a time, the ministry set up ambitious targets to disseminate ICS to households. However these targets were never realised and the reasons cited (amongst others) include lack of resources coupled with technological limitations (Clough, 2012). Nonetheless despite these challenges, the sector continued to grow steadily and currently several stakeholders (local and external) are involved in the sector by supporting businesses and/or through dissemination of several improved cook stove technologies. In recent times, the government has drawn out and implemented some policies and projects to tackle the energy challenges that the

[3] See Appendix 3 for a more detailed distribution of households by location and kitchen type

country faces. While the priority is to increase electrification rates in the country, there are also plans to ensure sustainable use of biomass energy resources particularly firewood and charcoal, both of which are the cheapest and major source of energy available to most Ugandans (See for instance MEMD, 2007, MEMD, 2014). The 2007 energy policy sets targets to increase the use of modern renewable energy from 6 percent to 61 percent by 2007, and also clear targets have been set up to scale up the adoption of efficient charcoal stoves from 20,000 then to 2,500,000 households by 2017 and the adoption of efficient fuel wood stoves from 170,000 currently to 4,000,000 by 2017. In addition, the policy also calls for the promotion of fuel and technology substitution in households, commercial buildings and in the industries. In the same way there are government efforts to provide incentives for consumers to switch to modern fuels (MEMD, 2007). Furthermore the Uganda national bureau of standards (UNBS) has established some energy regulations although these mainly focus on the manufacture and production of bio fuels, there is limited regulations governing the improved cook stove sector and there are almost no standards related to Indoor air pollution.

2.2. A brief presentation of the study Area

The study was conducted in Bunga trading centre in Ggaba parish within Makindye division. This division is situated in the southern part of Kampala city and is one of the five administration divisions that Kampala city comprises of. The others being the central division, Kawempe, Lubaga and Nakawa division all covering a total of 189 square meters with nearly 19 percent being water (KCCA, 2014). According to the Kampala city council authority (KCCA), approximately 23% of Kampala is fully urbanised, a substantial portion of the city about 60 percent is semi urbanised and the rest is considered rural (ibid). The city is home to an estimated 1.75 million people and a working environment for approximately 4.5 million people (ibid). Below is a map of Kampala capital city showing the 5 administration divisions. The location of the study is the area circled in red on the map.



Source: (KCCA, 2014: ii)

Fig 2: A map of Kampala City showing the 5 administration divisions

The recently concluded national census found Makindye division to be the most populous town council/urban division. The total population in the region is estimated to be 395,276 people of whom 52 % are females (UBOS, 2014b). The house hold size on average ranges between 4 to 6 people and the most common housing type is *Mizigo* (which is tenement) (ibid). The housing structures may contain three or more housing units that are either one or two roomed with (or without) a small store room.

Nearly all households have access to electricity although some households located in the informal settlements may not have direct access to electricity (ibid). For such households the electricity tariff is too high for them to afford. For instance in a household where electricity is utilised for services such as lighting, entertainment and phone charging, on average a household spends about 37,000ugx (about $14), a tariff some residents find high (MoLUD, 2014). In turn, some families resort to illegal power connections or give up on electricity all together. As with the rest of Uganda majority of the people in this division rely on biomass energy mainly charcoal for cooking.

2.3. Understanding the research topic

2.3.1. What are improved cook stoves?

Improved cook stoves are cooking stoves using biomass fuel (wood, charcoal, vegetable matter or paper) designed to maximise thermal and fuel efficiency and minimise emissions harmful to human health (Urmee & Gyamfi, 2014, UNEP, 2010). Although improved biomass stove designs vary to a large extent, most attempt to reduce fuel use and/or reduce smokiness. One of the main characteristic of an ICS over the traditional stoves is the use of insulating material such as clay or mud to conserve heat thus making the stove more efficient and in turn reducing fuel consumption. The methods which have been undertaken to reduce smokiness revolve around improving the combustion efficiency of stove to reduce emissions and/or venting emissions away from the user (Burwen & Levine, 2012). To make this possible, ICSs are designed to let air draft through the biomass fuel by ensuring it's suspended above the ground with a metallic or ceramic grate (ibid). In addition some ICSs are equipped with a chimney. As such, different classification can be used to classify existing stoves on the market today, for example based on the material used in construction of the stoves and whether it's fixed or portable (Urmee & Gyamfi, 2014). In the same way the classification can also be based on whether the stove is equipped with a chimney and if it has grates fitted in the fire box to increase fuel combustion (ibid).

Source: (Urmee & Gyamfi, 2014)

Fig 3: Above is an example of Envirofit stoves, below to the right are Ugastove charcoal stoves and to the left is the Ugastove rocket stove[4].

2.3.2. Brief overview of Cook stove programmes over time.

This section aims to present a brief trajectory of improved cook stove programmes in the global south from the 1970s to date. Energy and deforestation became a big concern for world development following the oil crisis in the 1970s. The increased concern in energy issues that followed the rise in the price of fossil fuels drew attention to the fact that in developing countries, most households relied on wood fuel to meet their cooking and heating needs (Barnes et al., 1994, Arnold et al., 2006). And soon there was an increasing attention to explore the impacts of wood fuel use on a broad scale, with

[4] Ugastove is an improved cook stove factory located in Uganda. Envirofit is a social enterprise with headquarters in Colorado State that manufactures and sells improved cook stoves to homes and institutions in developing countries.

wood fuel sometimes being labelled as the "other energy crisis" (Eckholm, 1975). During this time major institutions such as World Bank and UN argued that food and fuel needs of fast growing populations were resulting in deforestation (Manibog, 1984, Marcoux, 2000). Considering the predictions of an increasing rate of deforestation and the talk of an impending "fuel crisis", governments, NGOs, local and international organisations started to finance and develop stove interventions/programmes (Barnes et al., 1994). Prior to these energy crises households were able to climb the so called "energy ladder[5]" and utilise more modern fuels when their income increased and also when biomass become less affordable and difficult to obtain, a good example to evidence this concept is South Korea in the 1960s (ibid).

Contrary to the current smoke-reduction objective, the focus of stove designers at the time was primarily to achieve fuel saving through improved stove efficiency. Expert technician set out to develop more efficient stoves and were able to demonstrate an increased efficiency of about three to six times the efficiency of traditional stoves with the new designs (Barnes et al., 1994). Seeking to harness this seemingly huge energy efficiency, many development actors launched stove programs believing that the energy efficiency attribute of the stove would act as a major motivation for households to adoption of ICs. In addition this energy efficiency attribute was linked to reduction of conception of firewood thus reducing deforestation and the pressure on natural resources. As such the main agenda of the initial implementation impulse of ICS was wrapped in a discourse of concern for the environment, namely to combat desertification and deforestation. It's therefore not surprising that the ICS projects at the time were run by forestry experts who had little interest in the end users (Barnes et al., 1994, Barnes et al., 1993, Nystrom, 1994, Karekezi & Turyareeba, 1995). This primarily technological approach taken by experts during this time was based on the assumptions that the improved stoves would essentially be a better stove by the standards of the potential users. Therefore the potential users would adopt the stoves quickly and rapidly establish self-sustaining enterprises that would see wide spread diffusion of ICS. With time, there was emergent evidence from studies conducted in individual countries that revealed that clearing land for agriculture was the overriding threat to forests, and in addition timber logging and charcoal making contributed significantly to depletion of forest than traditional fuel wood use (Mannan, 1996). Consequently it

[5]The "energy ladder" also known as the fuel switching is a model for explaining household energy choice. This model explains a pattern of fuel substitution as household's economic situation changes (Hosier et al., 1987). The fundamental claim of this model is that house hold income has a linear unidirectional relationship with the type of fuel used as energy source in a household (ibid). According to the model there is a transition from the "traditional" to "modern and cleaner" fuels as the household income increases. The bottom of the ladder has fuels such as dung, residues and wood while the top end has fuels such as LPG and electricity.

became clearer that forest degradation could not be combated by handing out new cooking stoves (Arnold et al., 2003, Masera et al., 2006).

The late 1980s and 1990s witnessed a shift in the focus of improved cook stove programmes as complexities of introducing new technologies into diverse local contexts began to be unveiled. Stove programmes become more context-responsive and there was increased focus on the socioeconomic benefits and impacts of ICSs rather than stove performance. One of the most comprehensive reports at the time by Westhoff and Germann (1995) asserted that even though stove development programmes made a distinction between improved and traditional, improved stoves were not essentially better than their counterparts. The authors acknowledged that the technical performance of the stove was not the principal factor for successful implementation of stove development programmes, but rather the adaptability of the stoves to the social-cultural, economic and environmental features of the context. It can be concluded that the shift towards more context responsive approaches in stove development was reflective of wider trends in international development during this time, as noted by chambers (1992), the unsatisfying outcomes from expert forms of development research and planning in the 1970s led to the pursuit of alternative approaches to development. Another dimension of change in stove programmes during this time were the framing of benefits associated with the use of improved cook stoves. Promoters of ICS went beyond fuel saving and claimed that ICSs saved time used in cooking, this saved time could be used for more income generating activities and that overall stoves had the potential to improve the livelihood of the users. It was proposed that women would now spend less time in the woods collecting firewood and reduce on the difficult they encounter when collecting firewood (Barnes et al., 1994). More recently the emphasis on health benefits and health impacts of improved cook stoves is at the fore front of stove development programmes (Smith-Sivertsen et al., 2004, Schirnding, 2001). This emphasis is a result of the relationship that has been "*discovered"* between the use of fuel wood and smoke related health hazards arising from indoor air pollution associated with the use of traditional fires (Smith-Sivertsen et al., 2004). Against this background, improved cook stoves offer a solution to indoor air pollution problems resulting from biomass use (Ezzati et al., 2004), and as such stove programmes have been reinvented as health interventions (Hanbar & Karve, 2002).

3. Theoretical Framework

3.1. Diffusion of Innovation theory

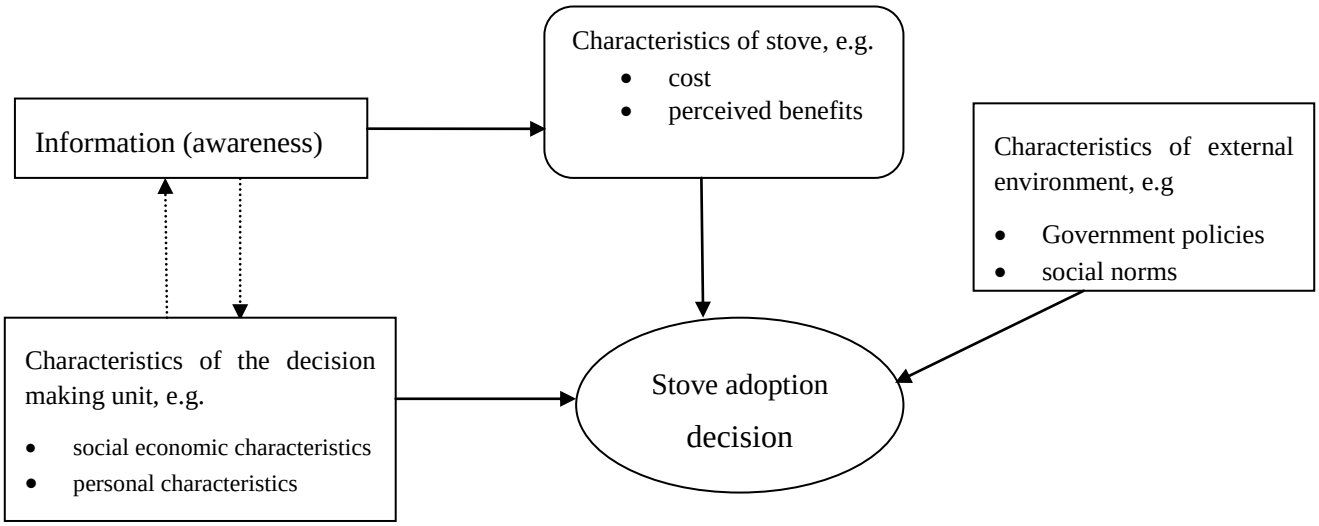
This study is informed by the "**diffusion of innovation**" theories. Technology adoption and diffusion theories seek to explain how and why innovations emerge, enter into use and become wide spread (or not). By far one of the most dominant models in these theories is Roger's *Diffusion of innovation theory*. For the purpose of this research; only a portion of this broad theory was found applicable namely the *innovation-Decision process* model and the perceived attributes of an innovation (See Rogers, 2003, Chapter 5). The *innovation –decision process* model attempts to comprehend how an individual makes a choice to adopt or reject a technology. According to the diffusion of innovation theory, the decision to adopt an innovation is a mental process consisting of five stages; Knowledge, Persuasion, decision, implementation and confirmation. The transition between different stages is affected by several factors. The knowledge stage is affected by the decision making unit such as social economic characteristics and personality characteristics. The persuasion stage is affected by the perceived characteristics of the innovation itself namely the innovation's relative advantage, compatibility, complexity, trialability and observability. He states that it is not so critical as far as human behaviour is concerned on the "objective newness" of an idea; the perceived newness of the idea determines ones reaction to it. The innovativeness of an individual determines when an individual adopts an innovation. Furthermore Roger asserts that the diffusion of an innovation is just as much a social process as it is a technical matter.

The diffusion of innovations theory has guided many studies that try to understand the uptake of improved cook stoves and improve dissemination efforts. Ruiz-Mercado et al. (2011) for instance, drawing on the diffusion of innovation theory and incorporating theoretical contributions from other authors (Pareek & Chattopadhyay, 1966, Agarwal, 1983, Shih & Venkatesh, 2004, Dearing, 2009), proposed a new framework to understand cook stove adoption and sustained use. In their framework, adoption of a new cooking device is seen as a dynamic complex process and a stage in the larger process of technology absorption and cultural adaptation. They argue that the adoption process of improved cook stoves is complex and that relatively fewer efforts have directly addressed it. In the same way, Burwen (2011) drawing on insights from roger's innovation theory and incorporating ideas from Shih & Venkatesh (2004) proposed a model that views stove uptake as a set of separable, observable decisions spread in time. The frame work details components of stove uptake as adoption, usage, substitution and maintenance. The author demonstrates a dynamic relation between these components adding to the argument that transition to new stoves is anything but linear. On the other

hand, to improve dissemination efforts (Dearing, 2009) explain how the diffusion of innovation theory can be applied to intervention development.

3.2. Model of analysis: Factors that determine energy choice

In analysing the empirical material, my objective is to identify the factors that influence the decision to adopt or not Improved cook stoves. Therefore that study will not explore the mental processes involved in making a decision but rather the factors that influence the decision. Following from the literature review conducted during this study, it has been revealed that technology uptake is a complex nonlinear process influenced by multiple factors and relatively few efforts has been made to directly address it. The decisions that govern the household energy profile are based on a complex interaction between economic factors (such as the cost of the cooking device), social factors (such as gender roles), cultural factors (such as cooking practices) and environmental factors (such as access to natural resources) (Masera et al., 2000, Leach, 1992). Such factors can be categorised into endogenous factors and exogenous factors. It's noteworthy that such a categorisation is made for analysis purposes only; in reality these factors are closely interlinked. Endogenous factors reflect the capabilities of households as well as their attitudes, preferences and expectations. On the other hand exogenous factors influence household decisions by affecting the choices available to the households as well as the incentives to choose one cooking technology over the other (Kowsari & Zerriffi, 2011). As such drawing from these insights, I have made the conceptual diagram below that illustrates the factors that influence stove adoption, to aid my data analysis and discussion.



Source: Author

4. Methodology

In the following section, the methodological approach undertaken in this study is discussed briefly. First the approach to inquiry is explained, followed by a brief overview of the research design, data collection methods used, sampling strategy and the process of data transcription and analysis. In addition issues of validity and reliability of the study are also presented as well as the ethical considerations made during the course of the study. Lastly the limitations of the study are presented.

4.1. Approach to Inquiry

A Qualitative case study approach was employed in my quest to understand why there exists a gap between demand and offer of improved cook stoves in Bunga, Uganda. A case study approach enables the exploration of phenomenon in detail with multiple methods in abounded context (Creswell, 2009, Bryman, 2008, Silverman, 2010). The choice of conducting a qualitative study was more obvious to me as contrasted to conducting a quantitative study, since I desired to understand the "*why*" behind the factors influencing adoption of cook stoves from a user's perspective which I wouldn't be able to capture had I followed the later. Furthermore the study is about the user's subjective perceptions with in a bounded reality and thus a qualitative case study is deemed more suitable. Notably the qualitative case study approach enabled me to a have direct interaction with the people and the place where the issue at hand is experienced. This kind of interaction enables a complex detailed understanding of the topic being explored (Creswell, 2007:40).

I hold a social constructivist world view for I believe that humans develop their own subjective meaning and understanding of their lived experiences and the world (Creswell, 2013). Therefore there isn't an objective world for everyone but a plural one, with multiple realities. Thus the goal of the study is to rely as much as possible on the participants' view of the issue being studied. To this end as a researcher I undertook an interpretive approach, as the meaning respondents give to a particular situation is central. Although qualitative research conventionally follows an inductive logic, generating theories or patterns (Creswell, 2009), my study can be placed along the inductive and deductive continuum. In which instance the gathered empirical data was neither used in generation of a new theory nor in testing an existing theory, but where theory guided the overall interpretation of the data.

4.2. Sampling strategies

The primary sampling technique utilised during the study was *Purposeful sampling*. This implies that the respondents and documents were selected based how well they informed the research purpose and question. In line with the research question, the study aimed at maximum variation among respondents in order to capture differing perceptions and opinions in the adoption of improved cook stoves and as such I interacted with people of varying backgrounds who however I categorised into two groups. The first category included improved cook stove users and the second category comprised of non ICS users (using either a simple non insulated stove or three stone open fire).This approach of maximum variation to sampling increases the likely hood that the findings from my study will reflect differences or different perspectives which is a principle in qualitative research (Creswell, 2007).

4.3. Methods

4.3.1. In depth interviews

I conducted Interviews as a primary source of data collection during this study. Interviews are an excellent way to access people's perceptions, meanings, definitions of situations and construction of reality and they are quite helpful in gathering opinions, belief and thoughts of participants (Bryman, 2008). In particular the semi-structured face to face interviews with open ended questions that I steered were purposeful in gathering in-depth knowledge about the topic from the informants. Semi structured interviews were especially useful in the study as they were flexible, allowed data collection from an array of questions while allowing freedom in the responses to the questions (Bryman, 2008). Additionally it enabled comparison of respondents and provided room to incorporate additional questions where it was deemed necessary however this was done with the scope of the research question (ibid). As listening to potential and beneficial users was crucial for answering the study's research question, interviews enabled people to express how they interpreted their social reality in they own language (Kvale, 2007).

A total of 13 interviews were held which comprised of three men and nine women, all in the range of 25-50 years and one girl of seventeen years. The interviewees included a total of 8 non Improved Cook Stove users. Out of respect and consideration for the respondent's time, nearly all interviews were conducted in the evening when I supposed based on local knowledge that the respondents would have completed most of the day's activities. The interviews lasted between 20 to 35 minutes and centred on the themes of the research question. The interviews took place in the households in order to preserve the familiarity of the environment and the naturalness of the research as suggested

by Bryman (2008). All interviews were recorded using Sony ICD recorder after a verbal consent from the respondents. Recording the interviews provided me with an opportunity to write down notes and additional questions on areas that needed further clarification during the course of the interview. However some potential respondents rejected being recorded and declined participating in the study doubting my intentions as expressed by one potential participant in the study who asked, *"What exactly are you going to use the audio recordings for? We don't want to be on news!"*. This may be interpreted as mistrust in the overall intentions of the researcher and/or the research purpose. At all times I respected the wishes of my participants and did not persuade them to participate if they declined. Luganda was the main language of inquiry during the interviews though there was occasional use of English. Since am a native and fluent Luganda speaker, there was no need of an interpreter.

In addition to the conducted interviews, I also carried out observations in the different households I visited. Silverman (2013:49) points out that observations complement the semi-structured interviews, which also help in the construction of a deeper understanding of the individuals and the group they represent, and that are important to understand the different cultural setting (Silverman & Marvasti, 2008:145). Thus, I tried to document what I saw, heard and how individuals behaved and participated as well as how I was treated and reacted to during our encounter. This was especially useful for me by giving me more insights in the study area's way of life. Additionally from the observations, I constructed some evidence that I later discussed during the interview with the participants (Mack et al., 2005).

4.3.2. Data Analysis and Interpretation

I was guided by Creswell (2009:150-153)'s elaborate six step approach during the data analysis process. The six steps includes organising and preparing data, reading through the data, coding, generation of themes and categories, interrelating themes and finally interpreting the meaning of themes. I manually transcribed the recorded interviews non-verbatim while retaining the information of the interview into word documents and then translated them into English. The data was listened to and read several times in order to gain a full understanding of the collected data. The analysis focussed on each question across all the respondents. The data was then categorised based on both the emergent patterns and also according to the pre-set categorised identified in theoretical framework. Ultimately the data was structured into categories and I attempted to find patterns within the categories and between categories, and then interpreted it. The interpretation aimed to give meaning to the data analysed. The findings were then presented to draw major lessons and also for comparison to theory and other recent studies on the topic and particularly to respond to the research

statement and purpose. During the analysis process the research guiding questions were continuously displayed to assist the researcher focus the study and stay within the scope of the research question.

4.3.3. Reliability and Validity

According to Creswell (2009:145), qualitative reliability involves investigating the stability of responses and it indicates that the researcher's approach is consistent across different researchers. Following the recommendations of Yin (2003) and Creswell (2009); the reliability of the data was assured by checking transcripts so they didn't contain any mistakes and making sure that the definition of codes and their meaning was constant throughout the coding process. I accomplished this by repeatedly listening to the recorded interviews used during the transcription process and continuously checking the application of codes.

On the other hand validity has to with the accuracy of data from the researcher's view point and can be assured by use of certain procedures (Creswell 2009:145). To ensure validity in the study, I followed the strategy of triangulation to a certain degree, used thick rich descriptions in presenting data and as well attempted to present counter or discrepant information in relation to the generated themes, as suggested by ibid and (Mikkelsen, 2005:197). The thick description give the reader an insight into the context, giving them an element of shared experiences and enable them to make their own interpretation of the findings and this may add validity to the study (Creswell, 2009).Triangulation was attained through the use of different sources of data namely, interviews and document analysis as well as through comparing the responses of the study's participants. Accordingly with this approach the generated category for instance; *characteristics of improved cook stoves* were based on interviews with the participants, reports from various international NGOs and also on recent studies. This can be claimed to add validity to the study. However I observed that all participants have their own individual point of view, and my focus was not on comparing their responses but rather understanding each individual unique and valuable constructed meaning of the topic of discussion. In the same way I do observe that the respondents might have either consciously or unconsciously altered the reality during the course of the interviews in order to give the "*best*" answer, and this might have impacted the validity of the study significantly. However I didn't concentrate my analysis on only what people said but also considered how they structured their responses and how they talked about the topic at hand.

4.4. Ethical considerations

Ethical considerations are fundamental for research and were reflected upon throughout the entire process of conducting this study. The ethical concerns relevant to the study are discussed below with

reference to the categories exemplified by Lipson (1994) namely; Informed consent procedures, confidentiality towards the participants and deception or covert activities (Creswell, 2007:141).

From the onset the participants were debriefed by the interviewer to introduce the nature of the study, the purpose of the study and how the research findings will be handled. Furthermore the voluntary nature of participation in the study was emphasized to each and every participant at all times and they were informed of their right to withdraw their participation at any time/stage during the course of the study. The participants were informed of the intention to Audio record the interviews and how this audio material will be used. All respondents in this study gave their verbal consent to participate in the study.

On the issue of confidentiality towards the participants; considerations were given to their anonymity and discretion of the information gathered from the participants. The information gathered from the participants has not been shared or utilised for a different purpose other than that described to the participants. All the names used in quotes in the data analysis section and throughout this thesis are fictitious in order to preserve the anonymity of the participants. Lastly, the researcher did not engage in any form of deception about the nature of the study, moreover the research topic was not politically or socially sensitive.

4.5. Limitations of the study

In this section the researcher will endeavour to critique the choices made during the research design and data collection process. In retrospect, the researcher observes that the interview questions were not as open ended as it was initially intended. This may be attributed either to the design of the questions namely that they were over structured or to the researcher's failure to follow up the answers of the participants in order to establish the necessary depth in their responses due to time limitations when conducting the fieldwork. Given the above mentioned limitation, some interview questions only provoked limited responses from the study participants. This might have led the study not to fully utilise the principal advantage of using a qualitative approach, since as (Mack et al., 2005) acknowledges, non-open ended questions do not allow for rich information. The second limitation is in line with the sample for the study. Although the research undertook purposeful sampling perhaps she could have been more even more focused in the choice of the location where to conduct the study. While in the chosen study area there were influences of cook stove market interventions, the research assumes that choosing a specific ongoing cook stove project might have been more illustrative of her arguments. None the less the findings in this research are insightful and

valuable in unveiling the dynamics of improved cook stove adoption more especially since they are user-centered.

5. Findings and Analysis

This section presents the synthesis of the empirical material gathered during field work. From the interviews conducted, a consistent pattern of major influences on the decision to adopt improved cook stoves emerged. The major themes identified as factors are presented and discussed below. The different factors are discussed and related to by the aid of the conceptual framework presented in theoretical framework section. Furthermore the findings are compared and/or contradicted to the existing research on adoption of improved cook stoves.

5.1. Knowledge and information

From the study it emerged that knowledge and information influenced the decision to adopt improved cook stoves in many ways. In this analysis knowledge is obtained when the individual gains exposure to the innovation's existence and gains some degree of understanding of the innovation (Rogers, 2003:171). In gathering empirical data, the participants in the research reported knowing about the existence of ICS and were able to described ICS when asked. Interviews demonstrated that even non users had been exposed to ICS in several ways such as through advertisements on TV, Radio, from stove vendors and from institutions such as the church. Moreover they were aware of the benefits they would gain if they were to use these improved cooking technologies for cooking. When asked about the benefits, they mostly pointed out that ICSs would enable them save fuel costs by using less fuel and through the preservation of heat. They obtained this information from the above sources and from their neighbors. However when asked to describe ICSs, some of the respondents associated the description of ICs to only one particular stove, the Uga stove. On the other hand, some non-users as well as users did not necessary explicitly know the attributes that differentiate an ICS from other stoves that are approximates of ICS.

From the study, the consequences of little information or misinformation about ICS were revealed. One interesting case was one *Marion* who knew that any other stove besides the "three stone stoves" is improved. Indeed one could argue that it is albeit not in the context of the improved cook stoves rhetoric. The misinformation or incomplete information had caused Marion to use an approximate of ICS, the *bare metallic* stove without any heat insulating properties. On the other hand some of the current users recall that it's the knowledge of the benefits associated with using an improved cook stove that prompted them to acquire one. As can be captured from Sarah's account (an ICS user);

"*..one day in one of the meetings with our women group, a person from an NGO briefed us about cook stoves and explained to us the benefits of using these new stoves. I instantly appreciated these benefits that I would obtain from using these stoves. After the meeting, I thought to myself that I should get this stove. I saved money and bought one of these red stoves [Uga stoves]."*

The quote above is an example of the codes in empirical data where the influence of knowledge on the adoption decision of improved cook stoves can be located. It can be argued that the knowledge one has about a new technology forms a foundation for the attitudes and perceptions that individual develops towards that technology. Furthermore that one's attitudes towards a certain technology influence their decision to adopt or not the innovation. This thinking is similar to that of (Meijer et al., 2014). Although their discussion centered on adoption of agro forestry innovations they articulated the role of knowledge and information in the adoption of innovations quite well and I find their discussion applicable to the case of adoption of improved cooking stoves.When one has a positive attitude towards the innovation, they are likely to adopt it and vice versa. While the study's objective was not to access ICS potential users' attitudes, from the content of the gathered interviews one can conclude that the respondents generally had a positive attitude towards the adoption of cook stoves. However the attitudes towards stove technologies and consequently the adoption decision are shaped by many factors which are interlinked in complex ways.

The findings discussed above that is, the knowledge the decision making entity possess about an innovation influences their decision to adopt an innovations particularly improved cook stoves in this case, agree with roger's theory that knowledge is a source of motivation for the decision to adopt an innovation (Rogers, 2003, chapter 5). In addition they agree with the empirical findings in Debbi et al (2014)'s systematic review of the factors influencing household uptake of improved cook stoves in low and middle income countries, in their review they identified knowledge and perceptions as an important factor in the uptake of ICS at household level. The role of knowledge and information in the adoption process of stove technologies or any innovation for that matter cannot be underrated. In understanding the role of knowledge in the adoption of innovations we encounter the question of whether the need for the innovation comes first or awareness of the innovation comes first and it's a highly debatable question (Rogers, 2003: 171). None the less I attempted to explore if potential improved cook stove users perceive improved cook stoves as a need in the section below.

5.2. Where is the attention: Energy Device or energy service?

Following Roger's innovation decision model, prior conditions such as perceived need, social norms and values, as well as existing practices influence the adoption decision process of an innovation. I

argue that understanding where the potential ICS Users focus is, that is, whether it is the cooking device or services obtained from using the device is important in unravelling the dynamics in adoption of improved cooking stove technologies. It is vital in attempting to comprehend why there is low improved stove adoption in the study area. During the study, it become apparent that ICS potential users paid little attention to the actual cooking device compared to the attained service, which is cooked meals. Looking at most of the available literature, in response to the problems associated with traditional cook stoves, more emphasis has been put on the technical side of the problem, namely addressing energy inefficiency and smoke reduction. Overemphasis on the technical side of the issue is problematic as it offers limited solutions. It mainly implies that the problem can be resolved with universally applicable technologies, practices and standards. It is important to see that ways in which households use energy technologies are adaptive responses to particular local conditions and norms and therefore are highly heterogeneous. From the "socio-technical" perspective, energy demand itself is embedded in the way home life is organised into habitual activities such as cooking, washing, entertainment and many more (Wilson & Dowlatabadi, 2007). What this means is that, in most cases people don't demand energy for its sake but rather for the services it helps deliver. This was evident in the study; an example is the expression by Nancy (non ICS user);

"*You see, what matters to me is that I cook my food. And I will do so with the stove which is available to me. Whether I cook it using an electric or charcoal stove, if am the one who has cooked it, it will taste the same way".*

This very same point can also be seen in Sarah's account (an ICS user) presented below,

"*What our husbands need is that food is ready on time and they will not look into how I cook it, which type of stove I use*"

From these and similar accounts in the study, we can infer that people may hardly give energy sources and devices the kind of attention stove promoters or energy product innovators suppose they do. On a basic level, what is important to a house hold is the food is prepared on time irrespective of the stove used. This is an important element in understanding the dynamics in adoption of stove technologies and therefore both the intended and unintended consequences of stove uptake. What has been revealed from the above findings is that as long as non ICS users satisfy their cooking needs with the available means, they may not view acquiring a new stove as a need. Not categorising the ICS as a need may imply not starting the innovation decision according to Roger's model if

perceived needs precede awareness. Of course the reality is far from being this simplistic and this point is better understood in the context of competing needs which we explore in the sections below.

In light of the above argument, since the main goal of the stove user is to prepare food and not utilisation of the cooking stove in itself, I argue that at a household the level of innovation being introduced is not only the stove itself but a new or modified set of the energy service (i.e. cooking practices). For instance, one of my respondents acknowledged that since they utilise the ICs they are not able to cook certain foods while some foods like rice, are now better cooked. In his words Musa (a stove user) says;

"*In the village where we used firewood to cook food, it was easy to roast these seeds [jackfruit seeds], but now I can't [when using an ICS] and I miss them."*

On the other hand, he also acknowledges that now they are able to make rice in a thinner sheet pan and cook it well. The modifications brought about by introducing a new stove to the household lead to new impacts in terms of what and how it can be cooked. These findings are similar to the findings in Bielecki and Wingenbach (2014) study, which found that improved cook stoves sacrificed some important functional and culture needs in rural Guatemala. By closely scrutinising the issue of cooking with rudimentary stoves, we can deduce that the problem is a social as well as a technical one.

5.3. Competing priorities

It was revealed during the study that many potential users don't prioritize the acquisition of improved cook stoves over other "developmental" needs notwithstanding their awareness of negative consequences associated with the use of the traditional cook stoves. The respondents placed getting their children to school, acquiring everyday necessities such as food, shelter, clean water as well as obtaining good health care among their priorities. This is not surprising as households are faced with these many competing demands in relation to spending their income. From an economic perspective, the lower the income, the greater the influence these competing priorities have on consumer behavior such as acquiring a new cook stove. The type of stove used for cooking is rarely prioritized as a need most notably when its acquisition ought to be balanced amidst such a large and pressing set of priorities. We can locate this from Jane's account (a non-user);

"....I would very much like to get a new stove. And possibly even get a cleaner one [gas stove] for am tired of using firewood as it makes my hands dirty. But there are also many things I have to do, I need to look for rent, food and send some money to my mother in the village. You find that I can't get all I want."

These findings are similar to the evidence gathered in Mobarak et al (2012)'s study where they found that rural women in Bangladesh did not prioritize nontraditional cook stoves over other developmental needs even though they expressed their awareness of the negative health consequences associated with traditional cook stoves. Understanding the notion of competing priorities may help us respond to why there is low adoption of cook stoves. In Roger's innovation-decision model; prior conditions such as perceived needs or felt problems kick start the innovation-adoption process. If we follow this reasoning, it means that if acquiring a new stove is not perceived as a need, the decision to adopt or reject an ICS may never be started. It is from this competing priorities background that we are in a better position to situate the meaning behind willingness to pay for the stoves as the cost of the improved cook stove was found to be one of the major factors influencing the adoption of improved cook stoves in addition to other perceived characteristics of the improved cook stoves.

5.4. Characteristics of the improved cook stoves

5.4.1. Fuel saving

From the interviews, it emerged that fuel savings were considered a motivation for the adoption of ICSs. Current users emphasized that by using ICSs they were using less fuel compared to when using traditional stoves and that in turn they were saving on the cost of cooking fuel for their everyday needs. In the context of the study area, it is pertinent to save on fuel given the increasing rise in the price of cooking fuel. as Martha narrates,

"Since I started to use my new stove, this bag of charcoal now lasts longer. You see, charcoal is becoming more expensive by the day. I invested in this new stove because I heard that it saves charcoal. And now I think it was a worthwhile Investment".

In the same way the non improved cook stove users claimed that the prospects of fuel saving is a contributing factor to their considerations of acquiring a new improved cook stove. In addition many respondents stated that they would be motivated to acquire a stove emitting less smoke while 2 female participants said the ability of a stove to cook faster would motivate them to acquire one.

These findings s are consistent with most research on improved cook stoves (See for instance Barnes et al., 1994, Ruiz-Mercado et al., 2011, Person et al., 2012, Debbi et al., 2014). In their study in neighboring Kenya (Person et al., 2012), found significant fuel savings to be a major motivator in the adoption decision of Improved wood stoves and that the value attached to the saving was largely influenced by the proximity and availability of the wood fuel. Another characteristic of improved

cook stoves closely linked to fuel saving that was indentified was the ability of the stove to preserve heat for a considerable amount of time.

5.4.2. Heat Preservation

The second desirable characteristic of the stove that was mentioned was heat preservation. The desire for a heat preserving stove in this area is deeply connected to the type of food cooked in the region. The traditional delicacy of the region, "matooke" is cooked for approximately 2 hours and then left on low heat until the household is ready to have their meal. The meal is usually served while hot. In some cases the "matooke" for both lunch and dinner is cooked at once and should be preserved warm for lunch and also until the night fall for dinner. The ICS is able to preserve heat because of its insulation material and like some respondents said because the fire is not blown by the wind compared to traditional cook stoves. Following from the literature review, this is a stove characteristic that is not explicitly found in many studies. This implies a difference in contexts and has implications for the decision to adopt or reject an adoption. It calls for the design and development of "stove context responsive" technologies and programmes. Another factor pointed out during the study was stove portability relative the stove's actual weight[6]. According to the users, the ICS that they were exposed to were relatively heavy. This is another very context specific requirement to be met by the stove programs developed in the region. Other factors mentioned included stove durability and the easy of heating up the stove. From the gathered interviews, it is evident that the technical characteristics of the stoves influence the user's decision to adopt or reject them. Another important factor that was mentioned as influencing the stove adoption decision process relating to the stove itself was the cost of the stove.

5.4.3. Cost of the improved cook stove

During this research, it was clear that the cost of the ICs is among the most important factors considered in the uptake of an ICS and this was emphasized by both non users and current users. Many aspects may influence the willingness to pay. For instance current stove users felt that the cost of acquiring the new stove would be offset in the long term in form of reduced fuel costs due to fuel saving and in form of freed time. This point is summarized well by a quote below from one of the participants, Sandra (an ICS user)

[6]In this region, people require portable stoves as they cook from the outdoors but then keep the stoves indoors. Due to land limitations and housing style, not many people have indoor kitchens.

"*This* stove was costly. *But I don't regret getting this new stove even if it was expensive. I now just put the pot on and return to my shop. I just need to check the water level every now and then."*

On the other hand non users felt that the cost of ICs was high and therefore a prohibitive factor for them to acquire ICs. The most quoted price was that of the locally made stoves by Ugastove which was 20000ugx (approximately$7.68). A closer look into their responses revealed that their unwillingness to pay may be better explained by the desire to acquire other prioritized needs. This can be observed in Maria's response when asked why she thinks an ICS is expensive,

"*You see with this 20,000ugx I can get a new phone. Why should a simple stove be the same price as a new mobile phone from china?"*

This is not to say that their ability to pay should be down played. For some households, the decision to acquire an ICS entails proper planning and negotiations on how to apportion their scare resources among their many needs. None the less some non-users seemed not to consider investment in ICS worthwhile since traditional stoves were easy to acquire and inexpensive, especially given the competing household priorities. In addition the willingness to pay is closely linked to perceived benefits of the cook stoves.

In summary these findings namely that the perceived characteristics of the improved cook stoves influence the users' adoption decision , are in agreement with the diffusion of innovation theory which claims that the attributes of an innovation in relation to its counterparts influences its rate of adoption. In this case the perceived benefits of improved cook stoves over the rudimentary stoves influence their uptake and consequently sustained use.

5. Discussion

What are the implications of the identified factors in the context of stove development?

This section attempts to relate the identified factors to the current trends in improved stove technologies and the broader field of development. There is a growing realization among development actors that many households in developing countries will continue to depend on solid biomass fuels in the foreseeable future, and as such improved stove technology development programmes and stove uptake questions will continue to be relevant. The factors identified in the study are in agreement with many other studies that have attempted to ascertain the factors that influence the adoption of improved cook stoves (e.g. Barnes et al., 1994, e.g. Ruiz-Mercado et al., 2011, Person et al., 2012, Debbi et al., 2014, Mobarak et al., 2012) albeit embedded in these factors are very context specific details. In the investigations of why there are low stove uptake rates,various

researchers have pointed out that the poor quality of improved cook stoves coupled with substandard performance is major factor contributing to the low improved cook stove up take rates (see for example Aggarwal & Chandel, 2004, Shrimali et al., 2011). In response to such results, the prevailing assumption in the new wave of stove development is that if the stove quality can be improved, stoves made durable and more technologically sound, potential beneficiaries will be inclined to adopt them. Its noteworthy however that it has also been argued that the major reason why stove programmes have failed to scale up is because they paid little attention to user's needs and cultural contexts and mostly emphasized technical factors such as energy efficiency (Lambe & Atteridge, 2012). It's therefore naive to assume that because of their perceived benefits, improved cook stoves will readily be accepted by potential users. From this study, it was evident that adoption and sustained use of cook stoves is complex and it necessities consideration of a wide range of factors which mutually influence house hold decision to adopt (or not) improved cook stove. One such factor is that of competing priorities that many households face. It became apparent that the type of stove used for cooking is rarely prioritized as a need, most notably when its acquisition ought to be balanced amidst such a large and pressing set of priorities faced by several households. Furthermore much as replacing traditional stoves with improved cook stoves may seem straightforward, they may not readily be accepted by households. This may be attributed to the fact that there are some vital tasks that an improved cook stove may not perform such as roasting of *jack fruit seeds* we encountered in this study. Therefore even though stove promoters may consider the benefits gained from using improved cook stoves outweigh the foregone benefits of traditional stoves, it is essential to take account the short falls associated with improved cook stoves as well. Since for many people cooking with traditional stoves these may be indispensable details.

A closer look at the trends in stove development programmes reveals an emphasis on technology and market driven approaches that pay little attention to local priorities as defined by the potential users. The potential users are primarily seem as 'customers' with energy demand that needs to be evaluated and supplied by actors in the global improved stove market (see for instance (World bank, 2011). By over emphasising the positive prospects of a combination of competitive markets, innovative finance alongside improved technologies, stove promoters seem to be disconnected from the realities of people reliant on biomass (Fraser, 2012, Sesan, 2012). As Bails et al (2009) point out this tendency of donor organization to incline towards neoliberal approaches in stove dissemination may counteract the primary objectives of stove programmes such as improving health of the potential beneficiaries. As such a goal mismatch is created between why development agencies disseminate ICSs and the goals the users wish to attain by adopting the use of ICS. The "triple benefits" of ICS

often found in ICS research appear to portray international development ideals which may not necessarily be shared by the people cooking with traditional stoves or on open fires. What is apparent is that different outcomes of adopting improved cook stoves will be valued in different local context. This is not a new realisation, the need to adapt ICSs to the local context has long been observed and it was for this reason that context responsive approaches were advocated for in the early 90s. However despite the rhetorical shift towards more context responsive strategies in implementation of stove programmes, it appears the priorities and policies of stove promoters are still dominant today in the same way they did in the expert led programmes of the 1970's. Just like Ramakrishna 1995 notes, the priorities of the potential beneficial are unlikely to be prioritised by the outside stove promoters unless there is an identified connection between the interests on both sides. Similarly (Masera et al., 2007) concluded in their study that "actual people's perceptions" are often overridden by those of "external stakeholders" when designing improved cook stove programmes. Therefore despite the incorporation of participatory development principles since the 1990's, local perceptions and perspectives of the beneficiaries continue to be neglected in practice.

6. Concluding Remarks

The attempt to understand the adoption process of improved cook stoves considering the perspectives of the local users has revealed some perceived factors that play a crucial role in the diffusion and adoption process. Such factors include cost of stoves, benefits of the stove, being able to cook traditional dishes and competing priorities among others. These factors mutually influence the decision to adopt an improved cook stove at household level or even community level. The absence or presence of the factor may act as a barrier or an enabler for stove uptake. From the study the importance of user's perceptivities in the design of improved cook stove technologies is revealed; if users don't value ICS or if the stoves don't meet their local needs, they may not adopt them. The failure of many previous cook stove programs can be attributed to lack of proper understanding of the people who use these technologies/ innovations (World bank, 2011). Ordinarily the functioning of the ICS has dominated the technology adoption discussion. Many studies relate the adoption of improved cook stoves almost exclusively to the benefits of ICSs over traditional stoves and to the price of the ICS. This utility based model doesn't take in account the effect of other factors such as competing priorities discussed above. The gap between the benefit of the technology as seen by the stove promoters /implementers and potential users can be problematic.

Contrary to the views of some stove promoters, the cooking needs of stove users are not simply less smoke or more fuel efficiency, they are diverse and sometimes broader than those delineated by some stove promoters. What this means is that the design and dissemination methods of ICS whether

market oriented or otherwise, should include features that are highly valued by potential users even those which are not directly linked to health and environment impacts of cook stoves. For no stove program can achieve its objectives without the people adopting and using the stoves in long term.

User perspectives are therefore important, if users do not value the stoves or the stoves do not meet there needs, they will not adopt the stove and /or continue to use them in the long. Although this study was not exhaustive in any way, it was evident adoption and sustained use of cook stoves is complex and it necessities consideration of a wide range of factors which mutually influence house hold decision to adopt (or not) improved cook stoves. As such in the discussion above I have attempted to emphasize the need for those promoting ICS to have a deeper understanding of the context in which potential adopters are part, and gain insight into the complex factors that govern behavior and provide a basis for doing things in a certain way, in order to ensure adoption and sustained use of ICSs.

References

Agarwal, B. (1983). Diffusion of rural innovations: some analytical issues and the case of wood-burning stoves. *World Development*, vol. 11, no. 4, pp. 359-376.

AGECC (2010). Energy for a Sustainable Future: Summary Report and Recommendations', New York, UNITED NATIONS.

Aggarwal, R. and Chandel, S. (2004). Review of improved cookstoves programme in Western Himalayan State of India. *Biomass and Bioenergy*, vol. 27, no. 2, pp. 131-144.

Agurto-Adrianzén, M. (2013). Improved cooking stoves and firewood consumption: Quasi-experimental evidence from the Northern Peruvian Andes. *Ecological Economics*, vol. 89, pp. 135-143.

Arnold, J.E.M., Köhlin, G.and Persson, R. (2006). Woodfuels, livelihoods, and policy interventions: Changing Perspectives. *World Development*, vol. 34, no. 3, pp. 596-611.

Arnold M., Köhlin, G., Persson, R.and Shepherd, G. (2003). Fuelwood Revisited: What has changed in the last decade?, Center for International Forestry Research (CIFOR).

Bailis, R., Cowan, A., Berrueta, V.and Masera, O. (2009). Arresting the Killer in the Kitchen: The Promises and Pitfalls of Commercializing Improved Cookstoves. *World Development*, vol. 37, no. 10, pp. 1694-1705.

Bailis, R., Ezzati, M.and Kammen, D.M. (2005). Mortality and Greenhouse Gas Impacts of Biomass and Petroleum Energy Futures in Africa. *Science*, , no. 5718, pp. 98-103.

Barnes D.F., Kumar, P.and Openshaw, K. (2012). Cleaner hearths, better homes: new stoves for India and the developing world, New Delhi, India, Oxford University Press and World Bank.

Barnes, D.F., Openshaw, K., Smith, K.R.and van der Plas, R. (1993). The design and diffusion of improved cooking stoves. *The World Bank Research Observer*, vol. 8, no. 2, pp. 119-141.

Barnes, D., Openshaw, F.K., Smith, K.and Robert, R. (1994). What makes people cook with improved biomass stoves? A comparative international review of stove programs. *World Bank Technical Paper, Energy Series*, , no. 242.

Bensch, G. and Peters, J. (2013). Alleviating Deforestation Pressures? Impacts of Improved Stove Dissemination on Charcoal Consumption in Urban Senegal. *Land Economics*, vol. 89, no. 4, pp. 676-698.

Bielecki, C. and Wingenbach, G. (2014). Rethinking improved cookstove diffusion programs: A case study of social perceptions and cooking choices in rural Guatemala. *Energy Policy*, vol. 66, pp. 350-358.

Bryman, A. (2008). *Social research methods*, 3rd edn, Oxford: University Press.

Burwen, J. (2011). *From Technology to Impact: Understanding and Measuring Behavior Change with Improved Biomass Cookstoves*, Energy and Resources Group, University of California, Berkeley.

Burwen, J. and Levine, D.I. (2012). A rapid assessment randomized-controlled trial of improved cookstoves in rural Ghana. *Energy for Sustainable Development,* vol. 16, pp. 328-338.

Chambers R. (1992). *Rural apprasial: rapid, relaxed and participatory*, IDS Discusion Paper 311., Institute of Development Studies (UK).

Clough L. (2012). The Improved Cookstove Sector in East Africa: Experience from the Developing Energy Enterprise Programme (DEEP)., London, United Kingdom, GVEP INTERNATIONAL.

Creswell, J.W. (2013). *Qualitative inquiry and research design : choosing among five approaches*, 3rd edn, Thousand Oaks : SAGE Publications.

Creswell, J.W. (2009). *Research design : qualitative, quantitative, and mixed methods approaches*, 3rd edn, Thousand Oaks, Calif. : Sage.

Creswell, J.W. (2007). *Qualitative inquiry & research design : choosing among five approaches*, 2nd edn, Thousand Oaks : SAGE.

Dearing, J.W. (2009). Applying diffusion of innovation theory to intervention development. *Research on social work practice,* vol. 19, no. 5, pp. 503-518.

Debbi, S., Elisa, P., Nigel, B., Dan, P.and Eva, R. (2014). Factors influencing household uptake of improved solid fuel stoves in low- and middle-income countries: a qualitative systematic review. *International Journal Of Environmental Research And Public Health,* vol. 11, no. 8, pp. 8228-8250.

Duflo E., Hanna, R.and Greenstone, M. (2012). Up in smoke: the influence of household behavior on the long-run impact of improved cooking stoves, National Bureau of Economic Research.

Eckholm, E. (1975). *The other energy crisis: firewood, ,* Washington, D.C.

Ezzati, M., Bailis, R., Kammen, D.M., Holloway, T., Price, L., Cifuentes, L.A., Barnes, B., Chaurey, A.and Dhanapala, K.N. (2004). Energy management and global health. *Annual Review of Environment and Resources,* vol. 29, pp. 383-419.

Fraser, Barbara (2012). , Killer cookstoves: Indoor smoke deadly in poor countries; cleaner stoves elusive. [Homepage of Environmental Health News], [Online]. Available: http://www.environmentalhealthnews.org/ehs/news/2012/not-so-improved-cookstoves Accessed 5/13/2015.

Hanbar, R. and Karve, P. (2002). National Programme on Improved Chulha (NPIC) of the Government of India: an overview. *Energy for Sustainable Development,* vol. 6, no. 2, pp. 49-55.

Kammen, D.M. (1995). Cookstoves for the developing world. *Scientific American,* vol. 273, no. 1.

Karekezi, S. and Turyareeba, P. (1995). Articles: Woodstove dissemination in Eastern Africa – a review. *Energy for Sustainable Development,* vol. 1, pp. 12-19.

KCCA (2014). Laying the Foundation For Kampala City Transformation: STRATEGIC PLAN 2014/15- 2018/19., Kampala: Kampala city council Authority.

Kowsari, R. and Zerriffi, H. (2011). Three dimensional energy profile:A conceptual framework for assessing household energy use. *Energy Policy,* vol. 39, no. 12, pp. 7505-7517.

Kvale, S. (2007). *Doing interviews.* London : SAGE.

Lambe, F. and Atteridge, A. (2012). Putting the Cook Before the Stove: a User-Centred Approach to Understanding Household Energy Decision-Making. *Stockholm Environment Institute, .*

Leach, G. (1992). The energy transition. *Energy policy,* vol. 20, no. 2, pp. 116-123.

Lipson, J.G. (1994). Ethical issues in ethnography. In Morse, J.M., (ed). *Critical issues in qualitative research methods.* Thousand Oaks, CA: Sage., pp. 333-355.

Mack, N., Woodsong, C., MacQueen, K.M., Guest, G.and Namey, E. (2005). *Qualitative Research Methods: A Data Collector's Field Guide.* North Carolina: Family Health International.

Manibog, F.R. (1984). Improved cooking stoves in developing countries: problems and opportunities. *Annual Review of Energy,* vol. 9, no. 1, pp. 199-227.

Mannan, M. (1996). Women targeted and women negated. *Development in practice,* vol. 6, no. 2, pp. 113-120.

Marcoux, A. (2000). Population and deforestation. *Population and the Environment, .*

Martin, W.J.,II, Glass, R.I., Balbus, J.M.and Collins, F.S. (2011). Public health. A major environmental cause of death. *Science (New York, N.Y.),* vol. 334, no. 6053, pp. 180-181.

Masera, O.R., Saatkamp, B.D.and Kammen, D.M. (2000). From Linear Fuel Switching to Multiple Cooking Strategies: A Critique and Alternative to the Energy Ladder Model. *World Development,* vol. 28, pp. 2083-2103.

Masera, O., Edwards, R., Arnez, C.A., Berrueta, V., Johnson, M., Bracho, L.R., Riojas-Rodríguez, H.and Smith, K.R. (2007). Impact of Patsari improved cookstoves on indoor air quality in Michoacán, Mexico. *Energy for Sustainable Development,* vol. 11, no. 2, pp. 45-56.

Masera, O., Ghilardi, A., Drigo, R.and Trossero, M.A. (2006). WISDOM: A GIS-based supply demand mapping tool for woodfuel management. *Biomass and Bioenergy,* vol. 30, no. 7, pp. 618-637.

Meijer, S.S., Catacutan, D., Ajayi, O.C., Sileshi, G.W.and Nieuwenhuis, M. (2014). The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. *International Journal of Agricultural Sustainability,* vol. 13, no. 1, pp. 40-54.

MEMD (2014). Biomas Energy strategy (BEST), UGANDA, Kampala: Ministry of Energy and mineral Development, Government of Uganda.

MEMD (2007). The Renewable Energy Policy for Uganda, Kampala,Uganda, Ministry of Energy and mineral development,Republic of Uganda.

Mikkelsen, B. (2005). *Methods for development work and research: a new guide for practitioners*, Sage.

Mobarak, A.M., Dwivedi, P., Bailis, R., Hildemann, L.and Miller, G. (2012). Low demand for nontraditional cookstove technologies. *Proceedings of the National Academy of Sciences of the United States of America*, vol. 109, no. 27, pp. 10815-10820.

MoFPED (2014). POVERTY STATUS REPORT 2014:Structural Change and Poverty Reduction in Uganda, Kampala: Ministry of Finance, Planning and Economic development. Goverment of Uganda.

MoFPED (2013). The state of Ugandan Population - population and social transformation: Addresing the needs of special interest groups., Kampala : Population secretariat, Ministry of Finance,Planning and Economic Development.

MoLUD (2014). , Kampala profile :Makindye [Homepage of Ministry of Lands, Housing and Urban Development], [Online]. Available: http://askyourgov.ug/request/37/response/37/attach/3/Makindye Municipality.pdf Accessed 5/11/2015.

Nepal, M., Nepal, A.and Grimsrud, K. (2011). Unbelievable but improved cookstoves are not helpful in reducing firewood demand in Nepal. *Environment and Development Economics*, vol. 16, no. 01, pp. 1-23.

Nystrom, M. (1994). *FOCUS Kitchen Design: A study of housing in Hanoi*, Lund University, Sweden.

OECD/IEA (2011). Energy for all: financing access for the poor, Organisation for Economic Co-operation and Development (OCED) / International Energy Agency (IEA).

OECD/IEA (2006). World energy outlook 2006, Organisation for Economic Co-operation and Development (OCED) / International Energy Agency (IEA).

Pareek, U. and Chattopadhyay, S. (1966). Adoption quotient: A measure of multipractice adoption behaviour. *The Journal of Applied Behavioral Science*, vol. 2, no. 1, pp. 95-108.

Person, B., Loo, J.D., Owuor, M., Ogange, L., Jefferds, M.E.D.and Cohen, A.L. (2012). "It is good for my family's health and cooks food in a way that my heart loves": Qualitative findings and implications for scaling up an improved cookstove project in rural Kenya. *International journal of environmental research and public health*, vol. 9, no. 5, pp. 1566-1580.

Rogers, E.M. (2003). *Diffusion of innovations*, 5th edn, New York : Free press.

Rogers, E.M. (1995). *Diffusion of innovations*, 4th edn, New York : Free Press.

Ruiz-Mercado, I., Masera, O., Zamora, H.and Smith, K.R. (2011). Adoption and sustained use of improved cookstoves. *Energy Policy,* vol. 39, no. 12, pp. 7557-7566.

Schirnding, Y.V. (2001). Gender differences in the impact of biomass fuel on health. *Energia News,* vol. 4, no. 4.

Sesan, T. (2012). Navigating the limitations of energy poverty: Lessons from the promotion of improved cooking technologies in Kenya. *Energy Policy,* vol. 47, pp. 202-210.

Shih, C. and Venkatesh, A. (2004). Beyond adoption: Development and application of a use-diffusion model. *Journal of Marketing,* vol. 68, no. 1, pp. 59-72.

Shindell, D., Kuylenstierna, J.C., Vignati, E., van Dingenen, R., Amann, M., Klimont, Z., Anenberg, S.C., Muller, N., Janssens-Maenhout, G., Raes, F., Schwartz, J., Faluvegi, G., Pozzoli, L., Kupiainen, K., Hoglund-Isaksson, L., Emberson, L., Streets, D., Ramanathan, V., Hicks, K., Oanh, N.T., Milly, G., Williams, M., Demkine, V.and Fowler, D. (2012). Simultaneously mitigating near-term climate change and improving human health and food security. *Science (New York, N.Y.),* vol. 335, no. 6065, pp. 183-189.

Shrimali, G., Slaski, X., Thurber, M.C.and Zerriffi, H. (2011). Improved stoves in India: A study of sustainable business models. *Energy Policy,* vol. 39, no. 12, pp. 7543-7556.

Silverman, D. (2013). *Doing qualitative research,* 4th edn, Thousand Oaks, CA : Sage Publications.

Silverman, D. (2010). *Doing qualitative research : a practical handbook,* 3rd edn, London : Sage Publication.

Silverman, D.and Marvasti, A. (2008). *Doing qualitative research: A comprehensive guide,* Sage.

Smith, K.R., McCracken, J.P., Weber, M.W., Hubbard, A., Jenny, A., Thompson, L.M., Balmes, J., Diaz, A., Arana, B.and Bruce, N. (2011). Effect of reduction in household air pollution on childhood pneumonia in Guatemala (RESPIRE): a randomised controlled trial. *The Lancet,* vol. 378, no. 9804, pp. 1717-1726.

Smith-Sivertsen, T., Díaz, E., Bruce, N., Díaz, A., Khalakdina, A., Schei, M.A., McCracken, J., Arana, B., Klein, R.and Thompson, L. (2004). Reducing indoor air pollution with a randomised intervention design–. *Norsk epidemiologi,* vol. 14, no. 2, pp. 137-143.

Smith-Sivertsen, T., Diaz, E., Pope, D., Lie, R.T., Diaz, A., McCracken, J., Bakke, P., Arana, B., Smith, K.R.and Bruce, N. (2009). Effect of reducing indoor air pollution on women's respiratory symptoms and lung function: the RESPIRE Randomized Trial, Guatemala. *American Journal of Epidemiology,* vol. 170, no. 2, pp. 211-220.

UBOS (2014a). Uganda National Household Survey 2012/2013, Kampala : Uganda Bureau of statistics.

UBOS (2013). Uganda in figures 2013, Kampala : Uganda Bureau of statistics.

UBOS (2010). Uganda National Household Survey Report 2009/2010. Socio Economic module, Kampala : Uganda Bureau of Statistics.

UBOS, (2014b). National Population and housing Census 2014, provisional results, Kampala : Uganda Bureau of statistics.

UNDP (2014a). Human Development Report 2014. Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience, UNDP.

UNDP (2014b). , Sustainable Energy | UNDP [Homepage of United Nations], [Online]. Available: http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/focus_areas/sustainable-energy.html Accessed 5/25/2015.

UNDP (2012). Integrating Energy Access and Employment Creation to Accelerate Progress on the MDGs in Sub-Saharan Africa.

UNDP and WHO (2009). The Energy Access Situation in Developing Countries: A ReviewFocusing on the Least Developed Countries and Sub-Saharan Africa, New York: UNDP and World Health Organisation.

UNEP (2010). INVESTING IN IMPROVED STOVES IN HAITI: DISCUSSION PAPER JULY 2010, United Nations Environment program.

Urmee, T. and Gyamfi, S. (2014). A review of improved Cookstove technologies and programs. *Renewable and Sustainable Energy Reviews,* vol. 33, pp. 625-635.

Westhoff, B.and Germann, D. (1995). *Stove images: a documentation of improved and traditional stoves in Africa, Asia and Latin America,* Frankfurt am Main : Brandes & Apsel.

WHO (2006). Fuel for life: household energy and health, france, World Health Organization.

Wilson, C. and Dowlatabadi, H. (2007). Models of Decision Making and Residential Energy Use. *Annual Review of Environment and Resources,* vol. 32, no. 1, pp. 169-203.

World Bank (2015a). , Population growth (annual %) data [Homepage of World Bank], [Online]. Available: http://data.worldbank.org/indicator/SP.POP.GROW Accessed 5/10/2015.

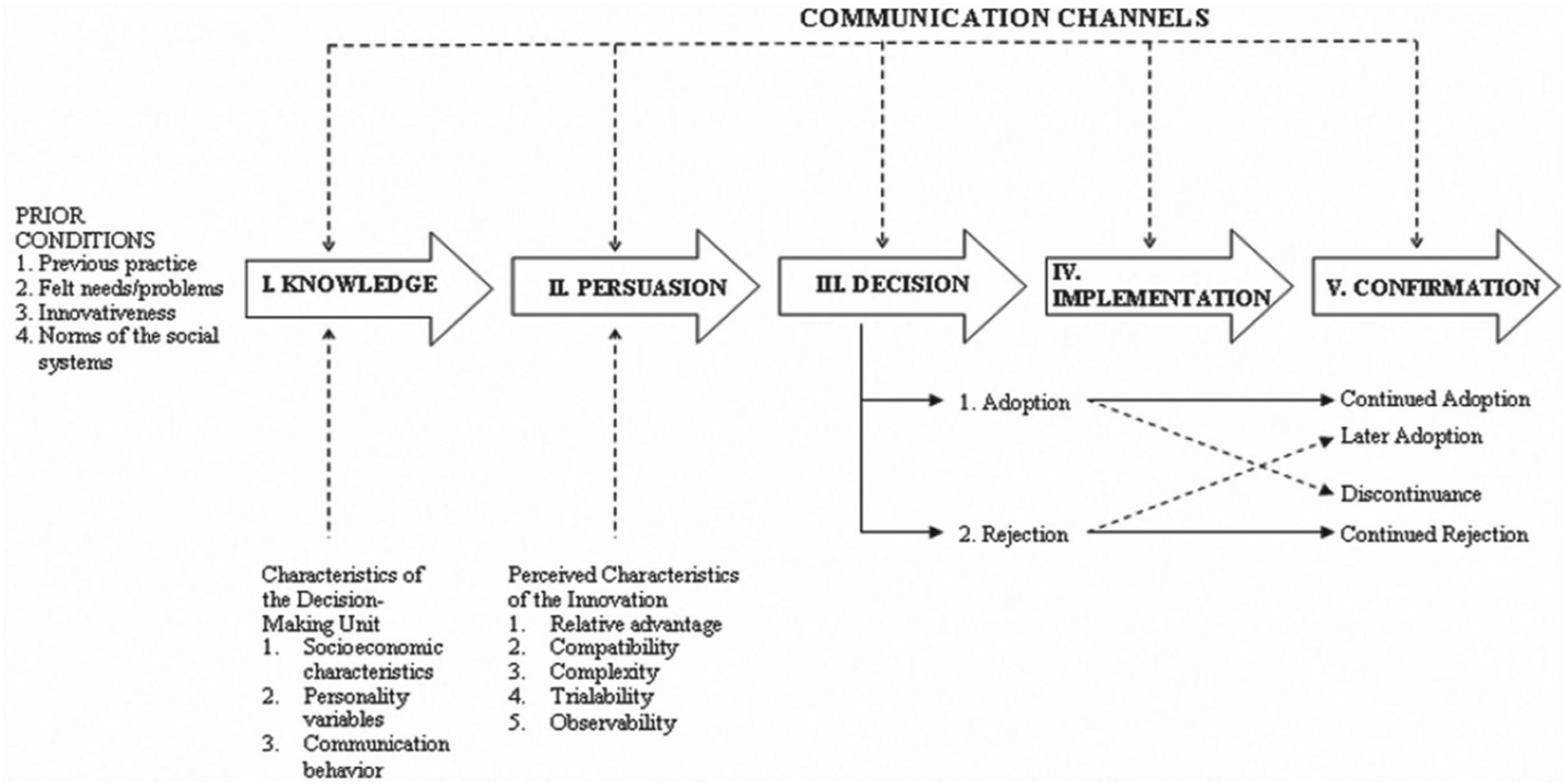
World Bank (2015b). , Uganda Overview [Homepage of World Bank], [Online]. Available: http://www.worldbank.org/en/country/uganda/overview Accessed 5/19/2015.

World bank (2011). Household cookstoves, environment, health, and climate change: A new look at an old problem, World Bank.

Yin, R.K. (2003). *Case study research : design and methods,* 3rd edn, Thousand Oaks : Sage Publication.

Appendices

Appendix 1: The Innovation-Decision process



Source: Roger (1995: 165)

Appendix 2: Distribution of households by cooking fuel type and location (%) over time

Residence	Firewood	Charcoal	Kerosene	Electricity	Other*	Total
2005/06						
Rural	89.4	8.2	0.8	0.1	1.6	100.0
Urban	22.9	66.1	3.5	0.8	6.8	100.0
Uganda	77.8	18.2	1.2	0.2	2.5	100.0
2009/10						
Rural	86.3	10.4	1.7	0.3	1.3	100.0
Urban	15.4	69.8	4.9	1.6	8.2	100.0
Uganda	73.0	21.5	2.3	0.6	2.6	100.0
2012/13						
Rural	89.4	8.2	0.2	0.2	2.0	100.0
Urban	36.4	54.4	2.8	1.4	5.0	100.0
Uganda	75.3	20.5	0.9	0.5	2.8	100.0

Others includes gas, cow dung, grass/reeds and others not specified*

Source: (UBOS, 2014a: 128)

Appendix 3: Ditsribution of hoseholds (%) by kitchen type and Location

Selected Characteristics	Type of Kitchen					
	Inside, specific room	Inside, no specific room	Outside, built	Makeshift	Open space	Total
Residence						
Rural	3.5	6 6	62.3	12.5	15.1	100.0
Urban	9.2	10.4	34.5	12.9	32.9	100.0
Region						
Central	5.5	7.7	39.0	18.4	29.4	100.0
Eastern	2.9	8.7	66.6	8.3	13.6	100.0
Northern	10.4	11.7	48.7	9.1	20.1	100.0
Western	2.1	2.7	67.4	13.3	14.6	100.0
Sub-region						
Kampala	15.0	11.7	13.0	14.9	45.4	100.0
Central I	5.0	8.4	41.6	17.1	27.9	100.0
Central II	1.9	5 2	47.2	21.6	24.2	100.0
East Central	1.6	8 3	61.3	9.0	19.8	100.0
Eastern	3.8	9.0	70.4	7.8	9.0	100.0
Mid Northern	17.8	15.5	54.2	2.6	9.9	100.0
North-East	2.2	17.0	10.5	31.0	39.3	100.0
West-Nile	1.9	3.0	56.4	10.2	28.5	100.0
Mid-Western	2.4	3.1	59.4	15.8	19.3	100.0
South Western	1.7	2 2	74.7	11.0	10.3	100.0
Uganda	5.0	7 6	55.0	12.6	19.8	**100.0**

Source: (UBOS, 2014a:130)

Appendix 4: Interview Guide: Users

Introduction

- I*ntroduce the researcher and the research.*
- *Disclose the purpose of the research and explain how the gathered data will be used.*
- *Explain confidentiality of the interviews, and,*
- *Request for consent to audio record the interviews.*

(Sample): I am Allen Tebugulwa and I am student of international development and management at Lund University. Am in my final year of the programme and am conducting this research as part of my Master's thesis. Thank you for your time and willingness to participate in my study. In this research I seek to understand why potential users choose to or not to adopt improved cook stoves.

I would like to remind you that participation is completely voluntary and you're withdraw from participating in this interview at any time. I would like to audio record this interview and therefore I am requesting for your permission to do so. I will uphold your confidentiality and will not use these recordings for any other purpose than the one I have informed you of. All the information I am obtaining from you will be made anonymous and nothing can be traced back to you. Once again I would like to thank you for your time.

- *collect some demographic data*

Name:

Age:

Gender:

- *proceed with the conversation guided by the questions below*

Questions

1. Do you know about improved cook stoves?
2. Describe to me any improved cook stove model you know.
3. How did you know about improved cook stoves?
4. When did you acquire your improved cook stoves?
5. Why did you decide to acquire an improved cook stove?
6. What were using to cook before you obtained an improved cook stove?
7. What are the advantages of using this stove over the one you had?
8. What are the disadvantages of using this stove compared to the old one?

9. Was it difficult to use the new stove?
10. Do you use your cook stove for all dishes you make?
11. Have you made any modifications to your new stove?
12. If you were to stop using your improved cook stove, what would be the reasons?
13. Do you think improved cook stoves are a status symbol?
14. Do you know anyone else using an improved cook stove in this area?

Appendix 5: Interview Guide: Non Users

Introduction

- I*ntroduce the researcher and the research.*
- *Disclose the purpose of the research and explain how the gathered data will be used.*
- *Explain confidentiality of the interviews, and,*
- *Request for consent to audio record the interviews.*

(Sample): I am Allen Tebugulwa and I am student of international development and management at Lund University. Am in my final year of the programme and am conducting this research as part of my Master's thesis. Thank you for your time and willingness to participate in my study. In this research I seek to understand why potential users choose to or not to adopt improved cook stoves.

I would like to remind you that participation is completely voluntary and you're withdraw from participating in this interview at any time. I would like to audio record this interview and therefore I am requesting for your permission to do so. I will uphold your confidentiality and will not use these recordings for any other purpose than the one I have informed you of. All the information I am obtaining from you will be made anonymous and nothing can be traced back to you. Once again I would like to thank you for your time.

- *collect some demographic data*

Name:

Age:

Gender:

- *proceed with the conversation guided by the questions below*

Questions

1. Do you know about improved cook stoves?
2. What are the features of an improved cook stove?
3. Where did you obtain the information about improved cook stoves?
4. Why aren't you using an improved cook stove?
5. If you decide to get one, what factors would you consider when getting one?
6. What do you know are the advantages of using an improved cook stove?
7. What do you know are the disadvantages of using an improved cook stove?
8. Do you think improved cook stoves are a status symbol?
9. Do you know anyone who is not using an improved cook stove in this area?