RESULTS BASED MANAGEMENT AND HOUSEHOLD SATISFACTION BY SMALL SCALE BIODIGESTERS IN UGANDA: A CASE OF HEIFER INTERNATIONAL/ UGANDA DOMESTIC BIOGAS PROGRAMME IN WESTERN REGION

BY

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2015

DECLARATION

I, George Asiimwe, declare to the best of my ability that this report is as a result of my own effort and has never been submitted for any Academic Award to this Institute and any other University or Institution.

Signature:…….Date:……

GEORGE ASIIMWE

APPROVAL

This is to certify that this dissertation titled 'Results Based Management and Household Satisfaction by Small Scale Biodigesters in Uganda: A case of Heifer International/ Uganda Domestic Biogas Programme in Western Region' was submitted for examination under our approval as Supervisors.

Signed:……Date:……..

Mr. WAHITU FRED

Signed:……..Date…….....

Mr. BAGAMBE HENRY

DEDICATION

This work is dedicated to Yvonne, Shalom and Solomon. Thank you very much for your patience.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABPP	Africa Biogas Partnership Programme
AEATREC	Agricultural Engineering and Appropriate Technology Research Center
APROCEL	Ankole Private Sector Promotions Centre
BCEs	Biogas Construction Enterprises
BOQ	Bill of Quantities
CBO	Community Based Organization
DGIS	Directorate General for International Cooperation
EAETDN	East African Energy Technology Development Network
HI/UDBP	Heifer International /Uganda Domestic Biogas Programme
HIVOS	Humanist Institute for International Development Cooperation
IPs	Implementing Partners
MDGs	Millennium Development Goals
MEMD	Ministry of Energy and Mineral Development
MFI	Micro Finance Institution
NGO	Non-Governmental Organization
PID	Programme Implementation Document for the HI/UDBP
SACCO	Savings and Credit Cooperative Society
SNV	Netherlands Development Organization
UBOS	Uganda Bureau of Statistical Abstracts
UCCU	Uganda Crane Creameries Union
UNBS	Uganda National Bureau of Standards
UNDG WGP	United Nations Development Working Group of Programming
UNESCO	United Nations Educational, Scientific & Cultural Organization

ABSTRACT

This study was carried out to examine whether the Results Based Management strategy (RBM) adopted by Heifer International/Uganda Domestic Biogas Programme, significantly contributed to the number of households that were satisfied with their biodigester installations as well as the services of the biogas actors. The research objectives were to examine the relationship between RBM that included; Capacity building process, involvement of stakeholders in the Strategic Planning, Implementation Monitoring process and household satisfaction.

A Correlational study design was adopted to examine the relationship between RBM and Household satisfaction. Data was got from a total of 350 respondents. Quantitative data was got by using close ended questionnaires on a 5 point likert scale from 235 households. In order to triangulate this data, 70 biogas promoters and 31 Masons were also subjected to questionnaires so as to get statistically significant data. Qualitative data was got by using structured Observation Checklists for the 235 households and Key informant Interviews (14) for purposes of corroboration. Qualitative data was systematically organised under themes and analysed for content where as quantitative data was analysed using SPSS package to generate both descriptive and inferential statistics.

Spearman's Correlation coefficient was run but only capacity building and Implementation processes were found to have a positive significant relationship on Household satisfaction (P<_0.000). Similarly, the relationship was indicated by regression analysis. This was further confirmed by multiple linear regression analysis that indicated that RBM contributed only 11.3% to Household satisfaction; thus 88.7% was contributed by other factors that were not included in this study. Based on the findings, there is need to create an enabling environment through; participative policy formulation, capacitating MFIs, provision of subsidy, building internal capacity of biogas Institutions and enforcing accountability.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter covers the background to the study, statement of the problem, purpose, objectives of the study, the research questions and the hypothesis. It also highlights the scope of the study, the significance, justification and operational definitions. The study was done in Western region of Uganda. It focused on whether the Results Based Management strategy (RBM) emphasised by Heifer International/Uganda Domestic Biogas Programme (HI/UDBP) was adopted by the biogas actors in the implementation of a national biogas programme and whether the targeted households were satisfied with both; the biogas services as well as the functionality of biodigesters.

1.2 Background to the Study

As recommended by Amin, (2005), the background to the study was presented under the historical, theoretical, conceptual and contextual perspectives.

1.2.1 Historical Background

Accessibility to renewable energy by the households especially in the Sub-Saharan Africa has posed to be one of the greatest challenges since time immemorial (Barnes and Willem, 1996; Karthik, Solmaz and Taherzader, 2012; Mshandate and Parawira, 2009; Njoroge, 2002). Inspite of the huge potentialities and abundant biomass resources that can be converted anaerobically to produce biogas energy, many rural households rely on burning wood and fossil fuels for energy which poses an environmental challenge (Mulinda, Qichun and Ke, 2013). Some of the bottlenecks that are reported to have impeded the use of Biogas; one of the appropriate renewable energy technologies across Africa; are related to poor workmanship, maintenance of the biodigesters and an enabling policy environment (Bansenah and Abeeku, 2010; Bond and

Templeton, 2011; Edjekumhene, 2001; Njoroge, 2002; Mulinda et al, 2013; Kuteesakwe, 2001; Pandey et al, 2007; Tumwesigye, 2011).

Reports indicate that there has been very little success recorded, despite the engagement of several stakeholders in different initiatives and Partnership programs that were geared to support the development of biogas technology across the African region (Mulinda et al, 2013). Some of the bilateral/ multi-lateral Institutions that have been engaged over the years include; Netherlands Development Organisation (SNV), Netherlands Directorate General for International Cooperation (DGIS), International Humanist Institute (Hivos),German Technical Cooperation (GIZ), WINROCK International and Biogas Institute of Ministry of Agriculture, China (Bioma).

Uganda is said to be one of the countries that has recorded very little success despite numerous initiatives tried out as early as the 1950s; by individuals, NGOs, Development partners and the Government itself to popularize the uptake of biogas technology by households (UDBP Programme Implementation Document (PID), 2009). Many Bilateral institutions that attempted to promote Biogas Technology between the 1950s and 2008, did not effectively address the energy requirements of a critical mass of households (Pandey et al, 2007). Indeed, less than 1,000 biodigesters were installed more-over after eighteen years (between 1990 and 2008) of protracted struggle to promote the use of the technology (Pandey et al, 2007).

For a very long time, the private sector players (Masons, Biogas Construction Enterprises, appliance fabricators, promoters) were almost inexistence in Uganda (Pandey et al, 2007; UDBP Annual report, 2013). Even households that had installed biodigesters, 15-30% of them had malfunctional biodigesters (Pandey et al, 2007) and it was worse (50%) in other countries like

Nigeria, Ghana, Burundi and Ivory Coast (Bond and Templeton, 2011). Studies indicate that it was majorly due to; lack of skills by masons, technicians and inadequate knowledge on operation and maintenance by Households (Bansenah and Abeeku, 2010; Bond and Templeton, 2011; Njoroge, 2002; Pandey et al, 2007; Tumwesigye, 2011).

Some of the critical challenges in Uganda just like in many African Countries; were exacerbated due to lack of technical and financial capacity as well as an enabling policy environment (Barnes and Willem, 1996; Karthik et al, 2012; Pandey et al, 2007). However, following numerous International conventions such as, the United Nations conference on environment in Brazil (UNECA, 2005); proponents of sustainable development agitated for the global commitment to 'agenda 21 of the Rio Declaration of 1992' in a bid to achieve the Millennium Development Goals. Bilateral Institutions were therefore, tasked to integrate sustainable development interventions in their results agenda to ensure that households had access to renewable energy technologies (UNECA, 2005).

In line with this global commitment, the Dutch Government through the Directorate General for International Cooperation (DGIS) collaborated with two Dutch development NGOs, HIVOs (as Fund manager) and SNV/Netherlands Development Organization (Technical assistance) in 2008; to fund the agenda of 'Biogas for better life' in six African countries, in response to the failed attempts to scale up biogas adoption amidst the severe impacts of climate change. This initiative by developing partners of Africa had been launched in 2005 in Nairobi (Mulinda et al, 2013 UDBP PID, 2009) to address the growing domestic energy crisis amidst reluctance by the respective African Governments to have sustained campaigns in their national policy debate (Mulinda et al, 2013).

In 2009, the Dutch Government committed resources to support Kenya, Tanzania, Ethiopia, Burkinafaso, Senegal and Uganda through the ambitious Africa Biogas Partnership Programme (ABBP Phase 2 Proposal; 2013; Mulinda et al, 2013) to install 70,000 household biodigesters by 2013 and combat poverty. In Uganda, the target was to install at least 12,000 household biodigesters and develop a commercially viable biogas sector through Heifer International as a national Implementing Agency (MEMD, 2010; UDBP, Annual report 2013). The initial implementation of the Uganda Domestic Biogas programme by 2010 was activity based but however, in order to achieve effectiveness, efficiency and a culture of accountability; the HI/UDBP programme adapted Results Based Management (RBM) strategy (UDBP, Annual report 2013).

The Results Based Management (RBM) strategy has evolved over the years and its origin is traced back to the 1950s when the famous Peter Drucker in 1954 introduced the concept of Management by Objectives (MBO) (UNESCO, 2011; Vahamaki, Schmidt and Molander, 2011). This participatory tool was widely used by both the Public Sector and Private business domain in the 1960s and 1970s because of its design. It focused mainly on objectives and performance but it did not address how resources could be allocated and used economically (Meier, 2003; Vahamaki et al, 2011).

In 1960s parallel systems like Planning, Programming and Budgeting systems (PPBS) approach had to be developed to address the concerns (Vahamaki et al, 2011) but even then, between the 1970s and 1980s, there was another emerging challenge that implementation of planned activities was never on schedule. The Programme Management by Activity (PMBA) approach was then adopted although it seems to have been applied more in the field of construction engineering and systems management (Meier, 2003).

In the Mid 1970s, Peter Druckers' earlier on popularised Management by Objective approach inevitably regained prominence even though it was criticised for its lack of a monitoring and evaluation component to enable prediction of the outcome of the resource inputs (Vahamaki et al, 2011). This gap in results orientation explains why the International donor community had to borrow a leaf from USAID by adopting the Logical Frame work approach around 1969 (Meier, 2003; UNESCO, 2011; Vahamaki et al, 2011).

In the 1980s, donors pushed for a paradigm shift to client and service oriented management where Governments were tasked to provide good services to clients, which led to the New Public Management approach (Binnendijk, 2011; Meier, 2003; Vahamaki et al, 2011). Quality service standards had to be developed such as quality assurance, International Standards Organisation (ISO) Accreditation, total quality management (TQM) (Meier, 2003).

In the 1990s, managing for results became an increasingly important public management theme (Meir, 2003; UNESCO, 2011). Tax payers mounted a lot of pressure on Governments around the world to demonstrate transparency and Accountability concerning the use of public resources (Meir, 2003). Many OECD Member states (donors) and the Multilateral Institutions (recipients) undertook reforms to improve public sector management (Flint, 2003).

In 2002 the AID Agencies had to redefine mechanisms to better measure, monitor and manage development. In 2003, CIDA, DANIDA, DFID and DGIS (Dutch Cooperation) as bilateral Agencies representing the Development Assistance Committee (DAC) working party; held a series of expert meetings that culminated in the 2005 Paris Declaration on AID Effectiveness (Flint, 2003; Vahamaki et al, 2011). Since then much emphasis has been put on strengthening

country capacities and promoting accountability of all major stakeholders in pursuit of results (Vahamaki et al, 2011).

1.2.2 Theoretical Background

A number of theories attempt to explain the multi-dimensional dynamics associated with the development work such as; the Stakeholder Theory by Freeman of 1984 as cited in (Seelan, 2010; Jensen, 2012; Horisch, 2014), the Economic Constraint Theory by Adesina and Zinnah (1993), and the Goal Setting Theory by Locke and Latham (1984). However, the theoretical basis underpinning this study is derived from 'Vroom's Expectancy Theory of 1964 as cited in (Redmond, 2010) because of its practical applicability to the context of the study**.**

Vroom's Expectancy Theory ('VEI), assumes that individuals have different sets of goals and therefore in order to orient them to achieve desired results, they must be motivated. Their motivational force is explained by; Valence, Instrumentality and Expectancy as key components (Redmond, 2010; Lunenburg, 2011). Expectancy, as one of the components of Vroom's Expectancy Theory; is the belief that higher or increased effort should yield better performance (Redmond, 2010). It assumes that for a person to be effectively motivated, that individual needs to have self-efficacy or personal conviction that their personal expenditure of effort would result in an acceptable level of performance (Scholl, 2002).

In context of the study, this particularly applies to the biogas actors such as the biogas promoters and masons who were obliged to look for potential households in order to meet the targeted number of household biodigesters. However to enhance expectancy according to Redmond, (2010) and Lunenburg, (2011); the biogas actors must have been availed with adequate resources and support to get the job done. As pointed out by Redmond (2010), all these

requirements constitute a Capacity building process that should be oriented to household satisfaction.

Instrumentality as another component of Vroom's theory; is the belief that favourable performance would result in a desirable reward or valued outcome (Redmond, 2010). It is perceived as the link between what is done and what someone receives as a reward (Redmond, 2010). Therefore, based on such a perception, individuals would be expected to make choices or decisions that maximise pleasure and avoid those that cause pain or frustration according to Lawler, Porter & Vroom, (2009) and Chen & Fang, (2008) as cited in (Redmond, 2010). In the context of the study, the biogas energy used by households for cooking or lighting was perceived as their 'desirable reward' to motivate them to invest in biodigesters (HI/UDBP Annual reports, 2010/13). On the other hand, the production incentives such as promotional fee and masons' fee were perceived as the 'desirable reward' to motivate the biogas actors to actively deliver services to households.

However, the value a person attaches on the above mentioned expected outcome or reward is what is referred to as Valence (Redmond, 2010). The expected value varies with individuals and is directly related to who they are; their needs, goals and values or preferences. This subjective value is based on the individual perception, attitudes and beliefs (Gerhart et al, 1995). In the context of the study, the monetary value (worth) of incentives was perceived as the 'attached value' by biogas actors. On the other hand, the associated benefits of using biogas technology were perceived as the 'attached value' to the households for instance; the reduction on expenditure on firewood or kerosene and the drudgery of looking for firewood.

1.2.3 Conceptual Background

Results Based Management (RBM) is one of the strategies that have been advanced by a number of donors and multilateral institutions following the 2005 Paris declaration on AID effectiveness, to demonstrate value for money given the scarce resources (Vahamati et al, 2011; Meier, 2003; UNESCO, Paris Bureau of Strategic Planning, 2011; Flint, 2003).

RBM strategy demands that all actors, contributing directly or indirectly to achieving of a set of results, ensure that their processes, products and services contribute to the achievement of desired results (United Nations Development working group of programming (UNDG WGP1), 2010). Results could mean outputs, intermediate outcomes, higher level goals or impacts depending on different contexts (Flint, 2003; UNDG WGP1, 2010). Different actors have therefore defined RBM to suit their specific context (UNESCO, 2011). In the same vein, it is argued that RBM should 'reflect the way an organisation applies processes and resources to undertake interventions to achieve commonly agreed results' according to UNESCO (2011, pg 6).

In this study therefore, Result Based Management (RBM) was defined conceptually as; the Capacity building processes, Stakeholder involvement processes as well as the Implementation Monitoring processes; which were adopted to ensure that households had access to satisfactory services provided by the actors and sufficient energy for cooking from biodigesters.

It was envisaged that through the capacity building process; the biogas actors would acquire the confidence to provide services so that in turn, households were empowered with knowledge and skills to operate their biodigesters and make use of the bioslurry (UDBP PID, 2009). The Stakeholder Involvement in strategic planning process was anticipated to create synergy and

stimulate commitment of biogas actors to provide readily accessible services to households. Besides, the implementation monitoring process was anticipated to become an effective feedback mechanism to ensure that biodigesters were in good working condition so that households could reduce on the expenditure on firewood and kerosene (UDBP PID, 2009).

Household satisfaction (Bajgain, 2005; Hayes, 2008) on the other hand, conceptually referred to the personal feeling and perceptions of the end users about the value for their money invested in biodigesters. This could have been in terms of the availability of biogas energy for lighting at night, effects of cooking on biogas such as the increased comfort, costs and work load reduction, improved health conditions and the agricultural benefits that accrue from the use of the biodigester installations (Bajgain, 2005). It also related to whether the service providers were readily accessible (Hayes, 2008) to respond to technical challenges, repair works, replacement of biogas appliances in situations where households had been confronted with challenges. As observed by Bajgain (2005, pg25), 'satisfaction is the most important factor to measure the success of any product or service'.

1.2.4 Contextual Back ground

Results Based Management strategy demands that actors address the needs of the people through efficient, effective processes and become accountable for the resources used as well as, to the people they serve (Binnendijk, 2001; Vahamaki, Schmidt and Molander, 2011).

This strategy was adopted by all the six African national biogas programmes under the Africa Biogas Partnership Programme (ABPP), including Heifer/Uganda Domestic Biogas Programme (UDBP PID, 2009); hitherto failed attempts by most biogas programmes in Africa to address the energy demands of a critical mass of households. The respective Governments lacked grass root

infrastructure of biogas actors and Institutional framework to disseminate biogas technology (Barnes and Willem, 1996; Martinot et al, 2002; Karthik, Solmaz & Taherzader, 2012).

Heifer International (HI-U) as a National Implementing Agency of the Africa Biogas Partnership Programme (ABPP) in Uganda got funding to implement the Uganda Domestic Biogas Programme using the RBM strategy (HI/UDBP Annual report, 2013). It had a commitment to install 12,000 household biodigesters by 2014, ensure their continued operation and satisfaction of households with energy benefits and bioslurry. It also had a task to commercialize the biogas sector and strengthen Institutions to sustain the biogas sector, (UDBP PID, 2009, HI/UDBP Annual report, 2013). As observed by Martinot, Akanksha, Lew, Moreira & Njeri, (2002), there was already a renewed global trend to commercialise the renewable markets. It was therefore inevitable, to elicit participation and decision making from all relevant stakeholders to ensure that they were effective, efficient and accountable.

In order to enable the biogas actors operate with efficiency in accordance with the Programme Implementation Document (UDBP 2009); HI/UDBP Programme had a commitment to empower biogas actors with knowledge, skills and incentives so that they could deliver satisfactory services to households. In the same vein, according to the HI/UDBP, Annual reports (2010/11), it nurtured the establishment of Biogas Institutions, provided production incentives based on their performance, financed a robust biogas awareness campaign and subsidised costs of biodigester installations by 35% in order to stimulate household demand.

In a bid to enable actors operate effectively in accordance with the Programme Implementation Document (2009); HI/UDBP Programme adopted a Multi stakeholder approach. According to the HI/UDBP Annual reports, (2010/13), it facilitated Strategic planning meetings where different actors participated in formulation of targeted number of households. Government

officials were engaged to elicit their commitment to fund a fiscal and financial policy environment as stipulated in the Renewable Energy Policy (MEMD, 2007). Financial Institutions were also engaged to provide affordable biogas financing to households as a business opportunity, in order to motivate households to leverage the high investment costs required to install biodigesters (UDBP Annual reports, 2011 and 2013).

In a move to orient actors to become accountable for results (UDBP PID, 2009); HI/ UDBP Programme adopted a Results Based Financing mechanism (RBF). According to the HI/UDBP, Annual operation Plans, (2012/ 13); biogas actors projected their targeted number of households to benefit from whatever planned output and funds would be advanced or re-imbursed in line with their projections or performance as evidenced by the HI/UDBP, Annual reports, (2012/13). Similarly, subsidy materials were channeled through Biogas institutions such as IPs and BCEs and were in turn, given motivational incentives such as BCE user fees and IP functional fees so as to ensure their commitment to household satisfaction.

However, there had never been any study to ascertain whether the grass root biogas actors had acquired the requisite capacity to provide satisfactory services to households, whether their targets were informed by production incentives, and above all, whether their services significantly motivated households to install and make use of the biodigesters for energy and Agricultural productivity.

1.3 Statement of the Problem

Access to energy has continued to be every country's dream for its citizens in Sub-Saharan Africa. It is a pre-cursor for development and in Sub-Saharan Africa, households require 75% of the energy for domestic purposes, out of 90% generated moreover from less efficient traditional sources like wood and charcoal (Barnes & Willem; Martinot et al, 2002; Pandey et al, 2007). In

response to the growing energy deficit in Uganda (MEMD,2004; Pandey et al, 2007), the Dutch Government funded the Uganda Domestic Biogas Programme, to promote the use of small scale biodigesters considered as a better renewable energy option in rural and peri-urban areas (HI/UDBP Annual report 2013). At least twelve thousand (12,000) beneficiary households had been targeted to use small scale biodigesters by the end of the first phase in 2013 but only 5168 had installed biodigesters.

The Programme adapted a Results Based Management strategy to prime up the development of a biogas sector and ensure that households accessed reliable and affordable biogas services from competent biogas actors. It financed biogas awareness campaigns, subsidised each biodigester installation and built the technical capacity of the biogas actors. It engaged them in strategic planning and provided motivational incentives tagged on delivery of results in a bid to ensure households had functional biodigesters and knew how to use them (HI/UDBP Annual Reports 2009/13).

Despite the interventions, anecdotal evidence from HI/UDBP Annual reports for 2009-2013 reveal that some biodigesters were malfunctional and even then, the biogas actors did not achieve the targeted number of households. It was therefore imperative to find out whether Women and children were still overburdened by the drudgery in quest for firewood for cooking (Mwakaje, 2008); whether households still had an energy deficit in light of the ever increasing energy prices (MEMD, 2004; Pandey et al, 2007) and whether they were still prone to respiratory tract infections exacerbated by the kerosene smoke or gaseous emissions from wood (Karthik et al, 2012).This study therefore, was aimed at answering questions whether there was a relationship between RBM and the satisfaction of households.

1.4 General Objective of the Study

The objective of the study was to examine the relationship between the Results Based Management and Household satisfaction in terms of their accessibility to cooking or lighting energy, affordability and reliability of biogas services.

1.5 Specific Objectives of the Study

The study was guided by the following objectives;

1. To examine the relationship between the capacity building process and the number of households satisfied with the services of the biogas actors.
2. To examine the relationship between stakeholder involvement in the strategic planning process and the number of satisfied households
3. To examine the relationship between the implementation monitoring process and the number of households satisfied with their biodigesters.

1.6 Research Questions

The research will focus on answering the following research questions;

1. What is the relationship between the capacity building process and the number of households satisfied with the services of the biogas actors?
2. What is the relationship between stakeholder involvement in the strategic planning process and the number of satisfied households?
3. What is the relationship between the implementation monitoring process and the number of households satisfied with the biodigesters?

1.7 Hypotheses of the Study

1. There is a significant relationship between the capacity building process and the number of households satisfied with the services of the biogas actors

2. There is a significant relationship between stakeholder involvement in the strategic planning process and the number of satisfied households

3. There is a significant relationship between the implementation monitoring process and the number of households satisfied with their biodigesters.

1.8 Conceptual Frame work

Results Based Management (I.V) **Household Satisfaction (D.V)**

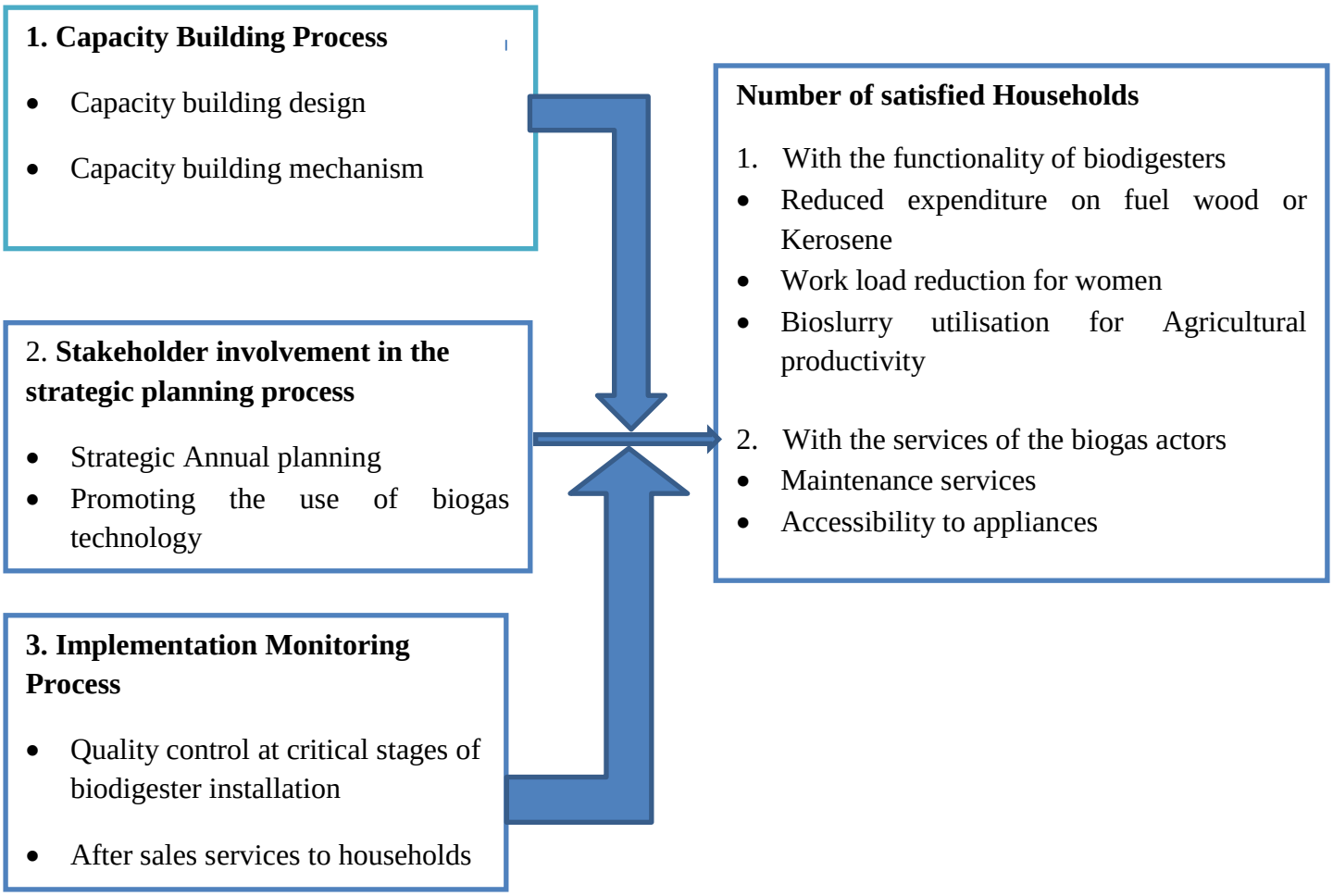

Figure 1: The Conceptual Frame work

Source: Adopted and modified from Malinga (2008); Nassamula (2013) and Komujuni (2014)

The Conceptual frame work (presented in Figure 1), indicates how Results Based Management as a strategy (Independent variable) impacts on Household satisfaction (Dependent variable). RBM in this context was used to refer to the processes along the results chain, how they were structured and implemented to ensure that households were satisfied. These included; the Capacity building process of the biogas actors who were anticipated in turn, to pass on the knowledge and skills to households to enable them make use of their biodigesters for cooking, lighting and farming. The Stakeholder Involvement in Strategic planning process was anticipated to create a sense of programme ownership in order to stimulate commitment of biogas actors to provide readily accessible services to households. The implementation monitoring process was anticipated to become an effective feedback mechanism to ensure that biodigesters were in good working condition so that households could reduce on the expenditure on firewood and kerosene (UDBP PID, 2009).

1.9 Significance of the Study

The study was meant to establish whether households in the rural and peri-urban communities had an improvement in service delivery in terms of accessibility to technical services, affordable financial services and whether they were empowered to be able to install, operate and maintain their biodigesters to reduce on the expenditure on kerosene used for lighting and firewood used for cooking.

To the policy makers, it was meant to provide an insight about whether the Programme contributed significant inroads to the ultimate goal of the Renewable Energy Policy (MEMD, 2007); that was formulated to create an enabling environment to ensure that households shifted from over dependence on the less efficient fuel wood or charcoal to the use of biogas as one of the modern renewable energy options in the energy supply mix.

The findings were also expected to contribute to the existing body of knowledge in relation to RBM as a management concept and in addition, provide a basis for further research on the contribution of biodigesters to climate change mitigation and the disease burden associated with exposure to smoke and greenhouse gas emission.

1.10 Justification of the Study

Inspite of a comprehensive Renewable Energy Policy in Uganda (MEMD, 2007), there is limited government budgetary allocation to operationalize a financial and fiscal policy framework in order to meet the targeted number of household biodigester installations (HI/UDBP Annual reports, 2010/13).

The study was prompted because un like in other ABPP Countries; the Government's mid-term priority strategies (MEMD, Annual reports for 2009-2013) were more inclined to the Rural electrification projects and Petroleum exploration yet Uganda's Policy goal is to increase the use of renewable energy from 4% to 61% of the total energy consumption by the year 2017(MEMD, 2007). Overtly, as indicated by Heikoop, (2013) and the Biomass Energy Strategy, (MEMD, 2013); there was need to compliment empirical data about the contribution of biogas energy to the energy supply mix to influence Policy direction.

1.11 Scope of the Study

1.11.1 Geographical Scope

The research study was conducted in the western region of Uganda, in four clusters based on the agro-ecological zones and reasonable concentration of beneficiary households. In reference to the HI/UDBP Annual Reports, (2009/13), at least one district was selected from the clusters of; greater Masaka zone where IDEAL as a Biogas Construction Enterprise (BCE) was based, greater Mbarara and Bushenyi where UCCU and APROCEL as Implementing Partners (IPs) and

METCO as a BCE, were based respectively. In addition, Ntungamo and Rukungiri represented the operational area of Biomeil as a BCE in the Kigezi cluster.

1.11.2 Content Scope

The study focused on the relationship between RBM strategy (IV) and the satisfaction of households (DV) that installed biodigesters in Uganda. RBM aspects were restricted to whether the Capacity building design or mechanism of its implementation (Malinga, 2008), contributed to household knowledge and skills in order to use biodigesters. It also focused on whether Involvement of Stakeholders (Komujuni, 2014), contributed to programme ownership and target achievement.

Implementation monitoring processes (Kusek and Ray, 2004) were restricted to the effective customer care practices provided to households. Satisfaction of the households (Bajgain, 2005) was restricted to household perceptions about whether biogas energy; was sufficient for their cooking or lighting at night, reduced expenditure on fuel wood and drudgery of looking for firewood by the women.

1.11.3 Time Scope

The main focus of the study was based on the five years of implementation of the first phase of the HI/Uganda Domestic Biogas Programme. According to HI/UDBP Annual Reports, (2009-2013); this is when numerous result oriented approaches were introduced to the different sector players in Uganda. These included; the multi-stakeholder approach and the Results Based Financing mechanism of the actors that was dependant on their ability to deliver results.

1.12 Operational Definitions

1.12.1 Results Based Management (RBM**)** is a strategy by the HI/UDBP to commit all the actors through their core business, to ensure households opted to use biogas energy.

1.12.2 Results Based Financing (RBF) is form of Payment where by all the actors (IPs, BCEs and Promoters) along the chain, would be paid in respect to the Results they delivered

1.12.3 The Biogas private sector players/actors: primarily refer to the Implementing Partners, Biogas Construction Enterprises, and MFIs as entities but also Masons, promoters, biogas supervisors as individuals; engaged to provide their core services to ensure installation of functional biodigesters.

1.12.4 Heifer International/Uganda Domestic Biogas Programme: refer to all the primary and secondary stakeholders including; the National Biogas Steering Committee, the Regional Biogas Associations, BCEs, IPs, MFIs, Staff of Heifer International and household beneficiaries

1.12.5 Implementing Partner**:** refers to a like-minded organisation coordinating all the functions of the biogas actors within its mandated area of operation to widen outreach cost effectively

1.12.6 Biogas Construction Enterprises (BCEs)**:** refers to small scale enterprises legally registered by the Registrar of Companies, consisting of certified masons trained by the programme to provide masonry work to households in need of biodigester installations.

1.12.7 Biodigester refers to an airtight dome shaped structure made of bricks and mortar that consists of reservoir into which a given amount cow dung mixed with water is placed daily to enable breakdown in absence of oxygen to produce biogas.

1.12.8 Biogas is one of the bi-products of anaerobic breakdown of cow dung comprising a mixture of the combustible methane and water vapour, carbon dioxide, hydrogen sulphide gases

1.12.9 Digestate or bioslurry is the remaining liquid fraction comprising a mixture of solution and solids after anaerobic digestion and is rich in nutrients (N, P and K), approximately half of the N is in organic form; the other half is mineral (ammonium, NH4)

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature related to the concept of Results Based Management and how it related to the satisfaction of Households that installed biodigesters in Uganda. This chapter focused on processes that had been crafted by the Programme to improve on the efficiency, effectiveness and accountability such as; responses to Capacity building gaps, Stakeholder involvement in strategic planning process and Implementation Monitoring Processes. Literature was reviewed from; Journal Articles, Peer reviewed publications by SNV, Biogas surveys commissioned by Heifer International, Research Dissertations, text books from Uganda Management Institute, Annual reports (2010/13) from both Heifer International/UDBP and Ministry of Energy and Mineral Development (Amber house) in Kampala.

2.2 Theoretical Review

The theoretical basis that was used to underpin this study was derived from 'Vroom's Expectancy Theory of 1964' because of its practical applicability (Greenberg, 2011; Hellriegel & Slocum, 2011; McShane & Von Glinow, 2011; Nadler & Lawler, 1983; Lunenburg, 2011) to demonstrate the linkage between motivation and the concept of managing for results.

Vroom's Expectancy Theory ('VEI') assumes that individuals have different sets of goals and that in order to orient them to deliver desired results, they must be motivated. Their motivational force is explained by; Valence, Instrumentality and Expectation as key components (Redmond, 2010; Lunenburg, 2011). Expectancy as one of the components; is the belief that higher or increased effort should yield better performance. It assumes that for a person to be effectively

motivated, that individual needs to have self-efficacy or personal conviction that their personal expenditure of effort will result in an acceptable level of performance (Scholl, 2002).

This particularly applies to biogas actors such as the masons and biogas promoters because they were obliged to put in a lot of effort and resources to look for potential households to install biodigesters. However, for stakeholders to believe that they can perform the Job successfully, a number of conditions must be fulfilled (Lunenburg, 2011; Redmond, 2010; Stecher & Rosse, 2007). The selected individuals would be expected to be knowledgeable and skilled to deliver satisfactory services, aware of their job requirements, provided with the correct resources, mentored and coached continuously to build their confidence to get the job done (Lunenburg, 2011; Redmond, 2010). All these requirements constitute a Capacity building process that would be envisaged to translate to household satisfaction.

Instrumentality on the other hand; is the person's belief that if they can meet performance expectations, they would receive a desirable reward or valued outcome (Scholl, 2002). It is also perceived as the link between what is done and what someone receives as a reward (Redmond, 2010). Therefore, based on such a perception, individuals would be expected to make choices or decisions that maximise pleasure and avoid those that cause pain or frustration according to Lawler, Porter & Vroom, (2009) and Chen & Fang, (2008) as cited in(Redmond, 2010).

It is said that to a large extent, an individuals' motivation is governed by the system of reward that can impact either positively or negatively. Therefore, individuals need to be oriented to believe that good performance would result in valued rewards and this requires to be well spelt out (Berger, 2009; Dunn, 2009; Mercer, Carpenter, & Wyman, 2010). In the context of the study, the Programme's effort to in calculate Instrumentality is partly explained by its deliberate

effort to provide incentives using a Result based financing mechanism. In this case, active biogas actors were rewarded production incentives that were paid based on numbers of household biodigesters installed or beneficiary households targeted.

However, the value a person attaches on the above mentioned expected outcome or reward is what is referred to as Valence (Redmond, 2010). The expected value varies with individuals and is directly related to who they are; their needs, goals and values or preferences. This subjective value is based on the individual perception, attitudes and beliefs (Gerhart et al, 1995). As argued by Lawler, Porter and Vroom (2009) cited in (Redmond, 2010); the bottom line is that individuals must have a strong desire to satisfy their needs if they are to elicit their effort.

Therefore if the above arguments are put into perspective, then the Programme incentives should have motivated biogas actors to provide services if they were worth the efforts of the actors. On the other hand, it would be expected that households would be satisfied, as long as the biodigesters were in good working condition to provide sufficient energy to save them; on cooking time, reduce drudgery of looking for firewood and expenditure on fuel wood or kerosene used for lighting.

Nevertheless, Vroom's Theory has been criticised by a number of scholars over the years. Wabba and House (1974) criticised the concept of Instrumentality; that it was ambiguous and difficult to operationalize. Similarly, Mathibe, (2008), was critical of the concept because of the nature of mainly focusing on the extrinsic motivational factors through the use of incentives to explain instrumentality. Mitchel and Biglan (1971) pointed out that the theory fell short of explaining how individuals update and change their beliefs over time.

On the other hand, other liberal critics of the expectancy model, including Graen, (1969), Porter and Lawler, (1968), Lawler, (1971) as cited in (Redmond, 2010) were of the view that the expectancy theory is simplistic in nature and needed to be updated. This line of thinking is also supported by Steers, Mowday & Shapiro (2004) who argue that although the ideas in the expectancy theory developed in the 1950s and 1970s are widely used, but over the years, it is anticipated that the thoughts and ideas within cultures could have changed. What motivated people years ago may still apply but with the change in time and mindset, there may be better approaches to motivate this new generation of individuals.

Considering the arguments by Mathibe (2008); it should not be a guarantee to assume that once a reward system is in place, then stakeholders will automatically increase their productivity to obtain that reward. If it was the case then, in this context of the study, one ponders why the programme's production incentives that were tagged on number of household biodigester installations; in essence do not seem to have elicited the stakeholders' commitment to deliver the desired targets.

However, observations drawn from Wilson and Gilbert, (2005), attempt to provide some insight to the study, in light of the wavering economic situation that is evidenced by the ever fluctuating dollar exchange rate in present circumstances. Wilson and Gilbert, (2005), have argued that the value individuals attach to an outcome can have either negative or positive impact on their satisfaction and that an individuals' satisfaction; also depends on whether the reward is below expectations or better than what that individual had anticipated.

2.3 Results Based Management and Household satisfaction

There is renewed global trend to focus on client satisfaction by Multilateral Development Institutions (MDIs) and their Agencies, while implementing programmes supported by donors in

developing countries (Bester, 2012; Binnendijk, 2011; Flint, 2003; Meir, 2003; Vahamaki et al, 2011).

The donors and the tax payers have always wanted to know whether their resources have been put to use and whether these resources have created a difference or impact to the lives of targeted people (Bester, 2012; UNESCO, 2011; United Nations Development working group of programming (UNDG WGP1), 2010; Vahamaki et al, 2011). In light of this, MDIs have a global commitment to contribute to the Millennium Development Goals by enhancing the capacities of developing countries to improve their performance.

However, one of the global challenges has been how to enable households in Africa to access renewable energy sources given the drudgery of looking for fuel wood that has led to; loss of productive time, destruction of natural forest ecosystem, indoor air pollution and climate change (Barnes and Willem, 1996; CEMA, 2005; Karthik et al, 2012). In the quest to deliver the desired changes, Heifer International as a National Implementing Agency of the Africa Biogas Partnership Programme (ABPP) had to adopt the RBM strategy to ensure that a critical mass of households accessed biogas energy by engaging the Government of Uganda and other relevant biogas actors to take on an active role or management responsibility to deliver services to households (HI/UDBP Annual reports, 2010/13).

Therefore, in accordance with the requirements of the RBM approach, the biogas actors were anticipated to adopt processes that would ensure an exponential increase in number of households using biogas energy (managing for results) and yet with minimal expenditure by the Programme in a bid to gain donor confidence (accountability for results or external reporting) as pointed out by Binnendijk, (2011) and Flint, (2003). Therefore the Programme adopted a Results based financing mechanism (RBF) where by incentives were paid depending on

performance of the actors. The RBF necessitated engagement of stakeholders in strategic planning to project anticipated number of households to benefit from whatever planned outputs in light of the programme targets and in addition, it required building their capacity to meet the targets (UDBP PID, 2009).

On the other hand, drawing from a comparative review of literature about the experience of other Multilateral Development Institutions (MDIs) such as UNDP, UNESCO, UNICEF, UNIFEM and World Bank; it is clear that the implementation of RBM approach necessitates focusing on the ultimate changes that interventions are supposed to induce in relation to targeted beneficiaries rather than on the type of interventions undertaken (Flint, 2003; UNESCO, 2011; Vahamaki et al, 2011). In the context of the HI/UDBP Programme mandate, the study attempted to establish whether the biogas actors had acquired capacity to deliver satisfactory services to the households, whether the engagement of the relevant stakeholders prepared them to own or sustain service delivery and whether they had developed a culture of results orientation focused on household satisfaction.

2.3.1 The relationship between Capacity building Process and household satisfaction

2.3.1.1 Capacity building design and household satisfaction

Many scholars have indicated that in order to have a good capacity building design (plan), it demands for engagement of all the relevant stakeholders (biogas actors) for a consensual plan of action (Malinga, 2008) so that the wishes, needs or capacity gaps of the targeted stakeholders are addressed (Aswapatha, 2002; Fisher et al, 2003).

Lack of an elaborate Capacity building design before inception of the HI/UDBP Programme, was the missing link in the past judging from the biogas feasibility study that was done in

Uganda (Pandey, et al, 2007). Similar studies that were done in other African countries (Bansenah and Abeeku, 2010; Barnes & Willem, 1996; Bond & Temploton, 2011; Mshandate and Parawira, 2009) also indicate that; the respective Governments lacked programmatic, technical, financial capacity that curtailed wide scale dissemination of the small scale biodigesters to households (Barnes & Willem, 1996; Heikoop, 2013; Hivos, 2013; Pandey, 2007 and Tumwesigye, 2011a & 2011b).

As a result of defective technical designs then, households suffered due to an interplay of many factors including; the use of inexperienced masons with low technical capacity, inaccessibility to suppliers of good quality construction materials and lack of monitoring or follow up by implementers (Barnes & Willem, 1996; Karthik et al, 2012; Njoroge, 2002). Many households had inadequate knowledge to maintain their biodigesters (Bond, 2011; Edjekumhene, 2001; Karthik et al, 2012, Njoroge, 2002; Pandey et al, 2007); consequently some biodigesters did not perform to their satisfaction. This is evidenced by studies done in countries like Ghana (Bansenah and Abeeku, 2010), Burundi, Ivory Coast, Tanzania according to Omer and Fadalla, (2003) as cited in (Mshandate and Parawira, 2009).

Notwithstanding, most African countries were overwhelmed by defective financial capacity design to encourage a fiscal and financial environment so that households could access biogas loans. The high upfront investment costs that are required for biodigester installations often proved to negate adoption by especially poor households (Bond & Temploton, 2011; Hivos, 2013; Loic, 2013; Pandey et al, 2007). Coupled with lack of awareness, over 90 percent of households in Uganda had to contend to the use of the less efficient fuel wood, charcoal, farm residues and wood wastes for their domestic energy needs (Hivos, 2013; National Biomass Study Project, 2003; MEMD, 2006; Okello et al., 2013).

Cognizant of the historical challenges, a number of approaches were emphasised at the inception of HI/UDBP Programme, in an attempt to have a result chain (Programme Implementation Document (UDBP PID, 2009). Furthermore, according to the UDBP PID, (2009), it was envisaged that households would have access to biogas information, would be empowered with subsidy or biogas loans to install biodigesters, and empowered with knowledge/ skills to operate their biodigesters. In a bid to have an effective network of biogas actors, they were anticipated to adopt a multi stakeholder approach and the Biogas Institutions such as Implementing Partners and BCEs were expected to ensure that households had access to services within their clusters.

This approach was adored because of the decade long experience by SNV of implementing a similar model successfully in Asian countries such as Nepal and Bangladesh (Hivos, 2010). However, it was not known why this seemingly good design could not create similar impact in Africa judging from the low biogas diffusion (installation) rates evident amongst the country Programmes under the ABPP framework. For instance, according to the technical report by Hivos (2010), only 3,000 biodigesters were installed cumulatively in all the six ABPP countries, which was far less than what had been installed in China or India alone where 40 million biodigesters and 4.5 million biodigesters were installed respectively (Lefebvre, 2011).

2.3.1.2 Capacity building Implementation mechanism and households satisfaction

As pointed out by Malinga (2008), having a capacity building design in place is a good thing but implementing it to successfully deliver desired results is more critical. In order to realise a sound Capacity building implementing mechanism, it is argued that a combination of strategies need to be employed geared to increase the ability of people, organisations or Institutions to carry out their tasks and responsibilities (Ghosh, 2002; Malinga, 2008; Nabaho, 2001; UNESCO, 2011).

These strategies could necessitate; ‘enabling’, ‘partnership’, and ‘support’ according to Malinga (2008) but in addition, they could even include core funding, computer software, technical and physical resources, management advice and information flow as recommended by Sahley (1995) cited in (Malinga, 2008).

Given the capacity gaps that were experienced by most African Governments, as well as the historical challenges that multilateral institutions faced prior to the inception of the Africa Biogas Partnership Programme, it is not surprising that a significant number of households with biodigesters to solve their domestic energy needs in Africa was never achieved then (Barnes and Willem, 1996; Bensah and Abeeku, 2010; Edjekumhene, 2001).

In response to these challenges, Heifer International/Uganda Domestic Biogas Programme (HI/UDBP), with financial assistance it got from the Netherlands Government, tried to address these capacity gaps through its elaborate capacity building mechanism (UDBP PID, 2009; HI/UDBP Annual reports 2009-2013). From the inception of the Programme, biogas actors were trained and allocated incentives to enable them deliver reliable services to households, the Biogas Institutions were nurtured to coordinate the dissemination of the technology and the Government, through the Ministry of Energy and Mineral Development was engaged as well to ensure its commitment of operationalizing the Renewable Energy Policy. In spite of all these efforts, no study had been done to ascertain whether this had a significant trickle-down effect, given that there was a deficit in the number of households that installed biodigesters compared to what had been anticipated.

The intent of the study was therefore to establish households’ perceptions to ascertain whether there was a relationship between Capacity building implementation mechanism and household satisfaction. It focused on whether households considered masons to have acquired knowledge,

skills or demonstrated professionalism to install functional biodigesters. In addition, it focused on whether the empowerment processes appropriately addressed the knowledge and skills gaps of household members to be able to derive energy for their cooking. Besides, the study sought to ascertain whether masons were supervised at the critical control stages of biodigester installations to avoid biodigester malfunctionality. It was also important to ascertain whether Households got sufficient information about biogas loans from MFIs and whether loans were attractive to enable them leverage the funding gap. Besides, the study attempted to ascertain whether households could readily access affordable biogas services from all the biogas actors.

2.3.2 The relationship between Stakeholder Involvement process and household satisfaction

2.3.2.1 Stakeholder involvement in Strategic planning process and household satisfaction

In order to institutionalise the RBM strategy, scholars have argued that stakeholders must be involved in strategic planning so as to become committed and motivated to focus on desired results (Flint, 2003; Kusek & Ray, 2004; Mc Allister, 2009). It is believed that once stakeholders have a say in how the results are defined, measured and reported on; it enhances stakeholder ownership and even commitment by recipient Governments or actors (Bester, 2012).

Therefore, what seems to come out clearly from many scholars is that implementation of the RBM strategy must be guided by a results frame work, designed by involving key stakeholders during planning (Meir, 2003; Allen, 2000) to define; objectives of programme interventions (Allen, 2000), expected changes of the intended beneficiaries (Meir, 2003), indicators to measure those changes and precise time frame to achieve the expected results (Allen, 2000; Binnendijk, 2001; Flint, 2003; Meir, 2003). However over the years, in the face of the specific challenges of developing countries, the implementation of RBM strategy necessitated the Development Agencies to persue development outcomes indirectly; by working with partners

through recipient Governments in order to support them implement their designed domestic policies and programmes. (Meir, 2003; Flint, 2003; Vahamaki et al, 2011).

In Uganda, the Government had an obligation to ensure that at least 20,000 households installed biodigesters by 2017, based on the recommendations by the biogas feasibility study that was conducted prior to the inception of the HI/UDBP Programme (Pandey et al, 2007).

In light of the Financial assistance from the Dutch Government to Uganda through the HI/UDBP Programme; at least 12,000 households were anticipated to install biodigesters by 2014 (HI/UDBP Annual report, 2013; MEMD, Annual report, 2013). The Programme management engaged Implementing Partners (IPs), Biogas Construction Enterprises (BCEs) to formulate annual targets and a consortium of other sector players such as Financial Institutions, biogas promoters, masons and Appliance fabricators to subsequently provide biogas services where they had core business and competencies (UDBP Annual Operations plans, 2011/13).

Despite their involvement, the actors never achieved the targeted number of household beneficiaries. According to the Biogas Socio-economic and Gender baseline survey report (Kahubire, Byaruhanga &Shariff, 2010), there were reported cases of households with malfunctional biodigesters, whereby about 69% of the households still complimented the use of biogas with fuel wood for cooking. HI/UDBP Annual reports, (2012/13) further revealed that the number of households that took on biogas loans from MFIs was low despite protracted attempts to engage them. All these scenarios were indicative of a gap in the level of household satisfaction.

This raises questions as to whether the biogas actors were committed to their performance targets which is believed to be a good measure of accountability for results; given the fact that the essence of RBM is to overcome wastage of resources through what is known as activity trap (Binnendijk, 2001; UNESCO, 2011).

It also raises questions as to whether the biogas actors were motivated by the Results based financing mechanism that emphasises allocation of financial support to stakeholders based on their performance (Managing for results); according to Binnendijk, (2001), Flint, (2003) and Vahamaki et al, (2011).

2.3.2.2 Stakeholder involvement in promotion, marketing of biogas and household satisfaction

Involvement of stakeholders in promotion and marketing function is believed to be an excellent strategy for efficient service delivery (Barnes & Willem, 1996). However, it is said that unless the service providers deliver quality and prompt services to customers, the image of the organization or institutions they represent could be jeopardized according to Bowen et al, (1989) as cited in (Bagambe,2008). In the same vein, Kotler and Armstrong (2004) have warned that unless an old customer is satisfied by a given service, it is always expensive to attract a new customer.

Unfortunately, prior to the implementation of the Africa Biogas Partnership Programme, this gap in result orientation is believed to have compromised the dissemination of biogas technology in Uganda and other African countries (Njoroge, 2002; Pandey et al, 2007). Studies indicate that in most of the African countries, there was insufficient capacity of biogas actors to create biogas awareness, install quality biodigesters or repair malfunctional biodigesters and yet the initial investment costs that were required for installation of biodigesters were very scary to ordinary households in rural areas (Bond and Templeton, 2011; Loic, 2013). In Uganda, biogas up take was further compromised by cultural bias in regard to the use of biogas especially for steaming bananas (Heikoop, 2013; Kahubire et al, 2010; Pandey, 2007; Smith et al, 2013).

According to the Programme Implementation Document (UDBP PID, 2009), the HI/UDBP Programme had to deal with the negative perception of the households, by engaging a grass root infrastructure of trained biogas actors to create awareness about biogas and to install quality biodigesters. Anecdotal evidence from HI/UDBP Annual reports (2012/13) indicate that the Programme committed some funds to create biogas awareness through; the biogas exhibitions such as; the Jinja Agricultural Shows, energy efficiency exhibitions, the Uganda Manufacturers Association (UMA) shows and coffee exhibitions shows.

In response, the Programme also subsidised biodigester installations by almost 35% for households to address the scary high initial investment costs and the subsidy materials were channelled through biogas actors to commit them to achieve the targeted number of households. Financial Institutions were also contacted to provide affordable biogas loans to leverage the funding gap and create awareness of their biogas loan product to induce households to invest in renewable energy utilization.

The Programme management even lobbied the Government to operationalize the Renewable Energy Policy guidelines (HI/UDBP Annual reports, 2010/12). However, as pointed by Heikoop (2013) and the Biomass energy strategy (MEMD, 2013), many stakeholders were never actively involved in participative formulation of the policy. Besides, Annual reports from the Ministry of Energy and Mineral Development (MEMD, 2009/13), indicate further that there was insignificant Government budgetary allocation to operationalize the fiscal and financial policy frame work (MEMD, 2007) to encourage households to supplement the Programme subsidy.

Despite the afore-mentioned efforts by the HI/UDBP Programme, there was no study that had been done to establish the significance of stakeholders' contribution to the desired enabling

environment that was envisaged to stimulate households to install biodigesters. The study therefore, attempted to establish whether the actors addressed issues of awareness creation, swiftly responded to household challenges, delivered subsidy in time, enabled households to access biogas loans, and functional biogas appliances.

2.3.3 The relationship between Implementation Monitoring processes and household satisfaction

Implementation monitoring process is a very key approach that enables internal checks and balances during Programme implementation (Kusek & Ray, 2004). Many Scholars contend that unless implementation monitoring is routinely done, it may be difficult to track progress of programme implementation (Implementation measurement) so as to provide remedial actions geared to household satisfaction (Barnes & Willem, 1996; Kafeero; 2010; Komujuni, 2014;Kusek et al,2004;Nsamba, 2013;).

The essence is that globally, there is an ever growing demand for achievement of millennium development goals (Mshandate et al, 2009; Flint, 2003; Meir, 2003; Vahamati etal, 2011) that has augmented the need to manage for client oriented results. Therefore, as pointed out by Kusek & Ray (2004), Results based monitoring and evaluation processes are now being directed to critically look at what happened then ('the so what question?'), if at all activities were done.

Under the ABPP frame work, the Programme instituted processes such as quality control/ management system to enable timely feedback and after sales service; to guarantee the performance of the installed biodigesters and ultimately household satisfaction (UDBP Annual reports 2010/13). The intent of the study therefore, was to establish whether these processes were effectively implemented as per the recommended schedule.

The study also attempted to find out from the households (end users) about their perception regarding the reliability of biogas services and whether households were able to get value for their money.

2.3.3.1 Quality Control and household satisfaction with the installed biodigesters

The term 'quality' is relative and can be described as good or poor depending on the nature of services or products according to Montgomery, (1996) as cited in (Hayes,2008). Quality expectations could also be defined in terms of design (Quality design) or conformance (Quality of conformance). Therefore to have good quality services or products, processes should be geared to ensure that they meet the requirements and expectations of the people who use them according to Montgomery, (1996) as cited in (Hayes, 2008) and Martinot, (2002).

UDBP Annual reports (2010/13) indicate that the Programme committed some funds to encourage individual masons, biogas supervisors and entities such as IPs and BCEs to ensure an elaborate quality control and management system geared to household satisfaction. This was to guard against poor masonry work as well as poor maintenance which are said to compromise the performance of biodigesters in many African Countries (Bansenah and Abeeku, 2010; Bond and Templeton, 2011; Njoroge, 2002; Tumwesigye, 2011).

HI/UDBP made it mandatory for the BCEs to guide households to ensure that the right quality and quantity of construction materials were procured beforehand. It was envisaged that all the biodigesters would be inspected by biogas supervisors during construction for purposes of quality assurance and technical guidance to masons. IP focal persons were expected to be in the know of every biodigester site under construction in order to deliver programme subsidy through the BCEs and deploy biogas supervisors in time (UDBP, PID, 2009). In addition, it was mandatory to train households on how to operate and maintain their biodigesters (UDBP PID,

2009; UDBP Annual Operational Plans, 2011/13). However, little was known about whether all the households were subjected or even appreciated all these necessary pre-conditions, or whether it had a significant relationship with the performance of biodigesters in terms of meeting the domestic energy and bioslurry requirements of the households.

Under ideal situation, a modest biodigester (6 cubic metres) which was promoted by HI/UDBP would be expected to sustain a cooking duration of six and half hours with one burning stove (Loic, 2013) using a daily replenishment of only 40 kilograms of cow dung (GTZ, 1997; SNV, 2013; Loic, 2013) as long as dung could be readily available in a homestead. Impeccable evidence from studies done on energy efficiency indicate that biogas has a more heating value of 6 kWh/Sm3 when compared to fuel wood (1.3 kWh of heat), charcoal (0.7 kWh) or gasoline which releases about 0.75kWh per cubic metre (Karthik et al, 2012; Loic, 2013).

The implication is that majority of the households would be expected to depend on their installed biodigesters for over 80% of their domestic energy needs as postulated in the UDBP socio-economic baseline survey (Kahubire et al, 2010). This is because biogas is believed to save on cooking time, expenditure on fire wood as a better renewable energy option (Pandey et al, 2007; Karthik et al, 2012; Neves et al, 2009).

However, it is also believed that some biodigesters will always manifest malfunctionality if quality control and management is not observed at the critical control points along the quality control chain (Karthik et al, 2012).Therefore the intent of the study was to find out the perception of households in regard to; whether they considered to have gotten appropriate advice on the right quality and quantity of construction materials beforehand, were advised on

the size of biodigester they installed and whether they appreciated the training on operation and maintenance of their biodigesters.

2.3.3.2 After sales services and household satisfaction with the small scale Biodigesters

Extending customer care service to the households is a hallmark in the implementation of the RBM strategy and is one of the best practices as recommended even by the New Public Management approach (Vahamaki etal, 2011; Meier, 2003; Binnendijk, 2011).

According to UDBP Annual reports (2010/13), the Programme had committed funds to orient actors to always schedule and provide after sales service every after six months following installation of a household biodigester. Biogas Supervisors were contracted to carry out routine after-sales services by conducting troubleshooting, minor repairs and provide reports as part of feed back to the BCEs. The later were expected to execute remedial action as enshrined in the contract agreement they made with the households (UDBP Annual report 2013).

In light of the Results based financing mechanism, it would have been expected that each of the households that installed a biodigester, to have been visited at least twice for the after sales services (UDBP PID, 2009). However, there was insufficient information about whether the BCEs honoured their contractual obligations with the households. The intent of the study was therefore to find out the perception of households about the after sales services and whether it had a relationship with the performance of biodigesters in terms of capacity to meet the energy and bioslurry requirements of the households.

2.4 Summary of Literature Review

The study provided some insight about how the Results Based Management strategy was crafted to ensure that a critical mass of households that installed biodigesters, were satisfied in terms of energy used for cooking or lighting as well as the services they got from the biogas actors. Although, RBM strategy received wide application by Multilateral Development Institutions and Agencies in the 21st Century, there was scanty information that augmented the contribution of this strategy in the implementation of biogas programmes in Africa.

Even when the Dutch Government endeavoured to build country capacities of member countries of the Africa Biogas Partnership Programme through its bilateral organisations (SNV and HIVOs), the number of households that installed biodigesters seemed to be low compared to the ambitious targets of the programme. The failure to meet these targets was mindboggling, given that there was no empirical researched data or evidence that could attribute the shortfall in outcomes to the strategies that had been employed such as; capacity building process, Multistakeholder engagement and implementation monitoring processes.

It is therefore not clear whether by adopting the RBM strategy; households were able to acquire adequate biogas energy for cooking, lighting and bioslurry to improve on their agricultural productivity. Similarly, it was not known whether the actors including; promoters actively disseminated biogas information, masons installed quality biodigesters, MFIs provided affordable biogas loans and or biogas supervisors ensured quality control.

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CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter describes the nature of research design that was undertaken, the methodology that was adopted for the study in terms of the study population, sample size and selection, sampling methods, data collection methods and Instruments. It also focuses on data quality control in terms of its reliability, validity, and procedure of data collection, data management and analysis and measurements of variables.

3.2 Research Design

A Correlational research design was adopted in order to determine the direction, strength of relationships and associations between variables, as recommended by Mugenda and Mugenda (1999).Quantitative approaches were used to collect the data from a randomly selected sample of 235 households using close ended questionnaires on a 5 point likert scale and data was analysed by SPSS package (version18) for both descriptive and inferential statistics (Amin, 2005; Sekaran, 2003). In order to triangulate this data, 70 biogas promoters and 31 Masons were selected by clustered sampling and also subjected to questionnaires so as to get statistically significant opinions.

Qualitative approaches were also adopted to provide narrative and descriptive data as recommended by Amin, (2005), so as to corroborate the quantitative data obtained from the 235 households. The respective households were subjected to Structured Observation Checklists while 14 Key Informants were purposively selected and subjected to Interviews. Qualitative data was then systematically organised under themes and analysed for content.

3.3 Study Population

According to Sekaran (2003), population refers to the entire group of people of interest to the researcher. The total Population was 5920 respondents in the entire country (HI/UDBP Annual report, 2013) and included; biogas households (5168), Focal persons of IPs (20), Focal persons of Financial Institutions (29), Directors of BCEs (19), Biogas promoters (548), masons (118), Biogas supervisors(14) and Appliance fabricators (4). The accessible population was 896 respondents in western region ((HI/UDBP Annual report, 2013) and was represented by 8 different strata (table.1) because of the different critical functions played by these various sector players in the dissemination of biogas technology.

3.4 Determination of the Sample Size and Selection

As recommended by Mugenda and Mugenda (1991), the selected sample from the accessible population was large enough to represent salient characteristics of the population.357 respondents were selected as the sample size to represent a population of 5920 respondents based **o**n the table adopted from Krejcie and Morgan (1970) (as cited in Amin, 2005). The respondents were stratified into 8 strata and among these were; IP Focal persons (2), Directors of BCEs(4), masons (31), biogas supervisors(4), promoters(70), Focal persons of Financial Institutions(3), Appliance fabricator(1), Biogas households(242) as indicated in table 1.

Table 1: Stakeholders' Population, Sample and Sampling Techniques

S/N	Category	Population in Uganda	Accessible population in western region	Sample Size	Sampling technique
1	BCEs Directors	19	4	4	Purposive
2	IP Focal persons	20	4	2	Purposive
3	Biogas Supervisors	14	4	4	Purposive
4	Focal persons of FIs.	29	5	3	Purposive
5	Appliance Fabricator	4	1	1	Purposive
6	Masons	118	65	31	Clustered
7	Promoters	548	140	70	Clustered
8	Biogas households	5168	673	242	Simple Random
Total		**5920**	**896**	**357**	

Source: Adopted from Krejcie and Morgan (1970) (as cited in Amin, 2005)

3.5 Sampling Techniques and procedures

As recommended by Babbie, (2007), probability sampling techniques including; Simple random sampling, cluster sampling and stratified sampling were used to determine respondents' sample sizes effectively to avoid bias. Purposive sampling as a non-probability sampling technique was also adopted to select mainly key informants, as recommended by Mugenda &Mugenda, (1991).

Stratified sampling enabled determination of a representative study area as emphasised by Mugenda and Mugenda (1999). Sixteen districts (16) under the programme area of operation were designated into four (4) clusters from where one district per cluster, was selected by simple random sampling. In each district, at least two (2) Counties were then selected by purposive sampling based on the evidence got from the HI/UDBP preconstruction data for 2010 -2013, which enabled inclusion of only Counties with a large sample space of biodigester installations.

According to Mugenda and Mugenda, (1999), stratified sampling technique involves dividing the population into 2 or more groups using a given criterion and then a given number of cases are randomly selected from each population sub-group. Simple random sampling technique as recommended by Amin, (2005) was used to enable selection of the sample in such a way that all the elements in the population had an equal chance or probability of being selected. On the other hand, purposive sampling technique as recommended by Sekaran (2003) was used in order to involve the choice of respondents or districts that were most advantageously placed or in the best position to enable acquisition of the information required.

On the other hand, in order to have a representative sample of respondents for each stratum (table 1); 242 household respondents were determined by simple random sampling technique using a sampling frame per selected district.

A sampling frame (Mugenda & Mugenda, 1999) was generated by writing a random list of names and telephone contacts of all households who installed biodigesters in two selected Counties and numbers were assigned to all the names. The assigned numbers were then written on respective pieces of papers, folded and placed in a container. At least sixty (60) papers were randomly picked to represent the corresponding number of household respondents for the study sample in every district.

Cluster sampling technique as recommended by Mugenda and Mugenda, (1999), was adopted in order to select all the active masons (31) and the biogas promoters (70) that had been contracted by Biogas Construction Enterprises (BCEs) within clusters. Cluster sampling was considered to be the ideal technique because the BCEs comprised masons and besides, got their clients through Biogas promoters. They constituted an intact group and as recommended by Mugenda and Mugenda, (1999), they formed units of observation.

As recommended by Sekaran (2003), all the key informants were purposively selected because they had access to vital biogas records, were knowledgeable and could provide detailed information about their respective sectors which enabled to corroborate answers obtained from the household respondents. As pointed out by Sekaran (2003), Key Informants required adequate representation in the study and therefore were assigned quotas. These included;, Biogas supervisors(4), Directors of the BCEs(4), Focal persons of the Implementing Partners(2) and Financial Institutions(2) and the Appliance Fabricator(1) were all included in the study.

3.6 Data Collection Methods

Both quantitative and qualitative approaches were used to collect data since the different data gathering techniques have different relative strength, weaknesses and appropriateness depending on subject of investigation as pointed out by Suzanne (1998) cited in (Nassamula, 2013).

3.6.1Quantitative Methods

3.6.1.1Questionnaire Survey

The study was concerned with some of the variables that could not be directly observed such as perceptions or feelings of respondents. Gathering such information could successfully be done with the help of questionnaires as recommended by Touliatos and Compton (1988).

Questionnaires were preferred because the respondents were many and besides, it enabled the collection of standardised information by asking the same questions to many respondents simultaneously (Mugenda and Mugenda, 1999). Respondents were contacted in advance through telephone calls and this enabled them to allocate time to fill the self-administered questionnaires instantly. Research Assistants were identified within the clusters to enable easy location of the selected households and quick establishment of rapport with the respondents.

3.6.2. Qualitative Methods

3.6.2.1 Interview Method

Interview method as recommended by Mugenda and Mugenda, (1999), was used to get in depth information to corroborate with data that was captured by questionnaires. Face to face interviews were administered to key informants (14) including; the Focal persons of the Implementing Partners (2), Finance Institutions (3), the Biogas supervisors (4), BCE Directors (4) and the appliance fabricator (1). The Interview method enabled establishment of rapport with the above mentioned key Informants and as recommended by Sekaran (2003), the interviewees furnished rich data that enabled to draw deeper understanding of some of the views and concerns expressed by households. In addition, as pointed out by Rubin (1995) cited in (Nassamula, 2013), interviews enabled the researcher to get a feel of the respondents' own experiences about the programme.

3.6.2.2 Field Observational Survey Method

As pointed out by Sekaran, (2003), data obtained by observation of events is said to be reliable and free from respondents' bias. Observations were made at the selected households to establish; sufficiency of biogas based on the gas pressure readings, number of biogas appliances installed and whether they were functional, site of the installed biodigester in relation to distance to the source of water or cow dung for routine replenishment, bioslurry level in comparison to recommended level, consistency of dung mixture and workmanship. Observations were also made to adduce evidence whether bioslurry was used for agricultural production (Appendix 11).

3.7 Data Collection Instruments

Touliatos and Compton, (1988), pointed out that the selection of instruments can be based on the nature of data to be collected, the time available and the objectives of the study. Therefore, as recommended by Sekaran, (2003); quantitative data was collected using the Questionnaires while qualitative data, was collected by the help of an Interview guide and a Structured Observation Check list.

3.7.1 Questionnaire

As pointed out by Mugenda and Mugenda, (1999) and Sekaran, (2003); questionnaires consist of a set of questions printed in a logical order. Questionnaires were designed by incorporating well-validated and reliable measures from independent variables of Capacity building process, Involvement of stakeholders in strategic planning, Implementation monitoring process and the dependent variable of Household satisfaction (Appendix 11, 1V and V).Demographic variables such as sex/gender of the respondent, age bracket, status in the household, household members, livestock numbers, primary source of income, estimated expenditure on energy, energy sources used for cooking or lighting before and after biodigester installation were included in the household questionnaire (Appendix 11).

Self-administered questionnaires with close ended questions were designed to collect data from; household respondents (242), promoters (70) and masons (31) in order to save time since the respondents would pick out from predetermined options of answers. Self-administered questionnaires were used in order to grant household respondents, masons and promoters, an opportunity to independently tick the options of their preference depending on their rating of the degree of agreeableness on five points likert scale.

3.7.2 Interview guide

As pointed out by Nassamula, (2013), an Interview guide stimulates respondents to provide their views, comments and opinions and therefore was used to compliment or corroborate the information obtained from the questionnaires. An interview guide with open ended questions was used to interview 14 key informants (Focal persons of IPs, FIs, BCEs and Supervisors).

3.7.3 Observation Checklist

Data obtained by observation is said to be reliable and free from respondents' bias according to Sekaran, (2003). An Observation Checklist (Appendix 111) was used to help corroborate answers from household respondents (242) and the instrument was structured to ensure data capture was made instantly. The Instrument was designed to capture data about; size of the biodigesters installed, the gas pressure readings, number of biogas appliances installed and whether they were functional, site of the installed biodigester in relation to distance to the source of water or cow dung for routine replenishment, bioslurry level in comparison to recommended level, consistency of dung mixture and workmanship. The Instrument was designed also to capture data about the homesteads to adduce evidence whether bioslurry was used for agricultural production.

3.8 Data Quality Control

3.8.1 Validity of Data Collection Instruments

Validity refers to the extent to which the instrument measures what it is intended to measure in terms of content, face validity and criterion validity (Amin, 2005). Content Validity was adopted for the study and according to Mugenda and Mugenda (1999), it is defined as the measure of the degree to which data collected using a particular instrument represents a specific domain of indicators or content of a particular concept. As emphasised by Mugenda and Mugenda, (1999), three experts who had worked with the HI/UDBP programme were requested to independently rate the relevancy of each question item to objectives of the research. The rating by each of the experts was computed to determine the Content Validity Index (CVI) as;

$$CVI = \frac{\textit{Number of items declared relevant/valid}}{\textbf{Total number of items}}$$

As recommended by Amin (2005), the inter-expert coefficient of validity (the average validity from all the experts) was also computed by determining the summation of all the ratings of experts who were of the view that the statements were valid and divided by the total number of experts as shown in the formula $CVI = \frac{\textbf{Summation of Experts ratings}}{\textbf{Number of experts}}$.

According to Amin (2005), the instrument would only be considered to have validity only when, the average validity from all the experts was 0.7 or above but any value below indicated otherwise. Adjustments were made based on the average validity from all three experts and in light of their recommendations. The statements in the questionnaires were adjusted to ensure clarity, the appropriateness of the items, their length and these comments were incorporated in the final questionnaires. All the forty seven (47) statements contained in the questionnaire that was designed for households were assessed and the CVI obtained was 0.82 which is in

agreement with the accepted values of 0.7 (Amin, 2005).In addition, all the eleven (11) statements in the questionnaire designed for masons and the twenty (20) statements for promoters had CVI of 0.727 and 0.714 respectively, which was also in agreement with the accepted value of 0.7.

Similarly, all questions for the various Key informants were assessed and their corresponding CVI were as follows; CVI of 0.77 for all the sixteen questions in the Interview guide for Biogas Supervisors, CVI of 0.73 for the nineteen (19) questions for the Directors of BCEs, CVI of 0.79 for the ten questions for the Focal persons of Financial Institutions while the CVI for the twenty questions for the Focal persons of Implementing Partners was 0.88.

3.8.2 Reliability of Data Collection Instruments

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda and Mugenda, 2003). According to Sekaran (2003), consistency indicates how well the items measuring a concept hang together as a set.

The degree of reliability of the instruments on Results Based Management and Household satisfaction with the small scale biodigesters was tested using the Cronbach's Alpha Coefficient (α) (Amin, 2005; Sekaran, 2003).

$$\text{The mean of Alpha score } (\alpha) = \frac{\text{Summation of alpha scores for the variables}}{\text{Number of variables}}$$

As recommended by Mugenda and Mugenda (1999), the research instruments were tested to ascertain whether they could yield consistent results or data after repeated trials, by the test-retest method. Ten questionnaires were pre-tested among randomly selected household respondents, 5 promoters and 2 masons in Mbarara district in western region and the results were analysed using SPSS software package to determine their reliability. A composite alpha coefficient (α) of 0.85 was obtained.

The same instruments were administered to another group of household respondents, masons and promoters in Mbarara district and a reliability coefficient of 0.82 was obtained. The questionnaires were later used in the field and after the field work, reliability was again tested on all the statements in the questionnaires and a value of 0.932 was obtained.

Table 2: Reliability Statistics

Cronbach's Alpha Coefficient ($\propto$)	Number of items
.932	47

Table 2 shows that 93.2% of the items in the questionnaire were highly consistent and reliable suggesting that they were related to each other. The interview guide was tested using the 'test-retest procedure' for reliability. In the test 5 respondents were interviewed and the answers kept. The same respondents were interviewed again after two weeks. The results were almost similar suggesting that the instrument was reliable.

Pretesting was done in order to find out whether respondents accurately interpreted questions. It also helped to clarify questions that were ambiguous. The questions were then be entered into the computer using the statistical package of social scientist (SPSS) and reliability analysis was then done for all variables in the questionnaire by computing Crouchback's Alpha to get results of the reliability of the measurements for the dependent variable. The mean (average) of the score was calculated as; the summation of alpha scores of the variables divided by the number of variables. Similarly this was done for biogas masons and promoters.

3.9 Procedure of Data collection

As a requirement by Uganda Management Institute (UMI), the letter of introduction from UMI was presented to the Ministry of Energy and Mineral Development to get relevant data and to Heifer International- Uganda Program, from where I was introduced to the Implementing

Partners and Biogas Construction Enterprises in the field respectively. The research instruments were then pre-tested which enabled the necessary adjustments.

Prior appointment with all the respondents and Research Assistants was made in advance before administering the research instruments. Research Assistants were identified from each selected District, trained beforehand to be able to establish rapport with households, interpret and translate questionnaires in the local dialect for some of the respondents whenever it necessitated. The respondents were contacted by telephone calls as a follow up on the appointments in advance which enabled them to allocate time to participate in the study. The biogas households were met at their residences to enable administering of questionnaires and observation study concurrently. The other respondents including masons, promoters, directors and focal persons were met at their respective offices.

3.10 Data Management and Analysis

Mugenda and Mugenda (1999) emphasise that raw data should be systematically organised in a manner that facilitates analysis. For quantitative data, the close ended questionnaires were designed on a 5 point likert scale (Mugenda and Mugenda, 1999). Before leaving the field, the, the researcher ensured that all questionnaires and observation checklists were complete which enabled statistical analysis subsequently.

The answer options were directly coded numerically for the variables that were measured at ordinal level, where as variables measured at nominal level; were first categorised and then coded. Coding enabled easy input of data in the SPSS package to establish whether there were relationships between the variables through descriptive and inferential statics.

For qualitative data, as recommended by Mugenda and Mugenda (1999), appropriate themes were generated to help formulate an interview guide and an observation check list, based on the literature reviewed and the study objectives. After data collection, the responses were categorised under key themes and assigned numbers to allow processing of the qualitative data.

However before analysis, raw data was edited to ensure completeness to avoid ambiguity or incomplete responses.

3.11Quantitative Data Analysis

Edited data was converted to numerical codes representing measurement of variables and their attributes to permit quantitative analysis (Mugenda and Mugenda, 1999). Data was then entered into the Statistical software package for social scientists (SPSS) version 18 for analysis which enabled presentation of descriptive results and generation of appropriate inferences. In order to present descriptive results, the data was summarised using SPSS to generate descriptive statistics such as the mean and standard deviation.

The mean or the average distribution of the scores by the respondents enabled to describe household satisfaction in terms of the degree of agreeableness to response choices concerning the Capacity building process, Stakeholder involvement in strategic planning and Implementation monitoring processes.

Standard deviation, as recommended by Mugenda and Mugenda, (1999) enabled to describe the extent to which individual scores of the responses in the distribution deviated from their mean or average. Results from the standard deviation were used to make quick comparison of the variations in responses. Whenever the value of standard deviation turned out to be big, then it would simply point out that there was a very big variation in terms of the degree of agreeableness amongst the respondents and vice versa as indicated in chapter 4.

In order to explain these variations, inferential statistics using correlation analysis and regression analysis were generated by SPSS. Inferential statistics as recommended by Mugenda and Mugenda (199) helped to describe or establish whether there is a strong or weak

relationship between Household Satisfaction and the Results Based Management strategies such as Capacity building, Stakeholder involvement and Implementation monitoring processes.

Spearman's rank correlation efficiency (Mugenda and Mugenda, 1999) helped to make a comparison of the contribution of the Results based management strategies to household satisfaction. On the other hand, results obtained by the regression analysis were used to compare the contribution of the different strategies to household satisfaction as detailed in chapter 4.

3.11.1 Qualitative Data Analysis

Data generated from the in depth interviews and observation checklists as recommended by Mugenda and Mugenda (1999) was subjected to content analysis through the data reduction process by outlining key points from each respondent and aligning them under themes derived from the research objectives. The key points were then be displayed in line with the themes on mind maps which enabled to make concrete conclusions.

3.11.2 Measurement of Variables

Variables can be measured according to four levels of measurements from lowest to highest as; nominal, ordinal, interval and ratio according to Mugenda and Mugenda (1999). The nominal scale was used to measure some of the demographic characteristics of the respondents while the ordinal scale was used in the measurement of attributes. A 5 point likert scale ranging from strongly agree to strongly disagree was used to measure the attributes of Results based management as an independent variable and satisfaction of households with biodigesters as the dependent variable.

3.11.3 Ethical Considerations

In order to minimise sampling errors, the accessible population was stratified into 8 strata to take care of the heterogeneity in terms of the different roles by stakeholders. Mainly probability

sampling methods were used for the study considering the scattered nature of the target population. On the other hand, observations and interviews enabled to collect data to corroborate and triangulate information.

In a bid to elicit high response rates, prior appointment with all the respondents was made in advance before administering the research instruments. Research Assistants were identified from each selected District, trained beforehand to be able to establish rapport with households, interpret and translate questionnaires in the local dialect for some of the respondents whenever it necessitated. However, most important of all, respondents were given freedom to tick their preferred options of choice accordingly.

CHAPTER FOUR:

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This study investigated the relationship between the Results Based Management and Household satisfaction with the small scale biodigesters in Uganda. This chapter presents the results of the analyses. The results are presented in terms of frequencies, percentages, mean and standard deviation displayed in tables. Results of statistical tests of hypotheses on relationships between variables are also presented.

4.2 Response rate

This section is organised according to the diverse respondent categories that included; Households that installed biodigesters, Biogas Promoters, Masons, BCE Directors, Focal persons of Implementing Partners (IPs) and Micro Finance Institutions (FIs). Various categories of Respondents were engaged since they played diverse functions along the biogas result chain.

The main purpose of the study was to establish whether households that installed biodigesters were satisfied in terms of energy needs and services offered by the different actors. The information from the household respondents was then triangulated by seeking the opinion of other biogas actors in relation to their perceived role along the biogas value chain. The Percentage response rate of the respondents is presented in Table 3.

Table 3: Stakeholders' Target sample size, Actual Response and Percentage

S/N	Category	Target sample size	Actual Response	Percentage
1	Biogas households	242	235	97.1
2	Masons	31	31	100
3	Biogas Promoters	70	70	100
	Subtotal(Questionnaire method)	**343**	**336**	**98**
4	BCE Directors	4	4	100
5	Biogas Supervisors	4	4	100
6	Focal persons of IPs	2	2	100
7	Focal persons of FIs	3	3	100
8	Appliance Fabricator	1	1	100
	Subtotal(Interview method)	**14**	**14**	**100**
	Total	**357**	**350**	**98**

Source: Primary data

Table 3 shows that a total of 357 respondents were sampled, out of whom 350 respondents were successfully subjected to questionnaires and Interviews, accounting for 98% response rate. Non-response mainly resulted from non-coverage of seven (7) household's respondents that were not available to be subjected to both the questionnaires and observation check lists, giving a response rate of 97.1%.

However, the Masons and Biogas Promoters registered100 percent response rate which was achieved resulting from their respective samples of 31 Masons and 70 Biogas promoters. All the respondents targeted for Interviews registered complete coverage (100 percent) arising from the sample of 14 respondents given that prior phone contact had been made. According to Mugenda and Mugenda (1999) a response rate of 50 percent is adequate enough, 60 percent is good while a response rate of 70 percent and above is considered as very good for analysis and reporting.

4.3 Background Information of the Households

The study considered a number of household characteristics such as; Sex/gender of the household respondents, marital status, age group, respondent's status in the household, number of household members, livestock numbers, sources of income, expenditures on kerosene or firewood, energy sources for cooking or lighting before and after they installed the biodigesters.

Data about the characteristics of the sampled households for the study was presented in tables (4-14) to provide a representative picture of the households that had installed biodigesters.

4.3.1 Sex /Gender of the household respondents that installed small scale biodigesters

The respondents were categorised exclusively as female or male. The aim was to establish whether the Sex/Gender aspect had any relationship with the decision making in relation to biodigester installation, status of biodigester functionality and usage in a household. The findings were presented in table 4.

Table 4: Sex/Gender of the household respondents that installed biodigesters

Back ground Characteristics	Variable	Frequency	Percent
Sex of respondents	Male	161	68.5
	Female	74	31.5
	Total	235	100.0

Source: Field research findings

The findings presented in the table 4 show that 68.5% of the respondents were Male while 31.5% were female. This implies that there was a fair representation in terms of sex or gender of the respondents who participated in the study. The findings indicate that there were more male headed households that installed biodigesters than female headed households. This reflects the contribution of biogas in addressing gender stereotypes in light of the traditionally ascribed roles in African society where it was mainly a responsibility of women and children to collect firewood for energy.

4.3.2 Marital Status of the household respondents that installed small scale biodigesters

Respondents were categorised according to whether they were married or not married.

Table 5: Marital Status of the respondents

Background	Variable	Frequency	Percent
Marital status	Married	205	87.2
	Not married	30	12.8
	Total	235	100.0

Source: Field research findings

The findings indicate that majority of the household respondents that had biodigester installations, were married (87.2%) and only a few (12.8%) were not married. The results are a reflection that the responses were gathered from adults (men, women) and youth to represent the diverse perceptions, opinions about the contribution of biogas technology to household satisfaction and how it addressed gender stereotype such as cooking; which was historically a woman's domain.

4.3.3 Age category of the households that installed biodigesters

Table 6: Age category of the household respondents who participated in the study

Background	Variable	Frequency	Percent
Age bracket of respondent	21-25	7	3.0
	26-30	3	1.3
	31-35	4	1.7
	36-40	41	17.4
	Above 41 years	180	76.6
	Total	235	100.0

Source**: Field research findings**

Table 6 shows that 76.6% (majority) of people in the rural communities who embraced the use of biogas technology and besides, participated in the study were mainly adults aged above 41 years. On the other hand, there were low percentages of the youthful age categories who participated in the study as evidenced by 17.4 % of the respondents in the age bracket of 36-40 years, 3% in the range of 21-25 years, 1.7% between 31-35 years and 1.3% in the age bracket of

26-30 years. This implied that majority of the participants were index household heads who were in the best position to provide sufficient information.

4.3.4 Status of the household respondents in terms of their hierarchy in a household

Respondents were categorised according to their status or hierarchy in a household to establish whether they were; household heads, Spouses, Children, relatives or Workers. Heads of families were defined as the ones who managed the incomes earned and expenses that were incurred by the household, and were considered by other members of the households as their head. The household head would either be male or female. The findings are presented in table 7.

Table 7: Respondents' status in terms of their hierarchy in the household

Background	Variable	Frequency	Percent
Respondents' status in the household	Head	172	73.2
	Spouse	48	20.4
	Child (Sibling)	5	2.1
	Other Relatives	3	1.3
	Worker	7	3.0
	Total	235	100.0

Source: Field research findings

Table 7 shows that majority of the household respondents were index family members where 73.2% of the respondents were household heads, 20.4% were Spouses, 2.1% were children (siblings), 1.3% were only related to the household while 3% of the respondents were members of the household designated as workers. This implies that to a great extent, the responses reflected the opinion of the decision makers in the households.

4.3.5 Average number of household members

Household members were defined as those that had lived in the household for the past 6 months or 12 months. Household members included also persons who might have spent less than 6

months in the household but joined the household with intention of living for an extended period of time. The findings are presented in table 8.

Table 8: Number of household members per household that participated in the study

Back ground Characteristics	Variable	Frequency	Percent
Number of Household members	0-5	91	38.7
	6-15	118	50.2
	16-25	24	10.2
	26-45	1	0.4
	Above 46	1	0.4
	Total	235	100

Source: Field research findings

Table 8 shows that 38.7% of the sampled households accommodated less than 6 household members while 50.2% (majority) had between 6-15 household members and 10.2% of the households had between 16-25 household members. However, only 0.4% (very few households) had household members in the range of 26 -45 household members or more than 46 members. The findings indicate that majority of the households had potential household members that could provide labour force to replenish the biodigesters routinely.

4.3.6 Number of livestock kept to enable accessibility to Cow dung for daily replenishment

Households were categorised according to the livestock numbers that they kept to allow them access cow dung within the vicinity and ensure routine replenishment of the biodigester.

Table 9: Average number of Livestock kept by households to enable accessibility to Cow dung for daily replenishment of their biodigesters

Back ground Characteristics	Variable	Frequency	Percent
Number of livestock	btn 1 and 4	145	61.7
	btn 5 and 10	68	28.9
	50-100	1	0.4
	Above 100	21	8.9
	Total	235	100

Source: Field research findings

Table 9 shows that 61.7% (majority) of the households that installed biodigesters kept less than 5 cows while 28.9% of the households kept between 5-10 cows. However, 0.4% of the households kept large herds of cattle above 50 cows and 8.9 % had beyond 100 cows kept within the vicinity of their homesteads. The livestock numbers kept are a reflection of the different livestock management systems by the households indicating the diverse agro-ecological zones across the region from where the sample size was drawn. The findings also indicate that majority of the households had livestock resources from which they could ably access cow dung for routine replenishment of their biodigesters.

4.3.7 Household primary sources of Income

Respondents were categorised according to their primary source of income with the aim to establish how they derived funds to invest in the installation of their biodigesters. The findings are presented in Table 10.

Table 10: Household primary sources of Income

Back ground Characteristics	Variable	Frequency	Percent
Primary source of income	Formal employment	14	**6.0**
	Business	48	**20.4**
	Crop farming	5	**2.1**
	Livestock rearing	2	**.9**
	Both crop and Livestock farming	166	**70.6**
	Total	**235**	**100.0**

Source: Field research findings

Table 10 shows that only 6% of the households derived their main source of income from formal employment, 20.4% of the households were mainly active in businesses, while 2.1 % and

0.9% derived their main income entirely from crop farming or livestock rearing respectively. The findings indicate that majority (70.6%) of the households that had installed biodigesters were majorly farmers practicing mixed farming and derived their main income from both crop and livestock farming.

4.3.8 Household average monthly expenditure on Kerosene and Firewood

Respondents were asked for their estimated monthly expenditure on firewood and Kerosene to establish whether their energy requirements for cooking and lighting could be sustained by depending exclusively on biogas. The findings are presented in the table 11.

Table 11: Household average monthly expenditure estimates on Kerosene and Firewood

Background Characteristics	Variable	Frequency	Percent
Monthly expenditure estimates on energy	Less than 10,000 UG.Shs.	26	11.1
	10,000-40,000 UG.Shs.	61	26.0
	50,000-90,000 UG.Shs	104	44.3
	100,000-150,000 UG.Shs.	37	15.7
	Above 150,000 UG.Shs.	7	**3**
	Total	253	**100**

Source**: Field research findings**

Table 11 shows that majority of the households still incurred some minimal costs on energy requirements even after installation of the biodigesters. The findings indicate that 11.1% of the households spent less than 10,000 Uganda Shillings on Kerosene and firewood while 26% spent less than 50,000 Uganda shillings. However, 44.3% spent less than 100,000 Uganda Shillings, 15.7% spent between 100,000- 150,000 Uganda Shillings while 3% spent more than 150,000 Uganda Shillings.

4.3.9 Household energy sources for cooking before they installed biodigesters

Household respondents were asked about the contribution of the energy sources for their cooking needs prior to installation of their biodigesters, to establish the percentage that was dependant on various traditional energy sources.

Table 12: Household main energy sources for cooking before they installed biodigesters

Background Characteristics	Variable	Frequency	Percent
Energy for cooking before installation	Firewood	218	92.8
	Charcoal	3	1.3
	Generator	13	5.5
	H.E.P	1	.4
	Total	235	100.0

Source: Field research findings

Table 12 shows that 92.8% of the household respondents revealed that they were dependant on firewood for cooking prior to the installation of biodigesters, 1.3% used to rely on charcoal, 5.5% on generators and 0.4% used Grid Electricity to cook. Majority (92.8%) of the households were dependant on firewood for cooking before they installed biodigesters.

4.3.10 The contribution of Energy sources for cooking after installation of biodigesters

Table 13: The Contribution of small scale biodigesters to household cooking energy needs

Background Characteristics	Variable	Frequency	Percent
Energy used for cooking after biodigester installation	Firewood	27	11.5
	Charcoal	3	1.3
	LPG	10	4.3
	Biogas	195	83
	Total	235	100.0

Source: **Field research findings**

Table 13 shows that after installation of the biodigesters; only 11.5% of the households entirely relied on firewood for their cooking, while 1.3% still supplemented their energy for cooking with charcoal, 4.3% used LPG but on the other hand, 83% entirely used biogas for cooking. The

findings indicate that after biodigesters had been installed, most households reduced on the over dependence on fire wood for their cooking needs.

4.3.11 The contribution of Energy sources for lighting after installation of biodigesters

Table 14: The contribution of small scale biodigesters to household energy needs for lighting

Background Characteristics	Variable	Frequency	Percent
Energy used for lighting after biodigester installation	Kerosene lantern	17	7.2
	Solar	54	23
	Biogas	136	57.9
	Generator	12	5
	H.E.P	16	6.8
	Total	235	100

Source: Field research findings

Table 14 shows that after installing biodigesters, 7.2% of the households revealed that they continued to rely on Kerosene lanterns while 23% used solar power for lighting. However, 57.9% entirely used biogas, while 5% used generators and 6.8% of the households used Grid electricity for lighting. This indicates that even after installation of biodigesters, only 57.9 % relied on biogas and about 42% of the households relied on other alternative sources of energy for lighting. The results reflected the different household energy needs and the state of functionality of the biogas appliances.

4.4 The relationship between Results Based Management and the satisfaction of households that installed small scale biodigesters in Uganda

The study was designed to examine the relationship between the Results Based Management and Household satisfaction in terms of household accessibility to cooking or lighting energy, affordability and reliability of biogas services.

In order to achieve this purpose, respondents were asked whether they agreed with the indicators that measure the relationship between RBM and Household satisfaction with the small scale

biodigesters in Uganda. This involved administration of questionnaires, observation checklists and conducting Interviews. The research objectives were to examine whether the RBM strategy that included; Capacity building process, Involvement of stakeholders in the Strategic Planning process and Implementation Monitoring process ultimately contributed to household satisfaction.

The relationships between the variables were analysed using quantitative data collected from a randomly selected sample of 235 households using Close ended questionnaires on a 5 point likert scale. In order to triangulate the information obtained from households, 70 biogas promoters and 31 Masons were also subjected to questionnaires so as to get statistically significant data. Qualitative data was obtained by using structured Observation Checklists for the 235 households and conducting Interviews to key informants (14).The findings were statistically analysed and results presented in descriptive tables to show frequencies, percentages, mean and standard deviation for each objective. The findings were further subjected to Spearman's rank correlation coefficient and Regression analysis and the results were presented in tables to show the relationship between the study variables.

4.4.1 Capacity building process and household satisfaction

The first objective of the study was to examine the relationship between the Capacity building process and the number of households that were satisfied with their biodigesters as a result of the services of the biogas actors. The Capacity building process was largely perceived in the context of its contribution to household satisfaction, but also how the biogas promoters, masons, Biogas construction Enterprises (BCEs), Implementing Partners (IPs) and Micro Finance Institutions (MFIs) were empowered so that they could be able to provide services.

Therefore it was defined in terms of four (4) value chain processes notably; biogas awareness creation in rural/peri-urban areas to demystify negative stereotyped perceptions about the technology, the process of Continuous training of Masons/promoters on the job for quality assurance, the process of empowerment of households with skills/ knowledge so that they could make use of their biodigesters and the process of financing biodigester installations to ensure affordability of the biogas services.

Data on this objective was analysed under the hypothesis 'There is a significant relationship between the Capacity building process and the number of households satisfied with the services of the biogas actors''. The views of the respondents were rated on a five point likert scale as; Strongly Disagree (SD)=1, Disagree (D)=2, Not sure (NS)=3, Agree (A)=4 and Strongly Agree (SA)=5. In the analysis of the results, ''Strongly Agree and Agree'' were taken to mean 'Agree' and ''Strongly Disagree and Disagree' were taken to mean 'Disagree' while the mean above three (>3) and less than one standard deviation (STD<1) of the mean meant Agreement with the statements and Mean below three (<3) meant Disagreement with the Statements. The findings are presented in Table.15

Table 15: Household respondents views about the relationship between the Capacity building process and household satisfaction (N=235)

Response by Biogas Households to the indicators of the Capacity Building Process			
The Process of creating biogas awareness in rural or peri-urban areas to demystify negative stereotyped perception about the technology	N	Mean	Std. Deviation
1.Motivated by biogas sensitisations	235	4.3064	.46197
2.Had access to information in brochures	235	2.4638	.92552
3.Radio programmes were very effective	235	2.3574	.89149
4.Motivated by biogas exposure visit	235	4.3277	.47036
5.Got biogas information during exhibition	235	1.9064	1.01683
6.Knew about biogas loans provided by MFIs	235	1.0553	.22909
The process of Continuous training of Masons on the job			
7.Supervisors inspected mason in time during installation	235	2.0340	.25925
8.Biogas Supervisor did a recommendable job	235	2.0000	.86232
The process of Empowerment of households with skills and knowledge			
9.My family and I were trained on the mixing ratio of cow dung to water	235	4.0553	.62114
10.My family and I were trained to operate and maintain biodigester	235	3.8383	.88640
11.We have an installed biogas pressure gauge	235	2.1915	1.83320
12.We can ably use gauge to determine sufficiency of gas	235	2.6809	1.92272
13.We know what to do when gas pressure is insufficient	235	3.4468	1.06636
The process of financing biodigester installations to ensure affordability of the biogas Services			
14.Biogas stove & lamp as subsidy, relieved me of the costs	235	4.7872	.41014
15.Masons' fee as subsidy, relieved me of investment costs	235	4.8553	.35253
16.Subsidy motivated many households to install biodigesters	235	4.7149	.45243
17.Even if there was no subsidy, i would still install biodigester	235	2.5489	1.81658
18.I was motivated by low interest loan to install a biodigester	235	1.4426	.49775
19.It was easy to get a loan	235	1.9064	1.01683

Sources: Primary data

Table 15 shows household responses to the four processes involved in Capacity building. Findings in relation to awareness creation (1-6), indicate that majority of the household respondents were in agreement with statements 1 and 4 as indicated by a mean greater than three (>3) and a standard deviation less than one (<1) respectively. This implied that biogas sensitisation trainings and the exposure visits by potential households to functioning biodigesters effectively induced them to install their own biodigesters respectively.

On the contrary, majority of the respondents disagreed with statements 2, 3, 5 and 6, which implied that brochures, Radio programmes, exhibitions and the biogas loan product promoted by MFIs, did not effectively communicate the message about biogas to induce households to install biodigesters as indicated by a mean less than three (<3) and a standard deviation less than one (<1) respectively.

Similarly, in relation to the process of continuous training of masons on the job (7-8), most of the respondents disagreed with statements 7 and 8; as indicated by a mean less than three (<3) and a standard deviation less one (<1). The findings indicate that majority of the respondents revealed that masons were not supervised during the critical control stages of installation of their biodigesters (7) and they did not appreciate the Biogas Supervisors' role during construction (8).

On the other hand, in relation to the process of empowerment of households with knowledge and skills (9-13), majority of the respondents indicated that they were able to make use of their biodigesters as shown by the responses that were in agreement with statements 9, 10 and 13.This implied that majority of the respondents were trained how to replenish their biodigesters as well as to operate or maintain them as indicated by statements 9 and 10 respectively, that had a mean greater than three (>3) and a standard deviation less than one (<1).

However, majority of the respondents did not have pressure gauges installed on their biodigesters according to statement 11 and only few were able to accurately determine sufficiency of gas as indicated by statement 12, with a mean less than three (<3) and a standard deviation greater than one (>1) respectively. Nevertheless, most respondents except a few, acknowledged that they knew what to do in instances when the gas pressure was insufficient as shown by statement 13, with a mean greater than three (>3) and a standard deviation greater than one (>1).

In relation to biogas financing (14-19), majority of the respondents acknowledged that they were able to install biodigesters because the costs of installation of biodigesters had been subsidised by the programme as shown by statements 14, 15 and 16 with a mean greater than three (>3) and standard deviation less than one (<1) respectively. Respondents indicated that they were unable to get loans to finance biodigester installations because the interest rate was not affordable and besides, it was not easy to process loans as indicated by statements 18 and 19 respectively. In order to triangulate the aforementioned views obtained from the household respondents, the opinion of biogas promoters and masons was also sought to provide more insight about the Capacity building process as shown in table 16 and table 17 respectively.

Table 16: Biogas promoters' views about the relationship between the Capacity Building process and household satisfaction

Response by Biogas Promoters to indicators of the Capacity Building Process			
Process of creating biogas awareness in rural/peri-urban areas	N	Mean	Std. Deviation
1.All potential households installed biodigesters	70	2.0000	.41703
2.Sensitisation trainings for potential households were easy to organise and conduct	70	2.3286	.88008
3.BCE/Masons always supported me to do biogas sensitisation trainings	70	2.1857	.90558
4.Masons aggressively seized potential households that expressed the desire to install biodigesters	70	1.2000	.65053
5.Households that installed biodigesters had heard about biogas through Radio programmes	70	2.7571	1.34526
6.Households that installed biodigesters had been motivated by exposure visits to functional digesters	70	4.7429	.84589
The process of empowering biogas promoters to do their roles			
7.Construction materials were readily available for the installation of biodigesters	70	3.8286	.96266
8. Households received programme subsidy in time	70	3.5286	1.09969
9.I was always paid a promotional fee as soon as a biodigester was installed	70	1.1571	.55523
10.The promotional fee motivated me to always look for more potential households to install biodigesters	70	1.2571	.73594
11.It was easy to convince households to install biodigesters	70	3.4429	.94233

Table 16 shows responses by biogas promoters in view of their core function of creating biogas awareness and how they were empowered to do their roles. In relation to awareness creation (1-6); Majority of the biogas promoters disclosed that the processes were compromised as shown by statements 1, 2, 3, 4, 5 except 6. This is indicated by a mean less than three (<3) and a standard deviation of less than one (<1) respectively.

According to responses to statement 1, promoters indicated that many potential households did not install biodigesters despite the awareness campaign. This was evidenced by a mean less than three (<3) and a standard deviation less one (<1). Promoters acknowledged that it was not easy to organise or conduct biogas sensitisation trainings for all the potential households and BCEs/Masons rarely provided support to ensure that sensitisation trainings were done, as indicated by responses to statements 2 and 3 respectively.

In addition, majority of the Biogas Promoters revealed that Masons were not aggressive to seize potential households that expressed the desire to install biodigesters, according to responses to statement 4. Based on the responses to statement 5, it was unveiled that only few households had heard about biogas through Radio programmes, as indicated by a mean less than three (<3) but a standard deviation greater than one (>1). On the other hand, majority of the biogas promoters concurred with the household respondents that exposure visits to functioning biodigesters motivated potential households to install biodigesters as shown by statement 6,with a mean greater than three (>3) and a standard deviation less than one (<1).

Similarly, in relation to the empowerment process (7-11); majority of the biogas promoters confirmed that they had been empowered to do their roles as indicated by their responses to statements; 7, 8 and 11, even though they encountered some setbacks as indicated by responses to statements 9 and 10. As shown by statement 7, most of the biogas promoters concurred with the household respondents that; the recommended construction materials were readily accessible

as indicated by a mean greater than three (>3) and a standard deviation less than one (<1). This implied that promoters could ably identify and recommend good quality construction materials to potential households. Majority of the promoters also concurred with the household respondents that; beneficiaries received subsidy in time, although a reasonable number of households delayed to get their subsidy, according to responses to statement 8. This is evidenced by mean greater than three (>3), however with a standard deviation of greater than one (>1).

On the other hand, majority of the promoters revealed that their ability to perform their core business was compromised because incentives in form of promotion fees were never paid immediately after installation of the biodigesters as indicated by responses to statement 10, which had a mean less than three (<3) and a standard deviation less than one (<1). The findings as shown by responses to statement 10, indicate that majority of the biogas promoters were not motivated by the promotional fee to look for potential households to install biodigesters although, according to the responses to statement 11; it was easy to convince households to install biodigesters as shown by the mean greater than three (>3) and a standard deviation of less than one (<1). Additionally, masons were also engaged in order to seek their opinion about the Capacity building process and the findings are indicated in Table 16 below.

Table 17: Biogas masons' views about the relationship between the Capacity Building process and household satisfaction

Masons' response to indicators of the Capacity building process			
Process of biogas awareness creation in rural/peri-urban areas	N	Mean	Std. Deviation
1.It was necessary to support promoters to explain B.OQ during sensitisations	31	4.9677	0.1796
2.I was always assured of potential clients after every biogas sensitisation	31	3.0645	1.2365
Empowerment of masons to fulfil their roles			
3.I got a siting fee for every biodigester that i sited for an interested household	31	1.9677	0.1796

Source: Field research findings

Table 17 shows masons' opinion in relation to awareness creation and how they were empowered to fulfil their roles in light of their core functions. In relation to awareness creation (1-2); responses to statement 1, indicate that masons recognised the importance of supporting promoters to explain the Bill of Quantities (B.O.Q) during sensitisations as shown by a mean greater than three (>3) and a standard deviation less than one (<1).

However, in relation to the process of empowerment, majority of the masons revealed that they were not always sure of getting potential clients immediately after every biogas sensitisations as indicated by statement 2; with an average or mean of three (3) and a standard deviation greater than one (>1). Furthermore, most of the Masons revealed that they never got all the incentives (siting fee) for some of the biodigesters they sited for the interested households as indicated in statement 3; with an average mean less than three (<3) and a standard deviation less than one (<1).

On the contrary, supplementary field observations had to be made at every selected household for purposes of corroboration. The purpose was to validate whether; biogas promoters had convinced the beneficiary households to install biodigesters of appropriate capacity. In light of the observations, accessibility to cow dung, water and labour appeared to have prejudiced some households to install biodigesters of relatively small gas volume retention capacity. Most of the installed household biodigesters in the greater Masaka and Bushenyi were of 6 cubic meter capacity that accounted for 54.4 percent. In Rukungiri and Ntungamo; 9 cubic meter biodigesters were the commonest, accounting for 33% of the total installations across the region. The 12 cubic meter capacity biodigesters and the 13 cubic meter capacity biodigesters accounted for only 8.5% and 4.2% of the total household biodigesters sampled for the study.

Similarly, the other purpose was to validate whether masons exhibited the requisite technical skills. On close inspection, it was realised that 54% of the total household biodigesters installed

(127 households) particularly in the districts of greater Masaka and Bushenyi, were established in close proximity to zero grazing units or night paddocks, which enabled household members to access cow dung easily within an estimated distance of less than 500 metres.

It was on the other hand important to note that in greater Mbarara, Ntungamo and Rukungiri districts, 38.2% of the households (90 households) accessed dung within a range of 500-1000 metres, while 15.3% (36 households) accessed dung beyond 1000 metres which necessitated extra costs for hiring of labour to gather the scattered dung.Majority of these households practiced semi-intensive systems of grazing cattle on large expanse of farmland because they had fairly large number of cattle.

Additionally, attempts were made to validate whether households had been empowered with knowledge and skills. Across the region, there was incredible observable evidence that a reasonable number of households had been empowered to operate and maintain their biodigesters. On investigation of the bioslurry consistency in the expansion chambers, close to 90 percent of the biodigesters (212 households) were found to have the recommended 'porridge-like' fluid viscosity. This was an indication that most of the households had learnt how to replenish their biodigesters with a mixture of cow dung and water in appropriate ratios.

There was overwhelming evidence and testimonies by 84% of the household respondents (197 households) who had used bioslurry as an organic fertiliser on banana plantations though on a small scale. The results were evidenced by the exceptionally bigger banana bunches and good looking, thrifty banana plantations compared to the controls where bioslurry had not been applied. This implied that majority of the households had benefited from their biodigesters in terms of agricultural productivity.

It was also observed that, 60% of the households (141 households) relied on liquid bioslurry and only 24% of the households (56 households) could adduce evidence that they had ever used

decomposed bioslurry based on the vivid evidence of the well managed bioslurry in the slurry management structures. However, 16 percent of the household respondents complained that their biodigesters were malfunctional and so did not use bioslurry at all.

Attempts were made to establish whether households got regular follow ups to ensure efficient operation of biodigesters. Based on observations, 62 percent of these biodigesters were found with lower levels of the bioslurry; below the recommended mark by more than six inches (6'') and only 38 percent of these biodigesters (89 households) had the level of bioslurry in the expansion chambers flushing with the outlet channel. This implied that majority of the biodigesters (62%) exhibited symptoms pointing to insufficient gas pressure in the airtight chamber which could have been as a result of either gas over use, leakage, irregular replenishment of the biodigesters or a combination of those factors.

In view of the capacity building process, key informants were also interviewed to seek probable explanations concerning some of the anomalies that compromised the process and they had the following to say;

Key Informant 1:

> Radio Clips, brochures and exhibitions could not effectively induce households to install biodigesters unless they were complimented with exposure visits. People were interested to know the biogas benefits and bill of quantities in order to compare and make informed decisions in light of other competing energy sources like solar and firewood.

Key Informant 2:

> The use of the Radio clips and Radio talk shows would have been good for mass communication, however not all people for example in the greater Mbarara preferred Radio West, neither was Radio Ankole preferred by all the people of Ntungamo and nor

was CBS Radio preferred by all the people in Masaka. Besides, Radio talk shows were often done once in a while because they were expensive and not everything could be explained to households through Radio clips.

Key Informant 3:

A number of staff and Board members of some Micro Finance Institutions were sensitised on biogas technology in order to induce them to provide biogas loan products but the results were discouraging. Many MFIs did not have enough loan portfolios, few MFIs responded for instance Kigarama People's SAACO, although some of the biodigesters got technical challenges which could have created yet another fear.

Key Informant 4:

At the inception of the Programme, biodigesters in some areas were discovered with gas leakages after installation mainly because some masons had used sand with a lot of impurities, others had compromised on layers of internal plastering of gas tight chamber of the digester. The Programme management facilitated masons for refresher trainings to ensure that they acquired skills in siting of biodigesters, interpreted technical designs and recruited biogas supervisors to follow up masons at construction sites.

Key Informant 5:

Some of the BCEs lacked enough competent masons since some trainee masons had dropped out due to lack of confidence, in preference to other regular construction works like erecting buildings in which we were involved as BCE. .

Key Informant 6:

> As a biogas supervisor just like my colleagues, I entirely know how all the masons work because; i supervised most of them although not frequently. I believe out of the four BCEs; METCO had the majority of competent masons because at least 8 out the 12 masons could work under minimum supervision, IDEAL ran a close second because at least 3 out of the 5 masons were skilled. WEBMAS and Conserve Nature were equally good, although each had only 3 masons out of seven masons respectively; who could work under minimum supervision.

In a bid to establish relationships between the Capacity building process and household satisfaction with the small scale biodigesters in Uganda, Spearman's rank correlation coefficient was used. The results are presented in Table 18.

Table 18: Correlations of the Capacity building process and Household satisfaction with the small scale biodigesters in Uganda.

Correlations				
			Capacity building	Household satisfaction
Spearman's rho	Capacity building	Correlation Coefficient	1	.295**
		Sig. (2-tailed)	.	0
		N	235	235
	Household satisfaction	Correlation Coefficient	.295**	1
		Sig. (2-tailed)	0	.
		N	235	235
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: Field research findings

Table 18 shows that there is a positive strong correlation between the Capacity building process and the satisfaction of households that installed small scale biodigesters in Uganda as shown by

the value of spearman's rank correlation coefficient of 0.295 at $p<0.05$. This suggests that a unit investment in the Capacity building process increases household satisfaction by 0.295.

Linear regression was used to establish the contribution of the Capacity building process to the satisfaction of households that installed small scale biodigesters. The findings are presented in Table19.

Table 19: Model summary between the Capacity building process and household satisfaction with the small scale biodigesters in Uganda

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.291[a]	0.085	0.081	0.2451
a. Predictors: (Constant), Household satisfaction				

Source: Field research findings

Table 19 shows the adjusted R square value of.0.081 which suggests that the Capacity building process accounts for only 8.1% of the satisfaction of households that installed biodigesters. The remaining percentage is contributed by other factors.

4.4.2. Stakeholder involvement in the Strategic planning process and household satisfaction

The second objective was to examine the relationship between Stakeholder Involvement in the Strategic Planning Process and the number of households that were satisfied with the small scale biodigesters. This process was largely looked at in terms of the perceptions held by the household respondents about the commitment of the biogas actors to deliver their core business. Data on this objective was analysed under the hypothesis 'There is a significant relationship between stakeholder involvement in the strategic planning process and the number of satisfied households'. The views of the respondents were rated on a five point likert scale as; Strongly

Disagree (SD)=1, Disagree (D)=2, Not sure (NS)=3, Agree (A)=4 and Strongly Agree (SA)=5. In the analysis of the results, ‘‘Strongly Agree and Agree’’ were taken to mean ‘Agree’ and ‘‘Strongly Disagree and Disagree’ were taken to mean ‘Disagree’ while the mean above three (>3) and less than one standard deviation (STD>1) of the mean meant Agreement with the statements and Mean below three (<3) meant Disagreement with the Statements. The findings are presented in Table 20.

Table 20: Household respondents’ views about the relationship between the process of involving Stakeholders in Strategic planning and household satisfaction. (N=235)

Response by Biogas Households to the indicators of the Stakeholder Involvement process			
The process of engaging Stakeholders to avail biogas services in order to meet the targeted number of satisfied households	**N**	**Mean**	**Std. Deviation**
20.Promoters mobilised households for biogas sensitisations	235	4.3064	.46197
21. It was easy to get masons through promoters to be able to install biodigesters	235	4.3064	.46197
22..Promoters gave us brochures	235	2.4638	.92552
23. Biogas promotional materials were always displayed/show cased at all exhibitions	235	1.9064	1.01683
24.Most MFIs encouraged their clients to get biogas loans	235	1.9064	1.01683
25.Most MFIs provided affordable biogas loans	235	1.0553	.22909
26.Cement is readily accessible	235	4.4000	.54065
27.Mud bricks are readily available	235	4.3830	.53721
28.River sand is readily available	235	4.2255	.82960
29.Biogas accessories are readily available	235	2.0128	.32661
30.Biogas appliances are cheap	235	4.2255	.82960
The process of delivering of biogas services to households in a Timely manner as per planned schedule			
31.The Mason sited biodigester immediately he was informed	235	2.3574	.89149
32.I got technical support to procure construction materials	235	3.5362	1.07902
33.A biogas Supervisor inspected the mason immediately he began constructing	235	2.3574	.89149
34.Mason installed the biodigester within 3 weeks	235	4.0213	.58796
35.Subsidy (dome pipe, lamp &stove) were delivered in time	235	3.919	.7264
36.Biodigester installation was completed within a month	235	3.8000	.87119
37.The Financial Institution swiftly processed for me a loan	235	1.1617	.40221
38.We got timely training on operations & maintenance	235	4.1957	.45758
39.We got timely training on bioslurry application	235	4.1957	.45758

Source: Field research findings

Table 20 shows that some of the biogas actors that were engaged to avail biogas services to households did not exhibit commitment as indicated by responses to statements 20-30.

In relation to the process of creating awareness, majority of the respondents appreciated the commitment exhibited by promoters as shown by statements 20, 21 (except 22 and 23); evidenced by the mean greater than three (>3) and standard deviation less than one (<1). They acknowledged that the promoters mobilised them for biogas sensitisations as indicated by statement 20 and linked them to masons when they developed the desire to install biodigesters as shown by statement 21. However, most respondents disclosed that promoters rarely distributed biogas brochures nor show-cased biogas promotional materials whenever there were exhibitions as a marketing strategy as shown by responses to statements 22 and 23 respectively.

In relation to the process of acquiring biogas loans (24 and 25); the findings also indicate that most Micro Finance Institutions (MFIs) did not encourage their clients to acquire biogas loans and accessibility to affordable biogas loans to finance biodigester installations remained a big problem according to responses to statements 24 and 25 respectively; evidenced by a mean less than three (<3) and a standard deviation less than one (<1).

On the other hand, the process of acquiring construction materials (26-30) was satisfactory. Most of the respondents readily got the construction materials from within their vicinity except biogas appliances as indicated by responses to statements 26, 27, 28, and 30 except 29 respectively. This implied that the Appliance fabricators did not provide reliable services in the rural areas.

On the other hand, in terms of timeliness to deliver services (31-39), majority of the household respondents disclosed that the delivery of some of the biogas services was compromised as indicated by responses to statements; 31, 33 and 37 that had a mean less than three (<3) and a standard deviation less than one (<1).

Respondents indicated that masons exhibited poor response times to do the siting and the subsequent process of biodigester installation as indicated by statement 31. However, respondents indicated that masons supported them in the process of procurement of the recommended construction materials with exception of a few cases as indicated by statement 32. Respondents divulged that poor response times by the biogas supervisors compromised timely inspection of construction works done by masons as indicated by statement 33.

On the other hand, respondents acknowledged that majority of the biodigesters were installed within the anticipated average duration of three weeks as indicated by statement 34, subsidy material was delivered in time as indicated by statement 35 and majority of the biodigesters were completed within duration of a month as indicated by statement 36. However, there was poor response time by MFIs to process loans as disclosed by majority of the respondents in light of the responses to statement 37. Even then, households got timely training on operations and maintenance as well as bioslurry training as indicated by statement 38 and 39 respectively.

In order to triangulate the aforementioned views obtained from the household respondents, the opinion of biogas promoters and masons was also sought to provide more insight about the process of involving stakeholders in strategic planning and promotion of biogas as shown in table 20 and table 21 respectively.

Table 21: The views of Biogas Promoters about the relationship between the process of involving Stakeholders in Strategic planning and household satisfaction

Response by Biogas Promoters to the indicators of the Stakeholder Involvement process			
The process of engaging Stakeholders to avail biogas services in order to meet the targeted number of satisfied households	N	Mean	Std. Deviation
12.I always fulfilled my quarterly targets of potential households that i linked to BCEs/Masons in order to install biodigesters	70	1.7143	1.16896
13.Most of the targeted households accessed loans from MFIs in order to install biodigesters	70	1.0714	.39274
14.Most households were trained how to operate and maintain their biodigesters	70	3.8857	.46758
15.Most households were trained how to apply bioslurry in the gardens	70	3.9857	.49615
16.Masons always addressed technical challenges immediately cases of biodigester malfunctionality were reported	70	2.4714	1.12574
17.All households have functional biogas appliances	70	3.1429	1.08060

Source: Field research findings

Table 21 shows that majority of the promoters concurred with the household respondents that; there was a low level of commitment exhibited by the different biogas actors that were meant to deliver services as shown by statements 12 to 16. In view of the commitment to meet the Programme targets; biogas promoters conceded that they did not ever hit the targeted number of households anticipated to install biodigesters as shown by responses to statement 12.

In relation to the process of acquiring loans; biogas promoters concurred with the household respondents that MFIs did not provide affordable loans to these households or motivate other potential households to install biodigesters as shown by the responses to statement 13. However, in view of the empowerment process; promoters concurred with the household respondents that training on aspects of operation and maintenance as well as bioslurry application were conducted at the appropriate time as shown by the responses to statements 14 and 15 respectively.

Similarly in terms of timely response to household needs (16-17), promoters concurred with the household respondents that; masons exhibited poor response time to address technical challenges whenever cases of biodigester malfunctionality were reported as shown by responses to statement 16. Accordingly, majority of the promoters were not sure whether all households had functional biogas appliances as shown by statement 17, that had an average or mean response equivalent to three (3) within a standard deviation of one (1).

Biogas masons were also engaged in order to seek their opinion about the process of involving stakeholders in strategic planning and promotion of biogas, the findings are indicated in Table 22 below.

Table 22: Masons' views about the relationship between the process of the Stakeholder involvement in strategic planning and household satisfaction

Descriptive Statistics			
Masons' response to indicators of Stakeholder involvement process	N	Mean	Std. Deviation
4.Majority of potential households who requested for siting, ultimately availed construction materials in time	31	2.2258	.71692
5.All households that were interested in biodigesters bought all construction materials in time	31	2.2258	.84497
6.Households received programme subsidy materials in time	31	3.7742	1.14629
7.Most households got loans from MFIs in order to install biodigesters	31	1.0323	.17961

Table 22 shows the opinion of masons about the Stakeholder involvement in strategic planning process, taking into perspective of the masons' core functions.

In relation to the poor response times as had been mentioned by household respondents and promoters; masons indicated that some of the households delayed to procure all the recommended construction materials, which in turn delayed the commencement of work, as indicated in statement 4. This is evidenced by the average or mean response of less than three (<3) and a standard deviation less one (<1) to statement 4.

In relation to the timely delivery of other biogas services (6-7); Majority of the masons with exception of a few, concurred with the household respondents and the promoters that there was timely delivery of subsidy material to the beneficiary households as shown by the statement 6, with a mean response greater than three (>3) within a standard deviation of one (1).

However, Biogas Masons affirmed that many households failed to access biogas loans from MFIs to enable them install biodigesters as shown by statement 7, that had a mean less than three (<3) and a standard deviation of less than one (<1).

Supplementary field observations enabled to validate some of the household concerns about the response times to technical challenges. In light of the observations, 14.5 percent of the households expressed dissatisfaction about the poor response to non-functional biodigesters. Four percent (4%) of these households (10 biodigesters) had completely abandoned their biodigesters because they cited the possibility of aggravated leakage of the digester dome (airtight chamber). On the other hand, 6% of the households (13 biodigesters) had faulty appliances that took form of broken mantles, broken glasses and others had poorly designed burners that could not support complete combustion of biogas. However, the malfunctionality of the 4.5% biodigesters was as a result of a combination of both technical and household factors.

Based on the observations, it was easier to validate that 30 percent of the biodigesters (70 biodigesters) performed quite well with respect to their installed capacity as evidenced by the pressure gauge readings. However, it was difficult to determine the gas pressure for 70 percent (165 households) of the household biodigesters because they did not have pressure gauges in spite of the demand for this service as disclosed by households. Based on findings from the observations made and the views expressed by the household respondents and promoters, it implied that masons portrayed poor response time in addressing the technical challenges reported by households.

On the other hand, the Key informants had the following to say about the commitment of biogas actors meant to contribute to the desired results through delivering their core business;

Key Informant 1:

> We always had targets but it was difficult to achieve them because Biogas Construction Enterprises were inconspicuous in remote areas and were not known by the rural folk in rural areas. They did not brand themselves as business entities and worst of all, most of the times, potential households failed to locate their offices in town because they did not have visible posters and so they missed some business opportunities

Key Informant 2:

> Many people in the rural areas desired to install biodigesters because of the subsidy and the associated benefits such as the smokeless cooking stoves, the luminous biogas lamps and the bioslurry. However, few households could accomplish their dreams immediately, others installed after a prolonged period of time trying to put resources together because the initial investment costs were high where as some did not, because they were not followed up by promoters or masons yet they had resources.

Key Informant 3:

> Biogas sensitization trainings coupled with the exposure of potential biogas users to functioning biodigeters were the most relevant promotional strategies. However, at times when the bill of quantities was not well explained to potential biogas users by the promoters, they were at times discouraged by some biogas users who often overstated the amounts they invested in their biodigester installations. This instilled a lot of empathy and non-commitment by potential biogas users.

Key Informant 4:

BCEs could not afford to facilitate masons to all remote areas to explain the ever changing Bill of quantities to all potential households identified by promoters because they could not break even. Most households took about 3-9monthsto procure construction materials following the sensitisations; which meant a low turnaround time yet the percentage subsidy contribution kept on declining over time.

Key Informant 5:

The Subsidy contribution by the Programme would have been very instrumental in achieving great number of biodigester installations because ordinary households in villages could not afford a lump sum of about three million shillings (3m Ushs.) to invest in a biodigester. However, the subsidy contribution was always changed now and then which portrayed promoters as if they were inconsistent with their message.

Key Informant 6:

Majority of the households installed relatively small biodigesters of 6 cubic meter capacity because the investment cost that was required of them was low compared to other biodigester sizes in light of the Programme subsidy contribution. Unless the Government and NGOs subsidizes the biodigesters, the targeted number can never be easily achieved.

Informant 7:

For us as Micro Finance Institutions, we did not get the revolving funds from Government as had been earlier anticipated; to support the BCEs and potential households. Therefore we could only provide loans at a rate of about 24% per annum in order to break even, since we also accumulated our loan portfolio at a high interest.

Key Informant 8:

As a Micro Finance Institution, we had an Agricultural loan product but did not have specifically a biogas loan product because it was a new technology and therefore the Board of Directors did not approve it as one of our priorities.

Key Informant 9:

We did not have targets for the biogas loan product since it was not our priority because of its long repayment period compared to the school fees loan product which was on high demand and yet every term parents had to borrow money to meet school dues.

Key Informant 10:

Many people lacked income security and therefore could not access reasonable loan amounts because their banana and coffee plantations had been affected by wilt. Others had low milk sales given the fact that they had few numbers of indigenous cattle to warrant loan acquisition.

Key Informant 11:

Every biogas supervisor had a minimum number of households for after sales services that were determined by Programme management depending on the number of households who were either due or overdue for the service.

Key Informant 12:

Even though I did not supervise all the biodigesters, I believe most households were technically advised on the kind of materials to buy and the biodigester sizes to install because it was a pre-condition.

Key Informant 13:

Most of the times the construction sites were scattered which could not allow supervisory work on all the masons at all the critical stages of biodigester installation and most pathetic of all, funds to facilitate movement to these sites was always delayed.

Key Informant 14:

The response rate to client complaints was overwhelming and we did not have the financial resources to solve many technical inadequacies. Therefore it took long to deploy competent masons to troubleshoot, execute the necessary repairs or reconstructions which frustrated some households and consequently abandoned their biodigesters

In a bid to establish relationships between the process of involving stakeholders in strategic planning and household satisfaction, the Spearman's rank correlation coefficient was used. The results are presented in Table 23.

Table 23: Correlations of the stakeholder involvement in strategic planning process and Household satisfaction with the small scale biodigesters in Uganda.

Correlationsa				
			Stakeholder Involvement	Household satisfaction
Spearman's rho	Stakeholder Involvement	Correlation Coefficient	1	0.049
		Sig. (2-tailed)	.	0.453
	Household satisfaction	Correlation Coefficient	0.049	1
		Sig. (2-tailed)	0.453	.
a. Listwise N = 235				

Source: Field research findings

Table 23 shows that there is insignificant correlation between the process of involving stakeholders in strategic planning and the satisfaction of households as shown by the spearman's rank correlation coefficient value of 0.049 at p>0.05. This suggests that a unit investment in the process of involving stakeholders in the strategic planning and to promote the technology only contributed to household satisfaction by 0.049.

Linear regression was used to establish the contribution of the Stakeholder involvement process to the satisfaction of households that installed small scale biodigesters. The findings are presented in Table 24.

Table 24: Model summary between the Stakeholder Involvement in Strategic Planning process and household satisfaction with the small scale biodigesters in Uganda

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.087a	0.008	0.003	0.27362
a. Predictors: (Constant), Household satisfaction				

Source: Field research findings

Table 24 shows the adjusted R square value of.0.003 which suggests that the stakeholder involvement process accounts for only 0.3 % of the satisfaction of households that installed biodigesters. The remaining percentage is contributed by other factors.

4.4.3. Implementation monitoring process and household satisfaction

The third objective was to examine the relationship between the implementation monitoring process and the number of households satisfied with their biodigesters. This process mainly looked at whether there was effective quality control and after sales services extended to the households that installed biodigesters. Therefore the focus was to discern perceptions held by the household respondents in terms of whether their biodigesters were installed according to the

specifications of the design or met household energy requirements for cooking, lighting and or bioslurry utilisation.

Data on this objective was analysed under the hypothesis 'There is a significant relationship between the implementation monitoring process and the number of households satisfied with their biodigesters'. The views of the respondents were rated on a five point likert scale as; Strongly Disagree (SD)=1, Disagree (D)=2, Not sure (NS)=3, Agree (A)=4 and Strongly Agree (SA)=5. In the analysis of the results, ''Strongly Agree and Agree'' were taken to mean 'Agree' and ''Strongly Disagree and Disagree' were taken to mean 'Disagree' while the mean above three (>3) and less than one standard deviation (STD<1) of the mean meant Agreement with the statements and Mean below three (<3) meant Disagreement with the Statements. The findings are presented in Table.25.

Table 25: Household respondents' views about the relationship between the Implementation monitoring process and household satisfaction

Response by Biogas Households to the indicators of the Implementation monitoring process			
Professionalism exhibited by masons during the process of biodigester installation	N	Mean	Std. Deviation
40.Satisfied with the site/location of the biodigester	235	3.940	.6830
41.Mason installed appropriate biodigester size	235	3.8723	.76284
42.Mason used quality materials in good ratio	235	4.1106	.66385
43.Biodigester has never been replastered/reconstructed	235	3.7617	1.20301
44.Mason followed up after installing biodigester	235	2.0936	.45263
The process of Quality control during the biodigester installation			
45.Supervisors inspected masons at critical stages of installation	235	1.3021	.91882
The process of conducting After sales service to the installed biodigesters			
46.After sales service was done every after six months	235	1.1319	.50175
47.A guarantee form was filled twice after every service	235	1.2426	.74299

Source: Field research findings

Table 25 shows the views of household respondents about the value chain processes of Implementation monitoring process.

As regards the process of biodigester installation (40-44); majority of the household respondents applauded the masons for having exhibited professionalism as shown by the statements 40, 41, 42 and 43 with exception of 44. This is evidenced by their mean responses that were greater than three (>3) with a standard deviation less than one (>1) respectively. This implied that respondents were satisfied with the sites where their biodigesters had been installed as shown by responses to statement 40. Majority admitted that the size of their biodigesters were appropriate for their family size as indicated by responses to 41. Respondents also admitted that they were assured about the quality and ratios of construction materials that were used by masons which implied that they recognised the essence of engaging masons in the procurement process as indicated by statement 42.

On the other hand, in relation to adherence to the design specifications of the Carmatec biodigester model; majority of the respondents indicated that they had never had serious technical challenges. On the contrary, some respondents disclosed that their biodigesters had been replastered while other respondents indicated that some biodigesters had been reconstructed. This is according to the statement 43; which had a mean response that was less than three (>3), with a standard deviation greater than one (>1). However, considering masons' response times and customer care; majority of the household respondents affirmed that masons never made follow ups after installations as shown by the mean response to statement 44, which was less than three (>3) with a standard deviation less than one (<1).

Similarly, most of the household respondents expressed their dissatisfaction regarding the poor quality control measures and after sales services (45-47) as shown by the mean response to these statements which was less than three (<3) with a standard deviation less one (<1) respectively.

Household respondents indicated that masons were not supervised during the critical control stages of biodigester installations and after sales service was never done promptly after every six months according to statements 45 and 46 respectively. Consequently, guarantee forms were not filled because after sales service was not conducted as shown by statement 47. This implied that the terms of the contract agreement between the biogas construction enterprises (BCEs) and the households were not honoured by the BCEs.

In order to triangulate the aforementioned views obtained from the household respondents, the opinion of biogas promoters and masons was also sought to provide more insight about the Implementation monitoring process as shown in table 25 and table 26 respectively.

Table 26: Biogas Promoters' views about the relationship between the Implementation monitoring process and household satisfaction

Response by Biogas Promoters to the indicators of the Implementation Monitoring Process			
The processes of Quality control and After sales service	N	Mean	Std. Deviation
18.Biogas supervisors did a commendable job to ensure good quality biodigesters	70	2.2000	.75373
19.All households got after sales services on schedule, twice every after six months	70	2.0286	.48068
20.Households that had faulty biodigesters always got quick response to technical challenges	70	1.9857	.31819

Source: Field research findings

Table 26 shows that majority of the biogas promoters concurred with the household respondents that; quality control and after sales services was compromised as shown by statements 18, 19 and 20. This is shown by their average mean response that was less than three (<3) with a standard deviation of less than one (<1) respectively.

Biogas promoters affirmed that biogas supervisors did not explicitly execute their role as shown by the responses to statements 18 and 19 respectively. Promoters also concurred with the household respondents that there was always poor response times to technical challenges on

biodigesters even when cases were reported by the households as shown by responses to statement 20. Biogas masons were also engaged in order to seek their opinion about the Implementation monitoring process and the findings are indicated in Table 26 below.

Table 27: Mason's views about the relationship between the Implementation monitoring process and household satisfaction

Mason's response to indicators of the Implementation monitoring process (Quality control and After sales service)	N	Mean	Std. Deviation
8.Biogas Supervisors were very resourceful to masons	31	3.8065	.60107
9.The host families were very cooperative to masons during biodigester installation	31	3.7419	.68155
10.All households can ably operate and maintain their biodigesters	31	3.9355	.35921
11.There was delayed payment of Mason's fee after installation of a biodigester	31	5.0000	.00000

Table 27 shows the opinion of masons about the Implementation monitoring process in light of their core functions (8-11). As regards the process of biodigester installation; majority of the biogas masons re-affirmed that it was critical for biogas supervisors to inspect the construction works at the critical control points as shown by statement 8.

In relation to customer care and the masons' relationship with the households; findings indicated that most host families were very cooperative and hospitable according to the masons as indicated by statement 9. Moreover, majority of these households had been empowered to operate and maintain their biodigesters as shown by responses to statement 10. However, in relation to masons' motivation to work; majority of the masons disclosed that they were never paid their incentives (masons' fee) in time after installing biodigesters as shown by the responses to statement 11.

Supplementary field observations had to be made at every selected household in a bid to corroborate some of the information obtained from the household respondents. Based on the in-situ observations made in relation to quality control; the poor workmanship on some

biodigesters indeed reflected that some masons were not supervised to ensure good quality finishing as evidenced by the poor nature of finishing and plumbing works. There were only about 66 percent of the biodigesters (155 households) that had very good finishing, with slabs of standard thickness of 5cm. On the contrary, 26 percent of the biodigesters (60 households) had poor finishing with cracked slabs that had a thickness less than 3cm whereas, 8.5 percent of the biodigesters (20 households) had very poor finishing with broken patches on slabs, and their thickness was found to be more than 5cm. It was also observed that close to 30% of the biodigesters had cracked man-hole covers. However, it was not established whether the air tight digester chambers had similar defects.

On the other hand, some biodigesters did not meet the quality expectations considering their site orientation as well as their gas volume capacity. Household respondents felt comfortable with the location and size of their biodigesters but in light of the observations; the high investment costs, accessibility to cow dung, water and labour appeared to have prejudiced some households to install biodigesters of relatively small gas volume retention capacity. Most of the installed household biodigesters were of 6 cubic meter capacity that stood at 54.4% and 9 cubic meter biodigesters at 33%. There were only 8.5% and 4.2% of the households that installed biodigesters of 12 cubic meter capacity and 13 cubic meter capacity respectively, yet some households were evidently found using firewood to supplement biogas use.

On close inspection, it was found that 54% of the households (127 households) in Masaka and Bushenyi installed biodigesters in close proximity to their zero grazing units or night paddocks, which enabled accessibility to cow dung within an estimated distance of less than 500 metres. It was on the other hand important to note that in greater Mbarara, Ntungamo and Rukungiri, most households practiced semi-intensive systems of grazing cattle on large expanse of farmland. In light of this scenario, some households could only access dung within a distance of 500-1000 metres but these accounted for only 38.2% (90 households) while 15.3% (36 households)

accessed dung beyond 1000 metres which necessitated at times, hiring of labour as revealed by some households especially in the cattle corridor.

Nevertheless, Key informants were interviewed to discern their opinion about the Implementation monitoring process and they had the following to say;

Key Informant 1:

> The 6 cubic biodigesters were sufficient for households that comprised less than 5 members but were inadequate to fulfill most of the households' energy needs especially for big families and therefore had to supplement cooking using firewood. However households that installed biodigesters of 12 cubic and 13 cubic were more satisfied than their counterparts who had 6 cubic biodigesters.

Key Informant 2:

> A reasonable number of biodigesters classified as 'training' or 'certification' plants had technical challenges because the masons who installed them were inexperienced. However, if there was effective supervision the number of malfunctionality of biodigesters would be reduced tremendously.

Key Informant 3:

> I would recommend for more refresher trainings to enable continuous improvement of masonry skills. Based on the experience of previous masons' refresher trainings; masons perfected the interpretation of the technical drawings of the different biodigester capacities even though some biodigesters have been found to be leaking. I think it is because they lacked supervision and therefore, they continued to mess up with measurements and internal plastering.

Key Informant 4:

> As a Biogas Construction Enterprise (BCE), we did not have enough financial resources to pre-finance masons or supervisors to ensure after sales services were done in time to reduce cases of biodigester malfunctionality but even then, we always received incentives for masons, promoters and BCE fees after a long time of waiting. If incentives could be paid in time, perhaps we could see more responsiveness by biogas actors.

Key Informant 5:

> As an Implementing Partner, we at times found it difficult to get requests from the BCEs and worst of all, sometimes the payment requests that were submitted lacked all the required household information to enable establish authenticity of the information before we could process the incentives.

Key Informant 6:

> I believe that if the masons together with their BCE directors and promoters were financially supported to hold regular meetings every month it would provide a platform to harmonise their complaints and to re-vist their strategies. They would also need some refresher training on basic data capture to enable submission of complete household forms to ensure timely payments.

In a bid to establish relationships between the Implementation monitoring process and household satisfaction, the Spearman's rank correlation coefficient was used. The results are presented in Table 28.

Table 28: Correlations of the Implementation monitoring process and Household satisfaction with the small scale biodigesters in Uganda

Correlations[a]				
			Implementation Monitoring	Household satisfaction
Spearman's rho	Implementation Monitoring	Correlation Coefficient	1	.256**
		Sig. (2-tailed)	.	0
	Household satisfaction	Correlation Coefficient	.256**	1
		Sig. (2-tailed)	0	.
**. Correlation is significant at the 0.01 level (2-tailed).				
a. Listwise N = 235				

Table 28 shows that there is a significant strong positive correlation between the Implementation monitoring process and the satisfaction of households as shown by the spearman's rank correlation coefficient value of 0.256 at $p<0.05$. This suggests that a unit investment in Implementation monitoring process contributed to household satisfaction by 0.256.

Linear regression was used to establish the contribution of the Implementation monitoring process to the satisfaction of households that installed small scale biodigesters. The findings are presented in Table 28.

Table 29: Model summary between the Implementation monitoring process and household satisfaction with the small scale biodigesters in Uganda

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.246[a]	0.061	0.057	0.34762
a. Predictors: (Constant), Household satisfaction				

Source: Field research findings

Table 29 shows the adjusted R square value of.0.057 which suggests that Implementation process accounts for only 5.7% of the household satisfaction. The remaining percentage is contributed by other factors.

4.4.4 Multiple Linear Regression Analysis between Independent variables and Household satisfaction with the small scale biodigesters

In an effort to find out how the independent variables interact with the dependent variable, multiple linear regression was used. Multiple linear regression combined all independent variables; capacity building process, stakeholder involvement in strategic planning and biogas promotion and Implementation monitoring process, in establishing the relationship or influence on the satisfaction of households that installed biodigesters. The elicit responses were presented in Tables 29 and 30.

Table 30: **Model summary between the process of; Capacity building, Stakeholder involvement in strategic planning, Implementation monitoring process and Household satisfaction with small scale biodigesters**

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.352a	0.124	0.113	0.34317
a. Predictors: (Constant), Implementation Monitoring, Stakeholder Involvement, Capacity building				

Table 30 shows the adjusted R square value=0.113 which suggests that 11.3% of the variation in satisfaction of households that installed biodigesters, is explained by the combined processes of capacity building, stakeholder involvement in strategic planning and implementation monitoring processes. The remaining percentage is contributed by other factors.

Table 31: Multiple Linear Regression coefficients between the processes of; Capacity building, stakeholder involvement, implementation monitoring process and household satisfaction with household biodigesters in Uganda

Coefficients(a)					
Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	1.551	0.345		4.498	0
Capacity building	0.393	0.109	0.276	3.608	0
Stakeholder Involvement	-0.049	0.101	-0.037	-0.487	0.626
Implementation Monitoring	0.194	0.066	0.191	2.931	0.004
a. Dependent Variable: Household satisfaction					

Table 31 shows that the Capacity building process and Implementation monitoring process were significant ($p<0.05$) while Stakeholder involvement in strategic planning was insignificant ($p>0.05$). The results indicate that both the Capacity building process ($p<0.05$) and Implementation monitoring process ($p<0.05$) significantly contributed to the number of households that were satisfied with their small scale biodigesters in Uganda. The results further indicate that even when the process of involving stakeholders in strategic planning and to promote the technology was combined with other variables including capacity building and Implementation monitoring process; it did not significantly contribute to the satisfaction households.

Table 31also shows that a unit investment in the Capacity building process and Implementation monitoring process contributes to the number of households satisfied with their biodigesters by 0.393 and 0.194 respectively. However, a unit investment in Stakeholder involvement in strategic planning and promotion contributed to the satisfaction of households by -0.049. For

example, by holding the Capacity building process and Implementation process constant, for every 1% investment in the process to involve stakeholders in strategic planning and to promote biogas, there was extremely very low contribution to household satisfaction by -0.049.

4.4.5 Testing hypothesis

The proposed hypotheses of the study were tested using the data that was generated. The aim was to find out the relationship between the independent variables that included; Capacity building process, Stakeholder involvement in strategic planning and promotion, Implementation monitoring and household satisfaction with the small scale biodigesters in Uganda as the dependent variable. The test was done objective by objective as follows;

The first objective of the study was 'to examine the relationship between the capacity building process and the number of households satisfied with the services of the biogas actors'.

The Null hypothesis was that 'there is a significant relationship between the Capacity building process and the number of households satisfied with the services of the biogas actors' where as the Alternative hypothesis was that 'there is no significant relationship between the Capacity building process and the number of households satisfied with the services of the biogas actors'. Results were determined by using the spearman's rank correlation coefficient at a 0.05 level of significance.

Table 32: Correlations of Capacity Building Process and Household satisfaction

Correlations				
			Capacity building	Household satisfaction
Spearman's rho	Capacity building	Correlation Coefficient	1	.295**
		Sig. (2-tailed)	.	0
		N	235	235
	Household satisfaction	Correlation Coefficient	.295**	1
		Sig. (2-tailed)	0	.
		N	235	235
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 32 shows that the spearman's rank correlation coefficient value of 0.295 at the level of significance of 0.00, at $p<0.05$ indicated that there was a very significant positive correlation between the Capacity building process and the number of households that were satisfied with their biodigester installations in Uganda. The Null hypothesis was therefore accepted and the alternative rejected.

The second objective was 'to examine the relationship between stakeholder involvement in the strategic planning process and the number of satisfied households'

The Null hypothesis was that 'there is a significant relationship between Stakeholder involvement in the Strategic Planning Process and the number of satisfied households 'where as the Alternative hypothesis was that 'there is no significant relationship between Stakeholder involvement in the Strategic Planning Process and the number of satisfied households'. Results were determined by using the spearman's rank correlation coefficient at 0.05 level of signifance.

Table 33: Correlations of Stakeholder Involvement in Strategic Planning Process and Household satisfaction

Correlations				
			Stakeholder Involvement	Household satisfaction
Spearman's rho	Stakeholder Involvement	Correlation Coefficient	1	0.049
		Sig. (2-tailed)	.	0.453
		N	235	235
	Household satisfaction	Correlation Coefficient	0.049	1
		Sig. (2-tailed)	0.453	.
		N	235	235

Table 33 shows that the spearman's rank correlation coefficient value of 0.049 at the level of significance of 0.453, at $p>0.05$ indicated that there was an insignificant positive correlation between the Stakeholder Involvement in strategic planning process and the number of

households that were satisfied with their biodigester installations. The Null hypothesis was therefore rejected and the alternative upheld.

The third objective was ‘to examine the relationship between the Implementation Monitoring Process and the number of households satisfied with their biodigesters.

The Null hypothesis was that ‘there is a significant relationship between the Implementation Monitoring Process and the number of households satisfied with their biodigesters’ where as the Alternative hypothesis was that ‘there is no significant relationship between the Implementation Monitoring Process and the number of households satisfied with their biodigesters’. Results were determined by using the spearman’s rank correlation coefficient at 0.05 level of signifance.

Table 34: Correlations of the Implementation monitoring process and Household satisfaction with the small scale biodigesters in Uganda

Correlations[a]				
			Implementation Monitoring	Household satisfaction
Spearman's rho	Implementation Monitoring	Correlation Coefficient	1	.256**
		Sig. (2-tailed)	.	0
	Household satisfaction	Correlation Coefficient	.256**	1
		Sig. (2-tailed)	0	.
**. Correlation is significant at the 0.01 level (2-tailed).				
a. Listwise N = 235				

Table 34 shows that the spearman’s rank correlation coefficient value of 0.256, at sign. 0.00, at $p<0.05$ indicated that there is a significant strong positive correlation between the Implementation Monitoring Process and the satisfaction of households. The Null hypothesis was therefore accepted and the alternative rejected.

4.4.6 Satisfaction of households that installed biodigesters in Uganda

The objective of the study was to examine the relationship between the Results Based Management and Household satisfaction in terms of their accessibility to cooking or lighting energy, affordability and reliability of biogas services.

Household satisfaction was defined in terms of the personal feeling and perceptions of the end users about the value for their money invested in biodigesters. The perceptions were viewed in terms of the availability of biogas energy for lighting at night, effects of cooking on biogas such as the increased comfort, costs and work load reduction and the agricultural benefits that accrue from bioslurry use. It also related to whether the service providers were readily accessible to respond to technical challenges, repair works, replacement of biogas appliances in situations where households had been confronted with challenges.

The views of the respondents were rated on a five point likert scale as; Strongly Disagree (SD)=1, Disagree (D)=2, Not sure (NS)=3, Agree (A)=4 and Strongly Agree (SA)=5. In the analysis of the results, ‘‘Strongly Agree and Agree’’ were taken to mean ‘Agree’ and ‘‘Strongly Disagree and Disagree’ were taken to mean ‘Disagree’ while the mean above three (>3) and less than one standard deviation (STD>1) of the mean meant Agreement with the statements and Mean below three (<3) meant Disagreement with the Statements. The findings are presented in Table.35

Table 35: Household respondents' views about the contribution of biodigesters in terms of energy for cooking or lighting and bioslurry for farming

Descriptive Statistics			
Household responses to indicators of satisfaction	N	Mean	Std. Deviation
1.Satisfied because we make use of cow dung to cook	235	4.1234	.59708
2.Satisfied because we save on time for cooking	235	3.6128	.96024
3.Satisfied because we save on expenditure on kerosene	235	4.1234	.59708
4.Satisfied because we save on time for collecting firewood	235	2.3149	1.03918
5.Satisfied because we save on expenditure on buying firewood/charcoal/LPG	235	4.1234	.59708
6.Satisfied because we can prepare a variety of dishes using biogas	235	3.7447	.83380
7.Satisfied because 3 meals can be prepared in a day using biogas	235	3.0255	1.14326
8.Satisfied because the size of the biogas burner is appropriate for the family size saucepans	235	2.2468	1.08542
9.Satisfied because we get bioslurry as organic fertiliser to apply in garden	235	3.7234	.94512
10.Satisfied because the biogas lamp can light at night for long duration of time	235	2.6511	1.13112
11.Satisfied because biogas appliances have never been faulty	235	1.4213	.49482
12.Satisfied because it is easy to access technical support in case of any challenge	235	1.9617	.88350

Table 35 shows that majority of the household respondents were satisfied with their biodigester installations as indicated by statements 1,2,3,5,6 and 9 as shown by the mean responses greater than three (>3) and standard deviation less than one (<1). This implied that respondents were satisfied because; they could make use of cow dung to cook as indicated by statement 1, could save on time for cooking (statement 2), could save on expenditure on kerosene (statement 3), could save on expenditure on buying firewood/charcoal/LPG (statement 5), could prepare a variety of dishes using biogas (statement 6) and also because of the benefits of bioslurry as organic fertiliser which they applied in garden (statement 9).

However, some of the respondents were dissatisfied as indicated by statements 4,7,8,10,11 and 12 as shown by the mean responses with less than three (<3) and standard deviation greater than one (>1). This implied that some respondents were still reliant on firewood for cooking as

indicated by statement 4, could hardly prepare three (3) meals in a day using biogas (statement 7), others had small sized biogas burners inappropriate for their family size saucepans (statement 8), the biogas lamps were insufficient and could not provide satisfactory light at night for long duration of time for some households (statement 10). In addition, some households disclosed that their biogas appliances were non-functional according to statement 11. Others, expressed dissatisfaction because they could hardly access technical support in instances when they got challenges as indicated by responses to statement 12. Based on the responses, promoters affirmed that households never got quick response to technical challenges whenever they reported these faulty biodigesters to masons who installed them.

On the other hand, from the impromptu field investigations that were made at the biodigester sites; there was glaring evidence that some biodigesters were irregularly replenished, particularly for many of the business people and elderly people who were dependent on hired laborers. This was evidenced particularly in greater Mbarara, Rukungiri and Ntungamo. It was evident that some households lacked access to portable water in their vicinity. Based on in-depth investigations; 53 percent of these households (124 households) sourced water from distant shallow wells and streams using either family or hired labour.

About only 15% of the households (36 households) had proximity to piped water supplied by the National water and sewage cooperation in an estimated distance of less than 500 metres to their biodigesters and only 32 percent (75 households) had water reservoir tanks installed in a distance of 500 -1000 metres. This implied that although households knew how to replenish their biodigesters, some of them had challenges to access the water for mixing dung.

Key Informants affirmed that quality control and after sales processes compromised the expectations of some households and one Key Informant had the following to say;

Key Informant 1:

Some households use their biogas sparingly mainly for lighter foods in order to save some biogas for lighting at night. This is a common habit that has been adopted by especially households that installed biodigesters with small capacity. They do not prepare meals like beans but rather use biogas for preparing any other fast cooking foods; sauce, evening tea, matooke, rice and water for milking or bathing.

CHAPTER FIVE:

SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The objective of the study was to examine the relationship between the Results Based Management and Household satisfaction in terms of their accessibility to cooking or lighting energy, affordability and reliability of biogas services. The findings revealed that Results Based Management has a significant relationship with the satisfaction of households that installed biodigesters in Uganda. This chapter, therefore, summarises the findings, discussion, and conclusion and makes recommendations to the study.

5.2 Summary of the study findings

This section presents key findings regarding respondents' perception about the contribution of the processes that were involved in Capacity building, Stakeholder Involvement in strategic planning and Implementation Monitoring to household satisfaction. The main purpose of the study was to establish whether households that installed biodigesters were satisfied as a result of services offered by the different actors.

Both quantitative and qualitative methods were employed to collect data. Quantitative data was collected using Close ended questionnaires designed for 235 Households as well as biogas promoters (70) and masons (31) for purposes of triangulation. The data was statistically analysed using SPSS and results presented in descriptive tables to show frequencies, percentages, mean and standard deviation for each objective. The findings were further subjected to Spearman's rank correlation coefficient and Regression analysis and the results were also presented in tables. Qualitative data was obtained by structured Observation Checklists for 235 households and conducting Interviews to key informants (14).

It was systematically organised under themes and analysed for content. The major findings are presented objective by objective in the subsections below.

5.2.1 Capacity building process and the number of households satisfied with the services of the biogas actors

The first objective of the study was to examine the relationship between capacity building process and the number of households satisfied with biogas services. The findings revealed that Capacity building process had a very significant positive relationship with the number of households that were satisfied with both the services and their biodigester installations in Uganda.

This was supported by descriptive and inferential statistics, results of interviews from key informants and observations made at the households using checklists. For example using descriptive statistics; household respondents indicated that the process of biogas awareness creation was satisfactory, because biogas sensitisation trainings as well as exposure visits to functioning biodigesters effectively induced them to install biodigesters. Similarly, the biogas promoters, masons, key informants shared the same opinion and this was further confirmed based on the field observations. Furthermore, the empowerment process was equally adored as revealed by household respondents and the biogas promoters because; the programme provided subsidies to resource constrained households, provided incentives to promoters, masons and the requisite skills to ensure that households could operate and maintain their biodigesters.

However, the study revealed that the empowerment process was compromised by the ineffective promotional strategies such as, Radio programs and brochures. These were said to be ineffective for awareness creation because of differences in preference for the Radio stations and low reading culture. Furthermore, the process was compromised by an ineffective motivational strategy. Biogas promoters and masons disclosed that incentives such as promotional fees,

masons fees and biodigester siting fees were always delayed which compromised grass root networks.

The process of continuously training masons on the job was also compromised because of lack of supervision during the critical control stages of installation of their biodigesters as disclosed by the household respondents and promoters. Some Key Informants even indicated that some BCEs lacked enough competent masons because some trainee masons had dropped out due to lack of confidence.

Additionally**,** the process of acquiring biogas loans compromised the capacity building process. Household respondents indicated that the initial investment costs were high yet they were unable to access credit from Micro Finance Institutions to finance biodigester installations due to high interest rates.

Results from inferential statistics also support the findings that the Capacity building process has a positive strong correlation with the satisfaction of households as shown by the value of spearman's rank correlation coefficient of 0.295 at a level of significance $p<0.05$. This suggests that a unit investment in the Capacity building process increases household satisfaction by 0.295. This was further revealed by multiple linear regression which showed that the Capacity building process ($p=0$) was very significant when measured at a significance level $p<0.05$. This meant that when the capacity building process was combined with other processes such as Stakeholder involvement in strategic planning and Implementation monitoring processes, it significantly contributed to the satisfaction of households that installed biodigesters in Uganda.

Finally, the study upheld the Null hypothesis which stated that 'there is a significant relationship between the capacity building process and the number of households satisfied with the services of the biogas actors.

5.2.2 Stakeholder Involvement in Strategic planning and Household satisfaction

The second objective of the study was 'to examine the relationship between Stakeholder Involvement in the Strategic Planning Process and the number of satisfied households'.

The findings revealed that Stakeholder Involvement in Strategic Planning Process had insignificant contribution to the satisfaction of households that installed biodigesters in Uganda. This was supported by descriptive and inferential statistics, interviews with key informants and observations made in the field.

For example using descriptive statistics, household respondents indicated that biogas sector players were not committed to their core business even though; subsidy materials were delivered in time, biodigesters were completed in anticipated time, trainings on operations, maintenance and bioslurry utilisations were done on time. The study revealed that the process of biodigester installation was compromised as evidenced by; poor response times by masons to do the siting and subsequent installation of biodigesters for households that expressed interest. The quality control process was also compromised by stakeholders as evidenced by poor response times by the biogas supervisors which compromised timely inspection of construction works done by masons.

In light of the findings from field observations, after sales services and customer care services were equally compromised; because masons exhibited poor response time to address technical challenges. For instance, 6% of the households (13 biodigesters) had malfunctional biogas appliances because they were un able to access masons and spares from Appliance fabricators for replacement, while 4.5% of the households had non-functional biodigesters because they had never got masons to do trouble shooting despite lodging complaints to masons several months. 4% of the households (10 biodigesters) out of those that had been sampled, cited aggravated leakage of the digester domes (airtight chamber), and therefore had completely abandoned their biodigesters.

Similarly, MFIs exhibited low commitment to provide core functions as indicated by the masons, key informants and biogas promoters. Biogas promoters revealed further that there was poor response by MFIs to process loans. On the other hand, a number of Key Informants disclosed several Institutional constraints notably; the Board of Directors governing most MFIs were non-committal to approve, let alone promote the biogas loan products as one of their priorities. Besides, most MFIs never got revolving funds from Government as stipulated in the renewable energy policy (MEMD, 2007);to support the BCEs and potential biogas users. Many people lacked income security and therefore could not access reasonable loan amounts because their banana and coffee plantations had been affected by wilt. Others had low milk sales given the fact that they had few numbers of indigenous cattle to warrant loan acquisition.

Results from inferential statistics also support the findings that the process of involving stakeholders in strategic planning and to promote biogas; had an insignificant correlation with number of satisfied households as shown by spearman's rank correlation coefficient value of 0.049 at $p>0.05$. This suggests that a unit investment in the processes to involve the various stakeholders in the strategic planning and to promote the technology only contributed to household satisfaction by 0.049.This was further revealed by multiple linear regression which showed that the Stakeholder involvement in strategic planning process was insignificant ($p>0.05$). The results further indicate that even when the process of involving stakeholders in strategic planning and to promote the technology was combined with other variables including capacity building and Implementation monitoring process; it did not significantly contribute to the satisfaction of households.

Finally, the study rejected the Null hypothesis which stated that 'there is a significant relationship between stakeholder involvement in the strategic planning process and the number of satisfied households.

5.2.3 Implementation Monitoring process and Household satisfaction with the small scale biodigesters in Uganda

The third objective was to examine the relationship between the implementation monitoring process and the number of households satisfied with their biodigesters. This process mainly looked at whether there was effective quality control and after sales services extended to the households that installed biodigesters. Therefore the focus was to discern perceptions held by the household respondents in terms of whether their biodigesters were installed according to the specifications of the design or quality of conformance to meet household energy requirements for cooking, lighting and or bioslurry utilisation.

This was supported by descriptive and inferential statistics, interviews with key informants and observations made in the field. For example using descriptive statistics, majority of the household respondents felt that masons had installed biodigesters according to the specification of the design because; majority of the household respondents (88.1%) believed that their biodigesters were suitably sited in relation to accessibility to cow dung, 90.7% believed that the quality of construction materials was good since masons had been technically consulted and engaged in procurement (refer to frequency table in Appendix X1). On the other hand with respect to conformance; 84.8 % of the household respondents acknowledged that the size of their biodigesters or the biogas retention capacity had significantly contributed to their household energy needs.

However, the study findings indicate further that irrespective of the household views**;** the process of quality control was compromised because majority of the biodigesters (91.9%) installed by the Masons were never supervised during the critical control stages of installation. Equally, the process of after sales service was compromised because 93.5% of the biodigesters had never been followed up by the respective masons for purposes of good customer care

practice. Based on the evidence from field observations, 97.5 of the household biodigesters never got their mandatory second after sales service yet at least 14.5% of the biodigesters had been either replastered or reconstructed (Appendix X1).

Based on the in-situ field observations, it was evident that the quality control process had been grossly compromised given that 64.5% of the biodigesters had man-hole slabs that could not fit the standard measurements and yet exhibited poor finishing. Although, it could not be easily established whether the air tight digester chambers had similar measurement errors and defects, the poor workmanship on some biodigesters hinted darkly to the possibility of biodigester malfunctionality as a result of technical challenges. As pointed out by Buren (1979), biodigester installations should meet the technical specifications because any slackening in attention to quality will always interfere with normal gas production

In the same vein, it was evident that some biodigesters did not meet the household energy requirements. It was observed that irrespective of the installed capacity, most biodigesters did not satisfy all the household cooking and lighting energy needs since 11.5% of households were evidently found using firewood to supplement biogas use and about 42% of the households relied on other alternative sources of energy for lighting (refer to table 14)

Results from inferential statistics also support the findings that the Implementation monitoring process has a significant strong positive correlation with the satisfaction of households as shown by the spearman's rank correlation coefficient value of 0.256 at $p<0.05$. This suggests that a unit investment in Implementation monitoring process contributed to household satisfaction by 0.256.

This was further revealed by multiple linear regression which showed that the Implementation monitoring process ($p=0.004$) was very significant when measured at a significance level $p<0.05$. This meant that when the Implementation monitoring process was combined with other

process such as Stakeholder involvement in strategic planning and Capacity building processes, it significantly contributed to the satisfaction of households that installed biodigesters in Uganda.

Finally, the study upheld the Null hypothesis which stated that 'there is a significant relationship between the implementation monitoring process and the number of households satisfied with their biodigesters'.

5.3 Discussion of findings

5.3.1 The relationship between Results Based Management and Household satisfaction with small scale biodigesters in Uganda

The objective of the study was to examine the relationship between the Results Based Management and Household satisfaction in terms of their accessibility to cooking and lighting energy, affordability and reliability of biogas services.

5.3.1 Capacity building process and Household satisfaction with the small scale biodigesters

The first objective of the study was to examine the relationship between capacity building process and the number of households that were satisfied with biogas services. Data analysis and interpretation of responses from household respondents, biogas promoters, masons, key informants as well as field observations revealed the following major findings under this objective.

The study revealed that the Capacity building plan was good as evidenced by UDBP Programme's array of grass root infrastructural network that consisted of biogas actors and Institutions such as Biogas Construction Enterprises and Implementing Partners that coordinated the implementation. This was a major breakthrough for the biogas sector considering the fact

that, this was historically one of the biggest challenges of implementing biogas programmes across the entire African continent since the 1950s (Bansenah and Abeeku, 2010; Barnes & Willem, 1996; Bond and Templeton, 2011; Njoroge, 2002;Martinot et al, 2002;Pandey et al, 2007;Tumwesigye, 2011).

However in view of the findings, the Capacity building implementation mechanism was grossly compromised because of lack of harmonisation between stakeholder interests and the desired results. The findings revealed that even though, there were significant in-roads in terms of awareness creation, empowerment of biogas actors with technical knowledge and provision of subsidy; recipient households were not empowered with credit facilities to compliment the subsidy. In addition, some biogas promoters and masons were not adequately supervised in order to enhance their skills and confidence which compromised the functionality of some of the household biodigesters.

The study on the other hand revealed that through the capacity building process, there was a significant percentage of the households (94%) that improved in terms of knowledge and skills; to replenish, operate and maintain their biodigesters as well as utilise bioslurry as an organic fertiliser (Appendix X1). It was a major breakthrough considering the impeccable evidence from both; the biogas feasibility study (Pandey et al, 2007) and the biogas user survey (Kahubire, Byaruhanga &Shariff, 2010) that indicated a skills gap amongst biogas users.

The acquired knowledge or skills however, did not translate into 100 percent reduction in terms of the dependency on non-renewable energy sources like fuel wood, kerosene for all the households. Based on the field observations, some biodigesters were not regularly replenished because some farmers, who grazed cattle, found it laborious to collect dung. In spite of exposure visits to model farmers, some households failed to utilise bioslurry on a large scale as an organic

fertiliser for commercial farming because it was equally labour intensive. This scenario seems to support earlier views that were made by Malinga (2008); who recognised that capacity building interventions in programme implementation required holistic innovative approaches in order to counteract the possibility of other impeding factors.

Based on the findings, it was evident that the capacity building strategy fell short of sufficient motivational factors to translate the acquired knowledge and skills into the desired number of targeted households with biodigester installations. This was attributed to prioritisation in funding for instance; there was inadequate funding of trainings and exhibitions; inadequate distribution of promotional materials despite an enormous grass root network of promoters; inadequate Radio programmes and yet they were mainly aired on specific Radio stations which limited achievement of targeted households because different people had different Radio preferences. This implies that there was still an existent gap in awareness creation. Therefore, as pointed out by Sahley, (1995) as cited in (Malinga, 2008), capacity building interventions can only contribute to desired results if they encompass; core funding, management advice and information flow.

On the other hand, the study revealed that, although the use of grass root promoters and Institutions appeared to be the most cost effective strategy adopted by the Programme to bridge the wide gap in dissemination of the technology (UDBP Annual reports 2010/13). This strategy did not translate into the desired numbers of biodigester installations because biogas actors as well as potential households lacked motivational factors. Households could not access affordable biogas loans from MFIs because of the high interest rates and the BCEs could not afford the loans from MFIs either, in order to pre-finance outputs. The perpetual delays in payment of production incentives such as promotional fee, masons' fees, BCE fees and

supervisors' fees, compromised the Results Based Financing mechanism (RBF) as a motivational strategy.

These findings were on the other hand, in agreement with the critical observations by Wakey, (2004) as cited in (Malinga, 2008); who emphasised that Capacity building should be much more than simply training and human resource development. Malinga (2008), in his study about Capacity building also observed that capacity building is a broad phenomenon that should be geared towards; 'empowerment', 'enabling', 'partnership' and 'support' to the stakeholders.
Similarly, Scholl, (2002) in relation to Vroom's expectancy theory made critical observations that; for a person to be effectively motivated, that individual needs to have self-efficacy or personal conviction that their personal expenditure of effort will result in an acceptable level of performance.

Therefore for stakeholders to believe that they can perform the Job successfully, individuals selected should not only have been trained to have the required knowledge and skills or job requirements clarified. They should equally be provided with the correct resources, mentored and coached continuously to build their confidence to get the job done (Lunenburg, 2011; Redmond, 2010; Stecher & Rosse, 2007). All these requirements constitute a Capacity building process that should be continuously provided in order to enhance household satisfaction. This particularly applies to the masons and biogas promoters because they were obliged to put in a lot of effort and resources to look for potential households to install biodigesters.

5.3.3 Stakeholder Involvement in Strategic Planning process and Household satisfaction with the small scale biodigesters

The second objective of the study was 'to examine the relationship between Stakeholder Involvement in the Strategic Planning Process and the number of satisfied households'. Data analysis and interpretation of responses from household respondents, biogas promoters, masons,

key informants as well as field observations revealed the following major findings under this objective.

The study revealed that UDBP Programme recorded the highest number ever in Uganda; of skilled biogas promoters, masons, Appliance Fabricators and Institutions (Pandey et al, 2007) that were empowered to create awareness and provide biogas services to the households in rural and peri-urban settings in a bid to demystify some of the negative perceptions related to adoption of the technology. However the general perception of the households was that the biogas actors were inconspicuous and thinly spread. Therefore; accessibility to technical services, biogas appliances and biogas loans largely remained a constraint.

According to the findings of the study, it was because the results chain or grass roots network was not sustainable since the biogas actors were largely dependent on external support in form of incentives. The grass root infrastructure consisted of; biogas promoters, masons, material suppliers, Biogas Construction Enterprises, Implementing Partners and Financial Institutions. Based on the findings, it was evident that many BCEs, promoters and masons entirely relied on the Programme's production incentives in order to sustain their core business. They lacked capacity to pre-finance some of the outputs to enable timely accomplishment of their targets so that then, they could get re-imbursement later.

The findings therefore, implied that even when the Programme invested heavily in strategic planning meetings the return on investment was low because; many biogas actors lacked ownership of the Programme and were unable to honor their commitment towards achievement of the Programme goal. Furthermore, the study revealed that lack of commitment was as a result of; delayed payments of incentives, lack of tailor-made business trainings to enhance the inherent capacity of the emerging BCEs, lack of motivation to mobilise their own financial

capacity and generally low business acumen to provide readily accessible biogas services in a business model.

The findings on the other hand, contradicted what had been anticipated according to the UDBP Plan Implementation Document (2009) as well as the Renewable Energy Policy of Uganda (MEMD, 2007). This was largely because the Government of Uganda, un like other countries under ABBP framework; exhibited little commitment to capitalise the Financial Institutions at affordable lending rates so that in turn, they would provide affordable biogas financing scheme to the BCEs as well as potential households (biogas users) to avoid gapsalong the results chain.

The findings also revealed that majority of the households that installed biodigesters were scattered across the region. The cost implication of providing technical services to those who had installed biodigesters was high and this seems to explain the poor response times exhibited by the actors to the households that would be in need of technical services. Based on the findings (Table. 10), majority of these households (70.6%) were mainly dependant on farming with low average monthly income estimated at UGX, 250,000 (UBOS, 2012).

Therefore many financially constrained households were left out without immediate financing options to cushion them amidst the ever declining subsidy contribution by the programme and this partly explains why they were scattered.In the face of lack of commitment that was exhibited by various stakeholders, it was not likely that the targeted number of satisfied households could be achieved. The above argument is supported by Vroom's theory of 1964 concerning motivation and work.

Chen and Fang, (2008) and Lawler, Porter & Vroom, (2009) as cited in (Redmond, 2010) made critical observations in relation to Vroom's expectancy theory that; individuals can only make

choices that maximise pleasure and minimise pain or frustration. In the context of the study it implies that, un less households were able to readily access affordable and satisfactory services; it would be hard to have an exponential increase in the number of potential households motivated to demand for the same biogas services from the sector players.

In an equal measure, biogas actors can only commit their resources to deliver satisfactory results as long as they are sure of getting results and therefore incentives, otherwise they will always be indifferent. The results based financing model as a measure of accountability for results and to help overcome what is known as activity trap (Binnendijk, 2001; UNESCO, 2008) could therefore not help to make any head way as long as the number of households accessing loans and finally installing biodigesters was low.

5.3.4 Implementation monitoring process and Household satisfaction with the small scale biodigesters

The third objective was to examine the relationship between the implementation monitoring process and the number of households satisfied with their biodigesters. Data analysis and interpretation of responses from household respondents, biogas promoters, masons, key informants as well as field observations revealed the following major findings under this objective.

The study revealed that the first phase of implementation of UDBP programme, recorded the lowest percentage of biodigester malfunctionality ever, in Uganda at 14.5% compared to 30% under previous programmes as indicated in the biogas feasibility study (Pandey et al, 2007). However, when compared to the 3% reported in 2010 in the Biogas Socio-economic and Gender Baseline survey (Kahubire, Byaruhanga &Shariff, 2010), it postulates a hypothetical upward trend or increase in the cases of malfunctionality. Based on the findings, malfunctionality was

largely due to poor conformance to the design specifications because of inadequate quality control.

However, the inability to conduct the mandatory after sales services appeared to be most pathetic threat. The customer care was inadequate characterised by lack of follow up and poor response times to technical complaints reported by households. The inadequacy of quality control measures and management system have been found to compromise the performance of biodigesters in many African Countries (Bansenah and Abeeku, 2010; Bond and Templeton, 2011; Njoroge, 2002; Tumwesigye, 2011) and therefore affect household satisfaction.

The study also revealed that some households still incurred some minimal costs on energy requirements even after installation of the biodigesters, as evidenced by those who were found cooking on firewood and using other alternative sources of energy for lighting. This implied that some of the biodigesters did not conform to quality expectations of the households in terms provision of adequate energy for cooking and lighting. This was attributed to; the inadequate after sales services, lack of financial resources to install appropriate biodigester sizes, but also inaccessibility to cow dung, water and labour within the household vicinity. All these factors appeared to have prejudiced some households to install 6 cubic meter biodigesters, of relatively small gas volume retention capacity yet majority of the households (50.2%) had large family sizes above the recommended ideal number of 6 household members (GTZ, 1997; SNV, 2013; Loic, 2013).

The findings therefore contradicted what had been postulated in the UDBP socio-economic baseline survey (Kahubire et al, 2010) where it had been anticipated that households would derive 80% of their domestic energy requirements from biodigesters to save on cooking time and expenditure on fire wood since biogas is believed to be a better renewable energy option (Pandey et al, 2007; Karthik et al, 2012; Neves et al, 2009).

As pointed out by Montgomery, (1996) as cited in (Hayes, 2008); in order to have good quality services or products, processes should be geared to ensure that they meet the requirements and expectations of the people who use them.

Similarly, the above view is supported by critical observations regarding motivation that were made by Gerhart et al, (1995) and Redmond, (2010) in light of Vroom's Theory. They observed that the value a person places on an expected outcome or reward (referred to as Valence) is directly related to his/her needs, goals and values or preferences. Therefore in the context of the study, un less the biodigesters enabled households to reduce on expenditure on fuel wood, kerosene or save on cooking time, the drudgery of looking for firewood, potential biogas users would never appreciate the value for money invested by their peers in the biodigester installations.

This argument is further supported by evidence got from studies done in countries like Ghana (Bansenah and Abeeku, 2010), Burundi, Ivory Coast, Tanzania according to Omer and Fadalla, (2003) as cited in (Mshandate and Parawira, 2009), where poor quality services had cost implications and significant negative perceptions about the uptake of the technology. Implementation monitoring is therefore very critical to ensure timely feedback and corrective measures to enable client satisfaction (Barnes and Willem, 1996; Kafeero; 2010; Komujuni, 2014; Kusek et al, 2004 and Nsamba, 2013).

5.4 Conclusions

The study examined the relationship between implementing the biogas programme using Results Based Management as a strategy and the number of households that were satisfied with their small scale biodigesters in Uganda. This was in relation to anecdotal evidence from HI/UDBP Annual reports for 2009-2013 which revealed that the targeted number of households

with biodigester installations was never achieved and even then, some of them had malfunctional biodigesters.

5.4.1 Capacity building process and Household satisfaction with the small scale biodigesters

The first objective sought to examine the relationship between the capacity building process and the number of households that were satisfied with the services of the biogas actors. The study concluded that;

I. The Programme's Capacity building design was good since the Programme managed to subsidise biodigester installations and in addition, established the relevant skilled biogas actors that were meant to impart knowledge and skills to the beneficiary households.

II. Generally, Capacity building process significantly contributed to the satisfaction of households that installed biodigesters in Uganda. This is evidenced by the value of spearman's rank correlation coefficient of 0.295 at a level of significance $p<0.05$. The multiple linear regression further confirmed that the Capacity building process ($p=0$) was very significant when measured at a significance level $p<0.05$. This meant that when combined with other process such as Stakeholder involvement in strategic planning and Implementation monitoring processes, it contributed to household satisfaction.

III. However, the Capacity building implementation mechanism was compromised and therefore impaired Programme efficiency and effectiveness because;

IV. Strategic measures to enhance social inclusion and equity for the resource constrained households were not sustained and therefore targeted numbers could not be achieved.

V. Households could not access affordable biogas services readily. Besides, the Government and Financial Institutions did not make significant contributions to the fiscal infrastructure and therefore a number of financially constrained households opted

to install small gas volume biodigester that could not support all their household energy needs.

5.4.2 Stakeholder Involvement in strategic planning process and Household satisfaction with the small scale biodigesters

The second objective specifically sought to examine the relationship between stakeholder involvement in the strategic planning process and the number of satisfied households in Uganda. The study concluded that:

I. Stakeholder Involvement in Strategic Planning process did not contribute satisfactory results to programme implementation and therefore compromised the efficiency and effectiveness of the programme because;

II. Household needs and therefore programme goals were not sufficiently addressed by the stakeholders that were involved. Various Stakeholders were engaged but there was a prolonged learning curve to harmonise the programme goals with the stakeholder interests or expectations.

III. The environment did not favour the biogas actors and Institutions to operate a business model because of low economies of scale and therefore sustainability remained a big challenge to reckon with.

IV. The biogas actors exhibited low commitment and therefore poor accountability for the programme resources invested in terms of time, funds for capacity building, stakeholder workshops and follow up meetings.

V. In light of the spearman's rank correlation coefficient value of 0.049 at $p>0.05$, it was evident that Stakeholder Involvement in the Strategic Planning process and to promote biogas technology did not significantly contribute to the satisfaction of households that installed biodigesters.

VI. Results of the multiple linear regression confirmed further that Stakeholder involvement in strategic planning process was insignificant ($p>0.05$). The results indicated that; even when combined with other variables including capacity building and Implementation monitoring process; it did not significantly contribute to the satisfaction households.

5.4.3 Implementation monitoring process and Household satisfaction with the small scale biodigesters

The third objective specifically sought to examine the relationship between Implementation monitoring process and household satisfaction. The study concluded that;

I. The Implementation monitoring process contributed to household satisfaction because the Carmatec model (biodigesters design) promoted by the programme was easy to maintain due to availability of cow dung, durable and relatively cheaper in the long run compared to other designs. In addition, trained masons were available to install according to design specifications.

II. Despite the high initial investment costs, the design required less construction materials compared to other designs and yet the materials were locally available except in some places.

III. Therefore the Implementation monitoring process contributed to the satisfaction of households as shown by the spearman's rank correlation coefficient value of 0.256 at $p<0.05$. The multiple linear regression confirmed further that the Implementation monitoring process ($p=0.004$) was very significant when measured at a significance level $p<0.05$. This meant that when the Implementation monitoring process was combined with the other process, it significantly contributed to the satisfaction of households that installed biodigesters in Uganda.

IV. Nevertheless, some biodigesters did not conform to quality expectations of the households given the fact that they produced insufficient energy for cooking and lighting contrary to their installed capacity. Therefore some households continued to incur some costs to supplement the energy requirements.

V. Quality control and after sales processes were compromised as a result of lack of programme ownership by biogas actors and inadequate devolution of management authority to enforce accountability along the results chain.

VI. Therefore, this affected the efficiency of programme implementation and in the long run, it is likely to have significant impact on the subsequent phase in terms of high reparation costs for faulty plants and to cleanse the programme image in areas where households reported malfunctional biodigesters and yet were not repaired.

5.5 Recommendations

In order to improve on the efficiency, effectives and make the biogas actors accountable in any subsequent biogas programme. They will need to be supported in the following ways;

5.5.1 Capacity building process and Household satisfaction

Basing on the findings in Chapter four, just like any Small and Medium Enterprises; there is need to nurture and strengthen the internal capacity of the upcoming biogas Institutions and biogas actors by the Government and Non-Government Organisations through;

I. Financing trainings in tailor made courses such as ; Biogas business management, Business planning, Promotion and marketing, Customer care, Resources mobilization and Financial management

II. Supporting the development of systems e.g. records management, financing and distribution of update manuals/ guidelines that suit the changing environment

III. Financing BCEs and biogas Associations to foster administrative structures through a cost-sharing arrangement to enable them have regular internal meetings and interface with their grass root promoters

IV. Providing BCEs with financial support in order to brand and increase their visibility through established offices/ market outlets in remote areas where there are potential clients

V. Financing the Development of business models to show the commercial viability of biogas to the private actors for instance Financial Institutions

VI. Financing the biogas actors on awareness creation through the media (Radio/TV talk shows, Exhibitions, spot messages, SMS etc.)

VII. Strengthening mechanisms that ensure a follow up on potential clients after sensitisation trainings for instance by documenting clients and scheduling regular follow up calls.

5.5.2 Stakeholder Involvement process and Household satisfaction

Basing on the findings in Chapter four, there was need to support the households by addressing the following critical areas;

I. Strengthening Agricultural extension component to market biogas technology by ensuring that households that install biodigesters make use of the bioslurry effluent as an organic fertiliser to improve on their household incomes.

II. Linking households to low cost and labour saving technologies like the locally fabricated dung mixers and rain water harvesting tanks in order to ensure routine replenishment of biodigesters

III. Linking the remotest biogas households to Appliance Fabricators to ensure accessibility and a constant supply chain of appliances through promoters, masons and extensionists

There is also a critical need to develop, strengthen strategic partnerships and collaborative linkages for promotion, marketing and funding construction of the biogas technology by;

I. Engaging Government through the Ministry of Energy and mineral development (MEMD) to pay special attention to private sector development; to ensure that it provided the missing credit as mandated by the Renewable Energy Policy of 2007.
II. MEMD should persue the 'clean start programme' funded by the Unitted Nations Capital Development Fund (UNCDF) and the Unitted Nations Development Programme in order to link poor households and micro-entrepreneurs to reliable, low-cost clean energy supplies through micro-finance.
III. MEMD and donors should provide financial support to rural based biogas associations to establish governance structures and to build management systems to enable them monitor the activities of the Biogas Construction for purposes of sustainability
IV. Biogas actors should engage in collaborative partnership with Institutions that support environmental conservation or with a growing concern for green energy to lobby for support in form of subsidy

5.5.3 Implementation monitoring process and Household satisfaction

In order to manage quality, the following measures have been recommended;

I. There is need to establish a biogas standards unit through the MEMD, to leverage on quality of services produced by the Biogas Construction Enterprises (BCEs) through periodic quality checks, on-site coaching and retraining of the new masons that have perpetually not measured up to the standards.
II. Institute accountability measures along the result chain but provide timely incentives
III. Adopt persuasive promotion and marketing strategy by supporting BCEs/IPs to commission functional plants in new areas or where the damage had been created.

IV. Share programme changes regularly with the satisfied biogas beneficiaries and adopt them as promoters to be able to get potential clients in remote areas in order to achieve targeted numbers cost effectively.

5.6 Limitations of the study

The following are some of the limitations that were encountered by the researcher and their effects mitigated.

I. Majority of the districts did not have reasonable sample space to allow selection of un biased and most importantly, a representative sample of the total population in Uganda by probability sampling procedures and therefore sample had to be got from 4 districts.

II. The region had varied agro-ecological zone and therefore due consideration had to be taken into consideration while selecting the sample

III. The household respondents were scattered in nature; therefore it increased on the man-days and it was costly in terms of facilitating the Research Assistants

IV. The low literacy level necessitated engagement of translators and in order to have reasonable response rates, the questionnaires had to be physically delivered to respondents

V. Fixing and harmonising appointments with household respondents was a challenge due to poor network in some places.

VI. The study did not look at the other Socio-economic benefits or factors of biodigesters such as improvement in sanitation, improvement in indoor air pollution or reduction in deforestation rates because of limited time and resources.

VII. The study did not also delve deeper into the contribution of biodigesters to Gender related issues such as the impact on work load reduction for women and children because of time factor.

VIII. There was no sufficient time to trouble shoot the biodigesters especially the ones household respondents claimed to have been malfunctional to establish the extent of impact as a result of technical inadequacy.

5.7 Contribution to the study

The research contributed to the body of knowledge about the Results Based Management as a strategy in implementation of energy programmes in light of the local socio-economic conditions in Uganda. Substantial information was captured to highlight the success and challenges in the Biogas sub-sector, as one of the renewable energy components. The study brought to limelight; the contribution of the Heifer International/Uganda Domestic Biogas Programme to the energy mix in Uganda between the period 2010-2014 in light of the donor support from the Netherlands Government and Technical backstopping by HIVOs and SNV.

The context of the study also contributed to the practical applicability in relation to Vroom's Expectancy Theory of 1964 as cited in (Redmond, 2010) .Vroom's Expectancy Theory ('VEI) is about motivation since it assumes that individuals have different sets of goals that need to be taken care of through motivation in order to deliver desired results and that in order to orient them to deliver desired results, they must be motivated. Their motivational force is explained by Valence, Instrumentality and Expectancy as key components (Redmond, 2010; Lunenburg, 2011). This knowledge is expected to provide an insight about the risk factors that need to be cushioned against when implementing programmes using Results Based Management approach and therefore, it will be reference material to Heifer International, the Government, Academicians and other development partners.

5.8 Areas recommended for future research

There is need to make an assessment of potential risks involved in credit provision of biogas services in Uganda , the contribution of biodigesters to poverty alleviation in Uganda, reduction in deforestation rates and the disease burden associated with indoor pollution.

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APPENDIX 1

DETERMINING SAMPLE SIZE USING A TABLE ADOPTED FROM KREJCIE,R.V AND MORGAN, D.W (1970)

TABLE FOR	Sample size	Population size	Sample size	Population size	Sample size
10	10	**220**	140	**1200**	291
15	14	**230**	144	**1300**	297
20	19	**240**	148	**1400**	302
25	24	**250**	152	**1500**	306
30	28	**260**	155	**1600**	310
35	32	**270**	159	**1700**	313
40	36	**280**	162	**1800**	317
45	40	**290**	165	**1900**	320
50	44	**300**	169	**2000**	322
55	48	**320**	175	**2200**	327
60	52	**340**	181	**2400**	331
65	56	**360**	186	**2600**	335
70	59	**380**	191	**2800**	338
75	63	**400**	196	**3000**	341
80	66	**420**	201	**3500**	346
85	70	**440**	205	**4000**	351
90	73	**460**	210	**4500**	354
95	76	**480**	214	**5000**	357
100	80	**500**	217	**6000**	361
110	86	**550**	226	**7000**	364
120	92	**600**	234	**8000**	367

130	97	**650**	242	**9000**	368
140	103	**700**	248	**10,000**	370
150	108	**750**	254	**15000**	375
160	113	**800**	260	**20,000**	377
170	118	**850**	265	**30,000**	379
180	123	**900**	269	**40,000**	380
190	127	**950**	274	**50,000**	381
200	132	**1000**	278	**75000**	382
210	136	**1100**	285	**10,000**	384

Adopted from Krejcie, R.V., and Morgan, D.W. (1970). Determining Sample Size for Research Activities. Educational and Psychological Measurement, 30, 607-610.

APPENDIX II

SURVEY QUESTIONNAIRE FOR BIOGAS HOUSEHOLDS (END USERS)

RESULTS BASED MANAGEMENT AND HOUSEHOLD SATISFACTION BY SMALL SCALE BIODIGESTERS IN UGANDA: A CASE OF HEIFER INTERNATIONAL/ UGANDA DOMESTIC BIOGAS PROGRAMME IN WESTERN REGION

Preamble

A study is being undertaken to understand how the stakeholders of the Heifer International/Uganda Domestic Biogas Programme implemented their functions during the first phase. The interest is to find out whether the sector players met their targets, whether the services by the sector players were readily accessible, affordable, reliable and whether this had a significant relationship to achievement of targeted numbers of functional biogas installations and as well numbers of satisfied clients.You have been chosen to participate in the study as one of the key stakeholders and we hope the findings will provide lessons to programme implementation of the subsequent phase.

I George Asiimwe, a student of Uganda Management Institute, therefore do promise that your answers will be strictly used for Academic purposes and shall be treated with the utmost confidentiality it deserves.

PART I: QUESTIONNAIRE IDENTIFICATION

Section 1.1 GENERAL INFORMATION

1. INTERVIEWEE NUMBER:……
2. DISTRICT:……
3. SUBCOUNTY:…….
4. VILLAGE:…….

PART 2: SOCIO ECONOMIC CHARACTERISTICS

SECTION2: RESPONDENTS BACK GROUND INFORMATION

5. Sex/Gender of respondent

1. Male	2. Female

6. Marital Status

1.Married	2.Not married

7. Age bracket of the respondent

21-25	26-30	31-35	36-40	Above 41
1	2	3	4	5

8. Status of the household respondent in terms of the hierarchy in a household

Head	spouse	child	relative	worker
1	2	3	4	5

9. Please indicate the total number of people in your household?

5-9	10-14	15-19	20-24	More than 25
1	2	3	4	5

10. Please indicate the average number of your livestock from which you access cow dung?

1-5	6-10	11-15	16-20	More than 21
1	2	3	4	5

11. What is the primary source of income for the household head?

Formal employment	Business	Crop farming	Livestock rearing	Both crop and livestock
1	2	3	4	5

12. What is the households' estimated monthly expenditure on kerosene and firewood?

Less than 10,000	10,000-40,000	50,000-90,000	100,000-150,000	Above 150,000
1	2	3	4	5

13	Please tick the main source of energy for cooking before you constructed a biodigester					
		Response				
	Energy source	1	2	3	4	5
	Firewood					
	Charcoal					
	LPG					
14	Please tick the sources of energy used for cooking after you constructed a biodigester according to priority					
	Energy source					
	Firewood					
	Charcoal					
	LPG					
	Biogas					
15	Please tick the main source of energy for lighting after you constructed a biodigester					
	Kerosene (lantern/lamp)					
	Solar					
	Biogas					
	HEP					
	Generator engine (diesel/petrol)					

Source: Adopted and Modified from the Biogas Socio-economic &Gender Baseline Survey (2010)

PART 3

SECTION B:

There is no wrong response, please respond honestly to the statement by indicating the extent to which you agree or disagree with the statement. Tick the number that best represents your opinion using the scale 1-5

1. Strongly Disagree 2.Disagree 3. Not sure 4. Agree 5. Strongly Agree

	Capacity building process					
	Biogas awareness strategies	**Response**				
16	My family and I were motivated by the biogas sensitisation trainings by promoters to install a biodigester	1	2	3	4	5
17	We had access to useful information about biogas through brochures distributed by promoters					
18	Biogas awareness through Radio programmes was very effective					
19	We were motivated to install a biodigester after an exposure visit to a functional biodigester					
20	We had an opportunity to hear about biogas during a biogas exhibition					
21	I got sufficient information concerning biogas loans from the financial institutions					
	The process of Continuous training of Masons on the job					
22	The biogas supervisor inspected the masons in time as soon as he began constructing the biodigester					
23	The biogas supervisor did a recommendable job during inspection of the construction works by the mason					
	The process of Empowerment of households with skills and knowledge					
24	My family and I were trained on the mixing ratio of cow dung to water					
25	My family and I were trained to operate & maintain the biodigester(light the biogas lamp, stove,)					
26	We have an installed biogas pressure gauge					
27	We can ably use gauge to determine sufficiency of gas					

28	We know what to do when gas pressure is insufficient					
	The process of financing biodigester installations to ensure affordability of the biogas Services					
29	Biogas stove & lamp as subsidy, relieved me of the costs					
30	Masons' fee as subsidy, relieved me of investment costs					
31	Subsidy motivated many households to install biodigesters					
32	Even if there was no subsidy, i would still install biodigester					
33	I was motivated by low interest loan to install a biodigester					
34	It was easy to get a loan					

	Stakeholder involvement in planning and delivery of the planned services to households					
	Accessibility to biogas services by households	1	2	3	4	5
35	Promoters mobilised households for biogas sensitisations					
36	It was easy to get masons through promoters to be able to install biodigesters					
37	Promoters gave us brochures					
38	Biogas promotional materials were always displayed/show cased at all exhibitions					
39	Most MFIs encouraged their clients to get biogas loans					
40	Most MFIs provided affordable biogas loans					
41	Cement is readily accessible					
42	Mud bricks are readily available					
43	River sand is readily available					
44	Biogas accessories are readily available					
45	Biogas appliances are cheap					
	The process of delivering of biogas services to households in a Timely manner as per planned schedule					
46	The Mason sited the biodigester immediately he was informed					
47	I got technical support to procure construction materials					
48	A biogas Supervisor inspected the Mason immediately he began constructing					
49	Mason installed the biodigester within 3 weeks					

50	Subsidy materials(dome pipe, lamp &stove) were delivered in time					
51	Biodigester installation was completed within a month					
52	The Financial Institution swiftly processed for me a loan					
53	We got timely training on operations & maintenance					
54	We got timely training on bioslurry application					

	Implementation monitoring process	1	2	3	4	5
	Professionalism exhibited by masons during the process of biodigester installation					
55	I am Satisfied with the site/location of the biodigester					
56	Mason installed appropriate biodigester size					
57	Mason used quality materials in good ratio					
58	Our Biodigester has never been replastered/reconstructed					
59	Mason made a follow up the after installing biodigester					
	The process of Quality control during the biodigester installation					
60	Supervisors inspected masons at critical stages of installation					
	The process of conducting After sales service to the installed biodigesters					
61	After sales service was done every after six months					
62	A guarantee form was filled twice after every service					
	Household Satisfaction					
63	Satisfied because we make use of cow dung to cook					
64	Satisfied because we save on time for cooking					
65	Satisfied because we save on expenditure on kerosene					
66	Satisfied because we save on time for collecting firewood					
67	Satisfied because we save on expenditure on firewood or charcoal					
68	Satisfied because we can prepare a variety of dishes using biogas					
69	Satisfied because 3 meals can be prepared in a day using biogas					
70	Satisfied because our sauce pans fit well on the biogas burner					
71	Satisfied because we get bioslurry as organic fertiliser					
72	Satisfied because the biogas lamp can light for a long time					
73	Satisfied because biogas appliances have never been faulty					
74	Satisfied because it is easy to access technical support for repairs					

Source: Applied Concepts adopted from Hayes, B.E., (2008).

Thank you very much for being a very good participant in this study

APPENDIX III

OBSERVATION CHECK LIST FOR HOUSEHOLDS THAT INSTALLED BIODIGESTERS

District……..

Sub county……..

Village……..

BCE that Installed the biodigester**……**

S/N	Subject under investigation	Tick appropriate category				
		1	2	3	4	5
1	Size of the biodigester	13 $\mathbf{M^3}$	12 $\mathbf{M^3}$	9 $\mathbf{M^3}$	6 $\mathbf{M^3}$	4 $\mathbf{M^3}$
2	Pressure gauge reading	14-16kpa	12-14kpa	9-12kpa	5- 8 kpa	0-4kpa
3	Functionality of the stove/burner	Very good; burns with an even, bright, strong, pale blue flame & hissing sound	Good; burns with a stable blue flame but with patches of yellowish flame	Fair; Flame shifts around unsteadily, visible yellow patches	Poor; Jerking bluish-yellowish flame and low heat intensity	Non functional burner
4	Functionality of the biogas lamp	Very bright intensity on lighting. Good size & spacing of air holes	Bright, takes some seconds to pick up	Fair light intensity, does not pick up after 1 minute	Poor, Jerking flame	Non functional Lamp
5	Evidence that routine water drainage was regularly done as part of the operations and maintenance procedure	Has all accessories, well protected in a manhole, no water in	All the accessories, but some water in the system	Broken accessories, manhole not covered, some water present on	Rusted accessories, no manhole to protect valve, a lot of water	No water drainage valve installed on the pipe line

		the pipe line on opening		opening valve	jerking on opening	
6	Mason exhibited good masonry skills through good finishing & construction of standard size of manhole covers	Very good finishing, with slabs of standard thickness of 5cm	Good finishing, with slabs of thickness btn-3.5-4cm	Fair slabs, with thickness either less than 3 or more than 5 cm	Poor finishing with cracked slabs, thickness less than 3cm	Very poor finishing with broken patches on slabs, and thickness more than 5cm
7	Accessibility to cow dung	Less than 500m	Btn 500-1000m	1000m-1500m	1500m-2000m	Above 1km
8	Water for routine replenishment	Less than 500m	Btn 500-1000m	1000m-1500m	1500m-2000m	Above 1km
9	Slurry canal construction	Very good	Good	Fair	Poor	Absent
10	Bioslurry level	Very good; flushes with outlet of channel	Good; slightly below or above by 6 inches	Fair, far below or above 6 inches	Poor, far below 30 inches or above and clogging the outlet	Bioslurry level far below, still in the bioslurry outlet manhole
11	Location of compost pits in relation to ease for utilisation	Very good	Good	Fair	Poor	Absent
12	Evidence of utilisation of bioslurry	Vegetable gardens	On Fruit orchads	On banana plantation	On pastures	Or not used at all

Source: Adopted and modified from; Buren (1997), the UDBP Quality control and Bioslurry checklists

APPENDIX IV

SURVEY QUESTIONNAIRE FOR BIOGAS PROMOTERS

Preamble

You have been identified as a suitable respondent to provide your views in a study undertaken to understand the process of creating awareness about biogas technology, the nature of services by the sector players and ultimately how it contributed towards the achievement of the targeted household biodigesters by the HI/UDBP Programme. Please your views will be confidential.

Instructions: There is no wrong response, please respond honestly to the statement by indicating the extent to which you agree or disagree with the statement. Tick the number that best represents your opinion. Use the scale 1-5 to choose/select the answer that best reflects your opinion (1. Strongly Disagree 2.Disagree 3. Not sure 4. Agree (AG) 5. Strongly Agree)

	Capacity building process	1	2	3	4	5
	The process of creating awareness about biogas technology in the rural/peri-urban areas	Response				
1	All the potential households in this county installed biodigesters					
2	Biogas sensitisation trainings for potential households were easy to organise and conduct					
3	BCEs/masons always supported me to do biogas sensitisation trainings to potential farmers(clients)					
4	Masons aggressively seized potential households that expressed the desire to install biodigesters					
5	Households that installed biodigesters had heard about biogas through Radio Programmes					
6	All the households that installed biodigesters had been motivated by exposure visits to functional biodigesters					
	The process of empowering biogas promoters to do their roles					
7	Construction materials were readily available for the installation of biodigesters					
8	Households received programme subsidy in time					
9	I was always paid a promotional fee as soon as a biodigester was installed					
10	The promotional fee motivated me to always look for more potential households to install biodigesters					
11	It was easy to convince households to install biodigesters					

	Stakeholder involvement in planning and delivery of the planned services to households	1	2	3	4	5
	Accessibility of biogas services to households					
12	I always fulfilled my quarterly targets of potential households that i linked to BCEs/Masons in order to install biodigesters					
13	Most of the targeted households accessed loans from MFIs in order to install biodigesters					
14	Most households were trained how to operate and maintain their biodigesters					
15	Most households were trained how to apply bioslurry in the gardens					
16	Masons always addressed technical challenges immediately cases of biodigester malfunctionality were reported					
17	All households have functional biogas appliances					

	Implementation monitoring process					
	Quality control & after sales services	Response				
		1	2	3	4	5
18	Biogas supervisors did a commendable job to ensure good quality biodigesters					
19	All the households got after sales services on schedule, twice every after six months					
20	Households that had malfunctional biodigesters always got quick response to their technical challenges					

APPENDIX V

SURVEY QUESTIONNAIRE FOR BIOGAS MASONS

Preamble

You have been identified as a suitable respondent to provide your views in a study being undertaken to understand the process of creating awareness about biogas technology, the nature of services by the sector players and ultimately how it contributed towards the achievement of the targeted household biodigesters by the HI/UDBP Programme.

Instructions: Please respond honestly by ticking the number that best represents your opinion.

1. Strongly Disagree 2.Disagree 3. Not sure 4. Agree (AG) 5. Strongly Agree

	Capacity building, service delivery & monitoring	1	2	3	4	5
1	It was necessary to support the promoters to explain the B.O.Qs during biogas sensitisations (cp)					
2	I was always assured of a potential household (client) after every biogas sensitisation (cp)					
3	I always got siting fee for every biodigester site established for an interested household (cp)					
4	Majority of the potential households who requested for siting ultimately availed construction materials in time (sd)					
5	All the households that expressed interest for biodigesters bought construction materials in time (sd)					
6	Households received programme subsidy materials in time					
7	Most households got biogas loans from MFIs in order to install biodigesters (sd)					
8	Biogas supervisors were very resourceful to masons					
9	The host families were very cooperative & hospitable to masons during biodigester installation					
10	Households can ably operate and maintain their biodigesters(m)					
11	Masons' fee was paid immediately after installation of a biodigester (m)					

APPENDIX VI

INTERVIEW GUIDE FOR THE DIRECTORS OF BIOGAS CONSTRUCTION ENTERPRISES (BCEs)

Preamble

You have been identified as a suitable respondent to provide your views in a study to understand the process of creating biogas awareness, the nature of services by the actors and ultimately how it contributed to results. Your views will be confidential.

Capacity building process

1. How many Masons ascribed to your BCE during implementation of the UDBP?
2. How many promoters were actively attached to your BCE?
3. Apart from installing biodigesters, were you engaged in other business as a BCE?
4. How did you manage to maintain the masons' and promoters' loyalty to the BCE?
5. Did you ever get any complaint concerning malfunctionality from the households?
6. What was the nature of the most common challenges households experienced?
7. How did you manage to ensure that household biodigesters were functional?

Stakeholder Involvement in strategic planning and promotion

Strategic planning

1. Did you ever have targets for household biodigesters to install as a BCE?
2. How did you come out with the targets?
3. What motivated you to come up with the targets?
4. Do you think the masons' fee, promoters' fee and BCE fees contributed to results

Promotion

5. Do you think the Programme's end-user subsidy significantly swayed households to install biodigesters?
6. Are there households that did not install biodigesters yet had resources?
7. What are the most relevant promotional strategies to entice households to invest in biodigesters installation?
8. In your opinion, what could be the reasons why BCEs failed to meet their targets?

Implementation monitoring process

1. Why do you think that some households still rely on fuel wood yet have biodigesters?
2. Are the construction materials and appliances readily accessible to households?
3. Were the programme incentives motivational enough?

APPENDIX VII

INTERVIEW GUIDE FOR THE FOCAL PERSONS OF FINANCIAL INSTITUTIONS

Preamble

A study is being undertaken to understand the process of creating awareness about biogas technology, the nature of services by the sector players and ultimately how it contributed towards the achievement of the targeted household biodigesters by the HI/UDBP Programme.

Capacity building process

1. What are some of the loan products you have created to entice clients to your institution
2. What does a household require to obtain a biogas loan from your financial Institution?

Stakeholder Involvement in strategic planning and promotion

Strategic planning

3. Did you have targeted number of households to benefit from biogas loan products?

4. What was your experience while handling households that expressed interest for the biogas loan?

Promotion

5. What were your interest rates?

6. How long did it take for a household to process a biogas loan?

7. What was response rate to acquisition of biogas loans?

Implementation monitoring process

8. What could be the annual percentage estimate of households that accessed biogas loans when compared to other loan products?

9. Why do you think that some households failed to access biogas loans?

10. What general recommendations would you make based on your vast experience?

APPENDIX VIII

INTERVIEW GUIDE FOR THE BIOGAS SUPERVISORS

Preamble

A study is being undertaken to understand the process of creating awareness about biogas technology, the nature of services by the sector players and ultimately how it contributed towards the achievement of the targeted household biodigesters by the HI/UDBP Programme.

Capacity building process

1. How many BCEs do you work with closely?

2. How do you rate the performance of the different BCEs in light of their masons' compliance to quality control issues?

3. What was the nature of the most common challenges households experienced?

4. How did you manage to ensure that household biodigesters were functional?

Stakeholder Involvement in strategic planning and promotion

Strategic planning

5. Did you ever have targeted number of household biodigesters for quality control or after sales services?

6. How did you come out with the targets?

7. Do you think all the masons provided guidance during procurement of materials?

8. Do you think all households were advised on the appropriate size of biodigesters before hand?

Promotion

9. Do you think the Programme's household (end-user) subsidy significantly swayed households to install biodigesters?

10. Did all the households get trainings in time on operations and maintenance?

11. What are the most relevant promotional strategies to entice households to invest in biodigesters installation?

12. In your opinion, what could be the reasons why BCEs failed to meet their targets?

Implementation monitoring process

13. Why do you think that some households still rely on fuel wood yet have biodigesters?

14. Are the construction materials and appliances readily accessible to households

APPENDIX IX

INTERVIEW GUIDE FOR THE FOCAL PERSONS OF IMPLEMENTING PARTNERS

Preamble

A study is being undertaken to understand the process of creating awareness about biogas technology, the nature of services by the sector players and ultimately how it contributed towards the achievement of the targeted household biodigesters by the HI/UDBP Programme.

Capacity building process

1. How many BCEs did you work with closely during implementation of the HI/UDBP?
2. What was your experience while working with BCEs?
3. How many micro-finance Institutions did you work with closely?

Stakeholder Involvement in strategic planning and promotion

Strategic planning

4. Did you ever have targeted number of households to assist install biodigesters?
5. How did you come out with the targets?
6. What motivated you to come up with these targets?

Promotion

7. Do you think the Programme's end-user subsidy significantly swayed households to install biodigesters?
8. Do you think the programme's incentives such as the IP fees, BCE fees, masons' fees and promoters' fees contributed greatly to the achievement of the targeted household installation?
9. What are the most relevant promotional strategies to entice households to invest in biodigesters installation?
10. In your opinion, what could be the reasons why targets were hard to achieve?

Implementation monitoring process

11. Why do you think that some households still rely on fuel wood yet have biodigesters?
12. Do you think households can meet the technical costs just in case they needed help?
13. What general recommendations would you make based on your vast experience that could help improve service delivery to the households?

APPENDIX X

FREQUENCY TABLES

Household responses to the indicators of the Capacity Building Process					
The Process of creating biogas awareness in the rural/peri-urban areas to demystify negative stereotype		Frequency	Percent	Valid Percent	Cumulative Percent
1.Motivated by biogas sensitisations	Agree	163	69.1	69.4	69.4
	Strongly Agree	72	30.5	30.6	100.0
	Total	235	99.6	100.0	
2.Had access to information in brochures	Strongly Disagree	10	4.2	4.3	4.3
	Disagree	166	70.3	70.6	74.9
	Agree	58	24.6	24.7	99.6
	Strongly Agree	1	.4	.4	100.0
	Total	235	99.6	100.0	
3.Radio programmes were very effective	Strongly Disagree	16	6.8	6.8	6.8
	Disagree	169	71.6	71.9	78.7
	Agree	50	21.2	21.3	100.0
	Total	235	99.6	100.0	
4.Motivated by biogas exposure visit	Agree	158	66.9	67.2	67.2
	Strongly Agree	77	32.6	32.8	100.0
	Total	235	99.6	100.0	
5.Got biogas information during exhibition	Strongly Disagree	94	39.8	40.0	40.0
	Disagree	105	44.5	44.7	84.7
	Not sure	3	1.3	1.3	86.0
	Agree	30	12.7	12.8	98.7
	Strongly Agree	3	1.3	1.3	100.0
	Total	235	99.6	100.0	
6.Knew about biogas loans provided by MFIs	Strongly Disagree	222	94.1	94.5	94.5
	Disagree	13	5.5	5.5	100.0
	Total	235	99.6	100.0	

Household responses to indicators of Capacity building process (continued…)					
The process of Continuous training of Masons on the job		Frequency	Percent	Valid Percent	Cumulative Percent
7.Supervisors inspected mason in time during installation	Disagree	231	97.9	98.3	98.3
	Agree	4	1.7	1.7	100
	Total	235	99.6	100	
8.Biogas Supervisor did a recommendable job	Strongly	58	24.6	24.7	24.7
	Disagree	148	62.7	63	87.7
	Agree	29	12.3	12.3	100
	Total	235	99.6	100	
The process of Empowerment of households with skills and knowledge					
9.My family was trained on dung to water mixing ratio	Strongly Disagree	1	0.4	0.4	0.4
	Disagree	10	4.2	4.3	4.7
	Not sure	3	1.3	1.3	6
	Agree	182	77.1	77.4	83.4
	Strongly Agree	39	16.5	16.6	100
	Total	235	99.6	100	
10.My family was trained to operate and maintain biodigester	Strongly Disagree	6	2.5	2.6	2.6
	Disagree	22	9.3	9.4	11.9
	Not sure	12	5.1	5.1	17
	Agree	159	67.4	67.7	84.7
	Strongly Agree	36	15.3	15.3	100
	Total	235	99.6	100	
11.We have an installed biogas pressure gauge	Strongly Disagree	165	69.9	70.2	70.2
	Strongly Agree	70	29.7	29.8	100
	Total	235	99.6	100	
12.We can ably use gauge to determine sufficiency of gas	Strongly Agree	132	55.9	56.2	56.2
	Agree	17	7.2	7.2	63.4
	Strongly Agree	86	36.4	36.6	100
	Total	235	99.6	100	
13.We know what to do when gas pressure is insufficient	Strongly Disagree	5	2.1	2.1	2.1
	Disagree	68	28.8	28.9	31.1
	Agree	141	59.7	60	91.1
	Strongly Agree	21	8.9	8.9	100
	Total	235	99.6	100	

Household respondents' views to indicators of Capacity building process (Continued….)					
The process of financing biodigester installations to ensure affordability of the biogas Services		Frequency	Percent	Valid Percent	Cumulative Percent
14.Biogas stove & lamp as subsidy, relieved me of the costs	Agree	50	21.2	21.3	21.3
	Strongly Agree	185	78.4	78.7	100.0
	Total	235	99.6	100.0	
15.Masons' fee as subsidy, relieved me of investment costs	Agree	34	14.4	14.5	14.5
	Strongly Agree	201	85.2	85.5	100.0
	Total	235	99.6	100.0	
16.Subsidy motivated many households to install biodigesters	Agree	67	28.4	28.5	28.5
	Strongly agree	168	71.2	71.5	100.0
	Total	235	99.6	100.0	
17.Even if there was no subsidy, i would still install biodigester	Strongly Disagree	126	53.4	53.6	53.6
	Disagree	15	6.4	6.4	60.0
	Not sure	3	1.3	1.3	61.3
	Agree	21	8.9	8.9	70.2
	Strongly Agree	70	29.7	29.8	100.0
	Total	235	99.6	100.0	
18.I was motivated by low interest loan to install a biodigester	Strongly Disagree	131	55.5	55.7	55.7
	Disagree	104	44.1	44.3	100.0
	Total	235	99.6	100.0	
19.It was easy to get a loan	Strongly Disagree	94	39.8	40.0	40.0
	Disagree	105	44.5	44.7	84.7
	Not sure	3	1.3	1.3	86.0
	Agree	30	12.7	12.8	98.7
	Strongly Agree	3	1.3	1.3	100.0
	Total	235	99.6	100.0	

The process of Stakeholder Involvement in Strategic Planning and promotion					
Household views about the process of stakeholder Involvement		Frequency	Percent	Valid Percent	Cumulative Percent
20.Promoters mobilised households for biogas sensitisations	Agree	163	69.1	69.4	69.4
	Strongly Agree	72	30.5	30.6	100.0
	Total	235	99.6	100.0	
21. It was easy to get masons through promoters to be able to install biodigesters	Agree	163	69.1	69.4	69.4
	Strongly Agree	72	30.5	30.6	100.0
	Total	235	99.6	100.0	
22.Promoters gave us brochures	Strongly Disagree	10	4.2	4.3	4.3
	Disagree	166	70.3	70.6	74.9
	Agree	58	24.6	24.7	99.6
	Strongly Agree	1	.4	.4	100.0
	Total	235	99.6	100.0	
23. Biogas promotional materials were always displayed/show cased at all exhibitions	Strongly Disagree	94	39.8	40.0	40.0
	Disagree	105	44.5	44.7	84.7
	Not sure	3	1.3	1.3	86.0
	Agree	30	12.7	12.8	98.7
	Strongly Agree	3	1.3	1.3	100.0
	Total	235	99.6	100.0	
24.Most MFIs encouraged their clients to get biogas loans	Strongly Disagree	94	39.8	40.0	40.0
	Disagree	105	44.5	44.7	84.7
	Not sure	3	1.3	1.3	86.0
	Agree	30	12.7	12.8	98.7
	Strongly Agree	3	1.3	1.3	100.0
	Total	235	99.6	100.0	
25.Most MFIs provided affordable biogas loans	Strongly Disagree	222	94.1	94.5	94.5
	Disagree	13	5.5	5.5	100.0
	Total	235	99.6	100.0	

The process of Stakeholder involvement in Strategic planning (Cont..)					
Household views about the Stakeholder Involvement in Strategic Planning (Cont…)					
26.Cement is readily accessible	Strongly Disagree	1	.4	.4	.4
	Agree	137	58.1	58.3	58.7
	Strongly Agree	97	41.1	41.3	100.0
	Total	235	99.6	100.0	
27.Mud bricks are readily available	Strongly Disagree	1	.4	.4	.4
	Agree	141	59.7	60.0	60.4
	Strongly Agree	93	39.4	39.6	100.0
	Total	235	99.6	100.0	
28.River sand is readily available	Strongly Disagree	10	4.2	4.3	4.3
	Agree	142	60.2	60.4	64.7
	Strongly Agree	83	35.2	35.3	100.0
	Total	235	99.6	100.0	
29.Biogas accessories are readily available	Strongly Disagree	5	2.1	2.1	2.1
	Disagree	226	95.8	96.2	98.3
	Not sure	2	.8	.9	99.1
	Strongly Agree	2	.8	.9	100.0
	Total	235	99.6	100.0	
30.Biogas appliances are cheap	Strongly Disagree	10	4.2	4.3	4.3
	Agree	142	60.2	60.4	64.7
	Strongly Agree	83	35.2	35.3	100.0
	Total	235	99.6	100.0	

The Process of Stakeholder Involvement in Strategic Planning and promotion (Cont…..)					
Household views about the Stakeholder Involvement in Strategic Planning (Cont…)					
The process of delivering of biogas services to households in a Timely manner as per planned schedule		Frequency	Percent	Valid Percent	Cum. Percent
31.The Mason sited the biodigester immediately he was informed	Strongly Disagree	16	6.8	6.8	6.8
	Disagree	169	71.6	71.9	78.7
	Agree	50	21.2	21.3	100.0
	Total	235	99.6	100.0	
32.I got technical support to procure construction materials	Strongly Disagree	1	.4	.4	.4
	Disagree	70	29.7	29.8	30.2
	Agree	130	55.1	55.3	85.5
	Strongly Agree	34	14.4	14.5	100.0
	Total	235	99.6	100.0	
33.A biogas Supervisor inspected the Mason immediately he began constructing	Strongly Disagree	16	6.8	6.8	6.8
	Disagree	169	71.6	71.9	78.7
	Agree	50	21.2	21.3	100.0
	Total	235	99.6	100.0	
34.Mason installed the biodigester within 3 weeks	Strongly Disagree	1	.4	.4	.4
	Disagree	10	4.2	4.3	4.7
	Not sure	2	.8	.9	5.5
	Agree	192	81.4	81.7	87.2
	Strongly Agree	30	12.7	12.8	100.0
	Total	235	99.6	100.0	
35.Subsidy materials(dome pipe, lamp &stove) were delivered in time	Strongly Disagree	12	5.1	5.1	5.1
	Agree	206	87.3	87.7	92.8
	Strongly Agree	17	7.2	7.2	100.0
	Total	235	99.6	100.0	
36.Biodigester installation was completed within a month	Strongly Disagree	6	2.5	2.6	2.6
	Disagree	27	11.4	11.5	14.0
	Agree	177	75.0	75.3	89.4
	Strongly Agree	25	10.6	10.6	100.0
	Total	235	99.6	100.0	
37.The Financial Institution swiftly processed for me a loan	Strongly Disagree	199	84.3	84.7	84.7
	Disagree	35	14.8	14.9	99.6
	Agree	1	.4	.4	100.0
	Total	235	99.6	100.0	
38.We got timely training on operations & maintenance	Disagree	2	.8	.9	.9
	Agree	183	77.5	77.9	78.7
	Strongly Agree	50	21.2	21.3	100.0
	Total	235	99.6	100.0	
39.We got timely training on bioslurry application	Disagree	2	.8	.9	.9
	Agree	183	77.5	77.9	78.7
	Strongly Agree	50	21.2	21.3	100.0
	Total	235	99.6	100.0	

The Process of Implementation Monitoring					
Households' views about the indicators of the Implementation monitoring process					
Response by Biogas Households to the indicators of the Implementation monitoring process		Frequency	Percent	Valid Percent	Cumulative Percent
40.Satisfied with the site/location of the biodigester	Strongly Disagree	1	.4	.4	.4
	Disagree	15	6.4	6.4	6.8
	Not sure	11	4.7	4.7	11.5
	Agree	178	75.4	75.7	87.2
	Strongly Agree	30	12.7	12.8	100.0
	Total	235	99.6	100.0	
41.Mason installed appropriate biodigester size	Strongly Disagree	2	.8	.9	.9
	Disagree	20	8.5	8.5	9.4
	Not sure	13	5.5	5.5	14.9
	Agree	171	72.5	72.8	87.7
	Strongly Agree	29	12.3	12.3	100.0
	Total	235	99.6	100.0	
42.Mason used quality materials in good ratio	Strongly Disagree	3	1.3	1.3	1.3
	Disagree	2	.8	.9	2.1
	Not sure	16	6.8	6.8	8.9
	Agree	159	67.4	67.7	76.6
	Strongly Agree	55	23.3	23.4	100.0
	Total	235	99.6	100.0	
43.Biodigester has never been replastered/reconstructed	Strongly Disagree	34	14.4	14.5	14.5
	Agree	155	65.7	66.0	80.4
	Strongly Agree	46	19.5	19.6	100.0
	Total	235	99.6	100.0	
44.Mason followed up after installing biodigester	Disagree	225	95.3	95.7	95.7
	Agree	8	3.4	3.4	99.1
	Strongly Agree	2	.8	.9	100.0
	Total	235	99.6	100.0	

The Process of Implementation Monitoring					
Households' views about the indicators of the Implementation monitoring (Cont….)					
Quality control process during the biodigester installation					
45.Supervisors inspected masons at critical stages of installation	Strongly Disagree	207	87.7	88.1	88.1
	Disagree	9	3.8	3.8	91.9
	Not sure	2	.8	.9	92.8
	Agree	10	4.2	4.3	97.0
	Strongly Agree	7	3.0	3.0	100.0
	Total	235	99.6	100.0	
The process of conducting After sales service to the installed biodigesters					
46.After sales service was done every after six months	Strongly Disagree	215	91.1	91.5	91.5
	Disagree	14	5.9	6.0	97.4
	Not sure	1	.4	.4	97.9
	Agree	5	2.1	2.1	100.0
	Total	235	99.6	100.0	
47.A guarantee form was filled twice after every service	Strongly Disagree	210	89.0	89.4	89.4
	Disagree	4	1.7	1.7	91.1
	Not sure	10	4.2	4.3	95.3
	Agree	11	4.7	4.7	100.0
	Total	235	99.6	100.0	

The opinion of other biogas actors about the Results Based Management Processes					
The Capacity building process as perceived by other stakeholders					
Promoters' views about the indicators of the Capacity Building Process					
Process of biogas awareness creation in rural/peri-urban areas		Frequency	Percent	Valid Percent	Cumulative Percent
1.All potential households installed biodigesters	Strongly Disagree	4	5.6	5.7	5.7
	Disagree	64	88.9	91.4	97.1
	Agree	2	2.8	2.9	100.0
	Total	70	97.2	100.0	
2.Sensitisation trainings for potential households were easy to organise and conduct	Strongly Disagree	1	1.4	1.4	1.4
	Disagree	59	81.9	84.3	85.7
	Agree	6	8.3	8.6	94.3
	Strongly Agree	4	5.6	5.7	100.0
	Total	70	97.2	100.0	
3.BCE/Masons always supported me to do biogas sensitisation	Strongly Disagree	10	13.9	14.3	14.3
	Disagree	49	68.1	70.0	84.3
	Agree	10	13.9	14.3	98.6
	Strongly Agree	1	1.4	1.4	100.0
	Total	70	97.2	100.0	
4.Masons aggressively seized potential households that expressed the desire to install biodigesters	Strongly Disagree	62	86.1	88.6	88.6
	Disagree	5	6.9	7.1	95.7
	Agree	3	4.2	4.3	100.0
	Total	70	97.2	100.0	
5.Households that installed biodigesters had heard about biogas through Radio programmes	Strongly Disagree	15	20.8	21.4	21.4
	Disagree	23	31.9	32.9	54.3
	Not sure	1	1.4	1.4	55.7
	Agree	26	36.1	37.1	92.9
	Strongly Agree	5	6.9	7.1	100.0
	Total	70	97.2	100.0	

Response by Biogas Promoters to the indicators of the Capacity Building Process (Cont….)					
Process of Biogas awareness creation		Frequency	Percent	Valid Percent	Cumulative Percent
6.Households that installed biodigesters had been motivated by exposure visits to functional digesters	Strongly Disagree	2	2.8	2.9	2.9
	Disagree	2	2.8	2.9	5.7
	Agree	4	5.6	5.7	11.4
	Strongly Agree	62	86.1	88.6	100
	Total	70	97.2	100	
7.Construction materials were readily available for the installation of biodigesters	Strongly Disagree	1	1.4	1.4	1.4
	Disagree	11	15.3	15.7	17.1
	Agree	45	62.5	64.3	81.4
	Strongly Agree	13	18.1	18.6	100
	Total	70	97.2	100	
8.Majority of Households received programme subsidy in time	Strongly Disagree	1	1.4	1.4	1.4
	Disagree	20	27.8	28.6	30
	Agree	39	54.2	55.7	85.7
	Strongly Agree	10	13.9	14.3	100
	Total	70	97.2	100	
9.I was always paid a promotional fee as soon as a biodigester was installed	Strongly Disagree	63	87.5	90	90
	Disagree	5	6.9	7.1	97.1
	Agree	2	2.8	2.9	100
	Total	70	97.2	100	
10.The promotional fee motivated me to always look for more potential households to install biodigesters	S D	60	83.3	85.7	85.7
	DA	6	8.3	8.6	94.3
	AG	4	5.6	5.7	100
	Total	70	97.2	100	
11.It was easy to convince households to install biodigesters	SD	1	1.4	1.4	1.4
	DA	18	25	25.7	27.1
	Not sure	1	1.4	1.4	28.6
	AG	49	68.1	70	98.6
	S A	1	1.4	1.4	100
	Total	70	97.2	100	

The Capacity building process as perceived by other stakeholders (Continued…….)					
Masons' views about the indicators of the Capacity building process					
Process of biogas awareness creation in rural/peri-urban areas		Frequency	Percent	Valid Percent	Cumulative Percent
1.It was necessary to support promoters to explain B.OQs during sensitisations	Agree	1	3.1	3.2	3.2
	Strongly Agree	30	93.8	96.8	100.0
	Total	31	96.9	100.0	
2. I was always assured of a potential client after every biogas sensitisation	Strongly Disagree	1	3.1	3.2	3.2
	Disagree	15	46.9	48.4	51.6
	Agree	11	34.4	35.5	87.1
	Strongly Agree	4	12.5	12.9	100.0
	Total	31	96.9	100.0	
3.I got a siting fee for every biodigester that i sited for an interested household	Strongly Disagree	1	3.2	3.2	3.2
	Disagree	30	96.8	96.8	100.0
	Total	31	100.0	100.0	

The process of Stakeholder Involvement as perceived by other biogas actors					
Promoters' views about the indicators of the Stakeholder Involvement Process in Planning					
The process of availing biogas services to meet the targeted number of satisfied households		Frequency	Percent	Valid Percent	Cumulative Percent
12. I always fulfilled my quarterly targets of potential households that i linked to BCEs in order to install biodigesters	Strongly Disagree	47	65.3	67.1	67.1
	Disagree	9	12.5	12.9	80.0
	Not sure	1	1.4	1.4	81.4
	Agree	13	18.1	18.6	100.0
	Total	70	97.2	100.0	
13. Most of the targeted households accessed loans from MFIs in order to install biodigesters	Strongly Disagree	67	93.1	95.7	95.7
	Disagree	2	2.8	2.9	98.6
	Agree	1	1.4	1.4	100.0
	Total	70	97.2	100.0	
14.Most households were trained how to operate and maintain their biodigesters	Disagree	4	5.6	5.7	5.7
	Agree	66	91.7	94.3	100.0
	Total	70	97.2	100.0	
15. Most households were trained how to apply bioslurry in the gardens	Disagree	3	4.2	4.3	4.3
	Agree	62	86.1	88.6	92.9
	Strongly Agree	5	6.9	7.1	100.0
	Total	70	97.2	100.0	

The Stakeholder Involvement Process as perceived by other biogas actors					
Promoters' views about the indicators of the Stakeholder Involvement Process (Contin…)					
16. Masons always addressed technical challenges immediately cases of biodigester malfunctionality were reported	Strongly Disagree	11	15.3	15.7	15.7
	Disagree	37	51.4	52.9	68.6
	Not sure	2	2.8	2.9	71.4
	Agree	18	25.0	25.7	97.1
	Strongly Agree	2	2.8	2.9	100.0
	Total	70	97.2	100.0	
17. All households have functional biogas appliances	Strongly Disagree	1	1.4	1.4	1.4
	Disagree	30	41.7	42.9	44.3
	Agree	36	50.0	51.4	95.7
	Strongly Agree	3	4.2	4.3	100.0
	Total	70	97.2	100.0	
Masons' views about the indicators of Stakeholder involvement process in Planning					
The process of availing biogas services to meet the targeted number of satisfied households					
4.Majority of potential households who requested for siting, ultimately installed biodigesters	Disagree	28	87.5	90.3	90.3
	Agree	2	6.3	6.5	96.8
	Strongly Agree	1	3.1	3.2	100.0
	Total	31	96.9	100.0	
5.All households that were interested in biodigesters bought all construction materials in time	Strongly Disagree	3	9.4	9.7	9.7
	Disagree	23	71.9	74.2	83.9
	Agree	5	15.6	16.1	100.0
	Total	31	96.9	100.0	
6.Households received programme subsidy materials in time	Strongly Disagree	2	6.3	6.5	6.5
	Disagree	4	12.5	12.9	19.4
	Agree	18	56.3	58.1	77.4
	Strongly Agree	7	21.9	22.6	100.0
	Total	31	96.9	100.0	
7.Most households got loans from MFIs in order to install biodigesters	Strongly Disagree	30	93.8	96.8	96.8
	Disagree	1	3.1	3.2	100.0
	Total	31	96.9	100.0	

The process of Implementation monitoring as perceived by other biogas actors					
Promoters' view about the indicators of the Implementation Monitoring Process					
The processes of Quality control and After sales service		Frequency	Percent	Valid Percent	Cumulative Percent
18.Biogas supervisors did a commendable job to ensure good quality biodigesters	Strongly Disagree	2	2.8	2.9	2.9
	Disagree	61	84.7	87.1	90.0
	Not sure	1	1.4	1.4	91.4
	Agree	3	4.2	4.3	95.7
	Strongly Agree	3	4.2	4.3	100.0
	Total	70	97.2	100.0	
19.All households got after sales services on schedule, twice every after six months	Strongly Disagree	3	4.2	4.3	4.3
	Disagree	65	90.3	92.9	97.1
	Agree	1	1.4	1.4	98.6
	Strongly Agree	1	1.4	1.4	100.0
	Total	70	97.2	100.0	
20.Households that had faulty biodigesters always got quick response to technical challenges	Strongly Disagree	3	4.2	4.3	4.3
	Disagree	66	91.7	94.3	98.6
	Agree	1	1.4	1.4	100.0
	Total	70	97.2	100.0	

The Implementation Monitoring Process					
Mason's views about the indicators of the Implementation monitoring process					
The processes of Quality control and After sales service		Frequency	Percent	Valid Percent	Cumulative Percent
8.Biogas Supervisors were very resourceful to masons	Disagree	3	9.4	9.7	9.7
	Agree	28	87.5	90.3	100.0
	Total	31	96.9	100.0	
9.The host families were very cooperative to masons during biodigester installation	Disagree	4	12.5	12.9	12.9
	Agree	27	84.4	87.1	100.0
	Total	31	96.9	100.0	
10.All households can ably operate and maintain their biodigesters	Disagree	1	3.1	3.2	3.2
	Agree	30	93.8	96.8	100.0
	Total	31	96.9	100.0	
11.There was delayed payment of Mason's fee after installation of a biodigester	Strongly Agree	31	96.9	100.0	100.0

APPENDIX XI

Figure 2: Showing pressure gauges connected to the biogas burners

Figure 3: Showing one of the biodigesters with cracked man-hole covers by one of the households that installed biodigesters

Figure 4: Showing the nature of plumbing works by one of the pioneer households that installed a biodigester in Rukungiri

Figure 5: Showing household members in Greater Bushenyi using a locally fabricated dung mixer to replenish their biodigester

Figure 6: Showing the recommended viscosity of bioslurry, flowing into the slurry pit

Figure 7: Showing the composting of bioslurry without solid material by one of the beneficiary household in Ntungamo

Figure 8: Showing one of households in Masaka composting the bioslurry by incorporating kitchen wastes

Figure 9: Showing one of the households in Rukungiri composting the bioslurry by incorporating with goat and sheep droppings


Figure 10&11: Showing both the control and the banana plantation where bioslurry was used as an organic fertiliser respectively in Mbarara district

Figure 11: Showing one of the biogas beneficiaries making use of the liquid bioslurry in Bushenyi

Figure 12: Showing one of the households that used bioslurry to establish a banana plantation on a rocky terrain in Ntungamo district

APPENDIX:XI1

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15 April 2015

TO WHOM IT MAY CONCERN

MASTERS IN MANAGEMENT STUDIES DEGREE RESEARCH

Mr. George Asiimwe is a student of the Masters in Management Studies of Uganda Management Institute 31st Intake 2013/2014 specializing in Project Planning and Management, **Reg. Number 13/MMSPPM/31/046**.

His research Topic is: **"Results based management and household satisfaction by small scale bio digesters in Uganda. A case of Heifer International Uganda domestic biogas programme in Western region."**

The purpose of this letter is to formally request you to allow this participant to access any information in your custody/organization, which is relevant to his research.

Dr Stella Kyohairwe
AG. HEAD/POLITICAL & ADMINISTRATIVE SCIENCE DEPARTMENT