

An Explorative Study On Adoption Drivers At The Bop:

Enabling profitability and social impact for improved cooking stoves in developing countries

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An Explorative Study on Adoption Drivers at the BoP:

Enabling profitability and social impact for improved cooking stoves in developing countries

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Being from India, I have seen the hardships faced by the people in my country. Hence, I was always interested in creating an impact in the society. When I was introduced to the concept of BoP it immediately caught my interest and I was sure I wanted to graduate with something related to the BoP market. Therefore, when Prof Kamp offered the topic **'Revenue Models for renewable energy in developing countries'** for my thesis, I jumped to take this opportunity.

While choosing which renewable energy technology I should select, while researching I found out that the two biggest barriers people face are lighting and cooking. I was surprised to find out that more people die due to Household air pollution (HAP then they do with malaria. Hence, I decided to pursue this topic.

The thesis journey has been a long but fruitful one. There were times when I wasn't sure whether I would make it on time. But due to the support and guidance of a few people I have been able to complete it on time. Hence, I would like to thank people who contributed for my successful completion of the thesis.

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Last but not the least I would like to thank my family back home who supported and gave me this opportunity to study at the TU Delft. Furthermore, I would like to thank the new friends I made in Delft who are like family far away from home. I would specially like to thank Nico van Ginkel for his sharp and critical inputs especially while developing the framework.

-Anuja Naiknavare

Delft, 30th August 2016

EXECUTIVE SUMMARY

The Bottom of the Pyramid (BoP) constitutes around 3.5-4 billion people belonging to an income category of less than 3000$ per year. The people belonging to the BoP usually belonging to developing countries having a high population and a poor standard of living. Around 82% of the population still lacks access to clean cooking technologies and use inefficient cooking methods causing household air pollution.

Previously governments and NGOs tried to disseminate energy solutions in the form of improved cooking stoves (ICS). However, due to lack of financing they failed to provide solutions though the donor driven mechanisms. This prompted a new breed of entrepreneurs to provide clean energy solutions to the BoP. Through the delivery of new clean solutions social entrepreneurs have to achieve two goals: profit and social. Even though a large number of entrepreneurs are tapping this field many firms face the problem of scaling their operations. Scaling the operations requires financing the same problem faced by the donor driven approach. Hence, in order to overcome the problem of financing, companies need to achieve profitability. The profitability of the company will be looked from the choice of revenue model chosen by the company. Also, profitability can be achieved through an intuitive way by increasing the number of people buying or adopting the product. However, majority of the companies face barriers with respect to adoption of the products. Furthermore, social enterprises aim to achieve a social objective through their products. Social objective can be achieved through four ways: health, safety, monetary & income generating opportunities. Hence, the thesis aims to study how do firms who call themselves social enterprises generate profits and create social impact at the same time? To understand the issue of profitability and social impact the study will find adoption drivers and the linkage between adoption drivers to revenue and social impact.

The research takes place in three steps. First step consists of theoretical background and literature review. The theoretical background looks at concepts of the BoP, donor to market driven approach, frugal innovation, consumer and company financing. The literature review consists of literature on business model, revenue model and product adoption at the BoP and ICS. The literature on product adoption at the BoP provided with the basis for the conceptual model. The conceptual model provided three variables that influence adoption at the BoP. These are product features, marketing characteristics and social context. The literature on ICS provides us with the list of drivers that match the characteristics of product features, marketing characteristics and social context. The last step consists of conducting semi-structured interviews with three Dutch companies Mansa Stoves, ACE & SimGas targeting the BoP Market in Africa. The interviews with the three companies helped to verify, validate and extend the framework. Therefore via the literature review and the semi structured interviews the final framework was developed. The final drivers that were discovered for product characteristics were willingness to pay, budget constraint, live demonstrations, leaflets, fuel savings, traditional cooking practices and extra product features. For marketing characteristics the drivers derived were consumer trust, awareness word to mouth advertising, hub model, flexible payments, end

user finance, discounts, warranty and after sales service. Finally social characteristics were consumer trust, aspirational budget and community budget. All these drivers influence the rate of adoption at the BoP hence increasing revenues. Also carbon financing and different type of revenue streams were dependent directly or indirectly on consumer adoption.

Further, these drivers were linked to the choice of revenue model and social impact created by the companies, Additionally, it was concluded that companies achieved profitability irrespective of the type of revenue model used. Also companies are only able to achieve a social impact if the consumer adopts the product. It was also concluded that in order to truly achieve social impact companies need to incorporate people in their business activities.

Finally, even though the aim of this thesis was to find **adoption** drivers the final result of the thesis was that these drivers had an influence on **retention of consumers** as well as **recoupment of costs.** These two factors are important to consider has retention leads to truly achieving a social impact because if consumers stop using the product their health, safety and monetary social aspects are compromised. Furthermore, recoupment of costs is important from the point of view of company's profitability. If recoupment of costs is not achieved company can go in loss.

The results of the study are critical for practitioners and academians. From the practitioner's viewpoint, the findings of the thesis provide a framework for present and future entrepreneurs trying to tap this difficult market. The adoption drivers will help the future practitioners to know what to expect when entering these countries. The research could also serve as a framework in overcoming adoption barriers faced by many companies. On other hand form the viewpoint of the academians the study extends the conceptual model developed by Weidner & Nakata and relate it two important aspects: profits and social impact. The academians can conduct further research in different parts of the world and for different renewable energy technologies and use the framework as a base.

It was discovered that further research is needed to look how do companies achieve social impact through income generating opportunities. How do companies specifically create income-generating opportunities and how is the income generating opportunities linked to adoption drivers? Another limitation was that out of the three companies only one adopted ownership revenue model while the other two adopted service revenue model. Future study needs to increase generalizability by extending the drivers and testing, validating in different countries. Even though this research looked at countries in Africa, drivers could change in countries like India, China or countries in South America.

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List Of Abbreviations

HAP-HOUSEHOLD AIR POLLUTION

RET-RENEWABLE ENERGY TECHNOLOGIES

ICS-IMPROVED COOKING STOVES

ACE-AFRICAN CLEAN ENERGY

SRM-SERVICE REVENUE MODEL

ORM-OWNERSHIP REVENUE MODEL

TCP-TRADITIONAL COOKING PRACTICES

EPF-EXTRA PRODUCT FEATURES

Chapter 1: Introduction

1.1 Chapter Introduction

Currently, most of the world's energy supplies are provided by fossil fuels causing pollution. By 2050 the world energy demand will increase radically especially in developing countries. EIA's International Energy Outlook 2013 predicts that growth in global energy usage mainly comes from developing countries(Peterson, 2013). Energy consumption in countries that have a growing population is increasing dramatically (Reddy *et al.*, 2004). Therefore, the need of the hour is to create affordable, clean energy technologies that can be implemented and are commercially viable in developing countries.

Due to the growing pollution and environmental problems, society is becoming aware of the need to develop and implement renewable technologies especially in the developed countries. However, renewable energy technologies are still struggling to find a foothold in developing countries (Douglas F.Barnes *et al.*, 1994). Several developing countries have tried to promote RET; unfortunately, there hasn't been a significant increase in the energy production from these sources. RET accounts for only 19 % of the world's energy use. Coal, petroleum and natural gas still dominate the world in energy consumption(Urban, 2015). The rural population in developing countries uses incumbent sources to meet the basic energy needs for cooking and lighting (biomass residue). The main energy sources in the sub-Saharan region are firewood and charcoal. However, the use of these traditional fuels has many disadvantages such as dangerous emissions and the fact that their heat is difficult to control (Parawira, 2009). Due to the undesirable effects of using these traditional fuels, depletion of non-renewable sources of energy and an ever-increasing energy demand, developing countries are focusing on meeting energy needs by using sustainable technologies.

Previously governments and NGOs tried to disseminate RET to the BoP market through the donor driver approach. However, due to **lack of financing** and the fact that people **stopped using the technologies** through the donor-driven market discouraged the government and NGOs to continue this initiative. Furthermore, over time technology improved rapidly enabling economies of scale. Developing countries have a demand driven market due to an increasing population (Asian Development Bank, 2015). The energy sector estimates that India will add 140 GW of renewables to reach 175 GW by 2022 (Singh, 2015). For the period up to 2020 and beyond, countries like Cambodia, the Lao PDR, Myanmar, Thailand, and Vietnam each have renewable energy targets varying from 6% to 20% of total energy supply(Asian Development Bank, 2015). Hence, there is a slow transition from the donor-driven approach to the market-driven approach.

Moreover, more than 1.3 billion people lack access to electricity, and 3 billion people cook with devices that are harmful to the health. 85 percent of people lack access to electricity, and 82 percent of people lack access to clean cooking facilities live in low-income rural

areas in developing countries (Doukas *et al.*, 2015). These people spend a significant amount of income on purchasing energy. One report by Winiecki *et al.* (2009) suggests that people living on less than US$1 per day spend 20-25% of their income on inefficient and unreliable energy sources. Companies are innovating in the way they sell renewable energy products and services to this group. This group of people call themselves social entrepreneurs. How does this group sell their products to the people that do not have access to clean energy? Furthermore, do they achieve profitability while doing so? Therefore, this thesis explores the aspect of profitability through the revenue models. Nevertheless, the study also explores the fulfillment of the social objective by these entrepreneurs. This makes it an exploratory case study as literature is scattered and is based on various concepts such as BoP, frugal innovations, **financing and adoption**.

1.2 Background

In this section concept such as BoP markets, BoP population and energy inclusion is described. This forms the basis of our study. The literature on BoP is sufficiently available which looks at the entire population that lies below the poverty line and lack access to clean energy. This section will provide an overview of the global characteristics of this population.

1.2.1 BoP

CK Prahalad popularized this term in his book titled "The Fortune at the base of the pyramid". The term Bottom of the pyramid refers to the segment of people living below an income of $2 a day. This group covers 4 billion people all over the world(C. K. Prahalad, and Hart, Stuart L, 2002). Figure 1 shows the income group the population belongs. People belonging to this segment primarily live in developing countries of Asia, Africa and Latin America (Klein *et al.*, 2012). Of the 8 billion people on the planet around 3 billion do not have access to main sources of energy. Hence, they rely on traditional sources of energy that emits CO_2 in the atmosphere. The need of the hour is to create sustainable solutions for the poor in such a way that it increases their standard of living. Therefore, it is believed that BoP will be a major source of sustainable innovation (C. K. Prahalad, 2011; C. K. Prahalad, and Hart, Stuart L, 2002)

The market for the BoP needs a combination of low cost, sustainability, good quality products that are also profitable for the companies (C. K. Prahalad, and Hart, Stuart L, 2002) The BoP market is very distinct from markets in developed countries. According to Prahalad, there is no global solution for this market. To a great extent there are numerous differences between every market for example India vs. Africa or within India as well. Hence, solutions need to cater to a particular industry, culture and segment of the BoP market (Klein *et al.*, 2012; C. K. Prahalad, 2011). The progress of BOP markets is not just about serving a current market more resourcefully, but it is usually about establishing new markets. Most of the times, it is a substitute for the current way by providing an innovative solution to the consumers(C. K. Prahalad, 2011).

Research by Biswas *et al.* (2001)suggests that sustainable energy will improve the quality of life, education and create **income-generating opportunities** for this low-income group.

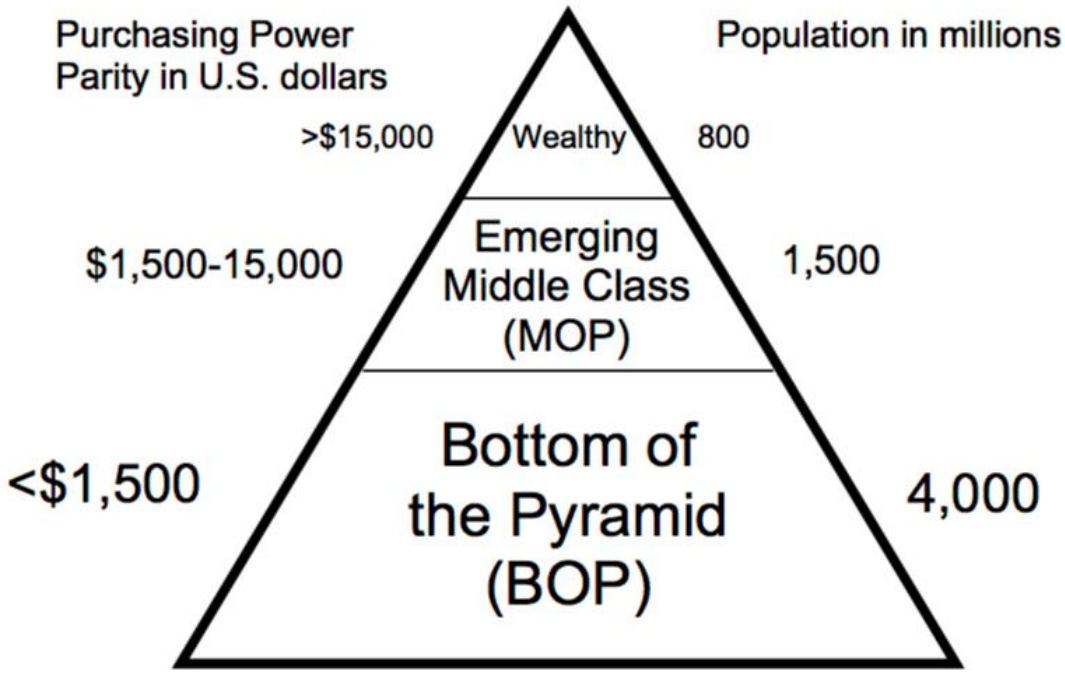


Figure 1:BoP v/s ToP (C. K. Prahalad, and Hart, Stuart L, 2002)

1.2.1.1 BoP Population and energy

The number of people globally who rely on traditional biomass fuels is nearly 3 billion. This accounts for little more than half of the population of the developing world. According to IEA (2006), 82% of the populations depend on traditional biomass fuels for cooking. Moreover, these fuels are inefficient and the fact that their heat is difficult to control. These fuels cause indoor pollution due to harmful emissions(Zuzarte, 2008).Indoor air pollution (IAP) causes 5 % of all women deaths in developing countries(Arif *et al.*, 2011). Also, IAP is known to kill more than 4 million people and is the foremost cause of death in South Asia (S.S. Lim *et al.*, 2013). The United Nations Commission on Sustainable Development (UNCSD) claims that shortage of access to energy hampers economic development and puts a burden on the environment (UNSCD, 2007).Additionally, people living in rural areas spend as much as 15% of the income on inefficient cooking fuels(South Pole Carbon, 2013)

Hence, this thesis will focus on the improved cooking stoves or ICS. The term ICS has been used interchangeably and it describes stoves that reduce and optimize emissions so this could be a biogas stove, solar stove or a simple stove that uses less biomass(Rehfuess *et al.*, 2013). Research by Energy for Sustainable Development Ltd *et al.* (2000) indicates, that the commercial success of ICS has led to reduction in poverty, reduced time spent in collecting firewood that can be used for fruitful work (Douglas F.Barnes *et al.*, 1994). Furthermore, it has achieved considerable **positive livelihood changes**, for example, improvement in diet, health & housing. Besides, families have substantial cost savings by **reducing expenditure** on fuels. Hence, access to ICS is needed for poverty eradication,

achieving gender equality, and educational development, better for the environment as ICS reduces carbon dioxide emissions to the air ((Douglas F.Barnes *et al.*, 1994; UNDP, 2010) Moreover, ICS considerably improves the quality of indoor and outdoor air (South Pole Carbon, 2013). While the benefits of adopting ICS is evident from a socio-economic perspective achieving **high adoption rate** and **economic viability** has been a challenge in the developing countries due to high upfront costs related to the different types of ICS in the market (Kolk. D, 2013)

The **prices** of the stove can be a considerable barrier to consumer adoption especially amongst low-income consumers or BoP. Low-income consumers in rural areas rely on agriculture or odd jobs for their income. Income obtained from a farm is varying and irregular. Hence, these consumers cannot afford high upfront payments or take high-interest loans from the banks. According to research, middle-class consumers in Africa are more prone to adopt the ICS than rural families (Douglas F.Barnes *et al.*, 1994)

1.2.1.2 Business Viewpoint

Previously governments and NGOs took an initiative to disseminate ICS to the BoP. They wanted to achieve a ***social objective*** by providing ICS that will help improve health and enhance safety for women. This was achieved through subsidies and distribution of ICS that were free of cost. This is called as the donor-driven approach. However, the Government and NGOs have faced many obstacles while using this method. It was noticed that consumers stopped using the product after one point of time. This has been explained more in Chapter 2. Moreover, the government could not afford to disseminate the ICS to a large group of people due to ***financing constraints***. Hence, another approach was required that could cater to this group. The market-driven approach emerged due to the constraints faced by donor-driven approach.

The market-driven approach involves companies to tap into this group. However, to overcome the financing obstacles faced by the NGOs and the government this approach required the companies to sell the product for **a profit** but at the same time to have a **social objective** in mind. These companies that have a social objective in mind are called as social entrepreneurs. Hence, business opportunities are created throughout the world by tapping into the BoP. The market size of this group over different sectors such as housing, water and energy amounts to 4 billion (Allen Hammond *et al.*, 2007). Due to the failure of the donor-driven approach, it opens new doors to provide fundamental needs to this group.

This opportunity is acknowledged by social entrepreneurs that are more focused on addressing social needs than maximizing profits for shareholders (Ridley-Duff R. J & Bull, 2011). Furthermore, social innovations are born such as solar lamps and biomass cook stove. By addressing social needs companies can create **income-generating opportunities** for the BoP market(Global Alliance of Clean Cookstoves, 2013; Lighting Africa, 2010).

However, the majority of the companies are still struggling to find a foothold in this market by creating scalable solutions. According to Harvey Koh *et al.* (2014) out of the 439 social business ventures merely **13%** of them had accomplished critical scale. It was observed that companies struggle to expand to a larger scale by replicating it in different regions. A major barrier for scaling is that consumers have limited purchasing power hence companies earn a small profit margin on each product sold (Jenkins *et al.*, 2010). Another major barrier is the fact that there are major differences between the western markets and developing markets which companies fail to acknowledge(Jenkins *et al.*, 2010)

1.3 Research Framework

In this section, the research framework will be described. Firstly the research objective is explained. Next, the research questions and sub-questions derived from the research objective are clarified. Following the research questions the scope and the relevance is defined. Finally, a research approach and organization of the thesis is described in the concluding subsection.

1.3.1 Research Aim & Objectives

How do companies that call themselves a social enterprise achieve social goals while being profitable at the same time? The objective of this research is to analyze the social impact achieved by social enterprises while achieving profitability. If the primary focus of these companies is to achieve a social objective is it still possible to be profitable? The thesis will analyze the impact on livelihood that these companies accomplish with their products. Furthermore, this study will analyze the profitability through the revenue models adopted by companies in developing countries. Additionally, it will also analyze the core adoption drivers that help companies achieve profits. Nevertheless, in this thesis we are mainly interested to comprehend whether or not these adoption drivers are applicable in the situation of companies achieving profitability and social objective. Moreover, this study will help to understand whether there is a relation between the adoption drivers to revenues and social objective. This will help provide a framework for future companies trying to tap this market. Please note that social enterprises can be for-profit or non-profit. But for the focus of this thesis, the term social enterprises have been used to represent the for-profit companies.

1.3.2 Research Questions

The research objective helped in formulating the research questions. In this thesis the issue of profitability and social impact will be explored. We intend to achieve the objective of the research by looking at the revenue model & social impact aspects adopted by social enterprises. The adoption drivers will help in explaining the increasing the rate of adoption, which in turn will increase the revenues and at the same time help companies to achieve the social objective. Hence, the main question is as follows:

How do social enterprises that cater improved cook stoves achieve profitability and social impact in developing countries?

The answer to the main research question will result from the case study, the cross-study analysis and the support of the sub-questions given below. The data needed for the case analysis is performed through the literature review.

Below the sub-questions that support to answer the main research question are given. These are as follows:

1. ***What is the different type of revenue models available in the literature for renewable energy technologies?***

The answer to the above sub-question will help get an overview on the revenue models available in literature.

2 ***What is the different type of revenue models adopted by social enterprises in developing countries?***

The answer to the above sub-question will help us get an overview of the kind of revenue models employed by companies. Furthermore, it will also help to explain and compare the revenue models present in literature (sub-question 1). Additionally, comparisons and differences between the revenue models adopted by the companies will be made.

3 Why do social enterprises choose a specific revenue model?

Answering this sub-question will yield insights on the choice of revenue model adopted by the company. This will help in answering why do companies use a particular revenue model? Does adopting certain revenue model increase the adoption rate amongst consumers? Hence a conclusion can be drawn on the revenue model that has the most success rate.

4 How do social enterprises create a social impact in developing countries?

The answer to the above sub question will provide us to get an overview on how exactly do these companies achieve social impact? This will help us to attain a further understanding on how the products sold by these companies have an impact on the consumer's livelihood.

5 What are the core adoption drivers that help social enterprises achieve profitability and social objective at the same time?

Answering this sub-question will help us explain the various components that help in adoption of the technology. This will also give an insight into the barriers and obstacles that companies face while trying to achieve profitability. Additionally a relation between the drivers and the revenue models (profitability) and social impact will be made.

In an attempt to search for answers to the sub-questions, a literature review will be conducted. This yields an insight on the various revenue models present in literature. However, the literature review might not help find all the relevant solutions to answer these questions. The literature review is presented in Chapter 2 & 3. Hence, a case study and a cross-case analysis approach are used to give an insight on profitability and social impact achieved by companies targeting BoP consumers. A semi-structured interview is conducted with three Dutch social enterprises. The findings of the interview and the

analysis are presented in chapters 4 & 5. The methodology to find the answers for each of these questions has been depicted in Table 1.

How do social enterprises that cater improved cook stoves achieve profitability and social impact in developing countries?		
Research Question	**Method**	**Chapter**
1. What is the different type of revenue models available in literature for Renewable Energy Technologies?	Literature Review	Chapter 3
2. What is the different type of revenue models adopted by social enterprises in developing countries?	Case Study Analysis	Chapter 4
3. Why do social enterprises choose a specific revenue model?	Case Study Analysis	Chapter 4
4. How do social enterprises create a social impact in developing countries?	Literature review and Based on case study & cross case study analysis	Chapter 2,Chapter 4,Chapter 5
5. What are the core adoption drivers that help social enterprises achieve profitability and social objective at the same time?	Literature Review and case study analysis & cross case analysis	Chapter 3 & Chapter 4,Chapter 5

Table 1:Summary of Method for each research question

1.3.3 Scope of the Study

This section gives us an outlook on the scope of the study. The scope is divided regarding market, type of renewable energy product, country and cases. This thesis aims to look at companies that provide energy to the BoP.

- **Types of Market**: The thesis will focus on low-income users (peri-urban, rural market) that lack access to clean cooking methods.
- **Renewable Energy Products**: The thesis will focus on different types of technology that caters to using renewable energy to cook food. These are improved cooking stove (ICS). These ICS could be Biogas Reactors or Solar stoves or merely efficient cooking stoves.
- **Countries:** The most suitable countries that fit the research are the BoP markets in developing countries because these markets lack access to basic facilities and use wood or charcoal for cooking food. The thesis will focus on companies based in the Netherlands that target the BoP market in developing countries. Some of the developing countries that will be selected are countries within Africa for example Kenya, Tanzania.
- **Cases:** The thesis will focus on renewable energy companies that focus on social entrepreneurship and provide efficient cooking stoves to the low-income BoP markets.

1.3.4 Relevance of Study

1.3.4.1 Scientific Relevance

The scientific contribution of this thesis is that it gives an insight on the issues of revenues that has been baffling advocates for years. The market-driven approach emphasizes on the fact that revenues play an important role to achieve scalability and replicability. As mentioned in section 1.2.1.2, companies struggle to achieve scalability due to the small profit margin earned on every product sold. This is mainly due to the fact that the market targeted by theses companies are unable to afford the products. If companies earn a small profit margin on each product sold, in order to earn higher revenues it is necessary to sell high number of units to the BoP market or to increase rate of adoption. Therefore it can be said that revenues are critical in achieving profitability. How do these companies earn revenues when they target this group? These companies need to focus on selling a high number of units. Present literature states that consumers are not very keen on buying the products due to factors such as affordability, the product does not match their consumer values and many other reasons which will be discussed in Chapter 3.Moreover, there is a missing link between consumer adoption and revenue in current literature. This will be understood with the help of revenue models. Does the choice of revenue model have an influence on profits?

In order to achieve higher adoption companies need to innovate in the way they sell to the BoP market. To understand innovative selling methods it is first needed to understand the barriers that companies face while targeting this group. Several studies have been conducted to identify adoption barriers for the BoP market especially for ICS. However, most of these studies focus on barriers of dissemination rather than drivers in order to achieve high adoption rates. Incumbent studies fails to provide an adoption framework for the BoP market. The product adoption framework developed by Cheryl Nakata & Kelly Weidner (2012) links poverty to adoption with three variables influence poverty negatively or positively to adoption. These variables counter the limits of poverty hence enabling higher rate of adoption. However, this model fails to elaborate on these variables. How exactly does one achieve adoption or in other words what are the drivers that enable adoption. Hence, this study combines two sources of literature and the three

case studies help in expanding and confirming the list of drivers. Further, how do these variables exactly influence adoption and what is the relation between adoption and the choice of revenue model? This thesis aims to reduce the gap between adoption drivers and revenues through the choice of revenue model employed by the enterprise. Please refer to Section 2.7 where the literature gap is explained in more detail. The derivation of the framework has been explained in more detail in chapter 3.

Therefore, this study intends to cover three case studies in which Dutch companies target African BoP market. Here comparisons and similarities will be made to check adoption drivers of ICS in different African countries. The results of this thesis combine two incumbent sources of literature leading to an elaborate framework using the framework developed by Cheryl Nakata & Kelly Weidner (2012) as the basis. Hence, in this thesis, we aim to reduce the gap by developing a ***framework*** that will look into finding a link between adoption and revenues & social impact (More information on social impact is provided in the next paragraph). This framework will offer an assemblage of knowledge on the applicable adoption drivers for ICS to achieve profitability. Hence, the drivers that are discovered give an overview for social enterprises to achieve profitability by increasing the adoption rate amongst consumers.

Social contribution is one of the main dimensions of scientific study. Hence, this thesis addresses the social aspects of energy inclusion. Further, it also addresses the livelihood impact or social impact. This thesis addresses the relation between social impact and consumer adoption to achieve profitability, which in turn will lead to scalability. In a nutshell the relation between adoption to both revenues and social impact will be derived through this study. Therefore, it can be said that the main scientific contribution of this thesis is to develop an adoption driver framework, especially for ICS.

1.3.4.2 Practical Relevance

The practical relevance of the study is to provide an input for future entrepreneurs concentrating on the BoP market especially with respect to the improved cook stoves. Moreover, the study also provides input for incumbent entrepreneurs to formulate strategies in order to overcome barriers in consumer adoption at the BoP market. Furthermore, recommendations given at the end help entrepreneurs to truly achieve social impact by uplifting livelihoods. The practical recommendations are provided in section 6.4.1.

1.3.5 Research Approach

This research approach will be theory-oriented based on literature review and by conducting semi-structured interviews with different sustainable energy companies (Verschuren *et al.*, 2010). The aim of this is to gain more knowledge about the theoretical aspect of the research. According to Verschuren *et al.* (2010) a research strategy or approach can be defined as a set of key decisions from which some key decisions will follow.

The first key decision is the choice of depth or breadth (Verschuren *et al.*, 2010). The aim or objective of this research is to explore the various innovative revenue models and types

of social impact adopted by different renewable energy companies in developing countries. A generalization outcome or result can be achieved by using a breadth strategy, but it requires the researcher to use a large-scale approach. Moreover, it will require contacting a large number of companies that will be difficult to achieve due to lack of time and responsiveness of companies. However, an in-depth strategy will help the researcher to achieve the objective of the research. The objective of the research advocates an in-depth research strategy, as it enables to achieve depth, elaboration, complexity and soundness thus minimizing a risk of uncertainties by using a smaller number of research units (Verschuren *et al.*, 2010)

The next decision to be made is a quantitative or a qualitative type of research method. As discussed, the research focuses on having an in-depth approach, and hence smaller numbers of research units are used. Furthermore, not enough knowledge has been obtained by the literature review and a literature gap exists which makes this an exploratory research project. As a result, a qualitative research method is used. Therefore, a case study method is employed and it is best applied when research addresses descriptive or explanatory questions and aims to produce a first-hand understanding of people and events (Yin, 2002). He names the following conditions for choosing the case study methodology: (1) the type of the research question, (2) the amount of control that the investigator has over the actual behavioral events, and (3) the degree of focus on contemporary, as opposed to historical events.

Exploratory studies can be undertaken by interviewing individuals (Sekaran *et al.*, 2010). Therefore, the case studies will be carried out by conducting semi- structured interviews. The goal of a semi-structured interview is to learn and build on information that might not have been considered necessary by the interviewer. However, relevant questions will be formulated to start the interview and new questions not present in the interview protocol, could be asked based on the respondents answers(Gill *et al.*, 2008; Sekaran *et al.*, 2010). The most commonly used qualitative method is the semi-structured interviews. So by using this qualitative research method the objective is to get an in-depth understanding that could be obtained otherwise by quantitative methods like questionnaires(Gill *et al.*, 2008) . The research approach has been depicted in figure 2.

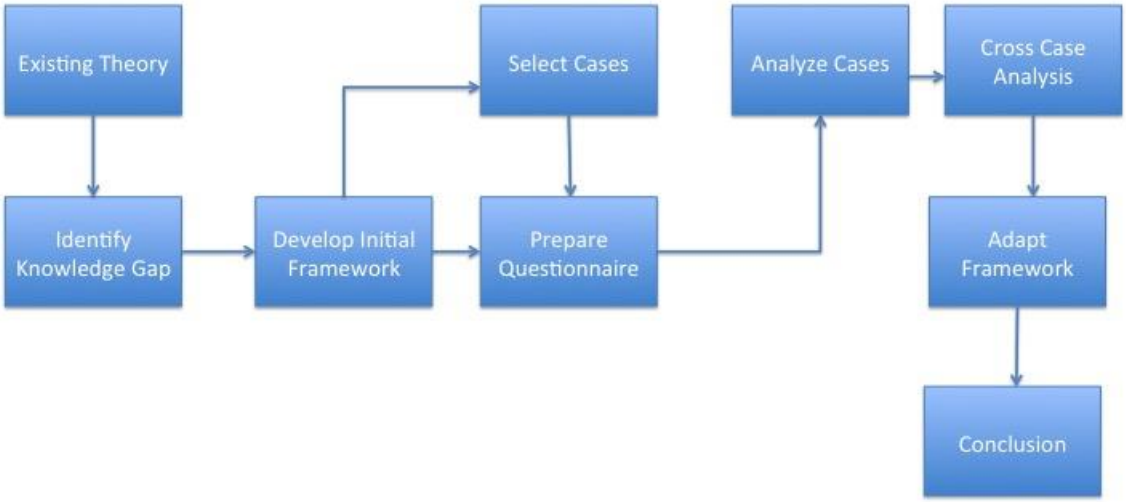


Figure 2: Research Approach

The ***framework is*** developed in four steps. The first two steps focus on developing the framework, and the last step verifies and validates it post interviews with companies.

Step 1: Literature Review/Theoretical Gap Identification

Step 1 involves the literature review. The purpose of this step is to look at the current literature available on different aspects that will contribute to this thesis. Concepts such as BoP, social entrepreneurship, frugal innovation, financing will be dealt with in more detail. Researchers such as A. Chaureya *et al.* (2009) have addressed the fact that one type of revenue model is better than the other. But the author fails to address the fact that there could be other factors that influence adoption and not only a particular revenue model. Moreover, the author fails to address the profitability issue with respect to the revenue model.

Step 2: Initial Conceptual Model

In this step, the conceptual model will be developed through the literature on product adoption at the BoP and ICS. The aim is to recognize drivers that increase adoption and build an initial framework. More details are provided in Chapter 2.

Step 3: Case & Cross Case Analysis

This step intends to build on the initial conceptual model developed in step 2. Chapter 4, which deals with the case study analysis, validates and verifies the adoption drivers discovered in step 2. More details regarding the interview procedure are provided in chapter 4.

Chapter 5 essentially performs a cross-case analysis to corroborate the information gathered in Chapter 4.This increases generalizability up to a certain extent. Furthermore, a conceptual framework is based on the ICS industry. More information is provided in chapter 4.

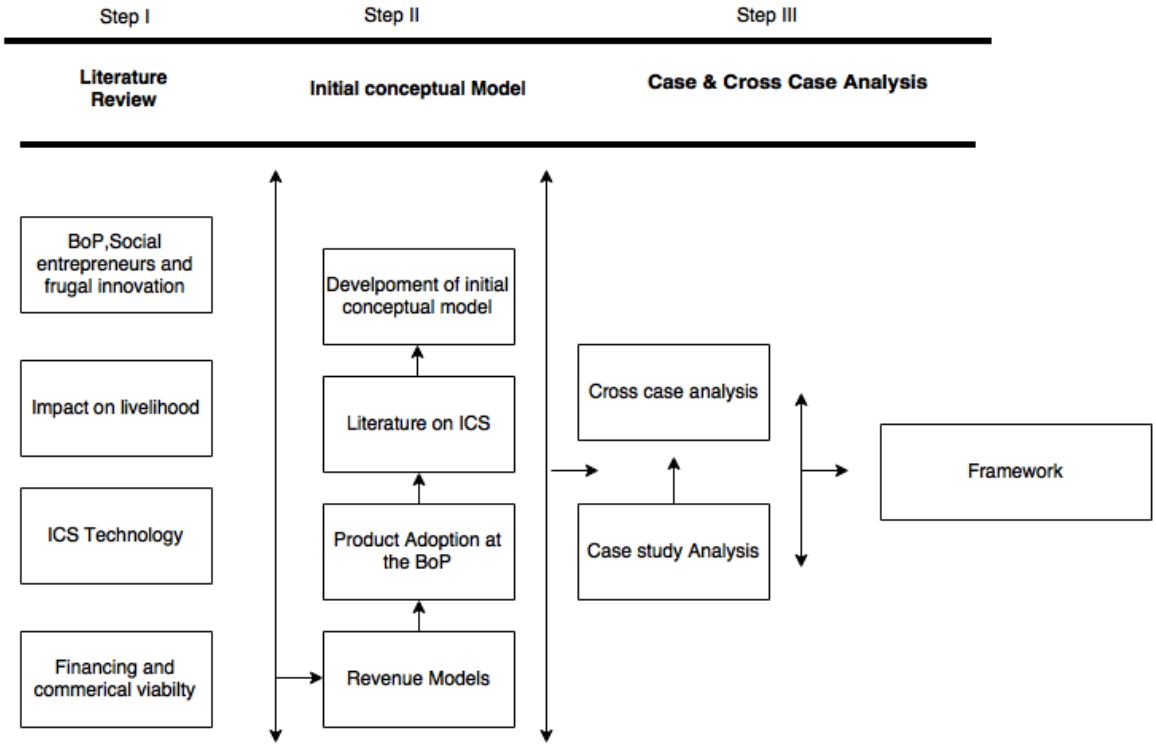


Figure 3:Research Steps

1.4 Organization of the Thesis

This sub-section provides a visual description of the flow of the thesis. The organization of the thesis can be seen in Figure 4.



Figure 4: Organization of Thesis

Chapter 1 will include in the introduction. This chapter describes the concepts of the BOP and the need for this research. The next chapter describes the theoretical background for the context of this thesis. Chapter 3 describes the concept of business model, revenue models and the adoption drivers. The conceptual model is derived from chapter 3. In Chapter 4 case study analysis is presented. Three cases are described in this chapter. Each case will represent a company from a different country in Africa. Chapter 5 a cross-case study analysis is presented. In this chapter, the different cases are compared, and their similarities and differences are analyzed. In chapter 6 the findings of the research are presented. The limitations and conclusion are discussed. In the last chapter reflections on the research are described.

Chapter 2: Theoretical Background

2.1 Chapter Introduction

Chapter 1 introduced the essential concepts needed to understand the aim of this thesis. Chapter 2 is a continuation of the previous chapter in terms of the theoretical background. Literature on the transition from a donor driven to a market driven approach is explained in more detail. Furthermore, the rise of social entrepreneurs, frugal innovation, social impact and ICS technology is described. Additionally, financing available for consumers and companies is made explicit. Finally, the literature gap of this thesis was identified that revenues is tied to adoption. What drives adoption and how is it related to revenues and social impact was also explored. When do companies truly achieve a social impact is made explicit.

2.2 An overview on the emergence of market driven approach: Donor Vs. Market

Before the emergence of market driven approach the government and NGOs took an initiative to disseminate ICS to the BoP. This was done via subsidies and distribution of ICS, which were free of cost. But, they faced a lot of barriers, which is discussed below. Hence, this section primarily discusses the efforts to successfully disseminate ICS to rural consumers by governments and NGOs.

2.2.1 Donor Driven approach

During the 1970's & 1980's many development programs were taken to promote the use of renewable energy technologies such as biogas and cooking stoves in developing countries. Donor driven programs tried to disseminate different types of cook stoves through subsidies. However, by the 90's only Kenya & Sri Lanka were successful in commercializing the variety of ICS (GVEP, 2009). Based on the donor statistics from the Organization for Economic Cooperation and Development by the year 2000 the development assistance for RET's totaled to approximately 3 billion $. Most of the capital was used for hydro, wind technologies and not for ICS (Martinot *et al.*, 2002) .

The role of the government in increasing the use of RET is very important. The most important channel for funding RETs in developing countries is the Government. The Government can achieve this through national programs, subsidization, grants, loans and tax incentives (Bobinaite *et al.*, 2014). Subsidies might help in promoting and sale of the stoves but will not help in achieving long-term use of stoves. On the other hand NGO-run programs may be more aware and flexible of the user requirements. However, NGOs would lack the capital needed to support the successful implementation of such programs (Douglas F.Barnes *et al.*, 1994)

Early donor driven programs faced many hardships because factors such as replication and sustainability were missing. The rate of adoption was small compared to the size of the BoP market. Further, the barriers faced by RET's in successful dissemination were lack of awareness, ***economic & financial*** constraints, technical risks, institution & regulatory barriers and finally behavioral aspects. Another important finding was that the

adoption of RET is based on the usefulness and quality of the technology compared to the traditional ones (Reddy *et al.*, 2004)

China, India & Nepal have implemented programs for disseminating biogas for cooking on a large scale. These countries have large biogas manufacturing facilities. China has installed 7.5 million biogas digesters. But, due to lack of training of households, eventually led in decreasing use of these reactors. India and Nepal have 3 million and 35000 biogas reactors installed respectively. Though these programs were successful in installing the reactors, 30% of these reactors were eventually not used anymore. Problems that were reported were lack of user training, and unskilled technicians. In Africa, most of the biogas reactors were installed through donor programs. But due to lack of water, high investment and insufficient feedstock these programs could not be replicated in other areas (Martinot *et al.*, 2002). Though the donor driven programs were fairly successful in countries such as China and India it had to overcome challenges such as **lack of financing** and **scalability**. The programs and solutions developed by NGOs were usually non-scalable due to lack of financing (C. K. Prahalad, 2011). However, these programs provided an impetus to new companies entering this challenging market.

2.2.2 Market Driven Approach

The transition from donor based to market based approach has been a slow process. The subsidies helped in dissemination of the ICS to some sections of the society however it had major drawbacks, such as people were not concerned about maintenance of the ICS because it was free. It was observed that when products are given for free, consumers tend not to value the product. This decreases the longevity of the product. Nevertheless, when a consumer buys a product it is observed that the value the product is higher and they tend to take better care of it (Schatz, 2015). Another major drawback was that donor driven mechanisms were not scalable. Therefore, to create a viable and scalable ICS industry, it is necessary to adopt a market oriented approach that will improve all aspects of the supply chain, from R&D to delivery mechanisms (GVEP, 2009)

The shift from the donor-based approach to the market based approach was majorly due to **lack of financing** and therefore NGOs and governments were unable to achieve scalability and profitability. Hence, to achieve market sustainability, business enterprises need to demonstrate innovative & robust business models with a profit making attitude(Martinot *et al.*, 2002). To summarize, this transition majorly took place to solve the importance of profitability and scalability and to solve the problems faced by the donor driven approach.

Nevertheless, if the ICS is sold through a market driven mechanism it must cater to consumer needs, user motivation to adopt it and lastly it needs to be inexpensive. This led to the rise of the social entrepreneurs and micro financing, which will be discussed in the next section. There are many factors that influenced the rise in the market driven approach. Firstly, technology has improved to a great extent that resulted in economies of scale. Secondly, the rise of micro financing enterprises and banks opportunities helped companies to take a plunge into this market. Thirdly, social entrepreneurs came up with

innovative solutions to cater to the market in such a way that consumers could afford paying for the technology. Mostly the transition took place due to the debt crisis of the 1980s.To maintain financial stability the countries were forced to cut down on public spending and the governments opened their gates to FDI. Due to cutting down on government spending and new policies a large number of organizations started tapping into this market to address a variety of problems often with the support of foundations and NGOs (Bailis *et al.*, 2009). Table 2 gives a summary on the shift from the donor driven to the market driven approach according to (Martinot *et al.*, 2002)

This section addressed the transition from a donor driven to a market driven approach. It also addressed the fact that **lack of financing** was a major deterrent for governments and NGOs to continue their efforts in dissemination of ICS. The next section will address the rise of social entrepreneur's who adopt the triple bottom approach social, environmental and economic objectives.

Donor Driven	Market Driven
Technology Fit	Market assessment
Equipment Supply Focus	Value added & user emphasis
Economic Viability	Social Needs, Financing & revenue solutions
Technical Demonstrations	Demonstrations of innovative business model such as social, financing & institutional
Donor gifts & government subsidies	Building sustainable markets
Programs & intentions	Experience & results

Table 2:Donor driven to Market driven adapted from (Martinot et al., 2002, p. 311)

2.3 Social entrepreneurship & Social impact

Social Innovation aims to provide solutions to the low-income groups that do not have access to resources or lack capabilities to sustain themselves. Therefore, the primary purpose of a social business is it to help the society by providing innovative solutions to the poor in such a way that it is profitable and self-sustaining (Yunus *et al.*, 2010). This concept is similar to social entrepreneurship. Social Entrepreneurship is characterized as 'a practice including the innovative use and combination of resources to seek opportunities to catalyze social change and/or address social needs'. Social Entrepreneurs use a strategy called as the base of the pyramid marketing. This strategy enables them to cater to the low-income population around the world because they believe the number of poor people are more then the rich ones hence by selling the products to them, for a small price will help achieve social as well as financial profits (Schatz, 2015).

Please note, for this thesis social entrepreneurs are going to be used as the people who cater energy solutions to the BoP. The main goal of social entrepreneurs is to cater to the low-income group by providing clean, scalable, affordable and accessible innovative solutions so that it can fulfill the economic, social and geographic characteristics of this

group and reduce poverty (Ballesteros *et al.*, 2013). A recent report suggests that there is a strong correlation to energy poverty and income poverty. The United Nations development Programs (UDNP) suggest that households that use wood, charcoal or dung as a cooking fuel is one of the major signs of poverty (Dr. Ewan Bloomfield, 2014). By bringing market based solutions social enterprises aim to provide equal **energy access** to this segment. Moreover, they are functioning with **profit** in mind (Roper *et al.*, 2005). These enterprises constitute of small medium enterprises (SME's), community cooperatives and non-governmental organization (NGOs). They design tailored, sustainable solutions built on consumer needs and financial capacity (Ballesteros *et al.*, 2013)

Therefore, social entrepreneurs aim is to substitute traditional cooking stove with the ICS by providing them with a sustainable solution that ensures social impact. There are four ways in which social impact can be achieved. They will be referred to four types of social impact. One is **health impact**, second is **safety**, third is **monetary gains** and last is **income-generating opportunities.** Future chapters will refer to the social impact as I, II, III, IV.

I. Health Impact
II. Safety Impact
III. Monetary Impact
IV. Income generating opportunities

1. **Health Impact:** Burning of wood and charcoal primarily causes respiratory diseases such as chronic bronchitis and emphysema(Hart *et al.*, 2013). By using ICS the HAP is reduced dramatically.
2. **Safety Impact:** The weight of collecting firewood falls mostly on women and young girls. These women travel long distances on foot to collect firewood. A study carried out in three villages in Kenya found that women travel a distance of 1.0km-10.5 km to collect firewood. Moreover, due to the long distance traveled by these women they face the danger of getting sexually assaulted (Hart *et al.*, 2013)
3. **Monetary Impact:** By using clean cooking fuels which can be purchased in shops, women will have more time for education and income generation which are important factors considered by social enterprises (Zuzarte, 2008).
4. **Income-generating opportunities-** A recent report suggested that 72% of SME's that include women in their supply chains were showcasing a growth in their profits. Some organizations target women to enhance their livelihood by providing income-generating opportunities. Sometimes women are involved in the production processes of ICS. Many women in developing countries are involved in building clay pots and ceramics. Additionally, women can add to the household income by selling the ICS. This will encourage more women to adopt ICS as it improves their social status and there is a significant increase in their income (Hart et al., 2013)

2.4 Frugal Innovation

Frugal Innovations were envisaged due to resource constraint environments. The products are designed in a way that it caters to the basic needs of the low-income consumers. The frugal products have low costs and look substandard compared to present products as they are made of simpler and low-cost materials (Zeschky *et al.*, 2011)

Iva Pesa is part of the Centre for Frugal Innovation in Africa, which is a collaborative effort between TU Delft, Leiden and Erasmus universities. For the context to this thesis the definition that is most appropriate is by Dr.Iva Pesa. She defined "Frugal Innovation as the re/design of products and services in a way that it remains inexpensive for the consumer and retains its user value" (Pesa, 2015b).

According to Roland Berger Strategy Consultants (2013) the international market share of frugal innovations will be twofold in the coming five years. Frugal innovation has a noteworthy social influence as it provides basic products and services to big markets. It helps to alleviate poverty by proving affordable and good quality products, which then significantly improves the health of the BoP (Eugenia Roscaa *et al.*, 2016)

This thesis will focus on companies that provide improved-cooking stoves (ICS) to the BoP market. ICS can be said to be a frugal innovation because it matches the characteristics of a frugal innovation. ICS are designed in a way that it reduces material usage, which in turn reduces cost of the product(Pesa, 2015b).

The successful implementation of frugal innovation does not only depend on ***affordability but consumer adoption*** also plays a very important role (Pesa, 2015a). Researchers like Y.A. Bhatti *et al.* (2013)have emphasized that frugal innovation does not only depend on innovative technologies but also depends on consumer adoption. Researchers like Zeschky *et al.* (2011) have also addressed the issue of understanding the needs and the local environment for the successful implementation of frugal innovations. The concept of business models, adoption will be addressed in chapter 3.

2.5 Improved Cooking Stoves-The Technology

This sub section describes the various ICS available in literature. The term ICS has been use interchangeably and its describes stoves that reduce and optimize emissions so this could be a biogas stove, solar stove or a simple stove that uses less biomass(Rehfuess *et al.*, 2013).Traditionally the cooking stoves used by low-income consumers are a three stoned fire. It is to be noted that 3 billion people all over the world use this type of cooking stove(Nordica MacCarty *et al.*, 2008). These stoves are all basically burning chambers that can be utilized as a part of numerous models and sizes of cooking stove. There are different types of cooking stove available in literature, but this thesis focuses on three different types of ICS relevant to the study.

1.Gasifier stoves –The gasifier stoves are gas burners that generate gas through biomass. These stoves use several fuels like firewood, charcoal and biomass residue such as coconut husks and maize cobs. Gasification of the biomass takes place at 700-1000C through a thermochemical conversion process. The air (oxidant) and gas flow through a fixed packed bed. Therefore oxidation and reduction reaction takes place between the air and the biomass(Mukunda *et al.*, 2010).

There are two ways in how the air enters the cooking stove one is natural draft and other one is forced draft. The easiest method is through the natural draft where air enters and hot air goes up. However, the main drawback of using this method is that air cannot be regulated easily. The other method is through forced draft. Air is forced by use of a fan. The main drawback of using this method is that it is prone to breaking down and more expensive than its natural draft counterpart(GVEP, 2008).

2.Solar stoves- Solar stoves have for some time been introduced as a fascinating answer for the world's issue of diminishing fuel wood sources and other ecological issues connected with wood fuel interest for cooking (Pouris, 2007). Solar stoves convert heat into energy. Solar cooler can convert 80 % of the sunlight into energy. A panel cooker consists of a reflective panel that guides the heat from the sun onto a black cooking pot. This vessel is covered in a plastic insulating oven bag. The insulating oven bag lets in solar energy and traps the heat. The food is cooked in high temperatures of 150C(One Earth Designs, 2014)

3.Biogas system-Biogas is a fuel that contains 65% methane and 35% CO_2. Biomass is fed into a digester where through the process of anaerobic digestion; biomass gets converted into methane gas in the absence of oxygen(B. R. Energy, 2009). Anaerobic digestion takes place when using microorganisms called as anaerobes(B. R. Energy, 2009), These anaerobes degrade the biomass and produce methane gas. The gas formed by the digester is fed to a stove as fuel. The similarity between Gasifier stoves and biogas are that both the technologies use biomass for cooking. But the burning of the biomass takes places through different mechanisms.

2.6 An overview on access to consumer and enterprise financing

According to Reddy *et al.* (2004) for successful dissemination of the ICS, financing needs to be given the utmost importance. To solve the issue of financing, there are different financing options that companies are using. These are carbon financing, subsidies and Micro-Financing institutions (Dr. Ewan Bloomfield; Fiona Lambea *et al.*, 2015; Marek Hudon, 2008). Micro financing and carbon financing are gaining a lot of interest among researchers as one of the viable solutions to solve the issue of achieving profitability.

Financing can be viewed from two different perspectives. One can be the consumer financing, that is the financing needed by a rural consumer and the other can be financing needed by the social enterprises. BoP consumers are unable to pay the full amount, due to variable cash flows. Additionally, these consumers cannot obtain loans from commercial banks and cooperatives due to lack of appropriate paperwork. Commercial

Banks and cooperatives require customers to have sufficient paperwork, which include utility bills, steady evidence of income, a bank account and sometimes even an identification card. Moreover, besides paperwork commercial banks and cooperatives require a guarantor to approve the small loans. Hence, rural consumers are unable to obtain loans from commercial banks (Fast Track Carbon, 2016). Consequently to address these issues Mohammad Yunus founded the concept of micro financing in the form of Grameen Bank (Morduch, 1999). According to Yunus access to credit is important for poverty eradication. With the help of MFI, the consumers can **generate income** for themselves and hence will be able to achieve the right to food and shelter (Marek Hudon, 2008). MFI's focus on low-income consumers who do not adhere to the paper work requirements (Fast Track Carbon, 2016). So, the aim of the MFIs is to alleviate poverty by providing financial credits to low-income consumers (Morduch, 1999).

Nowadays MFI is under a lot of scrutiny regarding its effectiveness in eradication of poverty in developing countries (Hartungi, 2007). According to researchers like Mersland *et al.* (2010) MFI's are focusing on the needs of the consumers who can afford to pay back the loan and are ignoring the financial needs the low-income consumers. A few MFI's are being called loan sharks due to charging of high interest rates (Marek Hudon, 2008). Presently a mere 12% of people belonging to the BoP is being assisted by the MFI's (Agnihotri, 2013).

From the perspective of social enterprise, financing is needed for scalability and replicability. Social enterprise can obtain financing from commercial sources or from subsidies or grants (philanthropic capital). Hence, the Bill and Melinda Gates foundation have come with creative ways to fund companies. Consequently, instead of providing direct funds nowadays the Bill and Melinda Gates foundation issues **loans** to the companies they support. The foundation perceives this as a creative approach to bolster companies by providing them with definite funding(Bugg-Levine *et al.*, 2012)

Additionally, another way a company can obtain financing is through commercial capital. Researchers like Agnihotri (2013) demonstrate that revenues assume a critical part for organizations attempting to build their profits. Companies can obtain financing from various sources. They can obtain loans from angel investors or from banks, venture capitalists and private equity (enterprises consisting of account managers that invest in new companies) or companies can opt for crowd funding. Renewable energy companies can obtain the initial funding from angel investors i.e. friends and family but it becomes difficult to gather funds when need to scale up. Furthermore, due to the high risks involved with renewable energy technologies it becomes difficult for them to obtain capital from these sources due to lack of guarantee. Banks offer credits to social enterprises as an advance yet they have high interest rates(Trivella, 2015). In any case, keeping in mind the end goal to acquire a credit from a bank the social enterprises have to exhibit a constant flow of money streams or cash flows. Cash flows indicate your financial status. Moreover, it determines the funding required for scaling and sustaining the business.

Carbon financing has a key part to play in the improvement of a worldwide business sector for clean cook stoves and powers as it can change the financing dynamics for cook stove ventures from one that has customarily centered around donor driven mechanism to one that draws in investments from the private segment. Clean cook stoves can conventionally save one metric ton of carbon dioxide emissions yearly, and numerous models can spare two to four times that sum. These sums change as per the kind of fuel utilized, ICS efficiency and product lifetime. Such cutbacks in emissions can be ensured and sold through worldwide carbon markets, creating noteworthy income for the stove organizations and giving choices to keeping costs low for the buyer(Global Alliance of Clean Cookstoves, 2013).

Another way a company can obtain financing is through crowd funding, Crowd funding is "a joint effort by users who network and put their money together, generally through the internet, having a specific end goal to put resources into and bolster endeavors started by other individuals or organizations" (Patrick T.I. Lam *et al.*, 2016). This system can be used by startups to raise money in their early stages of development. According to Patrick T.I. Lam *et al.* (2016) donation based or reward based crowd funding are useful for REC's during the beginning stage of development. But the major drawback of this type of financing is that new business ideas might get stolen and the possibility of fraud taking place is also very high.

The main argument of this section is to demonstrate the importance of financing. Financing is essential for companies to achieve scalability and replicability. However**,** **financing** is very much dependent on the **revenues** gathered by the social enterprise. Hence, in order to achieve profitability social enterprises requires validating a steady flow of income. Therefore, this thesis will focus on how do companies make revenues. This is analyzed with the help of revenue models. More information is provided in chapter 3.

2.7 Literature gap

The earlier section addressed the fact that in order to achieve profitability revenues play a very important role. If the company does not prove that it is profitable it becomes difficult for banks to provide loans to these companies. This proves to be a major barrier for companies to achieve scalability and replicability in other places. Financing is required to attain scalability and vice versa. According to Investopedia (2016) profitability is defined as monetary advantage that is acknowledged when the revenue exceeds the costs in order to support the business.

Profit=Total Revenues-Total Expenses

We can say that profit has two elements one is revenues and the other is cost or expenses. Expenses could be in the form of variable and fixed costs and the revenue is the form of cash flows or money.

Literature on ICS have stated repeatedly that the major barrier for adoption is affordability. Low-income consumers are unable to pay for the high upfront costs of ICS. In this thesis we intend to narrow the gap of achieving profitability through revenue models. More importantly literature has been addressed on the barriers that companies

face while trying to increase the adoption rate amongst low-income consumers. The literature on ICS specifically on the barriers in adoption have been scattered across different articles. Moreover, social enterprises aim to achieve **social objective** through four ways (health, safety, monetary & income generating opportunities). How and when do these companies achieve the social objective? Do they achieve social objective pre adoption or post adoption. Not significant attention has been given to the relation between revenues & social objective to adoption drivers specifically for ICS. Hence, apart from problem of achieving scalability through revenues, we also plan to address the issue on **adoption drivers** in this thesis.

2.8 Chapter Summary

This chapter provided a theoretical background on the concepts that are addressed in the study. First, the need for the market driven approach was explained. This took place mainly due to the fact that donor driven approach wasn't a sustainable solution. How do governments and NGOs cater to 3 billion people through the donor driven approach? Also, it was reported when products were given away for free consumers stopped using the ICS. Therefore, a market driven approach was needed to solve the barriers faced by the government. Due to this transition social entrepreneurs came into existence. These entrepreneurs use market driven approach to cater to the BoP. But, the main goal of these entrepreneurs is to maximize **social objective** than **profits** for their shareholders. Having said that it is necessary to note that revenues are needed to scale the operations to other parts of the world. If social impact has to be achieved by catering to a large number of people, revenues are needed to sustain their activities. There are four ways in which social impact can be achieved as mentioned above. But how do companies target this group when they can't afford to pay for the products? This was addressed in the financing section where it was argued that consumer financing is needed to help the BoP group to pay for the products. Also, in order to scale up social enterprises need to demonstrate a steady stream of cash flows in order to obtain financing from the banks or investors. Lets take a step back and ask how do companies achieve profitability and as they are social enterprises how do they achieve a social impact? It's a known fact that consumer adoption is essential for any business to make profits. Nevertheless, how do social enterprises ensure adoption to achieve profitability and social objective at the same time? Hence, the study intends to fill the literature gap by addressing the afore-mentioned issues.

Chapter 3: Literature Review

3.1 Chapter Introduction

Chapter 1 and Chapter 2 introduced all the important concepts of this study and most importantly defined the literature gap. The flow of this chapter goes as follows: First the methodology is described which explains methodology of the literature review. Secondly, ambiguity between the terms revenue model and business model will be clarified. Thirdly, literature on business models relevant to the thesis is discussed. Fourthly, literature on revenue models is carried out that helps in classifying the revenue models available in literature. Next, literature on ICS will be looked at; this helps in identifying the barriers and drivers. Finally, literature on product adoption at the BoP is looked at; this is the basis of the conceptual model. Furthermore, the literature on ICS and product adoption helps in developing the initial framework. Finally the chapter summary is represented.

3.2 Methodology for literature review

This section is mainly studied via desk research. The literature studied provides a holistic approach in understanding the global BoP population and not pertaining to a single country or region. The search includes a selection of literature that appears to be relevant. This has been done through different methods.

1. Some key words have been typed in the Google search engine. These key words include revenue models and business models and product adoption of BoP, improved cook stoves Due to explorative nature of this research when satisfactory literature suited for this thesis was not found the key words were changed or added.
2. Once relevant literature was found the references found within the paper has been used to look for more literature.
3. Next, Scopus and Google scholar has extensively been used to find relevant literature. The following data sources have been used:

Webpages:	
Google scholar:	
URL:	*https://scholar.google.nl*
Scopus:	
URL:	*http://www.scopus.com/*
Web of Science:	
URL:	*apps.webofknowledge.com*
Google search engine:	
URL:	*www.google.com*

Table 3: Sources of literature

3.3 Revenue Models v/s Business models

The two terms business model and revenue model have often been used interchangeably.

Therefore, it will be insightful to elucidate this confusion before going forward.

The concepts of business models have been around since the end of the 20th century due to the birth of new forms of business (e.g. e-business, BoP, emerging markets)(Zott *et al.*, 2011). According to Teece (2010) every business enterprise uses a certain business model. A business model basically incorporates all the key activities attempted by a business enterprise. Therefore, a business model expresses the creation and delivery of the value to the consumer. Also, a business model demonstrates how a firm **makes money** when the value is delivered. The key elements of a business model are shown in Figure 5.These elements are creation of value (selected technologies & features in product), delivery of value (determine benefits to the consumer) and identify market segments, next how can a firm make money with the value created? Finally convert these **payments into revenues**.

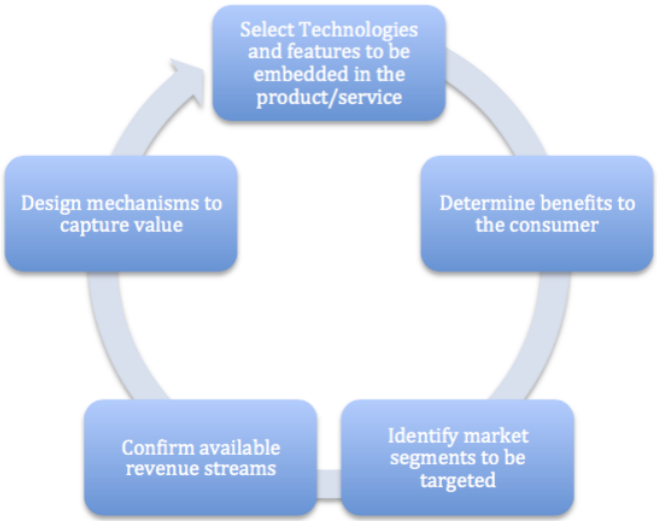


Figure 5:Elements of a business model(Teece, 2010, p. 173)

Researchers like Giesen *et al.* (2007); (Osterwalder *et al.*, 2005) are of the opinion that revenue model is a subset of a business model. Therefore, in order to obtain a greater understanding of the revenue model first we need to understand the concept of the business model. In figure 6, Giesen *et al.* (2007) addresses that a business model is basically made up of three elements. One is the industry model, revenue model and the enterprise model. Industry model indicates to innovating the value chain by moving into new key commercial enterprises. The enterprise model basically indicates innovating and creating and establishing new collaborations. The ***revenue model*** essentially mentions on the innovating strategies used by companies to make money or revenue.

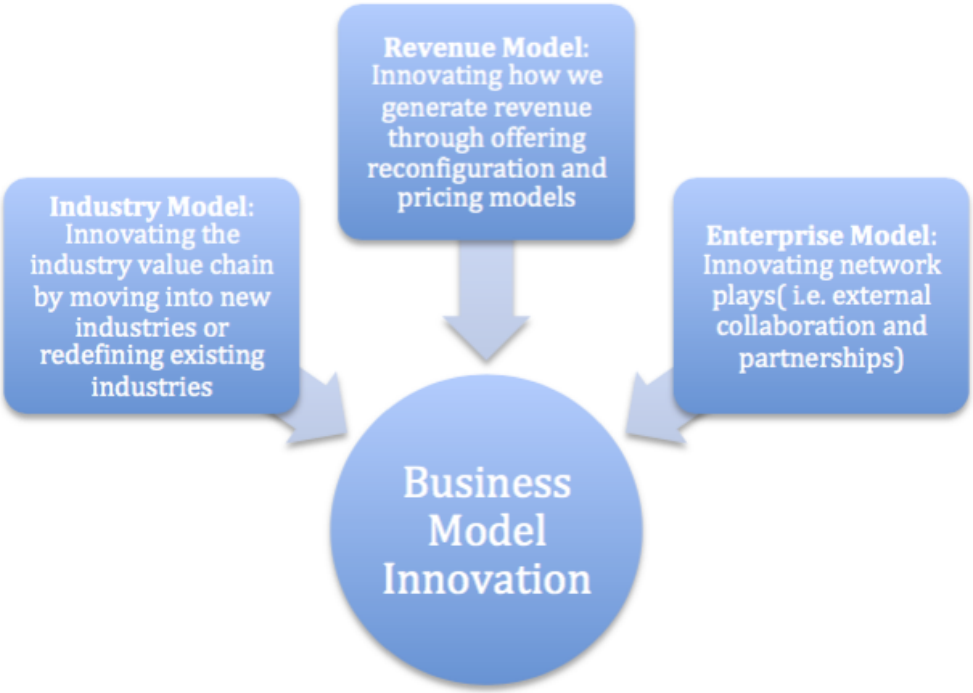


Figure 6:Framework of Business Model Innovation (Giesen *et al.*, 2007, p. 28)

3.4 Literature on Business Models

There are various definitions available in literature. One definition by Chesbrough (2002) states that the business model is "the heuristic rationale that associates technical capability with the achievement of financial value. Another definition of a business model claims that it consists of value proposition, value creation and value delivery. "Value creation is the heart of any business model, which can be seized by recognizing and capturing new business opportunities, new markets and new financial streams (Beltramello *et al.*, 2013; Teece, 2010). Value capture is about how to generate profits by providing goods, services or information to consumers.

The fundamental concern of the value proposition is with the product and service offering to create monetary return (Teece, 2010). The need to satisfy unrequired customer needs and to bring technologies to the market is captured by the business model. Additionally, Teece (2010) also claims that in order to seize value, technological innovation needs to be complemented with business model innovation. But, it lacks theoretical grounding in economics and business studies. Economic theory believes that if a product or service is provided at the market prices a consumer pays for it. However, this statement might not reveal reality. Teece (2010) discusses about business models as a value creation that entices customers to pay for this created value. This payment in turn, will increase the revenues of a company.

According to Zott *et al.* (2011)present literature on business models is in different areas fitting to the interests of the researchers. These are identified as strategic management, innovation & technology management and e-business management. Recently, the concept

of business models for sustainability and business models for the BoP market is fast gaining importance. To look at the profitability of renewable energy technologies, one needs to observe revenue models through the business model framework. The business models most relevant to this thesis are discussed below.

3.4.1 Business model for sustainability

The concept of business model for sustainability is fast gaining importance amongst researchers. According to Schaltegger *et al.* (2015) sustainability management is concerned with methods that deal with social, environment and economic issues in such a method that organizations contribute to the sustainable development at all levels. Organizations are looking to alter their business model so that they can cater to a wholesome sustainable development (Schaltegger *et al.*, 2015)

A business model for sustainability helps describing, analyzing, managing, and communicating (i) a company's sustainable value proposition to its customers, and all other stakeholders, (ii) how it creates and delivers this value, (iii) and how it captures economic value while maintaining or regenerating natural, social, and economic capital beyond its organizational boundaries (Schaltegger *et al.*, 2015). According to Schaltegger *et al.* (2015) sustainable value cannot be created only for the customers unless the value is created to all participating stakeholders. Furthermore, they also state that although a business model is market driven, a sustainable business model needs to create value to natural environment along with the stakeholders such as customers and shareholders (Schaltegger *et al.*, 2015)

3.4.2 Business model for BoP

According to Haefliger (2013) research into "building business models for developing economies and social uses" has risen in parallel to the exploration on business results to eradicate poverty in emerging countries. Researchers like MacMillan (2010), highlight new enterprises that effectively innovate business models to tap into new undiscovered markets and established social ventures are offering experts with lessons-learned and best practices for how to make profitable business models that also cater to specific social issues. Social enterprise business models need to come with new strategies to serve this market. The business model for a social enterprise can be divided into six elements according to (Lieberman, 2013). These are product sourcing and design, (2) distribution, (3) **affordability**, (4) **organization financing,** (5) **scaling,** and (6) **social impact**. End user financing is a very important factor in BoP business models. Offering financing to low-income consumers is a crucial component of an effective BoP business model. Lieberman (2013) concludes to successfully deliver value to the BoP a social enterprise should have appropriate technology, an innovative business model and interfacing with local context. But how do firms exactly make money and achieve social impact hasn't been described in detail. This can be said to be a drawback of the paper.

According to Knuckles (2016) business models for BoP serve to the four essential elements as described by (Haefliger, 2013). Haefliger (2013) describes a business model as having four elements, which are customer identification, customer engagement, value chain linkages and **monetization.**

Customer identification as the name suggests is who is your end user? Next is customer engagement how are you creating value for your end user? Value chain linkages can be in the form of partnerships or collaborations to tap into different markets. Basically, how are you going to deliver the created value? Lastly is **monetization**, how does your firm make money?(Haefliger, 2013)

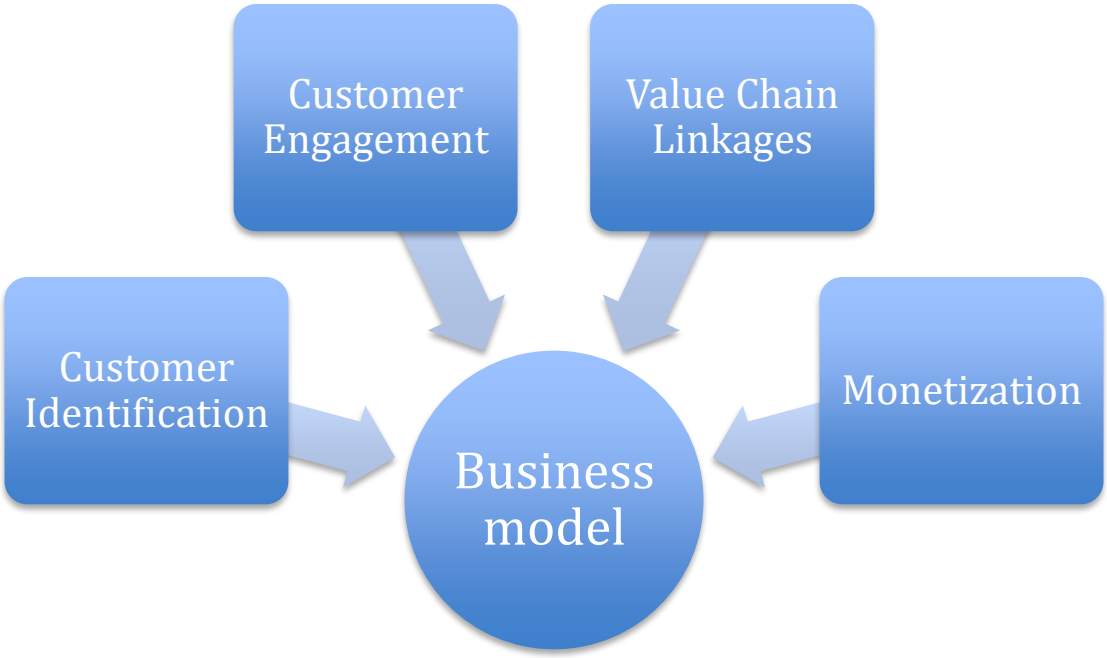


Figure 7:Elements of a BoP Business Model (Haefliger, 2013, p. 7)

Firstly, BOP business models sell to the low-income individuals at costs that they can afford. Secondly, enterprises are addressing the needs of their low-income consumers by offering unique products or services through various **pricing mechanisms.** Thirdly, value chains in low-income markets have innovative partnerships and collaborations in the form of NGOs. Lastly, BOP business models regularly allow consumers to make small installments over a period of time keeping in mind the end goal to make the product or service inexpensive (Knuckles, 2016).

3.4.3 Business Models offering Finance for Energy Access

According to Trivella (2015) scientific articles often relate energy and poverty. As previously mentioned MFIs is seen as a potential to reduce the economic hurdles for renewable energy technologies.

Authors such as Winiecki *et al.* (2009) believe that strong energy provider collaborations with MFI can overcome the barriers faced by energy enterprises. New partnerships with the energy sectors can open up undiscovered markets, and offer new products for existing customers. Therefore, to create a successful energy project it is necessary to create partnerships. Winiecki *et al.* (2009) described new business models offering finance for energy access, which has been summarized in Table 4.

The most popular business models offering finance for energy access are the one stop model and the financial institution energy enterprise partnership. But these payment schemes or business models have been researched for different sustainable energy products in various countries, but not for a specific product. Additionally, revenue models and adoption drivers have not been mentioned. But how do the companies make a profit or monetization? Which of these business models achieves scalability and profitability? Which revenue model achieves the most success?

Business Model	Characteristics
One Stop Model	Both the product and the consumer financing is provided by the same organization.
Financial Institution Energy Enterprise Partnership	The energy company takes care of offering the product the aftersales service and maintenance. While the financial institution offers the credit and takes care of the payments.
Umbrella Partnership Model	The energy company offers the product, aftersales service, maintenance. While the MFI's provides a loan to the partners who then provide the loan to the end user.
Franchise/ Dealership Model	Energy enterprises give credit to suppliers and franchises. This model is commonly utilized for generally reasonable items under approx. $50.
Brokering Model	External organization is paid by energy enterprise to source clients. The broker may likewise be included with payment collection, maintenance and post sales service.

Table 4 Business Model for financing adapted from (Winiecki et al., 2009, p. 21)

This section gave an overview of the elements a business model entails. Further, it tells us the major differences between a revenue model and a business model. This thesis focuses on how the company creates profits when catering to the low-income consumers. The profitability aspect or monetization of the firm will be looked through revenue models. The business models described by Winiecki *et al.* (2009) do not explain the innovative pricing schemes used by enterprises to cater to this market. It explains the innovative partnerships with financial institutions but what is the revenue model used by these enterprises? Moreover, what increases the adoption rate or what are the key adoption drivers? The next section we will analyze the literature on revenue models in more detail.

3.5 Literature on Revenue Models

This study will focus on revenue models because in section 2.6 it was determined that financing is a major deterrent for social enterprises to achieve scalability. To attract

financing companies need to prove to be profitable. Hence, profits of a company can be studied with the help of revenue models. Also it was determined merely 13% of companies are able to achieve scale in this segment. Next the current literature on revenue models is limited. Most of the researchers have addressed revenues through the business model framework. Hence, we will observe revenue models through the business model literature.

According to DaSilva *et al.* (2013) a revenue model is an element of a business model and can be defined as how a firm makes money through the sale of its goods or services and not how a company creates value. A revenue model demonstrates the way an enterprise makes **money** by using different revenue streams (Osterwalder *et al.*, 2005) For example the razor- razor model is a popular example of business revenue model. In this model razors are priced cheaply but the razor blades are priced at a higher price hence making it profitable (Teece, 2010).

Kolk. D (2013) looked at the business models adopted by SEC's in developing countries. The drawback of this paper is that it does not look into the issue of profits through the revenue aspect but suggests measures such as customer segmentation to achieve profitability. Literature that closest has come to the profitability aspect is by Chaurey (2009). This research addresses the feasibility of solar lanterns in the Indian rural context. According to them two types of revenue models exist: ownership revenue model and service revenue model. When the product is directly sold to the customer and the customer has to pay the upfront cost immediately it is said to be an ownership model. The other type of revenue model the authors suggest is the service revenue model. In this type of model the user can rent the solar lantern from a local village entrepreneur. The authors concluded that the primary reason behind the failure in dissemination of solar-based lanterns was due to the use of ownership revenue model. Through this model the owner primarily has to pay for the cost upfront. Hence, the owners have high capital expenditure. The authors suggest a different model that might help in disseminating the solar lanterns. They propose the rental model. Table 4 provides the advantages and disadvantages of the both the models (Chaurey, 2009). Even though this article is not related to ICS, it provides a stepping-stone towards different revenue models adopted by companies. Additionally, it provides insights on the advantages and disadvantages of two distinct revenue models. However, this research fails to address 'how' and 'why' implementing these revenue models will help attain profitability. It only addresses which revenue model is better than the other. Furthermore, it also fails to address the various types of revenue models such as the pay as you go revenue model that exist in literature.

Nowadays many social enterprises targeting low-income consumers are using a very popular model called pay as you go model. In this model low-income consumers essentially make a small payment for the product and post that they can purchase credits, which then goes towards paying off the full cost of the product. This revenue model is very popular for products such Solar home systems or DSE's (Trivella, 2015)

Another source of literature that comes closest to revenue models for ICS is by Shrimalia *et al.* (2011).The authors have analyzed the business model of ICS. According to the authors a business venture targeting low-income consumers must figure out how to make

ICS affordable to its consumers. The authors claimed that **budget constraint** was a key deterrent to achieve profitability. They deem that enterprises must keep in mind the budgets of the low-income consumers while catering to them. According to them a company must adopt different financial models for achieving scalability. These are **stove pricing strategy, enterprise finance/funding**, distributor finance, **Consumer finance**, **carbon finance** and government support(Shrimalia *et al.*, 2011). Stove Pricing strategy looks at how companies were initially forced to lower the cost but eventually had to increase the costs, as they could not sustain the business in the long run. Consumer financing is an important factor or driver in BoP business model. Hence, consumers can take a loan from a MFI to help make the payments over a period of time which makes the technology more affordable (Lieberman, 2013). However, this research fails to provide innovative revenue models and drivers that help achieve increased adoption rate.

The article by Knuckles (2016) was on business models for BoP markets. He mentioned there are four elements of a business model. For the revenue model, which is a subset of a business model, he believes that that enterprises catering to these markets allow consumers to make **flexible payments** which in turn increases the **adoption rate**(Knuckles, 2016).Therefore, even without obtaining a loan from the bank the consumer can make small payments over a period of time without any interest. This can be identified as another driver as consumers don't have the stress to pay the full amount upfront.

	Model	
Characteristic	Ownership	Fee-for service/rental
Initial cost	User owns the lantern	User does not own the by paying full cost lantern, rather rents it when required
Maintenance Cost	User pays for the maintenance cost	User does not have to pay the maintenance cost
Flexibility	User can use the lantern anytime and anywhere	User can use the lantern only once he receives it from the charging station
Recharging of battery	User is responsible for recharging	User is not responsible for recharging
Safety	User is responsible for the safety aspects of using the module	User is not responsible for safety aspects of using the module.

Table 5:Revenue Models (A. Chaureya et al., 2009, p. 2)

This section provided us with an overview on the various revenue models available in literature. These can be classified as ***ownership model, rental, fee for- service model and the pay as you go model***. However these models have been used for solar lanterns and

DSE's for the Indian context. Therefore, the question is can the same revenue model be implemented for a specific product in different countries? Or do companies require innovative revenue models to accommodate the needs of the people in different countries?

Knuckles has addresses the fact that by providing flexible payments or a service revenue model adoption rate will increase? Hence, we ask ourselves what are the key adoption drivers that can help increase the adoption rate in countries? Furthermore, do these drivers differ from company/country to company/country?

Additionally, it also helped us developing the adoption driver framework. The adoption drivers that were identified post the revenue models literature review was ***flexible payments, consumer/end-user finance and budget constraint***.

3.6 Literature on Adoption at the BoP

The above section discussed the various business model & the revenue models for the BoP market. We have tied the fact **revenues** of a company is dependent on **consumer adoption** in order to achieve scalability. Additionally, revenues are tied to gaining financing. How will the revenues of a company increase if end-consumers do not adopt the product? Moreover, when does social impact truly take place and what is its dependence on adoption & its drivers? This section will address the literature available on adoption at the BoP.

Cheryl Nakata & Kelly Weidner (2012) developed a conceptual model on product adoption at the BoP markets. The model developed by the authors is first of its kind on BoP adoption. Their framework describes how low-income consumers adopt new products hence proposing the ways it can be improved in the BoP market by offsetting the effects of poverty. In their research they have related poverty to adoption. Built on concepts of poverty and innovation Cheryl Nakata & Kelly Weidner (2012) states that product adoption takes place when social context dynamics, marketing environment and new product attributes moderate or stall a few parameters of poverty(Cheryl Nakata & Kelly Weidner, 2012; Wanasika, 2013).

According to Cheryl Nakata & Kelly Weidner (2012)adoption is a two-step process comprising of cognitive adoption trailed by material adoption. In other words a consumer first makes up his mind whether to buy it or not and then takes a purchasing action. In this thesis the definition of adoption is related to the actual purchase of the product. This is because as we are relating adoption to revenues and social impact, the actual purchase of the product is more important than wanting to buy the ICS. As mentioned before if the consumer stops at the first step of adoption, revenues of the company will not increase. The social impact relation to adoption is discovered in next few paragraphs. This study will use the material adoption definition for the context of the thesis.

The goal of this study is to link adoption with revenues and social impact. However, what are the factors that drive adoption? From the study by Cheryl Nakata & Kelly Weidner (2012)social context dynamics, marketing environment and new product attributes play an important role in driving adoption. This thesis will use the conceptual model derived

by the authors as a basis to develop the framework. The model provides a starting point to developing a framework for ICS. There are three characteristics of the framework developed by Cheryl Nakata & Kelly Weidner (2012).

It is to be noted that this thesis will not link poverty to adoption, as this is not the focus. But product characteristics, social context and marketing environment are important to be considered as these factors enhance consumer adoption. In chapter 2, the literature gap was identified where adoption was linked to revenues. Furthermore, once adoption increases it attracts commercial as well philanthropic capital hence increasing revenue was also determined. Therefore the initial model will be based on the aforementioned concepts. The conceptual model developed by Cheryl Nakata & Kelly Weidner (2012) is depicted in Figure 8. The framework derived from this conceptual model is depicted in figure 9. Coming back to chapter 2,the definition of social impact was provided. It was said that social impact could be achieved through 4 ways that are health, safety monetary and income generating opportunities. But now we can ask ourselves the question when is social impact achieved? Is it post adoption or before adoption? Firstly, if consumers adopt the ICS will their health improve because only once they use the product will the effects of less smoke will be achieved. Secondly, consumers will only notice the safety aspect once they purchase the product. Women travel long distances to collect fuel. Hence, they are prone to assaults. Once the consumers purchase the product the long distance travel to collect wood will reduce and so will the assaults. Thirdly, consumers spend 20$ of their income on purchasing fuel. Consequently, after a BoP consumer buys the product he save money on fuel, as the ICS will reduce these expenses over a period. Lastly, the income generating opportunities can be generated both pre adoption and post adoption. It is to be noted that for the purpose of this thesis the wording of product features has been changed to **product characteristics**, social context to **social characteristics** and marketing environment to **marketing characteristics.** This has been because drivers have been identified within each of these variables. Therefore, a ***characteristic*** is a more suitable word to demonstrate the features of the drivers.



Figure 8:Conceptual Model developed (Cheryl Nakata & Kelly Weidner, 2012, p. 23)

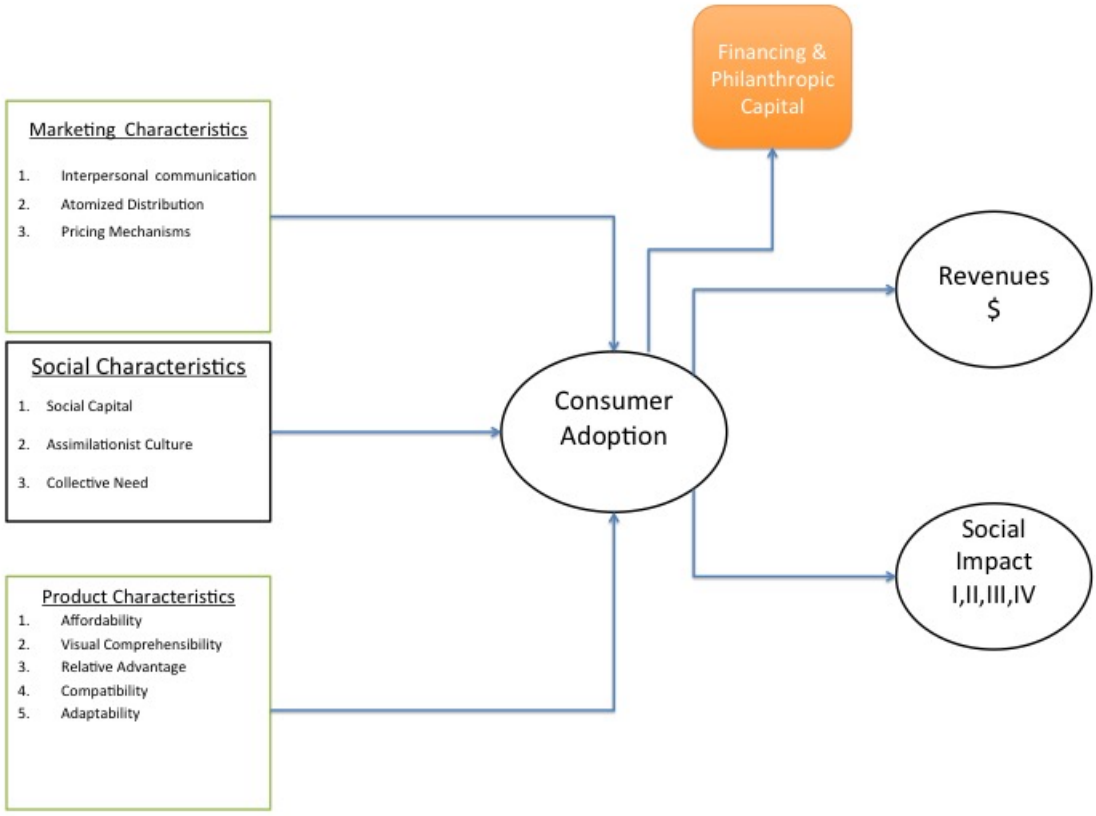


Figure 9:Initial Conceptual Model on the basis of Cheryl Nakata & Kelly Weidner (2012)

According to the research by Cheryl Nakata & Kelly Weidner (2012) product characteristics have four key attributes. These are affordability, visual comprehensibility, adaptability and relative advantage.

I. Product Characteristics

A. Affordability → According to Cheryl Nakata & Kelly Weidner (2012) affordability is a key characteristic that enhances consumer adoption. Hence, it can be said that affordability or the degree to which a product can be brought on limited income in key to consumer adoption(Cheryl Nakata & Kelly Weidner, 2012). However, affordability is not always about bottom of the barrel pricing mechanism. For the BoP market affordability entails that the prices should be lower than those of Top of the Pyramid but the consumers at the BoP do spend money on products that are of quality, reliability and value(Cheryl Nakata & Kelly Weidner, 2012).

B. Visual comprehensibility →Visual comprehensibility or the extent to which another product is naturally comprehended through its packaging, might be basic for reception. Past studies have demonstrated that practically unskilled buyers have an inclination toward pictorial products (Cheryl Nakata & Kelly Weidner, 2012)

C. Adaptability →Adaptability is basically the level to which the product is adaptable to the conditions of shortage and hostility. Adaptability also occurs when customers can change the product suitable to their needs. According to Markides (2007) products that have found most success is when it addresses and over comes the restrictions faced by the poor. For example the product can be used for many reasons like the soap bar that can be used for bathing and laundry requirements(Cheryl Nakata & Kelly Weidner, 2012).

D. Relative Advantage →This is thought to be the critical indicator regarding adoption. Relative advantage alludes to "the extent to which an innovation is seen as being superior to the thought it supersedes". Research demonstrates the BoP customers are inclined to adopt a product that takes a glimpse at the limitations confronted by these consumers.

E. Compatibility →Compatibility is "the extent to which an innovation is seen as stable with existing values, past encounters, and needs of potential adoptees" (Rogers, 2003). Research by Cheryl Nakata & Kelly Weidner (2012) indicates that compatibility is one of the main drivers to facilitate an increase in adoption. The consumer will not buy the product if it is not compatible to the needs and use of the user. It should be consistent with the consumption habits of the end-users.

II. Social Characteristics

Additionally, besides technological adoption social context helps in consumer adoption.

A. Social Capital →Social capital refers to "**trust**, norms, and networks that can improve the efficiency of society by facilitating coordinated actions. Research indicates that low-income consumers are highly dependent and wiling to help each other. Furthermore, they are dependent on each other's advice on purchase decisions(Cheryl Nakata & Kelly Weidner, 2012).

B. Assimilationist Culture →Low-income consumers frequently stay in territories where they are presented to and encompassed by a prevailing society, for example, in squatter towns on the edges of urban centers. That prevailing society maintains innovation, riches, and utilization, introducing pictures of a glorified existence of solace and social acknowledgment. Their introduction constitutes an assimilationist society, which is attracted to the "great life" guaranteed by the prevailing authority. Different people, by complexity, reject that culture, which they see as outsider and forced. They require, rather, to hold their standard qualities and ways of life brought from far away town. These persons are non-assimilationist. As new items tend to start in the higher society, whether exhibited by remote or neighborhood associations, an assimilationist society wants to raise the desire for and satisfaction for a higher quality of life(Cheryl Nakata & Kelly Weidner, 2012)

C. Collective Need →Consumer adoption is spurred by societal needs and not by individual needs. In light of the above, societal need drives appropriation of new items that can be shared by giving advantages, for example, cost investment funds, social trade, and dispersed welfare(Cheryl Nakata & Kelly Weidner, 2012)

Lastly, the marketing environment is key in increasing adoption. This includes interpersonal promotions, atomized distribution & Payment forms

III. Marketing Environment

A. ***Interpersonal communication*** →This deeply affects adoption. Consumers are more likely to adopt a product when people they trust promote the product. Personal ties persuade or dissuade consumers to purchase a product.

B. ***Atomized Distribution Channels*** →The geography of developing countries is vast and diverse. The major challenge faced by companies is to reach these consumers. Hence, innovative distribution channels are needed to reach the consumers. These include retailers, post office, microfinance sales and distribution channel and independent contractors.

C. ***Payment forms*** →This scheme makes energy more inexpensive and accessible. Therefore it complements their energy consumption needs and the variable cash flows (Ballesteros *et al.*, 2013; Beltramo *et al.*, 2014). According to Ojala *et al.* (2012)the flexibility of payments will increase the customer base, as the customers don't feel the stress or pressure to pay a huge amount upfront.

These moderating variables developed by Weidner & Nakata fail to explain how exactly do these characteristics help in increasing adoption. For example: in product characteristics the authors have mentioned the product should be adaptable to the conditions of shortage & hostility. But these authors have failed to explain what are the drivers that need to be included in a product to ensure the product meets adaptability. Also within product characteristics they have mentioned that the product should have a relative advantage or should deem superior existing products. But how can companies that target this market ensure their product is superior is not provided. Another example: in marketing environment, the authors have mentioned that payments forms should be inexpensive and accessible. But again the authors fail to explain the ways with which a company can enable payments plans or reduce the burden of cost to the consumer. As this

thesis is looking at ICS as a product focus, let us check whether incumbent literature on ICS provides us with drivers for each of these characteristics.

3.7 Literature on Improved Cooking Stoves (ICS)

There has been a growing interest amongst researchers regarding ICS. The various studies embody the way that, for the majority of its advantages, technology alone regularly can't take care of adoption issues. Interests in life-enhancing advances, for example, cook stoves, must be joined by advanced research in the factors that influence user adoption(Beltramo *et al.*, 2014). Many researchers have focused on the factors that are most likely to increase the adoption rate amongst consumers. This is included in the works of(Ahmed Mushfiq Mobaraka *et al.*, 2012; Arif *et al.*, 2011; Beltramo *et al.*, 2014; Douglas F.Barnes *et al.*, 1994; Jessica J. Lewis *et al.*, 2015; Pamela Jagger *et al.*, 2016; Rehfuess *et al.*, 2013). According to them the most likely adoption factors are household income, size of the house & ***access to credit***. But almost all the researchers agree that the major deterrent to stove adoption is the ***budget constraints*** faced by these consumers.

Budget constraints amongst consumers are a major deterrent to adoption. Additionally, researchers noted that consumers did not appreciate the price of the stoves. The consumers considered the stove overpriced for the exchange of value. Moreover, during their study it was observed that majority of the participants had to change their cooking habits to adjust to the design of the ICS (Douglas F.Barnes *et al.*, 1994; Gunther Benscha,Peters, 2015; ROSENBAUM *et al.*, 2015). ICS that do not cater to ***traditional cooking practices*** results in changing cooking behavioral habits of the poor. Research indicates that ICS should adhere to traditional cooking practices to ensure adoption(Ballesteros *et al.*, 2013; THURBER, 2009). Families that buy rather than collect solid fuels are more prone to adopt ICS (Rehfuess *et al.*, 2013). Future studies should aim at sustained use or **customer retention** of the ICS (Gunther Benscha,Peters, 2015; Levine *et al.*, 2012). Lack of ***after sales maintenance*** is considered to be a major deterrent in achieving sustained use. Moreover, research indicates that female-headed houses are more likely to adopt ICS than their male counterparts (Jeuland *et al.*, 2014; M.A. Jeulanda *et al.*, 2015). But one study suggests that women have considerably lesser willingness to pay (Beltramo *et al.*, 2014). According to researcher (Gunther Benscha,Michael Grimmb, *et al.*, 2015; Rehfuess *et al.*, 2013) depending on market forces might not be sufficient and hence access ***to credit or end user financing schemes*** are needed to increase adoption of ICS. (Beltramo *et al.*, 2014; Jessica J. Lewis *et al.*, 2015; Rehfuess *et al.*, 2013) believe that ***flexibility of payment plans and discounts*** might help achieve greater adoption. Ahmed Mushfiq Mobaraka *et al.* (2012) carried out an experiment found out the most valued characteristic viewed by the consumers was ***reduction in fuel costs***. ***Fuel savings*** include time in collecting the fuel or savings in family expenses when fuel is purchased. Also for greater adoption perceived value of the ICS should be greater than the perceived value of the traditional cooking stoves(Rehfuess *et al.*, 2013)

The above section gave an overview on the various barriers faced by programs to disseminate ICS. The aim of the literature review on ICS was to determine the common themes across the literature. It was observed that the adoption factors and barriers were scattered all across the literature. Even though the major deterrent across the literature

was budget constraint, very little importance was given to **adoption drivers**. Moreover, none of the literature explicitly stated the relation between revenue to social impact and adoption drivers. Therefore, after reviewing the literature on ICS it can be said that there is gap that needs to be addressed. Lack of a common source of information on adoption drivers makes it difficult to gain an overview on profitability & social impact. The final list of drivers that was concluded after the literature on ICS was ***consumer trust, budget constraint, willingness to pay, flexibility of payments, discounts, after sales & service, fuel savings and traditional cooking practices & end user finance.***

The literature on ICS identified several drivers that should be taken into account for consumer adoption. Therefore, we can relate the drivers derived through product adoption of BoP markets and ICS literature to develop the initial framework. The selection of these drivers was done is such a way that they matched the characteristics presented in framework. Additionally, the drivers were included if it was mentioned in more than 3 papers and matched the characteristics presented in the framework developed Cheryl Nakata & Kelly Weidner (2012).

For example: it was noted that traditional cooking practices play an important role while designing an ICS and the literature on product adoption at the BoP stated that the innovation should be compatible to past encounters and needs of potential adoptees. However, what drives the product to be compatible is not mentioned explicitly in the conceptual model by Cheryl Nakata & Kelly Weidner (2012). Hence, we can combine the literature on ICS and product adoption at the BoP markets to state that traditional cooking practices can be listed under compatibility. In other words traditional cooking practice is a driver for consumer adoption and comes under product feature→compatibility→traditional cooking practices. Similarly this combination of literature provides with an extensive list of drivers for consumer adoption. Figure 10 shows a pictorial representation of how these drivers were included. The arrows match the header it belongs too. This is explained in more detail in the next section. Some drivers were not found through the literature on ICS. For example **no drivers** were found for:

1. **Product Features**
    - Visual Comprehensibility
    - Adaptability
2. **Social Context**
    - Social Capital
    - Assimilationist Culture
    - Collective Need
3. **Marketing characteristics**
    - Atomized Distribution

Lets hope the interviews with the companies yield discovery of some new drivers that match with **visual comprehensibility, adaptability, social capital, assimilationist culture, collective need & atomized distribution.**

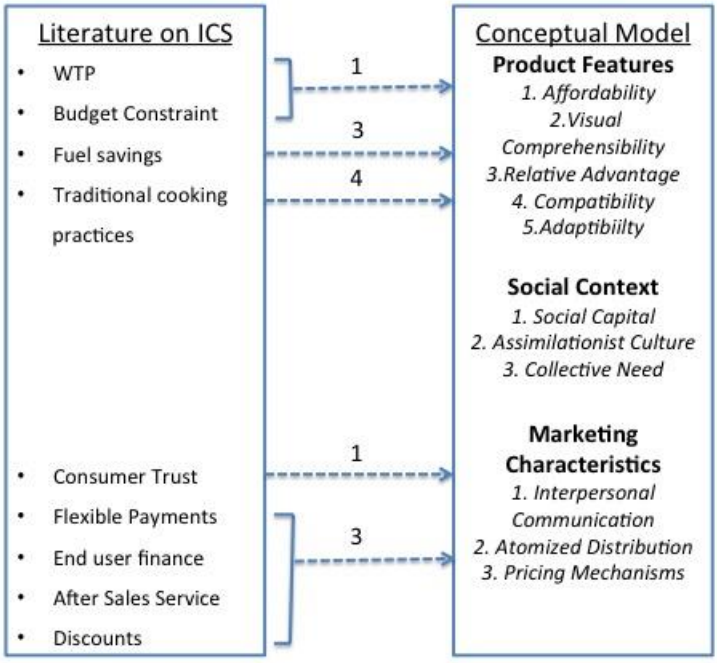


Figure 10:Derivation of the drivers

3.8 Developing the Framework

This section will explore deeper in to the framework derived from the literature review. This thesis uses the framework but instead of poverty links the most obvious relation, which are revenues & social impact to consumer adoption. Surprisingly this relation hasn't been researched. Hence, this thesis has developed a framework, which has been built on the basis of what Weidner proposed. Also literature review on ICS helped to recognize barriers & drivers that when used by companies helps in to increase the rare of adoption.

The adoption drivers recognized are WTP, budget constraint, fuel savings, traditional cooking practices and consumer trust flexibility of payments, end user finance, after sales service & discounts. These drivers could change post the interview but this gives a good start for the interview. The drivers identified through the ICS have been added under the appropriate headers. More explanation has been provided below.

I. Product characteristics

A. Affordability

Pricing Strategies/Budget Constraints

According Chaurey (2009) the prices should match paying capabilities of rural

consumers. Hence companies should adopt different pricing models and identify users capacity to pay. The most important consideration for a low- income user is the budget constraint or budget limitations. This is because of different priorities and varying income due to which they can pay for energy in small increments (Ballesteros *et al.*, 2013). This is very similar to budget constraint hence pricing strategy and budget constraint will be grouped under one category.

Willingness to Pay (WTP)

The maximum amount an individual is willing to pay (WTP) for product/services is a common measure in economics. It is the value of the product/service to the individual (Shogren *et al.*, 1994). The research conducted by Yoon *et al.* (2014) found out that awareness of solar home systems is high with high income and educated households. He conducted a survey in Uttar Pradesh, India. Furthermore, the authors concluded that there is a relation between market price and a customer's willingness to pay.

B. Visual comprehensibility

No drivers were found through the literature on ICS. Let's check if any drivers appear post the case analysis.

C. Adaptability

No drivers were found through the literature on ICS. Let's check if any drivers appear post the case analysis.

D. Relative Advantage

Fuel Savings

Fuel savings include time in collecting the fuel or savings in family expenses when fuel is purchased. Furthermore, for greater adoption perceived value of the ICS should be greater than the perceived value of the traditional cooking stoves. Fuel savings are perceived to be a very important benefit, as most families have to spend a major proportion of their income on fuel(Sesan, 2012). Families perceive financial savings to be greater than time- savings (M.A. Jeulanda *et al.*, 2015; Rehfuess *et al.*, 2013). Low-income consumers that have to buy fuel wood will prefer ICS, as it will save them money (Mark C. Thurbera *et al.*, 2014; Rehfuess *et al.*, 2013; THURBER, 2009)

E. Compatibility

Traditional Cooking Practices

According to the report conducted by Ballesteros *et al.* (2013)traditional cultural practices assist in deciding groups energy requirements. A report by (Sreyamsa *et al.*, 2010)suggests, products that force users to change their traditional cooking behaviors have low adoption rate. Hence, these practices help in determining the consumer needs and requirements, which help the company to create customizable solutions for their consumers. If renewable energy products and services match the needs, uses and financial capabilities of this segment, it will increase the revenues of the company (Ballesteros *et al.*, 2013)

II. Social Characteristics

A. Social Capital

No drivers were found through the literature on ICS. Let's check if any drivers appear post the case analysis.

B. Assimilationist Culture

No drivers were found through the literature on ICS. Let's check if any drivers appear post the case analysis.

C. Collective Need

No drivers were found through the literature on ICS. Let's check if any drivers appear post the case analysis.

III. Marketing Characteristics

A. Interpersonal communication

Consumer Trust

According to Moorman *et al.* (1994)trust can be defined as "willingness to rely on an exchange partner in whom one has confidence". Another definition by Morgan *et al.* (1994)is, trust can be defined as "when one group has assurance in another groups reliability and integrity". Many consumers and banks are concerned about renewable energy products and services. They consider it to be risky investments. Trust undertakes a more prominent part in rural markets than in urban markets with regards to financial transactions (Lakshman, 2015). Research indicates that consumers feel more secure and are inclined to purchase these products from a known source. Therefore, it is necessary for providers to raise awareness, provide technical support in the form of service and maintenance (Ballesteros *et al.*, 2013). So, consumer trust plays an important role in increasing the adoption rate between consumers.

B. Atomized Distribution

No drivers were found through the literature on ICS. Lets check if any drivers appear post the case analysis.

C. Payment forms

Flexibility of payments

This scheme makes energy more inexpensive and accessible. It complements their energy consumption needs and the variable cash flows (Ballesteros *et al.*, 2013; Beltramo *et al.*, 2014). According to Ojala *et al.* (2012) the flexibility of payments will increase the customer base, as the customers don't feel the stress or pressure to pay a huge amount upfront.

End user finance

According to researchers (Gunther Benscha,Michael Grimmb*, et al.*, 2015; Rehfuess *et al.*, 2013) depending on market forces might not be sufficient and access to credit or end user financing schemes are needed to increase adoption of ICS. This enables low-income

consumers to afford the product over a period of time.

After sales service

The report conducted by Ballesteros *et al.* (2013)states that providing after sales service is key to **retain consumers** and instill confidence in the product. This enhances adoption and retains consumers.

Discounts

Discounts enable the product to become more affordable to the consumer. This enables matching the varying income of the consumers.

The figure below has been developed through the literature on consumer adoption, literature on ICS. The green colored boxes indicates the adoption drivers that were derived through the literature on ICS. The figure 11 indicates that when consumer adoption increases this has a direct influence on the revenues, which then attracts financing and philanthropic capital.

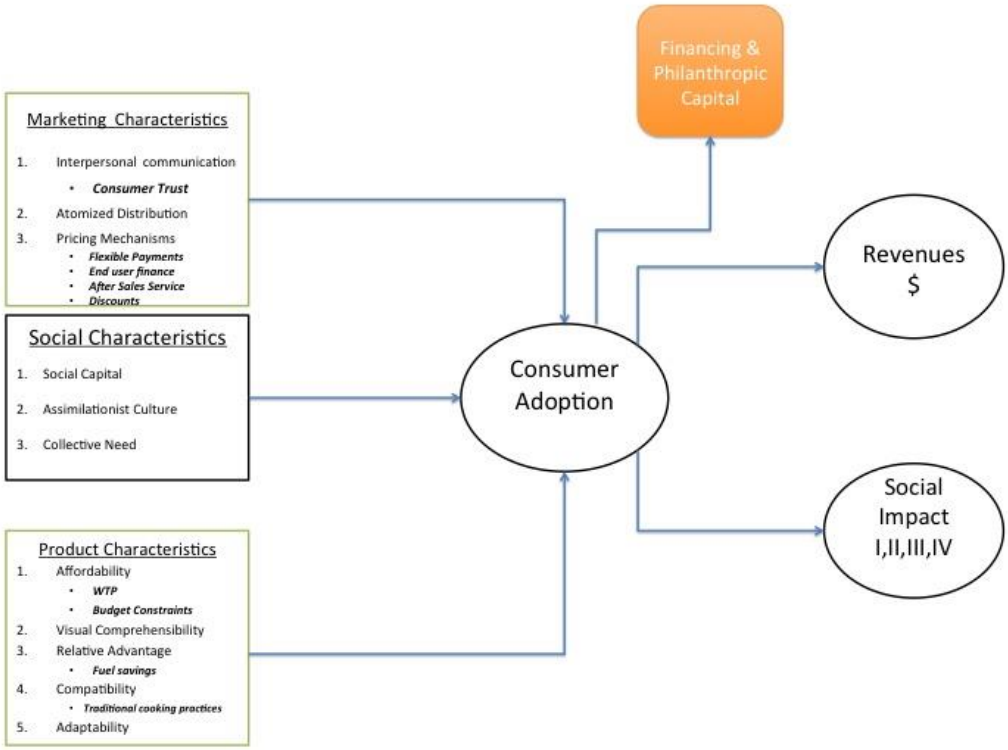


Figure 11: Framework with drivers

3.9 Chapter Summary

The revenue model of an enterprise is basically how the company makes money. The firm delivers the value in the form of a product or a service. The consumer then pays an amount for the delivered value. The company creates a revenue stream in the exchange for this product. This payment or revenue can be used for future operations. Historically

companies are dependent on consumer adoption to increase revenues. How do the companies facilitate an increase in adoption? Therefore, some aspects of adoption drivers influence the choice of revenue model used by a company.

This chapter provided answers to the different type of revenue models available in literature. Through the literature review three different kinds of revenue models were identified. These were the ***ownership model, service model and the pay as you go model***. In the literature pay as you go model has been identified as a revenue model and a business model. Nevertheless, for this thesis we classify it as a third model. Literature by A. Chaureya *et al.* (2009) insinuates that ownership model dissuades consumers in buying the product due to high upfront cost and service revenue model is the best way to tap this market The differentiation of revenue models and business models supports and streamline the case analysis thus preventing vagueness in the study.

Also the literature on Product adoption & ICS at the BoP gave us a starting point on adoption drivers. The literature on product adoption at the BoP provided us with an initial conceptual model. The literature on ICS provided us with the drivers that can enhance adoption resulting in increasing revenues. Additionally this chapter provided us a starting point on ***drivers*** required to increase the ***rate of adoption.***

The concept of revenue models will help understand about profitability. There is absence of literature specially to check adoption drivers that are relevant for social enterprises to achieve profitability. The adoption drivers will be determined by interviewing companies who target this market with the ICS. Checking which drivers fit which revenue model will be the best way for further validation.

The adoption drivers derived from the literature review are relevant for increasing adoption. These variables help in increasing adoption, which then can help attracting financing options, which can be used for scalability. Furthermore, a link between consumer adoption and social impact was established. Social impact can be achieved only after consumer adoption. This provides a starting point and can change post the case analysis. The drivers that were derived from the literature review were are divided into three aspects:

Technological/Product features: WTP, Budget constraints, fuel savings, and traditional cooking practices.

Societal: Not found yet through literature review

Marketing: Consumer trust, flexible payments, end user finance, after sales service & discounts These drivers are checked by conducting case analysis through semi-structured interview with companies. The drivers are extended post the analysis.

Chapter 4: Case Study Analysis: Methodologies & Result

4.1 Chapter Introduction

The previous chapter looked at the revenue models available in literature for the renewable energy sector. From the literature review on revenue models three different revenue models have been identified. These are ownership revenue model, service revenue model and the pay as you go revenue model. Next literature on consumer adoption and ICS was looked at. From this review a basic framework was discovered. The framework of this thesis was based on the literature on consumer adoption at the BoP. Subsequently adoption drivers were added to the framework that was found through the literature on ICS. This chapter will try and validate the framework by the means of a semi-structured interview.

This chapter performs a case study on 3 different companies to check and extend the framework that was developed. The chapter goes as follows: First the case selection and methodology used will be described in more detail. Next case analysis of Mansa Stoves BV, African Clean Energy and SimGas will be presented. Finally, the chapter summary is presented.

4.2 Methodology

Case study analysis is important to validate and verify the drivers and framework found through literature(Yin, 2002). By gaining in-depth data from the companies the framework developed in chapter 3 can be confirmed. This section reflects the different choices made during the thesis. The choices include those of the sector, market, region, technology and company selection.

4.2.1 Selection Procedure

The sector we looked at was the Renewable Energy industry. Specifically in the renewable energy industry we looked at improved cooking stoves because the two biggest problems people living in developing countries face are lack of access to efficient lighting and cooking.

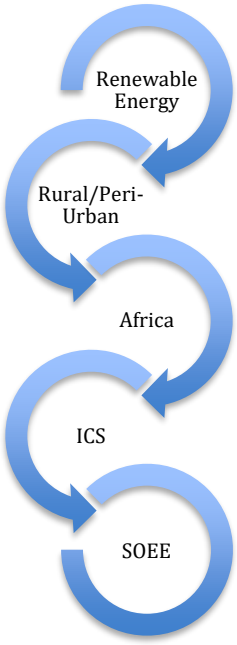


Figure 12: Selection Procedure

It was decided to look at the emerging concept of social entrepreneurs who are working towards a social objective but with a profit in mind. These entrepreneurs want to achieve profitability and scalability through new innovative revenue models. Additionally, social impact is validated with the help of the framework derived in chapter 3. This thesis looks at how Dutch companies target the African BoP market. Figure 12 shows a pictorial representation of the selection process.

The companies that were selected had to fulfill three definite criteria. One it should be a social enterprise. Two, it should cater to the improved cooking segment. Three, it should be market based and had to be a for-profit company. With these criteria in mind the companies were found through Google search. The keywords that were used were innovative, cooking stoves, companies and Bottom of the pyramid. The UN Foundation has formed a global alliance for clean cook stoves (GACC). This alliance is public-private partnership that helps to save lives, empower women and children by building a network of clean cook stove manufacturers(GACC, 2016). This website provided a list of companies that are involved in the cook stove implementation. The initial list of companies is presented in the Appendix. The final list of companies that were willing to take part in the research has been given in table 6. This includes, Mansa Stoves B.V, African Clean Energy and SimGas BV.

Companies	Location	Market	Customers	Type of ICS
Mansa Stoves	The Netherlands	Gambia, Nigeria, Netherlands	Peri-Urban and Rural	Natural Draft biomass gasification
African Clean Energy	The Netherlands	Cambodia, Lao PDR, Lesotho, Netherlands, South Africa, Uganda, Zambia, Zimbabwe	Rural (predominantly)& peri-urban	Forced Biomass gasification
SimGas	The Netherlands	Tanzania, Kenya	Rural	Biogas

Table 6:Companies for the Case study

4.2.2 Data collection

4.2.2.1 General Information

The companies were contacted via email. The email contained a short description of the thesis. This included the research objective, research questions and summary of the thesis. Data was collected through company websites and interviews.

The interview took place with founders or the business development team. Language used while communicating was English. The interviews with companies Mansa Stoves, African Clean Energy (ACE) & SimGas was done at their office in Dordrecht, Amsterdam and The Hague respectively in the Netherlands. The interview with Mansa Stoves was conducted at their office in Dordrecht with Mr. Paul Engelsman the founder of the company. Next the interview with ACE was conducted with Mr. Ruben Walker, the commercial director of the company at their office in Amsterdam. Lastly the interview with SimGas was conducted with Ms. Dorine Poelhekke working as a business developer at their office in The Hague. No confidentiality agreements were signed with the companies. The interviews took place during the month of May 2016.The length of the interview was for about an hour. Before the start of the interview permission was taken if the interview could be recorded. The three companies allowed recording the conversation. The interview was recorded through the author's smart phone. It was a semi-structured interview, which consisted of preset questions, open questions and closed questions (adoption drivers). End of the interview the interviewees were asked to rate the adoption drivers from a scale of 1-5.Next the interview was transcribed and sent to the companies for verification and validation. Required permission was taken from them to use the transcript interview. The interview protocol has been provided in Appendix.

4.2.2.2 Interview Procedure

The primary aim of this research is to verify the adoption driver's in four ways: First, verify the framework through the case study approach. Second, expand the framework

especially for the ICS. Third, analyze the revenue models used by the social enterprises. Lastly, analyze the social impact created by the company. Previously mentioned this thesis would use a semi-structured interview to gain insight on the innovative revenue models and the adoption driver framework. Hence, a questionnaire was prepared. As it was a semi-structured interview it gives the interviewer to change the question depending on the answer provided by the interviewee. Please note that this study was an iterative one. The conceptual model developed by Cheryl Nakata & Kelly Weidner (2012)was discovered post the interview with Mansa Stoves. The interview with Mansa Stoves provided a clear indication that adoption is dependent on various aspects of the business. The framework developed by Cheryl Nakata & Kelly Weidner (2012) fit the scope of the study and the interview with Mansa Stoves. Therefore, some drivers for atomized distribution and adaptability were not found post the interview. Additionally, even while conducting the interview with the founder these characteristics were not given importance by the company. The interview procedure is divided into sections. The interview protocol has been provided in Appendix A.

Interview Protocol: The interview procedure started by introducing the interview and interviewee. Post, which the company was made aware of the goal of the thesis. The interview procedure can be divided into two parts: Open questions which involved asking about business model and revenue model; second part was the closed questionnaire where they were asked to rate the adoption drivers from a scale of 1-5. A five point likert scale is used to define the importance of each of the adoption driver derived through the literature review. Figure 13 shows the various categories of questions that were asked during the interview.

- **Company Profile:**Firstly questions regarding the company was asked.This included the type of product,market segment for example rural or peri-urban,countries they target were asked.The answers provided marks the basis for the company profile.
- **Business Model-**Before asking specific questions on the revenue mode, questions on the business model were asked to the interviewee.Value proposition ,value delivery and value capture were asked.Furthermore questions regarding marketing, distribution were also asked.
- **Importance of financing-**An open questions regarding financing was asked to the companies.How do they attract commercial or philantropic captital to invest in the business was asked. The type of financing is linked to the cash flows generated by the company.The cash flows are dependent on the adoption of the consumers.Hence they helped to verify the causal links between adoption, financing and revenues.
- **Revenue Models-**This part of the interview asking questions regarding the type of revenue model used by the company. This could be the ownership model or the service model or the popular pay as you go model.Next questions were focused on why certain revenue models were selected and whether the choice of revenue model help achieve profitabilty?Furthermore, what are the different revenue streams used by the company?

- **Barriers-** Questions regarding the barriers faced in dissemmination of the ICS was explicitly asked.Next the question how did they overcome the barriers?If they are still struggling to overcome the barriers what are the future ways of facing and resolving them was asked.
- **Social Impact-**Questions about the impact of livelihood were asked.First an open question was asked what is the impact of livelihood on the consumers?Next why did they deem to be important? How did they achieve social impact?
- **Adoption Drivers-**This marks the start of the aided phase of the interview. From the literature review a few drivers were discovered.These drivers were scaled from a scale of 1-5. 1 being not relevant and 5 being extremely relevant.Before they could rate the drivers the companies were asked to rate how important they think were adoption drivers from a scale of 1 to 5. The three compnies first asked for clarfication on what are adoption drivers.Once the confusion was elcuidated they companies were asked to rate the adoption drivers derived from literature from 1-5.For each of the adoption driver how and why these drivers are relevant to the company's profitabilty was asked.Next they were asked an open question if they coud think of any drivers that were important acoording to them.This was asked at the end because once they have an idea of what exactly are adoption drivers the companies can understand what type of drivers are being asked and can provide relevant information. This procedure helps to validate and extend the framework derived through the literature review.

- **1-Not relevant**
- **2-Slightly relevant**
- **3-Moderately relevant**
- **4- Very Relevant**
- **5-Extremely Relevant**

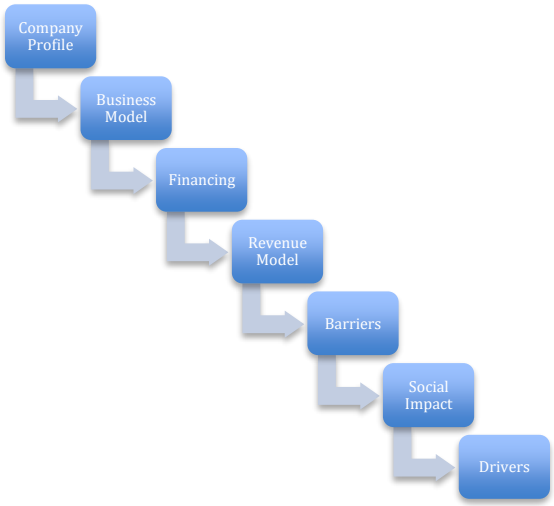


Figure 13:Interview Categories

4.3 Case 1: Mansa Stoves

The interview was conducted with Mr. Paul Engelsman the founder of Mansa Stoves B.V. The interview was conducted in his office in Dordrecht, The Netherlands. The duration of the interview was 45 minutes. The case analysis includes company profile, business model, revenue model and drivers for adoption.

4.3.1 Mansa Company Profile

Mansa is a small medium enterprise located in the city of Dordrecht. They started operations in 2012. Mansa is on a mission to reduce premature deaths that are caused due to HAP. The key design is to reduce the health risks cooking with fire on charcoal. Mansa stove reduces substantial fuel hence costs will be recovered in only 3 months. Their vision is to provide 200000 stoves by 2020. The cook stove was designed with students of TU Delft and local women of Zambia. Currently the stove production takes place in Netherlands and China where they have partnered with a local entrepreneur from Nigeria. Furthermore, they also target Zambia and in the future they are planning to provide the stoves to India and Ghana. This year they sold 10,000 cook stoves(Engelsman, 2016).

Paul of Mansa Stoves has founded an NGO called Yep! Africa. This stands for youth empowerment. Yep! Africa is a social enterprise that trains young people in youth empowerment and social entrepreneurship (Yep! Africa, 2016). Paul states," Yep! Africa & Mansa stoves work hand in hand".

4.3.2 Technology Description

The technology used by Mansa Stoves is gasification. This technology was described in detail in chapter 2. This technology used by Mansa Stoves is natural draft i.e. (forced air to generate heat). The sand collar module ensure stability & isolates heat. The charcoal is heated through natural air. The charcoal contacts with oxygen leading to gasification of the biomass. The key design of the Mansa stove is to reduce the health risk of cooking on fire on charcoal without demanding too many changes in the cooking habits of the women. It saves them the cost of the fuel hence they will recover the costs of the stove within 3 months. Figure 12 depicts a Mansa Stove.

Key Feature of Mansa Cook stoves

- Cooks 3X faster
- Saves Fuel
- Adheres to traditional cooking practices
- Smoke Free

The price of the Mansa Cook stove is around 60$.



Figure 14: Mansa Cook stove (Mansa Stoves, 2016)

4.3.3 Mansa Revenue Model

Mansa uses the **ownership revenue model.** Paul quotes "We are not a bank, we cannot provide money to them to pay for the stove. In the cook-stove business we were advised to use the service revenue model. However, we don't believe in that model. The consumers pay the cost upfront". Mansa stoves have collaborated with a local entrepreneur in the form of a franchisee model. Mansa BV help the local entrepreneurs in the technical know how, marketing and setting up the business. Paul says," We look for partners that have a passion for social entrepreneurship and who can sponsor the business without the need for a loan"

4.3.4 Mansa Consumer Adoption Drivers

This section will delve more into the importance of each of the adoption drivers identified through literature.

I. Technological Characteristics

A. Affordability

Budget Constraint

2

Mansa does not deem Budget constraint or pricing strategy as very important driver in its ownership model. Paul says " we have priced our stove 10$ more than World Bank asked us to and we are still able to achieve sales".

Willingness to pay

5

Mansa deems WTP to be relevant to its ownership revenue model. They desire to own the ICS but are unable to afford it. Revenues are highly dependent on consumers WTP.

B. Visual Comprehensibility

Live demonstrations

5

Yeppers are sent to its peri-urban and rural consumers to demonstrate the working of the ICS. They teach the consumers how to properly use it.

C. Adaptability

No drivers were found through the literature that matched the characteristics of adaptability. Further, interview with Mansa Stoves did not yield any new drivers for adaptability. Let us check if any drivers appear post the interview with ACE & SimGas.

D. Relative Advantage

Fuel Savings

5

Mansa deems fuel savings as an extremely relevant driver for adoption. Currently low-income consumers spend 200-250$ per year in buying fuel. Hence you end up saving 100-160$ per year on fuel with our product.

E. Compatibility

Traditional cooking practices

5

Mansa considers traditional cooking practices extremely high. Paul claims that, "People use the Mansa cook stove because it gives the same taste of food as to what they are used too. We tried solar cooking before but consumers hated it. There has to be a relation between women and fire. Moreover, local woman were incorporated in the design of the cook stove"

II. Social Characteristics

A. Social Capital-

No drivers were found through the literature that matched the characteristics of social capital. Further, interview with Mansa Stoves did not yield any new drivers for social capital. Let us check if any drivers appear post the interview with ACE & SimGas.

B. Assimilationist Culture

No drivers were found through the literature that matched the characteristics of assimilationist culture. Further interview with Mansa Stoves did not yield any new drivers for assimilationist culture. Let us check if any drivers appear post the interview with ACE & SimGas.

C. Collective Need

Community Budget

5

Consumers in communities put the money together and collectively buy the stove. As one person is not able to afford the product, community payments help a few families use the stove.

III. Marketing Characteristics

A. Interpersonal Communication

Consumer Trust

5

"Nigeria is a market with 170 million people. Many young people live in the cities that are earning very well. They buy for their mothers & grandmothers. Hence we target those people who can afford it and who buy it for their families. We used our Yeppers! We send the youth to the villages to demonstrate how to use the stove".

Awareness

5

"We create awareness not by saying this is good for your children's health but by emphasizing on the point that your family will save money. They don't care about health they are more worried about monetary aspects"

B. Atomized Distribution

No drivers were found through the literature that matched the characteristics of atomized distribution. Further interview with Mansa Stoves did not yield any new drivers for atomized distribution. Let us check if any drivers appear post the interview with ACE & SimGas.

C. Pricing Mechanisms

Flexible Payments

1

"Ownership model does not facilitate flexible payments. There's always the worry if people will pay it back on time. Hence, we don't believe in flexible payments"

End user finance

1

"Mansa does not deem end-user finance as important. MFI charge and exorbitant interest rate around 50-60%. We don't believe in these systems. We really try to do it through the power of the people themselves"

After sales service

1

Mansa does no deem after sales service as important from the point of view of adoption. According to Paul "our products are robust and hence don't need after sale service"

Discounts

5

"We provide discounts in the form of the ***buy one give one*** method. This method entails that we sell the cook stoves in the form a BBQ set in the Netherlands for 100$ and then sell a cook stove to BoP at subsidized price of 10$. We will never give it away for free."

Marketing Characteristics

1. Interpersonal communication
    - Consumer Trust
    - **Awareness**
2. Atomized Distribution
3. Pricing Mechanisms
    - Flexible Payments
    - End user finance
    - After Sales Service
    - Discounts

Social Characteristics

1. Social Capital
    - Consumer Trust
2. Assimilationist Culture
3. Collective Need
    - **Community Budget**

Product Characteristics

1. Affordability
    - WTP
    - Budget Constraint
2. Visual Comprehensibility
    - **Live Demonstration**
3. Relative Advantage
    - Fuel Savings
4. Compatibility
    - Traditional cooking practices
5. Adaptability

Table 7:List of Drivers through Case 1

New Drivers→Awareness, Community Budget, Live demonstration

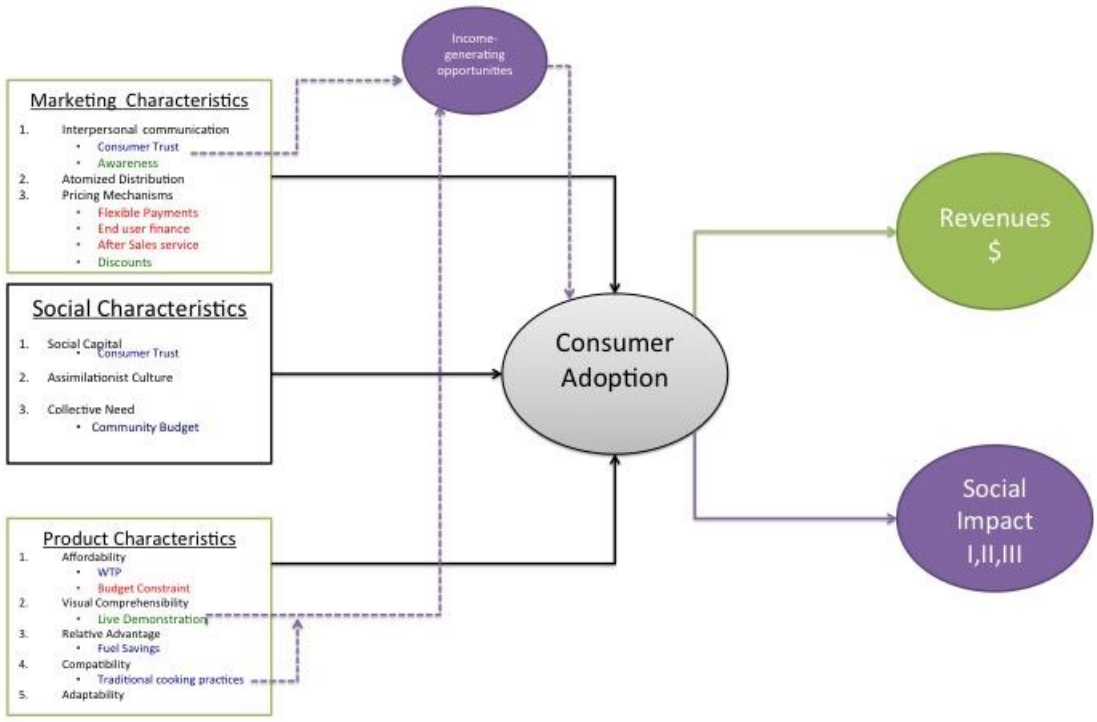


Figure 15:Mansa Stoves BV Framework

Green Color →New Drivers post the case analysis

Red Color →Not important by the company

Blue Color →Deemed important by the company

Purple Color →Social Impact IV (income generating opportunities)

4.3.5 Case Summary

The interesting thing to note with the analysis of this case study was the importance of partnerships. Mansa Stoves have created partnership and a network, which enables them to create a profit without using banks or philanthropic capital. The ownership revenue model has removed the risk related with payments. Besides, the analysis of the case study helped us to add more a few more adoption drivers. ***Awareness, and live demonstrations, community budget*** was some of the drivers that were discovered post the case analysis. No drivers could be added for atomized distribution and assimilationist culture as the interview did yield any for these characteristics.

Buy one give one allows selling the same product for a different use to a different market. This enables Mansa Stoves to create new market opportunities while helping the consumers at the BoP who will not be able to afford the product otherwise.

Another interesting was to note that the budget constraint is not the most important aspect to consider while setting a pricing strategy. Profitability is achieved and high costs do not deter consumers from buying the product. Paul doesn't believe in financing through banks or philanthropy. He believes that sales are made through the power of people. Hence, for this case, adoption did not attract financing because of the discretion of the owner.

Social impact was achieved once consumers adopt the ICS in 3 ways: Health impact, safety and monetary savings (fuel savings). Women were included in designing the product alongside TU Delft students. Hence, this increased adoption amongst consumers as the product catered to specific cultural practices. This also provided income-generating opportunity to the women who helped in the initial design of the product. Furthermore, Yep!Africa enables empowers and trains youth in social entrepreneurship. They hire the youth to sell the products to the local villages hence creating income-generating opportunities for them.

It is clear that Mansa stoves are totally dependent on sales of its products. Hence adoption drivers play an important role for revenues. The framework holds for this case. Lets check if this hold for other cases as well.

4.4 Case 2: African Clean Energy (ACE)

The interview was conducted with Mr. Ruben Walker who is the co-founder and commercial director of African Clean Energy. The interview was conducted in his office in Amsterdam, The Netherlands. The duration of the interview was 45 minutes. The case analysis includes company profile, business model, revenue model and drivers for adoption.

4.4.1 African Clean Energy Company Profile (ACE)

African Clean Energy was established in 2011.The aim of this family business is to create an impact via traditional cooking on poverty and environment. Its operations are mainly in Lesotho, Africa. The main commercial office is in Amsterdam, Netherlands. African Clean Energy offers state of the art ICS with an innovative business model through new partnerships and revenue model. 60 people work for ACE. Their factory is located in Maseru, Lesotho. The decision to set up a manufacturing plant in Maseru was primarily due to the fact that it is Least Developed Country (LDC) rated country. This means in order to improve the local economy creation of jobs is very important. ACE has provided jobs to local men & women. Also they have commercial offices in Uganda as well. Future plans entail expanding operations to Asia such as India, Cambodia & Nepal. ACE has sold over 40,000 cook stoves in two years. The price of this ICS is 100$. They claim their profit margin is about 15%.(Walker, 2016)

4.4.2 Technology Description

The technology used by ACE is gasification. But unlike Mansa Stoves a fan is used to blow oxygen into the chamber. A fan blows oxygen into the chamber through openings at both

the base and the top. This drives the flame to rise in temperature until it comes to roughly 1000°C. These settings cause the biomass to gasify. At that point the hot gas flows up to the top, meeting more oxygen and combusting totally. The stove will create energy as much as 5kW. At the point when completely charged, the battery will power the fan for more than 20 hours of cooking. The battery can likewise be utilized to charge a cell phone or run LED lighting, and can be enhanced utilizing a solar panel(A. C. Energy, 2016).Figure 16 depicts an ACE stove.

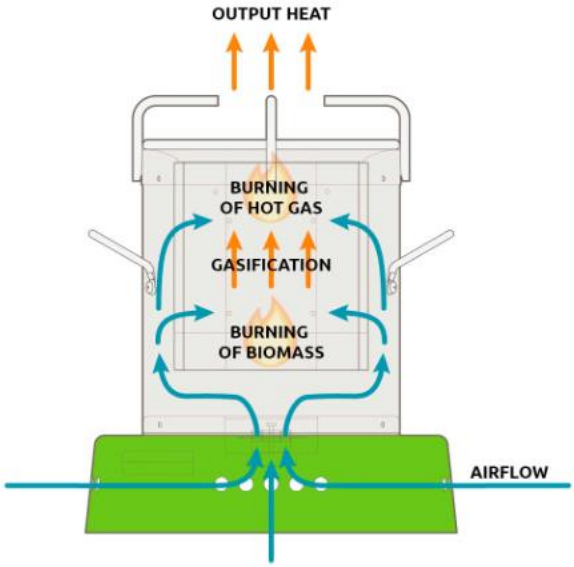


Figure 16:ICS African Clean energy (A. C. Energy, 2016)

4.4.3 ACE Revenue Model

This section will look at the revenue model adopted by ACE and its adoption drivers. ACE adopts the **service revenue model** (SRM) for its commercial activities. Below the description of how ACE employs this model is given.

- ACE has partnered with Kiva. They get the capital from Kiva. Kiva is a non-profit association with a mission to interface individuals through loaning to reduce poverty. Utilizing the web and an overall system of microfinance foundations, Kiva gives people a chance to loan as meager as $25 to make opportunity around the globe.
- ACE takes a picture of the groups that they cater. This picture goes on Kivas website. Americans lend a minimum amount of 25$. ACE gets capital for a 0% interest rate. ACE lends it to the end-user to buy the stove. The end user pay us back in installments in 9 months and ACE pays it back to Kiva and pays it back to the Americans. An administrative fee is charged for transaction.
- ACE sends a sales team to the rural areas. The people who are interested sign up with the sales team. The finance is provided to a group of people to buy the cook stove.

- The group of people pay back the in the form of monthly installments to ACE through mobile payments.

ACE provides the financing to the end-user. To understand how ACE operates a comparison is made with a bank. A bank provides a loan to the consumer to buy a car. Every month the consumer pays a small installment to the bank to repay the loan cost. ACE provides this loan to groups of people. The groups of people can have a varying size from 8-30.Another way that ACE caters to the low-income consumers is by partnering with MFI. ACE states, "This system is very good. We make a profit margin of about 15% through our commercial sales".

We can conclude that ACE's operations are profitable and hence commercially viable. Through these operations ACE is able to scale to other countries. The innovative tie up with Kiva allows ACE to get the necessary capital for its operations. However, Ruben Walker the commercial director of the company also stated "It is not possible to use Kiva for all the commercial sales and use for funding for the entire BoP population but it's a good starting point".

4.4.4 ACE Consumer Adoption Drivers

This section will delve more into the importance of each of the adoption drivers identified through literature.

I. Product Characteristics

A. Affordability

Budget Constraint

2

ACE does not deem Budget constraint or pricing strategy as an applicable driver in its service revenue model. They think that if the product offers the consumers a wide range of possibilities budget constraint should not be barrier for the same. Furthermore, for a service revenue model small amount of payments over a period of time makes it affordable for the consumer at the end.

Willingness to pay

5

ACE deems WTP to be relevant to its service revenue model. They have adopted the service revenue model as it aligns with the mentality of the rural consumers. They desire to own the ICS but are unable to afford it. Revenues are highly dependent on consumers WTP.

B. Visual Comprehensibility

Live demonstrations

5

ACE sends its sales agents to its rural consumers to demonstrate the working of the ICS teach the consumers how to properly use it.

C. Adaptability

Extra Product Features

5

ACE considers providing additional features such as charger or lighting makes the product more attractive increasing consumer adoption. Ruben quotes "I do not consider my consumers to be poor. I treat them as any normal consumer. If the value proposition is high they will definitely adopt it"

D. Relative Advantage

Fuel Savings

5

ACE deems fuel savings as an extremely relevant driver for adoption. Currently low-income consumers spend 20-25$ per month in buying fuel. Savings with this product is 10,15 $ per month. They quote "low-income consumers know how much they are spending on buying fuel or the amount they need to buy a candle or charge their phone". With this stove all the additional costs are reduced.

E. Compatibility

Traditional cooking practices

3

The company doesn't consider traditional cooking practices extremely important. They quote "Not totally irrelevant but its not the be all and end all. Something's are better than they used to be. For example "In 2006 if you would have asked a phone user what would you want in your future phone? They would have asked for a smaller Nokia phone. Nobody would have grasped the idea of an iPhone. So it is important to know what people want but I think its important to know far ahead to know what people could want"

II. Social Characteristics

A. Social Capital

Consumer Trust

5

Low-income consumers are heavily dependent on the advice they receive from the community to make big purchases. Hence personal ties encourage or discourage buying decisions. Ruben said, "Post our sale in villages people have been calling us to demonstrate and sell our product there"

B. Assimilationist Culture

No drivers were found through the literature that matched the characteristics of assimilationist culture. Further interview with ACE did not yield any new drivers for assimilationist culture. Let us check if any drivers appear post the interview with SimGas.

C. Collective Need

Community Budget

Ruben didn't explicitly mention this but he did mention that loans were provided in a group of 8-30 people. The group pressurizes each other to pay the installments on time. Hence, this is added to the list of drivers.

III. Marketing Characteristics

A. Interpersonal Communication

Consumer Trust

5

The local women sell the cook stoves to the community. Ruben quotes "They have faced the problems of using inefficient cooking stoves. They don't have to fake their enthusiasm. Hence, consumers can relate to them while buying this cook stove. However, consumer trust is a two street. We provide them with the finance to pay us back hence we trust that they will pay it back"

ACE service revenue model the quality of trust has a positive effect in increasing the adoption by low-income consumers. Ruben quotes "We haven't had any default payments yet"

Awareness

5

"We create awareness not by saying this is good for your children's health but by emphasizing on the point that your family will save money in terms of costs on electricity charging and of course fuel costs. They are not really concerned about health they are more worried about monetary aspects"

B. Atomized Distribution

No drivers were found through the literature that matched the characteristics of assimilationist culture. Further interview with ACE did not yield any new drivers for atomized distribution. Let us check if any drivers appear post the interview with SimGas.

C. Pricing Mechanisms

Flexible Payments

4

They think flexible payments are a major driver for their service revenue model. This makes energy more inexpensive and accessible over a period of time. This complements their energy consumption needs and varying income. The major disadvantage of using flexible payment scheme is that it comes with transaction costs. Transaction cost is the additional cost that

is incurred when an economic trade takes place. Ruben quotes “These are negligible costs that won’t affect our adoption in the long run”

End user finance

5

ACE provides end-user finance to their customers through the scheme described above. Their partnership with Kiva helps them provide finance to their consumers. The only worrying aspect of this scheme is that low-income consumers will pay the monthly installments on time. Till now haven’t had any defaults. As we provide group loans if one person is lagging behind the group pressurizes that person to pay up.

Warranty & after sales service

5

Warranty was added post the interview with ACE. ACE thinks warranty and after sales service is an important driver for consumer adoption Ruben quotes “Our products don’t break down. However, if there’s a problem you can call us in the capital city of Lesotho. Standard warranty is one year. You can’t destroy the stove. Someone dunked them in water and the electronics die and rarely the battery has any problem if they do we just replace that component and it costs a few dollars. But we don’t charge them for that. This gives them the confidence to buy the product that if something goes wrong there is way out”

Discounts

2

ACE deems this to be not an important driver for consumer adoption.

Marketing Characteristics

1. Interpersonal communication
    - Consumer Trust
    - Awareness
2. Atomized Distribution
3. Pricing Mechanisms
    - Flexible Payments
    - End user finance
    - **Warranty** ***& After sales service***
    - Discoun***ts***

Social Characteristics

1. Social Capital
    - Consumer Trust
2. Assimilationist Culture
3. Collective Need
    - Community Budget

Product Characteristics

1. Affordability
    - WTP
    - Budget Constraint
2. Visual Comprehensibility
    - Live Demonstration
3. Relative Advantage
    - Fuel Savings
4. Compatibility
    - Traditional cooking practices
5. Adaptability
    - **Extra Product Features**

Table 8:List of drivers after case 2

New Drivers→Warranty, Extra Product Features

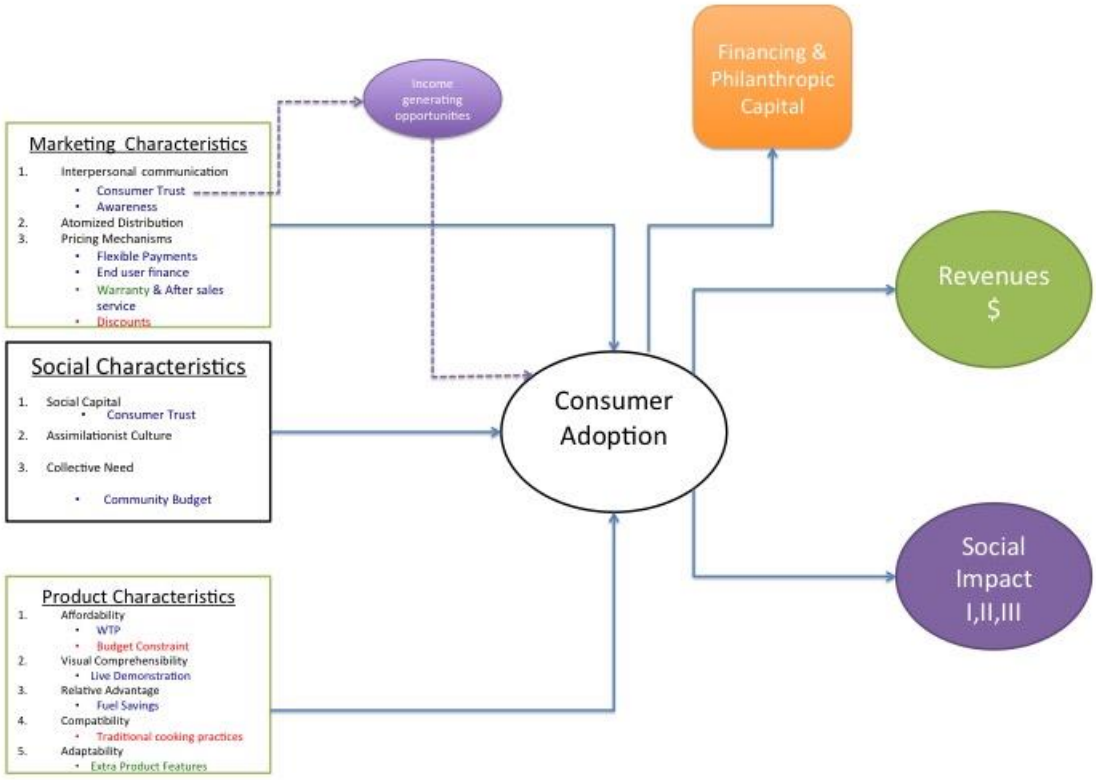


Figure 17:ACE Framework

Green Color →New Drivers post the case analysis

Red Color →Not important by the company

Blue Color →Deemed important by the company

Purple Color →Social Impact IV (income generating opportunities)

4.4.5 ACE Case Summary

ACE incorporates provision of end user financing in its operations. We can say that ACE uses the one stop business model**. One stop financing** business model is when the company provides financing, product and after sales maintenance to the consumers. Its key partnership with Kiva enables them to utilize capital at 0% interest rate. Furthermore, the service revenue model used by ACE has attracted philanthropic capital in the form of a partnership with BMW Foundation Carbon Initiative.

ACE has a local presence, which helps them to target local people and address their problems. The factory is setup in the capital city of Lesotho. The initial framework was quite appropriate in the case of ACE.A few new drivers were added to the list such as ***extra product features and warranty***. The framework for ACE has been shown in figure 15. The green color indicates the new drivers that were recognized post the interview with ACE. However, no drivers could be deduced for the social characteristics and atomized distribution. One key observation was that consumer trust was added to interpersonal

communication, as well as social objective. Hence, an overlap of drivers was deduced through the case analysis.

Another interesting thing was to note that high price of the cook stove did not discourage users from buying the stove. Ruben quoted "Products need to be affordable but not cheap". Hence, there is a difference in affordability and cheap pricing. Pricing the cook stoves very cheap will deter companies from providing warranty and after sales service to the consumers. We can say that ACE achieved profits while catering to the rural market without reducing the price of the stove drastically.

ACE considers impact on livelihood as an important driver for adoption. "Half of our sales team is women. They have faced the problems of using inefficient cooking stoves. They don't have to fake their enthusiasm. Hence, consumers can relate to them while buying this cook stove. Furthermore our company also employs women to work in the factory."

To conclude there is definitely a relation with revenues and social impact to consumer adoption. Let us check if this is true for the last case as well.

4.5 Case 3: SimGas Company Profile

4.5.1 SimGas Company Profile

SimGas is a Dutch, innovative company that majorly focuses on providing clean energy solutions to the rural market. They offer rural families in Africa the opportunity to enhance their lives and incomes. The teams in the Netherlands and East Africa work together to design an mass produce high quality, modular domestic biogas and bio-sanitation systems (SimGas, 2016) . One key difference between SimGas and other companies chosen in the case study is that SimGas is a farm solution provider. Nevertheless, this company was selected in the case study analysis as the biogas produced from the system is mainly used to power cooking stoves. Furthermore, it is part of the Global Alliance of clean cooking stoves as well as Dutch spark for cleaning cooking solutions. The aim of both these organizations is to cater clean cook stoves to the BoP using a market-based approach. Hence SimGas fits in the scope of the thesis.

The interview was conducted with Ms. Dorine Poelhekke who works as a business developer at SimGas BV. The interview took place at their office in The Hague, Netherlands. The duration of the interview was for an hour.

The price of the biogas system for 3m3 system is 600$. This includes installation, maintenance and a two-year warranty. They have sold 1500 biogas systems to the rural areas till now (Poelhekke, 2016).

4.5.2 Technology Description

This relates to the biogas technology description provide in chapter 2. A farmer feeds the digester with manure from livestock. Through the process of anaerobic absorption microorganisms transform the manure into biogas. A pipe is connected from the digester

to the farmer's house. This pipe is connected to the cook stove. Furthermore, biogas can be used for lighting purposes. The farmer uses the slurry as a fertilizer hence creating income. This has been depicted in Figure 18.



Figure 18:SimGas Biogas system(SimGas, 2016)

4.5.3 SimGas Revenue Model

This section will look at the revenue model adopted by SimGas and its adoption drivers. SimGas adopts the **service revenue model (SRM)** for its commercial activities. SimGas B.V is the main company located in the Netherlands. SimGas has sister companies located in Tanzania and Kenya. These are called as SimGas East Africa Pvt Ltd. Below the description of how SimGas employs this model is given. Figure 19, provides an overview of SimGas service revenue model. SimGas employs various revenue streams to earn profits.

- SimGas provides financing in house. But this model is different from the one that we have observed with ACE. The consumers pay SimGas a small amount upfront. The consumers pay the remaining money in flexible payments within 3 years. This can vary depending on consumer to consumer. The monthly installments vary from 25-30 per month. SimGas doesn't provide financing to the consumers but enables flexible payments. This has been depicted in Figure 19.
- SimGas has adopted the hub service delivery model. The hub service delivery model is basically where SimGas subsidiaries in Tanzania or Kenya have a small office or shop within maximum 10 kms of their consumers. The customers make money transfers through Mobile Money.

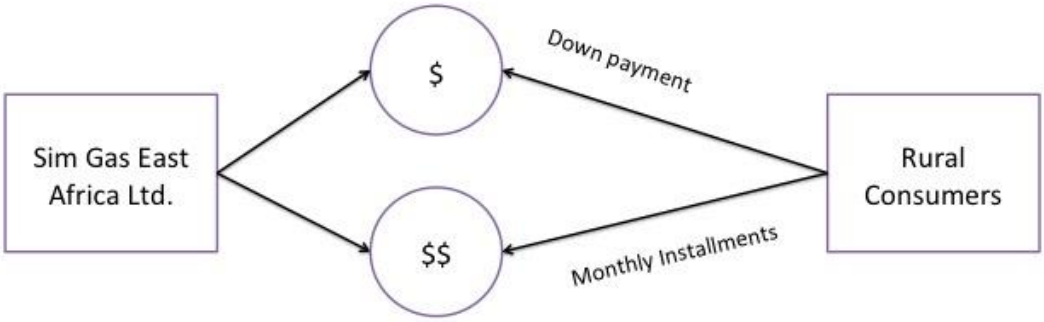


Figure 19:SimGas Service Revenue Model 1

- Another interesting revenue stream is through intellectual property rights (IPR). The biogas system has been researched and designed by SimGas BV. Whenever a system is sold by SimGas East Africa a small payment goes to SimGas BV as patent right. Figure 20 depicts the revenue stream created by IPR.
- Furthermore, SimGas East Africa Ltd. hires SimGas BV to help them to increase sales by marketing or writing a business plan. This can be said to be another revenue stream generated by SimGas BV.
- The fourth revenue stream is Carbon Credit sales. Customers who use biogas to cook instead of burning wood receive carbon credits. SimGas 'buys' the Carbon Credits from its customers in the form of a discount to the biogas system (~100USD). SimGas then sells the Carbon Credits to Carbon funds (Zukunft des Kohlenstoff Marktes and C-Dev from the Worldbank). This creates an additional revenue stream to the company that subsides the cost of the biogas system. This will make the biogas system affordable to rural households. Moreover, it will extend the warranty period from the present 2-year warranty period to a 5-year warranty period. This will create trust and confidence amongst consumers(SEPPALA, 2016).This has been depicted in figure 21.

We can conclude that SimGas BV operations are profitable and hence commercially viable. Through SimGas BV various revenue streams they are able to scale to other countries. They are already expanding to nearly all the East African countries. They have operations

presently in Kenya, Tanzania and Rwanda. However, operations in Rwanda are yet to start. In the coming years, we plan to expand to Ethiopia and Uganda. The subsidiaries or daughter companies such as SimGas East Africa Ltd pay the parent company for the using the technology patent and for the services that generates further revenue. Dorine Poelhekke states, "We are looking to change our revenue model in the future by using the pay as you go model where we put a chip on the biogas system and if the consumer fails to pay one can simply turn off the system"



Figure 20: SimGas Revenue Stream 2

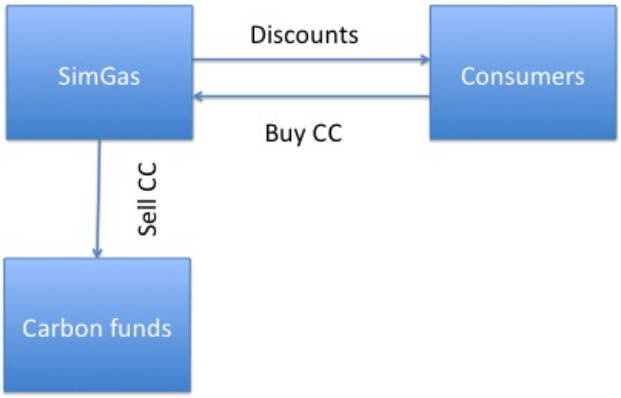


Figure 21:SimGas Revenue Stream 3

4.5.4 SimGas Consumer Adoption Drivers

This section will delve more into the importance of each of the adoption drivers identified through literature.

I. Product Characteristics

A. Affordability

Budget Constraint

5

SimGas deems budget constraint as an extremely important driver. The company creates tailor-made financing schemes to make it affordable to the rural group.

Willingness to pay

5

SimGas deems WTP to be relevant to its service revenue model. They have adopted the service revenue model as the consumers cannot afford to pay 600$ upfront. They desire to own the Biogas system but are unable to afford it. Revenues are highly dependent on consumers WTP.

B. Visual Comprehensibility

Live demonstrations

5

SimGas sends its sales agents to rural villages to demonstrate the working of the biogas system. Furthermore, the consumers that are interested can sign up with the sale agents. The sale agents make an appointment to demonstrate and train at least two members of the household them how to use it properly.

Leaflets

5

SimGas provides leaflets to their consumers when the technicians come to install the systems. This makes it easier for them to learn how to use and maintain the system properly

C. Adaptability

Extra Product Features

2

SimGas does not consider providing additional features such as charger or lighting as extremely relevant. Dorine quotes "We do provide them with biogas lamps if they are interested at an additional cost but it is not very relevant to consumer adoption"

D. Relative Advantage

Fuel Savings

5

SimGas deems fuel savings as an extremely relevant driver for adoption. "We sit and do that cost and benefit analysis with them. The first three years they have to pay 25-30$, but post that they will have free energy for at least 17 more years. They will save time and money in terms of collecting and buying fuel," states Dorine.

E. Compatibility

Traditional cooking practices

3

SimGas does not consider this to be an extremely important factor. She states," Previously in the Netherlands we also cooked on wood, however now we might cook on charcoal only for barbeques. Hence, even in these areas, there is a slow transition taking place"

II. Social Characteristics

A. Social Capital

Consumer Trust

5

Low-income consumers are heavily dependent on the advice they receive from the community to make big purchases. Hence personal ties encourage or discourage buying decisions. Dorine said, "Consumers can break or make the product. If one person doesn't like the product then your product has failed in that village"

B. Assimilationist Culture

Aspirational Value

5

According to SimGas this is an extremely important driver. Dorine states, "These consumers aspire to own something better than they already do. The biogas system gives them a chance to have the feeling of doing better in life or climbing up the socio-economic ladder. It makes them feel empowered".

B. Collective Need

Community Budget

2

SimGas stated that maintenance is required for a biogas system to run efficiently. Hence, a number of families cannot buy the product together it lacks accountability.

III. Marketing Characteristics

A. Interpersonal Communication

Consumer Trust

5

This is a combination of consumer trust in the **social characteristics** and impact on livelihood **in product characteristics.**

Word to Mouth Advertising

5

Word to Mouth advertising is key in this market says Dorine.

Awareness

5

SimGas considers this to very important regarding top adoption. "We do tell them that it's better for their health, but for them it's not the most important incentive to buy. The most important incentive is saving costs. If you make up the balance with them this is your cost and this is how much you will save," says Dorine

B. Atomized Distribution

Hub Model

This is not a driver but it's a model used by SimGas. The hub model basically entails having a range of small offices spread out through the

country, each at a distance of max 10 km away from our customers. The shop always has a technician on call and spare parts are also available.

C. Pricing Mechanisms

Flexible Payments

5

SimGas thinks this is extremely relevant for the service revenue model. This makes energy more accessible and affordable over a period of 2 years. However, sometime their cows die and biogas system doesn't work, as there is no cow-dung fed to the system. This leads them to buy LPG, which is more expensive. Default payments take place due to these reasons.

End user finance

5

SimGas considers in-house financing extremely relevant to consumer adoption. "Previously SimGas had tie ups with MFI. However, consumers are not very happy with MFIs. Firstly, most of these institutions are not professional. Next they charge exorbitant interest rates. Our consumers tell us to provide in-house financing," states Dorine. Hence, only if the companies provide in house financing does consumer adoption increases as it creates more trust.

Discounts

4

SimGas provides discounts in terms of carbon financing. The amount of money SimGas gets in exchange for carbon credits a part of it is given in the form of discounts to the **consumers.**

Warranty & After Sales Service

4 & 5

SimGas provides two-year warranty to their consumers. According to Dorine this is the most important driver and not all companies provide after sales service and warranty to their customers. Due to the hub service model the consumers always have the confidence if anything breaks down SimGas technicians are always available.

Marketing Characteristics

1. Interpersonal communication
    - Consumer Trust
    - Awareness
    - **WTM**
2. Atomized Distribution
    - **Hub model**
3. Pricing Mechanisms
    - Flexible Payments
    - End user finance
    - Warranty & After sales service
    - Discounts

Social Characteristics

1. Social Capital
    - Consumer Trust
2. Assimilationist Culture
    - **Aspirational Value**
3. Collective Need
    - Community Budget

Product Characteristics

1. Affordability
    - WTP
    - Budget Constraint
2. Visual Comprehensibility
    - Live Demonstrations
    - **Leaflets**
3. Relative Advantage
    - Fuel Savings
4. Compatibility
    - Traditional cooking practices
5. Adaptability
    - Extra Product Features

Table 9:List of drivers after case 3

New Drivers→WTM, Hub Model, Aspirational Value, Leaflets

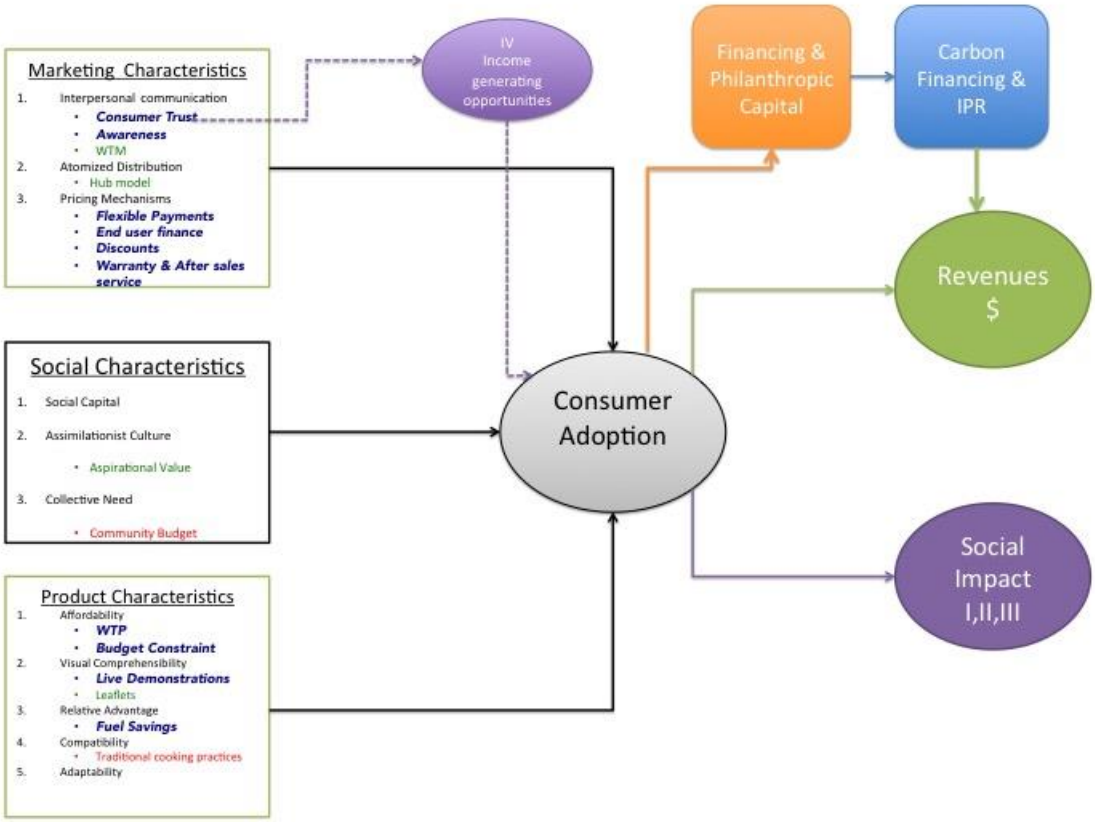


Figure 22: SimGas Framework

Green Color →New Drivers post the case analysis

Red Color →Not important by the company

Blue Color →Deemed important by the company

Purple Color →Social Impact IV (income generating opportunities)

4.5.4 SimGas Case Summary

SimGas BV doesn't depend only one revenue stream to make profits. But it employs various revenue mechanisms that help in scalability and replicabilty. One revenue model is the service revenue model where the consumers pay a small payment upfront and the rest of the cost is paid monthly. Next one is when the daughter companies (SimGas East Africa) have to pay a small amount to the parent company as IPR. Furthermore, additional revenue is generated when the daughter company hires the parent company to help them with sales, marketing and over all business. Next SimGas also sells carbon credits to WHO. The carbon credits enable SimGas to provide discounts to their consumers. However, the key thing to note is that directly or indirectly the revenue streams are dependent on consumer adoption. For example, only if a system is sold to the consumer does the parent company make a small monetary fee. Furthermore, if SimGas has installed an X number of system can they sell their carbon credits to World Bank. Therefore, it can be said that even though a company can make revenues through various mechanisms they are directly or indirectly related consumer adoption. Moreover these multiple revenue streams have

attracted angel investors and philanthropic capital in the form of subsidies from the African Government.

SimGas thinks there is tremendous impact on livelihood. Firstly, the can sell the extra fertilizer that is made through this system. If not the fertilizer they have better and healthier crops due to the use of this organic fertilizer, which also generated additional income. “We also employ a mechanism where when a women sells or recommend this system to other people in the village and if the family buys the systems the women gets a small commission fee. This motivates them to create awareness”, said Dorine. Hence, SimGas fulfills social impact through four ways described before

1.Through the biogas system SimGas eliminates the effect of HAP.

2.The energy is delivered at the home itself hence women do not need to travel long distances to collect wood, charcoal etc.

3.Once the payment for the biogas system is made the consumers save money on buying fuel. Hence, they have free energy for 17 years. This saves the cost on fuel they would normally spend.

4.Lastly income-generating opportunities are created as the farmers can sell the fertilizer produced through the biogas system. Another way to generate income is by selling healthier crops by using organic fertilizer. Furthermore, women can generate additional income through recommendation schemes offered by the company.

The initial conceptual model was quite appropriate in the case of SimGas. A few new drivers were added to the list such as ***aspirational value, word to mouth advertising and leaflets*** and the hub model which is a distribution model. The framework for SimGas has been shown in figure 22. The green color indicates the new drivers that were recognized post the interview with ACE.

Next SimGas generates revenues through carbon financing and IPR.A key thing to notice is that financing schemes are dependent on consumer adoption. For example: If the sister company fails to sell the biogas system to a consumer SimGas BV will not obtain the license fee through the IPR. Another example that can be provided is UN will only make payments for carbon financing to SimGas BV if they are successful in selling the product to the consumer. Hence, its can be observed that carbon financing and IPR are both dependent on consumer adoption to generate revenues.

A vital fact to notice was the various mechanisms used by SimGas to promote the system. This included providing a commission to the people who recommend to others, and sending the same technicians to install, repair and maintain the system, which instilled trust between the consumers and the company. To conclude there is definitely a relation with revenues to consumer adoption either directly or indirectly.

4.6 Chapter Summary

This chapter looked at three different Dutch companies namely Mansa Stoves BV, African Clean Energy and SimGas BV. The social enterprises essentially employed two different revenue models ownership and service revenue model. Also SimGas wants to adopt the pay as you go revenue model in the future. Mansa Stoves adopted the ownership model while African Clean Energy and SimGas adopted the service revenue model. Nonetheless, the two companies that adopted the service revenue model employed different ways to generate revenues. African Clean Energy tied up with Kiva to get capital and provide this capital to the consumers hence enabling them to buy the product. ACE also used mobile payments to enable recoupment of costs. SimGas allowed the consumers to pay a down payment and pay monthly installments. Furthermore SimGas also made additional revenues through patent, service delivery and carbon credits. While Mansa Stoves were dependent on partnerships and consumer adoption for revenues.

Both **the ownership and service revenue mode**l employed by the companies helped them to achieve **profits**. A service revenue model is employed when the consumers pay the costs periodically and ownership revenue model is employed when the consumer has to pay the entire cost upfront. A key observation was that even though the costs of the three products were so high it did not deter the consumers from adoption. The costs of the Mansa Stove was 60$, the cost of the ACE was 100$ while SimGas was 600$. Mansa Stoves that used the ownership had innovative ways targeting the market. They targeted young people who lived in the city but wanted to buy this product for their parents. The young people had decent wages and hence were able to pay the full amount upfront. Furthermore, Mansa Stoves targeted communities together, which enabled consumers to deposit the money as a whole. The buy one give one model also helps Mansa stove to reduce the original price to a more affordable price that matches the paying capabilities of the consumers. The service revenue model employed by ACE and SimGas enabled a flexible payment scheme that helped cater to the varying income of these consumers.

The initial conceptual model derived from ICS literature and product adoption at the BoP fit well with the cases. New drivers were discovered post the analysis. These were ***discounts, warranty, additional features live demonstrations, aspirational value, leaflets, word to mouth advertising***. The drivers such as WTP, Live demonstrations, fuel savings, traditional cooking practices, consumer trust, awareness, were given more than 3 on the likert scale have been included in the final list. This is because all the three companies deemed the drivers to be important for adoption.

Budget constraint wasn't given importance by Mansa Stoves & ACE. SimGas deemed it to be very important. The reasoning behind why this made it the final list was because Mansa Stoves, ACE & SimGas all target people living in the peri-urban or rural villages. They fail to target people living truly at the BoP. More information about different markets is given in section 6.3.1. Hence, this framework is made for future entrepreneurs who would like to target the BoP. Therefore this is included in the final list. **Extra product features** wasn't deemed important by SimGas. But was deemed important by ACE. This was included because SimGas does offer extra product features such as biogas lamp

(optional) or in the future milk chillers. Further, in order to scale up in the future product designers should ensure that new features could be added easily if the consumer demands it in the future.

Another important discovery that **traditional cooking practices** was deemed to be very important in the ICS literature. However, 2 out of the 3 companies that were interviewed stated, it to be of medium importance. The 2 companies that charged consumers on the steeper side for their product and employed the service revenue model did not deem traditional cooking practices as important for adoption. Both SimGas and ACE agreed that unless there is no technology push that changes the behavior of the consumers the product would not be adopted. However, Mansa stated traditional cooking practice as an important consideration while designing the product. The traditional cooking practices driver even though was given medium importance by the two companies has been included in the final list of drivers because according to literature by (Ahmed Mushfiq Mobaraka *et al.*, 2012; Arif *et al.*, 2011; Beltramo *et al.*, 2014; Douglas F.Barnes *et al.*, 1994; Jessica J. Lewis *et al.*, 2015; Pamela Jagger *et al.*, 2016; Rehfuess *et al.*, 2013) and Mansa Stoves it was deemed to be extremely important. Also the two companies (ACE & SimGas) did not give it an extremely low score either.

Community budget wasn't deemed an important driver for ACE & SimGas. Mansa Stoves deemed it to be an important driver. This was ironic because ACE provides group loans (8-30), which can be categorized in community budget. Hence, this was added to the final list.

Flexible payments, end user finance was deemed important by ACE & SimGas because they used the service revenue model. On the other hand Mansa Stoves did no deem it to be important because the company used an ownership revenue model. This has been included in the final list because

Next, only SimGas deemed **discounts** as an important driver. This was ironic because Mansa Stoves is trying to use the buy one give one model to ensure that people who cant afford the product can by selling barbeque sets to the European market for a higher price and provided an ICS fro 10$. Hence, this was included in the final list. **After sales service & warranty** were considered important by ACE & SimGas. This wasn't considered important by Mansa stoves but it has been added because two companies deemed it to be an important driver. Further this increase consumer trust. Consumer trust was relevant to and has been used interchangeably in marketing characteristics as well as social characteristics.

Furthermore, companies that adopted service revenue model adopted warranty and after sales service due to high product costs. We can also imply that the adoption drivers signify the type of revenue model employed by the company. In other words the type of revenue model adopted by a company is dependent on the adoption drivers.

Finally new drivers were discovered from the last interview with SimGas. These were **WTM, Hub Model, leaflets and aspirational value.** These were included even though they could not be checked with the previous two companies because while having a conversation with the companies they indirectly stated hat word to mouth advertising makes or breaks the product. Next Hub Model, leaflets & aspirational value were included because they matched the characteristics of the framework by Cheryl Nakata & Kelly Weidner (2012).

Another interesting that comes out of the case analysis the addition of **partnerships**. Partnerships help global companies to make a local presence in the country they target. Additionally, partnerships also help companies provide capital and money to the consumers that cannot afford to pay the cost upfront. Next, partnerships in the form of sister companies help in selling, providing maintenance and manufacture the products. Therefore, it can be concluded that without partnerships companies would not able to increase consumer adoption. Therefore, through the case analysis the relationship between partnerships and consumer adoption was realized. This chapter provided with the answers to how they create a social impact to this group. It was observed that three out of the four social impacts (health, safety & monetary) was achieved only once adoption takes place. This can be said because only once the consumer adopts the product there will be a significant effect on the health. The fact that women do not have to walk long distances to collect wood increased the safety aspect. Finally the monetary aspect will be felt in the long-term and not immediately because only after a period of usage the consumers and paying off the cost of the ICS will the consumer feel the monetary impact of using such a stove. The income generating social impact was achieved one way or the other either in the form of inculcating the women in design like in the case of Mansa stoves or in the case of selling the cook stoves like in the case of ACE or SimGas.

Chapter 4 helped us understand that the choice of the revenue model adopted by the three cases. It helped elucidate the fact that the choice of revenue model depends on the risk taking appetite of the owner or founder. In the case of Mansa Stoves he uses the ownership model because he is not comfortable with the system of providing loans or money to the consumers. Also, from the three case studies it was observed that higher the price of the stove or system the chances of using a service revenue model were more. Another important revelation was found post the analysis that consumer adoption driver directly or indirectly affects the revenues. Moreover consumer adoption drivers entail to look at all aspects of the business that can drive adoption and is not specific to only one aspect of the business. However, it can be concluded although companies target the BoP, they are unable to target the people living really at the bottom as it is not possible to manufacture good quality, robust products and provide after sales service at an extremely low price. Through chapter 3 & chapter 4 a final list of drivers needed to increase the rate of adoption was determined. Following are the final list of drivers:

Partnerships

• Local entrepreneurs
• NGO's
• Financing Partners
• Sister company
Marketing Characteristics
Interpersonal communication
• Consumer Trust
• Awareness
• WTM
Atomized Distribution
• Hub model
Pricing Mechanisms
• Flexible Payments
• End user finance
• Discounts
• Warranty & After sales service
Social Characteristics
Social Capital
Assimilationist Culture
• Aspirational Value
Collective Need
• Community Budget
Marketing Characteristics
Affordability
• WTP
• Budget Constraint
Visual Comprehensibility
• Live Demonstration
• Leaflets
Relative Advantage
• Fuel Savings
Compatibility
• Traditional cooking practices
Adaptability
• Extra Product Features

Table 10:Final List of Drivers

Chapter 5: Cross Case Analysis

5.1 Chapter Introduction

In chapter 4 a case analysis was performed. This resulted in a framework of consumer adoption at the BoP. Furthermore, in chapter 4 every case was analyzed separately as different cases. Chapter 5 looks at all the cases in a more holistic manner.

The aim of chapter 5 is to perform a cross case analysis. A cross case analysis entail to compare the similarities and differences obtained from the results in chapter 4. Lastly, the final conceptual model will be developed through information collected and analyzed in chapters 4 & 5.Through the interviews new drivers were discovered. For example the interview with Mansa Stoves drivers such as awareness, community budget & live demonstrations were learnt. It was learnt Mansa Stoves uses the ORM to achieve profitability. Next, the drivers discovered through the interview with ACE were extra product features & warranty. Moreover, ACE uses the SRM. Lastly, it was learnt SimGas uses the SRM to achieve profitability. The drivers discovered through the interview with SimGas were extra wtm, aspirational value, & hub model. It was learnt that all three companies achieve health, safety and monetary social impact once adoption had taken place. The next sections will check every driver against the revenue model & social impact.

5.2 Adoption Drivers in relation to revenue models & social impact

This section will try to compare the adoption drivers of the three cases that use both Service revenue model (SRM) and the Ownership Revenue Model. Coming back to chapter 3,three characteristics were identified that increase consumer adoption at the BoP. These are product characteristics, social characteristics and marketing characteristics. Furthermore, drivers were identified within each of these characteristics. For every adoption driver identified in the previous chapter first a discussion about its importance for a particular revenue model will take place. Followed by an analysis on how every driver influences and interacts with increasing the revenues of the company. Next, lets look at the relation of the drivers with respect to the social impact. This will further validate and verify the relation between adoption drivers with respect to the four types of social impact identified in the previous chapters.

Product Characteristics

A. Affordability

WTP

The WTP driver was important for all the three cases. Unless consumers are not willing to pay for the product, adoption will not increase. Hence, WTP did not affect the type of revenue model employed by the company. It was considered important by all three companies irrespective on the type of revenue model employed by the company.

Social Impact- This is an independent driver and not related to the social impact. Nonetheless, it is an important driver for consumer adoption.

Budget Constraint

Budget constraint was considered to be a very important driver according to literature on ICS. But only SimGas BV considered budget constraint to be an important driver. Both ACE and Mansa Stoves BV did not consider budget constraint to be important driver. This is indicated in figure 23. It is interesting to note that all three companies are charging their customers 60$, 100$ and 600$ (Mansa Stoves, ACE, SimGas) more than what the World Bank recommended. Yet SimGas deems budget constraint to be an important driver. However, SimGas provides a biogas system unlike the other two cases. A biogas system is a farm solution that is why the price is higher than the cooking stoves provided by Mansa Stoves & ACE. Two cases (Mansa Stoves & ACE) agreed that if you are providing a good quality product budget should not be given the most important.

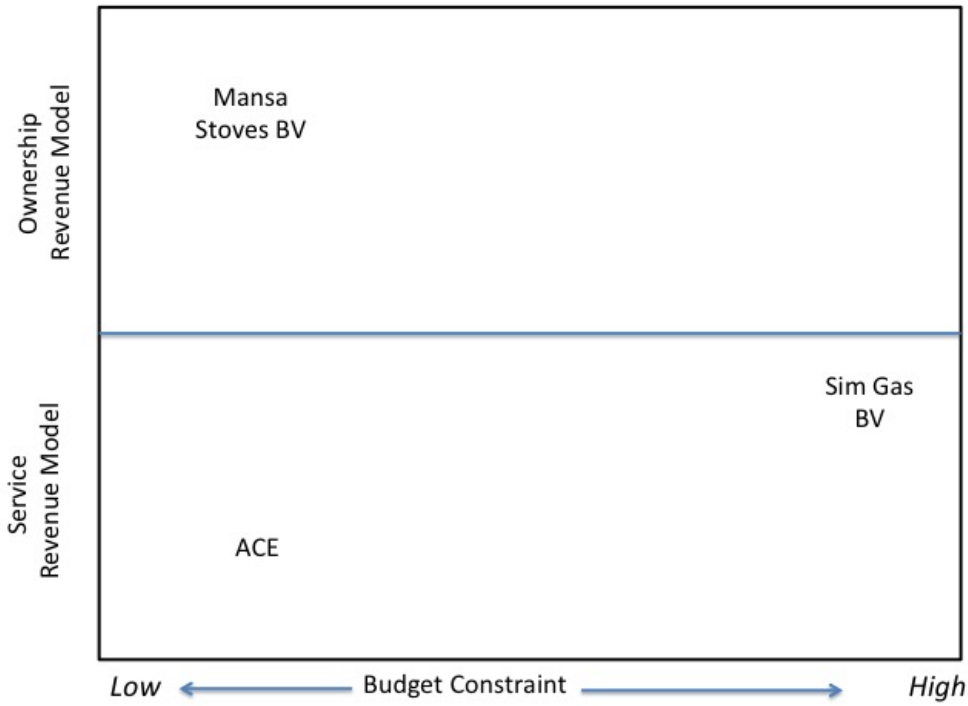


Figure 23:Budget Constraint v/s SRM & ORM

Social Impact- This is an independent driver and not related to the social impact. Nonetheless, it is an important driver for consumer adoption.

D. Visual Comprehensibility

Live Demonstrations

The three case studies deem live demonstration as an important driver for consumer adoption. Live demonstrations are needed because it creates awareness amongst consumers. Furthermore, this way it educates and motivates the consumers to buy the product. In sum, live demonstrations are relevant to both types of revenue models as it enhances **consumer adoption** and ensures **customer retention**. It ensures customer

retention because the people learn to use the product through visual demonstrations. This leads to higher maintenance thus increasing longevity.

This driver has no impact on the choice of revenue model or social impact but is needed to enhance consumer adoption and customer retention.

Leaflets

Most of the BoP consumers are uneducated. SimGas provides leaflets to educate consumers how to use the product. These are pictorial descriptions of how to use the biogas system. This enhances the consumers understanding on how to maintain and use the product that enables the products life span to increase. This is an independent driver and not related to the revenue models or social impact. Nonetheless, it is an important driver for consumer adoption. Furthermore, this will ensure **customer retention** in the long run.

B. Relative Advantage

Fuel Savings

The fuel savings driver was important for all the three cases. The products offered by the company saved fuel for the consumers. As noted before BoP consumers spends 25$ a month on fuel. Hence, unless the value offering by the company to the consumer does not save fuel significantly consumer adoption will not take place. This driver is deemed important irrespective of the type of revenue model employed by the company. Therefore, fuel savings has a relative advantage over other technologies.

Social impact-This driver is not related to the type of revenue model employed by the company. Though, it plays a major importance on the social impact created by the company. As mentioned previously BoP consumers spend a major portion of their income on fuel every month. Therefore, if consumers adopt the product they will save a large portion of their income. Through this the monetary social impact is achieved once consumer buys the product.

C. Compatibility

Traditional Cooking practices

It was interesting to note how there was a difference between the importance companies deemed traditional cooking practices. According to literature on ICS traditional cooking practices plays an important role in consumer adoption. If a product does not adhere to the behavioral practices of the women, consumer adoption does not take place. According to Mansa Stoves BV this was a very important factor. Paul the founder of the company states, there needs to be relation between the women and the fire. Besides, Mansa Stoves used local women to help with the design the stove.

Nevertheless, on the other hand according to both ACE and SimGas BV traditional cooking practices play a role but not a very significant role for consumer adoption. Yet, the

companies did not scale this driver as not significant but marked it as moderately significant. Both the companies compared it with a mobile phone. Consumers did not know they wanted a phone until it came in the market. Hence, there needs to be technological push. ACE and SimGas both adopt the service revenue model, while the Mansa stoves adopts the ownership revenue model. The Mansa stoves BV needs the consumer to adopt the product to have an increase in revenues. Figure 24 depicts the preferences of the three companies.

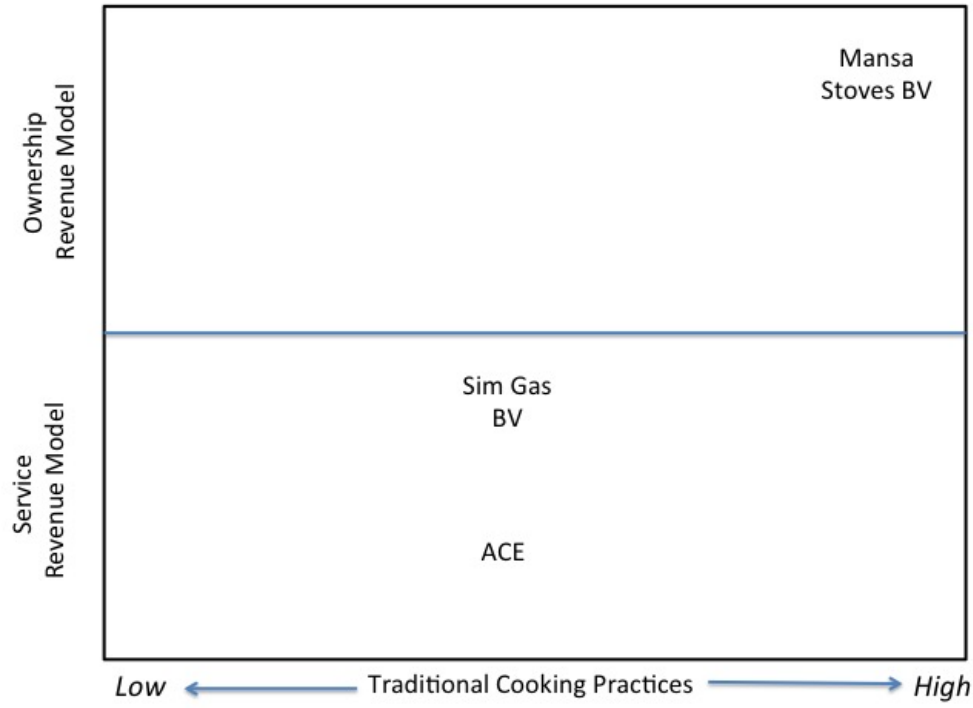


Figure 24:TCP v/s SRM & ORM

Social Impact-Mansa Stoves procured the assistance of local women to design the product. Hence, Mansa Stove included women in the business activities and thus providing income-generating opportunities to them. The inclusion of women in the business activities enables the company to adhere to the specific cultural practices in the design of the product that has an impact on adoption. Through this way the company achieves the 4th type of social impact. Moreover, if the specific cultural practices are taken into account **customer retention** is also achieved.

E. Adaptability

Extra Product Features (EPF)

ACE was the only company that offered extra features such as lighting and charger to the consumer in its product. ACE deemed extra product features as important for consumer adoption. In the case of SimGas that offered biogas lamps on request at an additional cost did not deem EPF as a significant driver in consumer adoption. Mansa Stoves did not

consider extra product features as an important driver for consumer adoption. Paul stated by giving extra features leads to break down of the product.

In the future SimGas will be offering milk chillers that will work through biogas. This can be considered to an extra product feature that will have an impact on adoption. This is independent of the choice of revenue model but is important from the point of view of consumer adoption.

Social Impact-Social impact is created in the case of ACE providing lighting and charger to the consumers as they save costs on wood and charging their phones. Hence, the social impact monetary savings is achieved by providing EPF.

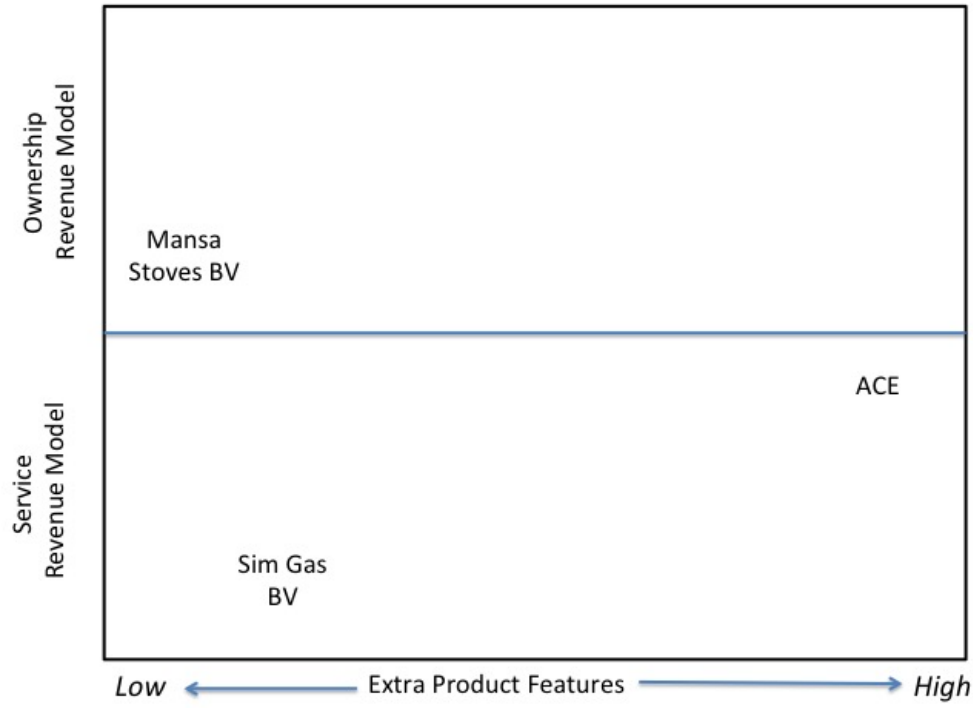


Figure 25:EPF v/s SRM & ORM

Social Characteristics

A. Social Capital

Consumer Trust

Social impact-All three companies deemed consumer trust as an important driver. This is independent on the choice of the revenue model. Nevertheless, it has a social impact because consumers trust each other's recommendations. All the three companies stated that the consumer makes or breaks the product. Consumers are more likely to adopt a product when people they trust promote the product. Personal ties persuade or dissuade consumers to purchase a product. This is similar to word to mouth advertising. Hence, the

fourth type of social impact is created. Additionally, providing after sales service and maintenance also creates consumer trust. In the case of SimGas the same technicians are sent to the customer's houses during the complete warranty period. This ensures **customer retention.**

B. Assimilationist Culture

Aspirational Value

SimGas deems aspirational value has a very important driver for consumer adoption. In all three interviews aspirational value wasn't explicitly mentioned. However, through the interviews its can be concluded that the BoP consumers want to climb the socio-economic ladder of their community. By offering a product that enables them to do so enhances adoption. This is independent of the choice of revenue model or social impact Nonetheless it is an important driver for consumer adoption.

C. Collective Need

Community Budget

SimGas does not deem community budget as an important driver for consumer adoption. According to SimGas the matter of accountability comes in the picture if a community as whole pays for a biogas system. A biogas system involves maintenance and feeding the system with biomass. If somebody fails to do so the chances of the system breaking down are very high. Hence, SimGas does not deem this be an important driver. ACE provides loans in the form of groups of sizes varying from 8-30.Therefore, if one person fails to reimburse the cost, the community pressurizes to pay the amount. But every person owns the cook stove individually.

In the case of Mansa Stoves they deem to an important driver as they use the ownership model. Mansa Stoves does not provide end-user finance and flexible payment schemes. Hence, community budget is the method to sell the stoves and make a profit. To conclude, community aspect of this group should not be ignored.

Social Impact- This is an independent driver and not related to the social impact. Nonetheless, it is an important driver for consumer adoption. Furthermore, this will ensure ***repayment of costs*** in the long run.

Marketing Characteristics

A. Interpersonal communication

Awareness

Awareness is an important driver for the three companies. This is independent of the choice of revenue model. But it's an important driver for consumer adoption. All three companies state that awareness entails communicating cost-savings feature is a major incentive for consumers to buy the stove. Mansa Stoves, ACE and SimGas make the consumers realize the amount of money they would save if they would buy the stove. This enables adoption.

The health impact is also an important awareness driver, but consumers do not heed to the health aspect at the time of adoption. However, post adoption less smoke makes them realize the importance of having an improved cooking stove.

Social Impact-This driver has a social impact through two ways: health impact and monetary impact. But it is to be noted that the social impact is achieved by the companies only post adoption**.** For example: The company creates awareness by asserting on the monetary savings they will achieve by using the stove. Besides, ACE & SimGas also mention the health impact while selling the stove. Nevertheless, the health and monetary impact will be achieved only post adoption. It is a driver to motivate consumers to buy the product but the social impact will be achieved only after adoption.

Word to Mouth (WTM) advertisings

This is an important driver according to the three companies. WTM advertising can make or break the product. Therefore, having a good quality product is important for adoption. Also, the three companies stated that if one person has a bad experience this would deter future adoptees from buying the product. Nevertheless, this is independent of the choice of revenue model.

Social Impact: Companies like SimGas & ACE use women to sell their products. SimGas provides a commission to the women who are successful in selling their products to the BoP market. This enables the company to create income-generating opportunity for these women. Further, through these women adoption increases as the BoP consumers are more comfortable buying the product from people they know. Through this way the company achieves the 4th type of social impact that enhances consumer adoption.

B. Atomized Distribution

Hub Model

Although hub model cannot be deemed as a driver for adoption some key characteristic of the model could be noted. Hub models entail having a small office or shop within maximum 10 kms of their consumers. This creates consumer trust. The consumers trust that even if something breaks down a technician is available to get it repaired. This is independent of the type of revenue model a company uses. As mentioned previously all companies deem consumer trust to be an important driver to increase adoption. The hub model helps to increase the trust amongst consumers.

This is an independent driver and not related to the revenue models or social impact. Nonetheless, it is an important driver for consumer adoption. Also, it will ensure customer retention in the long run.

C. Pricing Mechanisms

Flexible Payments

Flexible payments entail consumers paying in small amounts over a period of time. It is noteworthy to notice that Mansa Stoves employs an ownership model does not deem flexibility of payments as an important driver for consumer adoption. On the other hand, ACE and SimGas consider flexible payments to be an important driver for consumer adoption. It is to be noted that both ACE & SimGas use in-house financing through different mechanisms. In the SRM flexibility of payments is done in two ways: partnering with MFI or NGOs such as Kiva by paying the entire amount at once in exchange for a small monthly cost from the consumers. Its operations are like a bank without charging any interest. Secondly, the consumers pay a small amount upfront and the remaining amount is paid in small installments over time. ACE and SimGas collect the payments through mobile payments. Therefore, it can be concluded that companies employing an ownership model do not use flexible payments schemes while companies employing a SRM use flexible payments schemes.

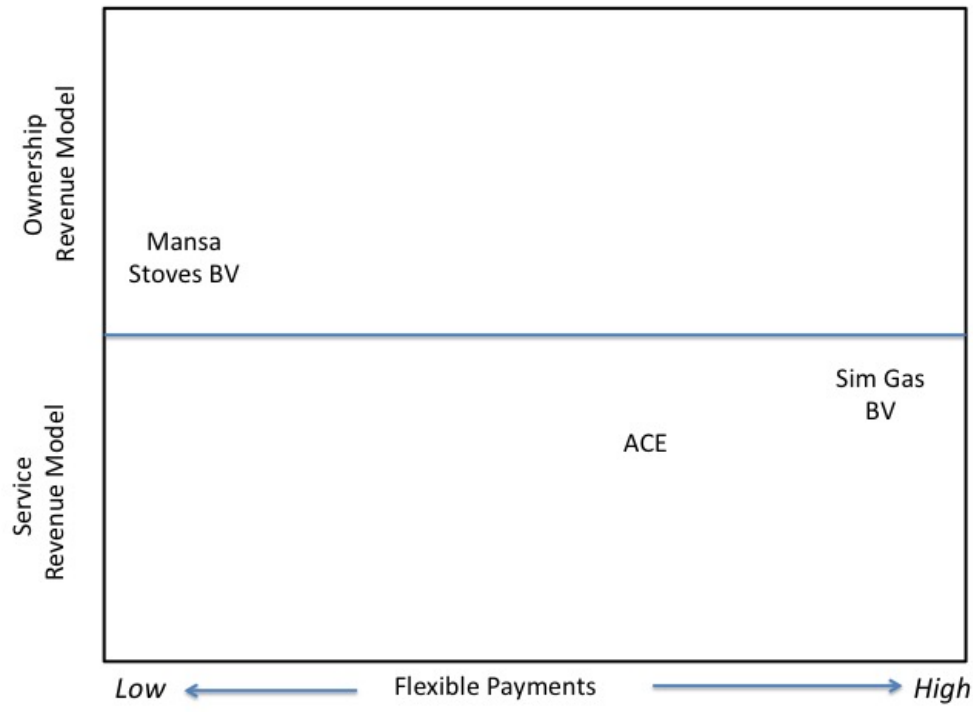


Figure 26: Flexible Payments v/s SRM, ORM

Social Impact-Through this no social impact is created but it has a direct relation on the choice of the revenue model used by the company.

End user finance

Mansa Stoves BV uses an ownership model as the revenue model. However, Mansa Stove does not use an end user finance mechanism. This is interesting to note because the company caters to people who can't afford the full amount upfront. Even though Mansa Stoves does not use end user financing it has still proven to be profitable. The success of the model used by Mansa stoves is majorly due to community budget, which is explained

in chapter 4

One would think companies employing a service revenue model would not need end user financing. However, both SimGas & ACE employ a service revenue model use end-user financing. ACE & SimGas provides **in-house financing** through different mechanisms and partnerships. Furthermore, what makes ACE and SimGas different from Mansa stoves are the former companies charge a higher price for their products compared to the latter. Moreover, due to the high price charged by the two companies warranty and after sales service can be provided. This is explained below in more detail. To conclude end user financing is an important driver for consumer adoption. Even though Mansa Stoves doesn't use the end user financing its importance cannot be ruled out yet. Mansa Stoves does not target the people truly at the BoP. They target young people who can afford the price of the stove living in the cities to buy the product of their mothers and grandmothers. But this strategy is not scalable. This method will limit the number of people a company can target. Yet, to target the consumers truly at the BoP end user financing will be key to have an increase in consumer adoption. Hence, end user financing is an important driver for both ownership and service revenue model.

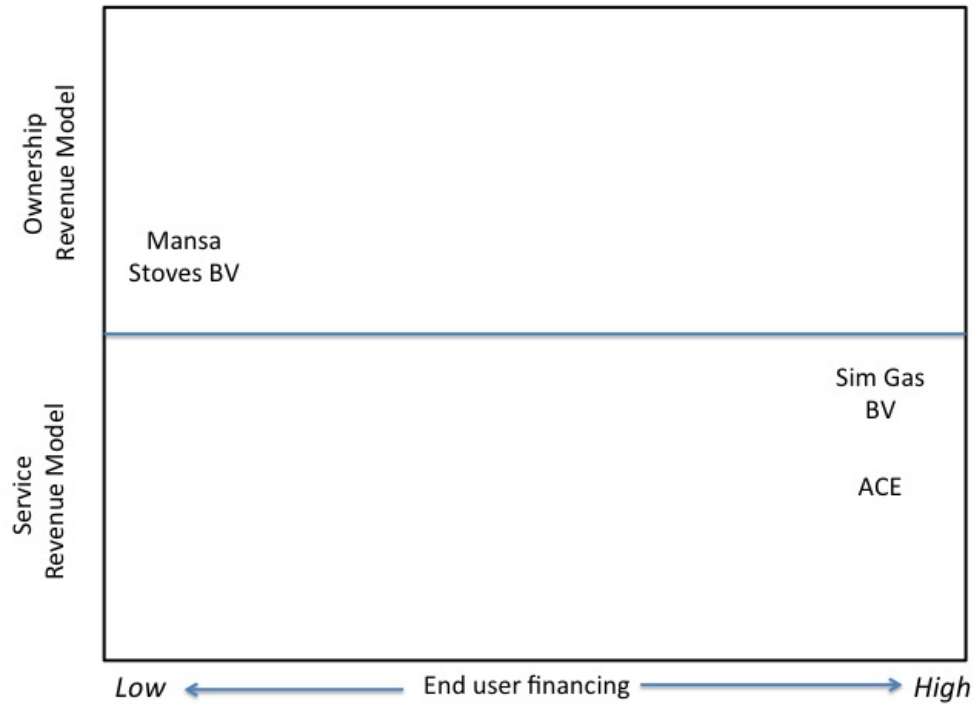


Figure 27:EUF v/s SRM & ORM

Social Impact-Through this no social impact is created but it has a direct relation on the choice of the revenue model used by the company.

Warranty & after sales service

It is interesting to note that ACE and SimGas that use the service revenue model deem

warranty and after sales service as an important driver for adoption. Both the companies charge a higher price for their products. This enables them to provide warranty & after sales service. Furthermore, the cost of the biogas system offered by SimGas for 600$ includes the cost of the warranty and after sales service. Hence, by charging a higher price these two drivers can be incorporated.

On the other hand Mansa Stoves that employs an ownership revenue model does not deem warranty & after sales service as an important driver. The company believes if you provide strong, robust and good quality product it will rarely break down. Therefore, warranty and after sales service is not needed to enhance consumer adoption. To conclude, higher the price of the stove warranty and after sales service can be offered.

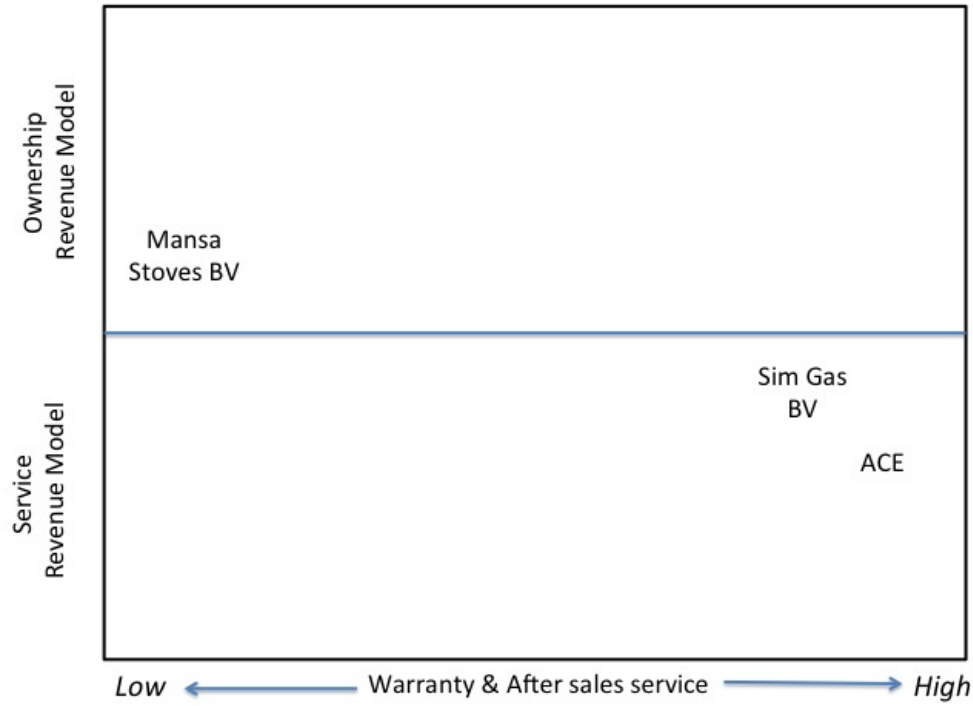


Figure 28:Warranty & After Sales Service v/s SRM & ORM

Social Impact- Through this no social impact is created but it has a direct relation on the choice of the revenue model used by the company. Therefore, this has a direct influence on **customer retention**.

Discounts

SimGas provides discounts in the form of carbon credits as explained in chapter 4.SimGas buys the carbon credits from the consumer by providing them a 100$ discount right at the start. Hence, according to SimGas this is an important driver for adoption because in the long run it makes the biogas system accessible and affordable to the BoP consumers.

Mansa Stoves provides discounts by using the buy one give one model. Mansa Stove refurbishes the cook stoves in the form of barbeque sets and sells them in Europe for

100$. Through the revenues collected via this method, the company manages to subsidize and sell the BoP consumers the ICS at 10-20$. According to Mansa stoves discounts is an important driver for consumer adoption. ACE does not deem discounts as an important driver for consumer adoption.

This driver is not related to the choice of the revenue model but more to the choice of the company. Also, an interesting thing to note is that both the companies who consider discounts as an important driver have found innovative ways to provide the same product at a lesser price. Moreover, the companies can provide discounts only if they can recoup the costs through some other revenue stream. For example: in the case of SimGas they sell the carbon credits to organizations like Zukunft des Kohlenstoff Marktes and C-Dev from the Worldbank) and in the case of Mansa stoves they can provide discounts by selling the product to the Top of the pyramid. It is important to note that discounts cannot be provided to all consumers but only to a small percentage.

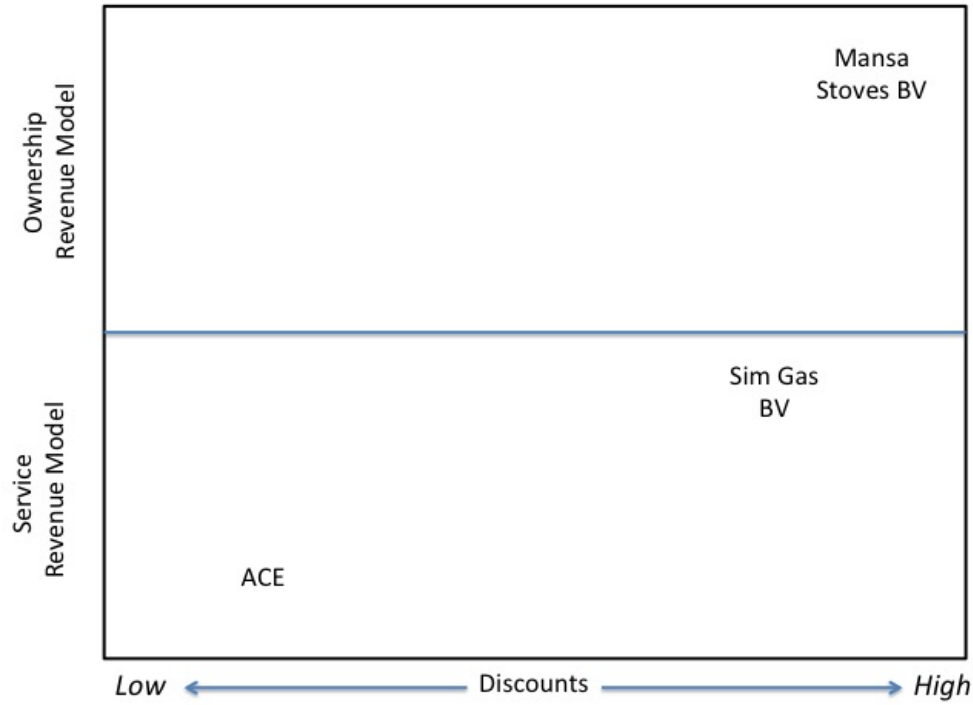


Figure 29: Discounts v/s SRM & ORM

Social Impact-Social Impact is created through **monetary savings**. Because companies provide discounts to the consumers, they are able to save money and in the long run end up paying less money. The provision of discount can be said to be an incentive to adopt the product. On the other hand only if consumers adopt the product the BoP customer feels the monetary social impact. So, social impact in the form of monetary savings is achieved only once the consumers adopt the product.

5.3 Analysis in relation to the research questions

The previous sections provided with the differences and comparisons between each case. This section will provide an implication for the answers to the research questions that were formulated in Chapter 1. Answers to the sub-questions formulated in chapter 1 have been answered across the 5 chapters. This section explains some answers to sub-questions related to Chapter 4 & 5.The adoption drivers were checked against both the revenue aspect as well as the social impact. This enabled to check the influence of each of the drivers on both revenues as well as social impact. Therefore, apart from helping to answer the last sub-question it provides an in-depth view on the individual driver and its influence on profitability & social impact.

5.4 Chapter Summary

This chapter looked at the information gathered from the case study in chapter 4. The primary goal of this chapter was to look for similarities and differences between the three case studies. Furthermore, this chapter was divided into parts one was the adoption drivers with respect to revenue models (revenues) and next was checking adoption drivers with respect to social impact. A few observations were made post cross case study analysis.

Some drivers directly related to the choice of revenue model used by the company. Drivers such as WTP, budget constraint, community budget, flexible payments, end user finance, warranty & after sales service had a direct influence on the choice of revenue model. Mansa Stoves adopted an ownership model hence drivers such as flexible payments and end user finance were not deemed as important for adoption. An interesting thing to note is that Mansa stoves does not deem end user financing as important for adoption but considers community budget to be an important driver for consumer adoption. Nevertheless, the discretion to not use end user financing in this case lies in the hands of the company and hence cannot be generalized to companies employing ownership models. Mansa stoves are dependent on community funds to pay for the upfront cost of the product. Therefore, the company taps on the collective need characteristics of this segment to buy the product. Moreover, Mansa Stoves does not provide warranty & after sales service to the consumers. This is because do the robustness and lesser likelihood of the product to break down leading to not providing warranty & after sales service. Also, as Mansa Stoves is only dependent on the consumer adoption to increase revenues this scheme deters providing warranty & after sales service to the customers. On the other hand ACE & SimGas charge a higher price and hence have a provision of warranty & after sales service.

ACE & SimGas employed service revenue model that allowed flexible payments through various financing schemes. They used partnerships like Kiva to provide capital to the consumers to buy the product. Or SimGas provided in-house financing by enabling a small payment upfront and the rest in installments. Therefore, it can be said that partnerships are key to increase the ***rate of adoption.***

Social impact was achieved either directly or indirectly through the drivers. There are four ways through which a company can achieve social impact, health, safety, monetary and income generating opportunities.

The drivers that influence health (social) impact on a consumer are awareness. Three companies noted that health impact does not seem appealing to the consumer to buy the product. Though, once adoption takes place over a period of time consumers realize the health impact as the ICS emits less smoke. Therefore, the company achieves health social impact(I) once adoption takes place. No specific drivers were found in relation to safety social impact(II). But similar to the health impact this will be realized by the consumers once adoption takes place.

Monetary savings social impact (III) is achieved through ***awareness, discounts and fuel savings.*** The companies convince the consumers to buy the product by asserting on the monetary savings of buying this product .The provision of discount is an incentive for consumers to buy the product however social impact is felt only once consumers buy the ICS.

Income generating opportunities (IV) are achieved when women are included in the design of the product. This is related to the traditional cooking practices driver. By using women in the business activities a company is made aware of the specific cultural practices and can incorporate in their design. But at the same time, some companies do not consider this to be a very important driver, as consumers do not know what they want. Nevertheless, this driver is included because up to a certain extent this plays an important role for adoption.

Income-generating opportunities are created when locals are used to sell the products like in the case of ACE & SimGas. This leads to creating consumer trust, as women from the village don't have to fake enthusiasm while selling the product. The drivers that influence using BoP population to sell your products are word to mouth advertising, consumer trust. This can be said to pre adopting driver that influences a customer to purchase the product and at the same time create income-generating opportunities. This has an impact on the income-generating opportunities, which in turn leads to an increase in adoption.

The four characteristics partnerships marketing, social and product all influence the rate of adoption. This attracts financing in the form of carbon or philanthropic capital that in turn has an effect on revenues. Social impact is achieved majorly post adoption. For the companies to truly achieve social objective consumers need to adopt the product. This adoption will take place with the help of the characteristics and the drivers that have been discovered through this study.

Another interesting observation is the effect of the drivers on customer retention and recoupment of cost. Drivers like traditional cooking practices, live leaflets, and warranty

and after sales service, consumer trust leads to ***customer retention***. If the ICS adheres to traditional cooking practices and there is no need for behavioral changes consumers will continue to use the product. Moreover, a leaflet assists consumer's use and maintains the product. This leads to increasing the longevity of the ICS. The consumer trust is created because of providing after sales service and warranty ensuring the service center is close to the villages. These factors lead to customer retention. This is explained more in chapter 6.

Companies using service revenue model ensured ***recoupment of costs*** took place because of the community budget driver. ACE offers community loans so in case a person fails to make a payment on time the community pressurizes that person to pay up. Through the case and cross case analysis the adoption framework is depicted in figure 30.

Red Box→New box post analysis

Purple Box→Social Impact

Orange box→Financing

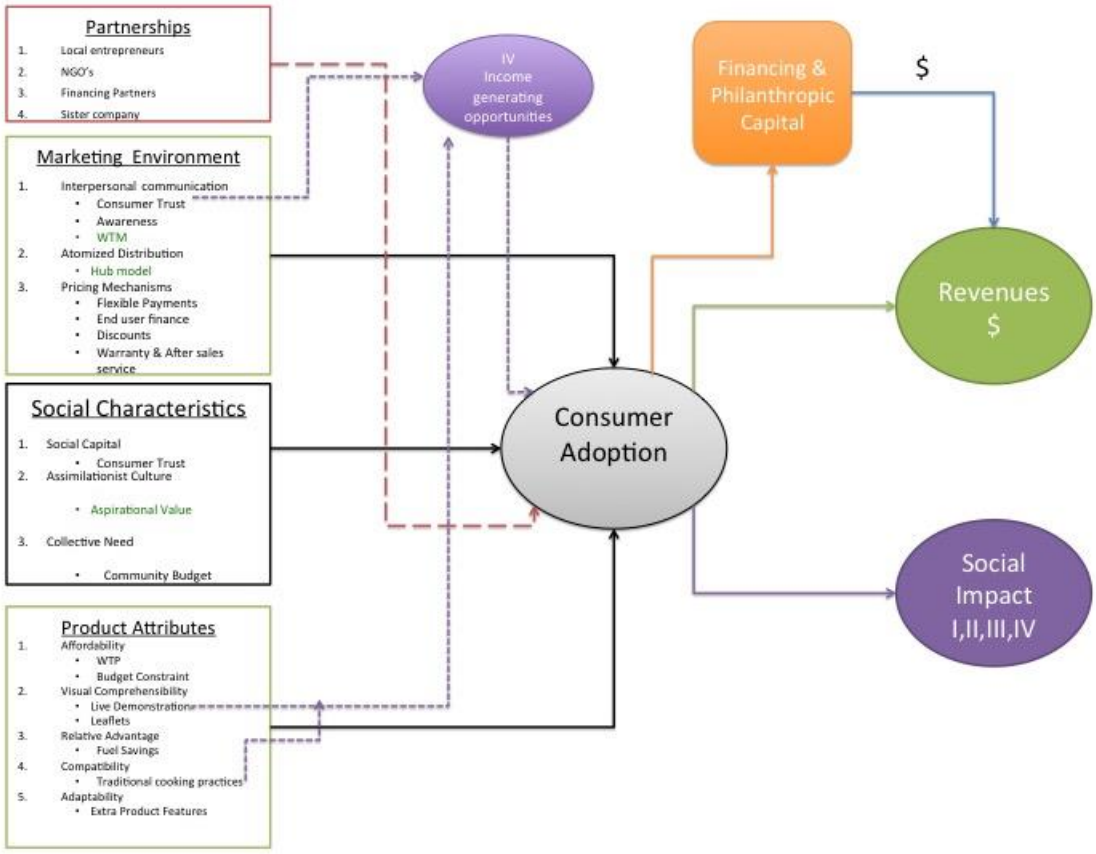


Figure 30:Adoption driver Framework

Chapter 6:Conclusion, Discussion and Recommendations

6.1 Chapter Introduction

The aim of this study was threefold. Firstly, the aim was to understand the innovative revenue models used by social enterprises. Followed by which the aim was to understand social impact achieved by these enterprises. So in a threshold it was to understand how do these companies achieve two objectives (Profit & Social)? To understand this, research undertook a three-step study to realize the objectives. The first 5 chapters described the three steps in detail. The first chapter dealt with providing the introduction of the study. The introduction provided some basic background and methodology used that set the path for the future chapters. The second chapter described the background that led to identification of the theoretical gap in the thesis. The gap addressed on the fact that adoption drivers were the missing relation in tackling the issue of profitability and social impact. The third chapter deals with the literature review where concepts of business model, revenue model was described in detail. From the literature review it was concluded that the revenue model is a subset of the business model. The business model is essentially a framework that looks into all the premeditated activities taken by a company to ensure profits and value to the customer. The revenue model is basically how a firm makes money.

The same chapter performs a literature review on product adoption at the BoP and literature on drivers and barriers faced by ICS. Through the literature on product adoption at the BoP the basis for the framework was discovered. But this framework linked poverty to adoption and variables that influenced adoption such as product features, social context and marketing characteristics. This framework failed to show the drivers in each of these characteristics that help accelerate consumer adoption. The literature on ICS dealt with barriers and drivers faced in disseminating ICS. Therefore, drivers were discovered through the literature on ICS. Through this literature an initial framework was developed. The fourth and fifth chapter entailed verifying, validating and extending the conceptual model against the three cases that were logically selected to represent the scope of this thesis. The initial framework fit pretty well with the three cases and most importantly the framework was also extended not only in the case of drivers but also a fourth component (partnerships) missed by the literature on product adoption at BoP was added.

Chapter 6 discusses three aspects to conclude the findings of this research. Firstly, the conclusion section will present the answers to the five sub questions. Followed by the answer to the main research question with the support of the sub questions will be presented. Next a discussion section will be presented that will describe facts that are not linked to the research question. Next practical and academic recommendations will be described in detail. This will entail recommendations to the future and present entrepreneurs. Also it provides recommendations for future academic studies.

6.2 Conclusion

The main objective of this research is to analyze how companies make profits and achieve social objective at the same time? The profitability aspect is understood through the revenue models and drivers, while social impact is achieved through adoption drivers. Hence, the main research question was formulated to reach this objective. The main research question is answered with the support of sub questions. The answers to some sub question were discovered through literature review while some others were discovered through only case analysis or both literature and case analysis.

6.2.1 Sub questions

What is the different type of revenue models available in the literature for renewable energy technologies?

Literature: Given the fact that literature for revenue models is scarcely present other sources were looked at in order to get a better idea. The present literature indicates that revenue model can occur in various forms. However, the article by A. Chaureya *et al.* (2009) forms the basis for the literature used for this thesis. According to the authors two types of revenue model exist: Ownership & Service revenue model. Ownership revenue model is when the customer pays the entire amount upfront in exchange for the value (ICS) delivered. Service revenue model entails paying for the service or product recurrently. Furthermore, the authors such as A. Chaureya *et al.* (2009) believe that companies adopting the service revenue model have higher chances of increasing the **rate of adoption** because the product becomes affordable by matching the varying income of the consumers. Nowadays, the ***pay as you go model*** is gaining a lot of popularity. This can be classified as the third revenue model available in literature.

What is the different type of revenue models adopted by social enterprises in developing countries?

Case Study: The different types of revenue models chosen by the companies were the ownership revenue model and the service revenue model. But it was interesting to note that companies like SimGas were planning on employing the pay as you go model in the future. The rationale behind adopting the pay as you go model in the future is to eliminate the risk of **recoupment of costs** that most enterprises fear they will not receive. For the other two companies Mansa Stoves and ACE it will be difficult to use the pay as you go model. This is said because the technology developed by them cannot support delivering energy periodically like in the case of solar home systems. Nevertheless through the case analysis, it can be concluded two types of revenue model were presently employed the ORM & SRM.

Why do social enterprises choose a specific revenue model?

Case Study: During the investigation of the three companies it was astonishing to see that regardless of the kind of revenue model chosen profitability was reached. Additionally, the choice of the revenue model depends on the risk taking nature of the entrepreneur. If the risk taking nature of the entrepreneur is low he will employ the ORM. In the case of

the ownership revenue model the enterprise was dependent on the consumer adoption to have an increase in the revenues. Nevertheless, ownership model also could dependent on the partnerships with MFI or some sort of financing mechanisms that are similar to the service revenue model. The enterprises that used the service revenue model were dependent on partnerships with NGOs & in house financing mechanism to cater to this group. Though, the enterprise employing the service revenue model (SRM) and ownership revenue model believe that consumers can afford the product due to the fact they spent 20-25$ a month on buying wood and charcoal while using traditional cook stoves. Therefore, it can be concluded that profitability is achieved regardless of the kind of revenue model adopted by the company.

How do social enterprises create a social impact in developing countries?

Case Study: Four types of social impact are achieved when catering ICS to the BoP market. These are health, safety, monetary and income generating opportunities. From the three case studies it can be concluded that companies achieve all four the types of social impact one way or the other.

Health→Once the consumer adopts the ICS there is reduction in smoke. This leads to a decrease in the number of health problems that are related to inefficient cooking methods. To conclude ICS reduces Household Air Pollution, which leads to an improvement in health.

Safety→ Women have to travel 2-3 hours a day to collect wood. This puts them at a risk of getting physically attacked. However, once ICS are used the amount of wood needed to cook is reduced tremendously. This limits the number of hours women spend a day on collecting wood.

Monetary→As previously mentioned BoP consumers spend 20-25$ on charcoal every month. By adopting an ICS this cost reduces substantially (100-200 $ a year). Hence, the money saved on energy can be used firstly to pay of the cost of the ICS to the social enterprise and secondly this money can be used for education or to improve the standard of living.

Income generating opportunities→Mansa Stoves used women to help design the cook stove. This led to an income generating opportunity for a small number of women. African Clean Energy employs local women to sell products to the BoP. They believe by using local women chances of adoption are higher amongst the masses. Similarly SimGas has adopted a scheme, which enables people to earn a small commission if they are successful in selling the ICS to the community. Furthermore, the local people can earn extra income by selling the organic fertilizer produced through the biogas system provided by SimGas.

From the above answers it can be noticed that social impact is achieved only once the consumer adopts the ICS. However, when using locals to design or sell the ICS enhances consumer adoption plus creates income-generating opportunity. This can be said to be an impetus for adoption. But what exactly entices the consumer to adopt the ICS? This will be answered with the help of the next question.

What are the core adoption drivers that help social enterprises achieve profitability and social objective at the same time?

Literature: Through the literature on the barriers and drivers of ICS, the most common drivers that were explicitly mentioned in more than 3 papers were added to the list. Next, these drivers were selected on the basis of whether they fit the basic conceptual model discovered through the literature on BoP adoption. The main drawback of the literature on product adoption of the BoP market was firstly it linked poverty to adoption. Three main criteria were needed too influence consumer adoption at the BoP. These were product, social & marketing characteristics. Each of these characteristics was given more explanation on how to drive adoption. Hence, for product characteristics it was mentioned that the product should be affordability, visual comprehensibility, relative advantage, compatibility and adaptability. For social characteristics, it was social capital, assimilationist culture and collective need. Finally for marketing characteristics it was interpersonal communication, atomized distribution & pricing mechanisms. However, it failed to provide for instance how affordability should be achieved? What are the drivers that can help achieving affordability? The drivers were identified through literature on ICS. The rationale behind this was to check which driver fit the initial conceptual model. Hence, drivers such as consumer trust, WTP, budget constraint, traditional cooking practices, flexibility of payments, after sales service, end user financing, were identified that fit the initial conceptual model.

Case study: Through the three case studies it was observed that the initial conceptual model and drivers fit very well. Some drivers that were not identified in the literature were added through the case studies. Drivers such as awareness, live demonstrations & community budget were discovered from Mansa Stoves. Drivers such as warranty & extra product features were discovered through ACE and drivers wtm, aspirational value, leaflets & hub model were found through SimGas. This sub question as what are the core adoption drivers that help social enterprises achieve profitability and social objective at the same time? One key observation was that all the drivers identified through the literature and case studies are all important for adoption. Hence, no one driver was identified that could achieve revenues and social objective at the same time. Only once adoption could be achieved can revenues be attained. Furthermore, three (health, safety, monetary) social objectives were achieved only once adoption took place. This meant all the drivers are equally important and are needed for consumers to buy the product for the enterprises to actually achieve social objective. Moreover every driver influenced either revenues or social impact. For more information regarding the adoption drivers please refer to chapter 5.

6.2.2 Main research question

How do social enterprises that cater improved cook stoves achieve profitability and social impact in developing countries?

An explorative method was used to answer the main research question. This involved going back to the beginning when efforts were made to disseminate ICS to the BoP market. Through this two things were found: the reason for failure for dissemination was due to lack of commercial viability and second consumers stop using the product if given away for free. Hence, social objective could not be achieved through traditional ways. The

research tries to add a new dimension to the knowledge of adoption at the BoP in relation to companies making revenue and social objectives. Additionally, it aims to fill the literature gap by on relevant drivers that help social enterprises achieve two goals profits and social objective. The goal of this thesis was to discover adoption drivers. Going back to section 3.8 after sales service was important for retention of consumers. Therefore a surprising result was that these drivers have an influence on not only ***rate of adoption, but also retention & recoupment of costs.***

6.2.2.1 Holistic perspective

Before we look deeper into the framework let us try to answer the main research question. Following a thorough analysis of the three cases and literature 18 adoption drivers were derived. These drivers belonged to the three categories derived by Cheryl Nakata & Kelly Weidner (2012). The rationale was quite intuitive; as the number of consumers increases so will the revenues. The revenue aspect was looked through the revenue model employed by the enterprise. But it was concluded that regardless of the kind of revenue model chosen by the enterprise profitability was achieved. Nevertheless, consumer adoption plays a very important role for both types of revenue models. How do companies achieve consumer adoption? It was also concluded that three out of four social objectives (health, safety, monetary) are also achieved once adoption takes place. Therefore, adoption drivers are needed to achieve both profitability and social objective. These adoption drivers hope to lure the customers hence increase rate of adoption, which will help companies achieve profitability and social impact. Furthermore, adoption is key to earning revenue through other streams. Hence, it can be concluded adoption drivers are key to achieving both profitability and social impact. Let us look at these drivers in more detail in the next section to get a thorough answer to the main research question.

6.2.2.2 Detailed perspective

The relevant adoption drivers are given below that help social enterprises achieve profitability and social objective are given below. Please note different drivers help achieve either profitability or social objective. Furthermore, these drivers have an *effect on rate of adoption, retention & recoupment of costs.*

Rate of adoption is important to increase profitability and social impact. Retention is important to achieve social impact and finally recoupment of cost is important for increasing revenues. Let us check how each of the drivers influences rate of adoption, retention & recoupment of costs.

PRODUCT CHARACTERISTICS

I. Affordability

A. WTP & Budget Constraint

The social enterprises use wtp & budget constraint so that it matches the varying income of the consumers. This affects rate of adoption and recoupment of costs. The WTP will ensure recoupment of costs and budget constraint ensures adoption amongst consumers.

II. Visual Comprehensibility

A. Live Demonstrations

Live Demonstrations educates the consumer to use the product in the right way. Furthermore, it also entices the consumer to actually make the purchase. Hence live demonstrations affects the adoption decision of the consumer and it also helps customer retention in the long run. This is said because through live demonstrations consumers are taught how to properly use the product that ensure low product breakdown and hence **customer retention** takes place.

B. Leaflets

Leaflets enhances consumer understanding on the maintenance of the product. This will have an impact on ***customer retention and rate of adoption.***

III. Relative Advantage

A. Fuel Savings

Fuel savings driver is important for ***rate of adoption*** because once consumers learn the costs saved on fuel it entices them to buy the product. Furthermore this has an effect on ***retention of the customers*** as the monetary savings every month will ensure consumers to continue using the product.

IV. Compatibility

A. Traditional cooking practices

Traditional cooking practice is an important driver, as consumers do not require too many changes in the way they cook. If the technology demands too many cooking changes rate of adoption might not take place. However, a key thing to keep in mind is that while ensuring that traditional cooking practices is incorporated in the design of the product it should also provide possibilities to the consumers that they need but haven't thought about. Through this way ***rate of adoption*** will increase and ***customer retentio***n takes place.

V. Adaptability

A. Extra Product Features

EPF entices consumers to adopt the product because they perceive the product to be a value for the cost of their money. This drives the ***rate of adoption*****,** which leads to generating revenues and social impact.

SOCIAL CHARACTERISTICS

I. Social Capital

A. Consumer Trust

Consumer Trust is BoP population trusting the social enterprises product offering. Hence,

to ensure the consumers trust the ICS, it is essential to build the trust. The three cases ensured consumer trust was build by using local women to sell the products. BoP customers are keener to buy products from people they trust. This has an effect on ***rate of adoption.***

II. Assimilationist Culture

A. Aspirational Value

Aspirational Value is an important driver for ***rate of adoption and customer retention***. If the consumer believes the product helps them climb the socio-economic ladder of the society it accelerates adoption. Additionally, in the long run consumers will not stop using the product as they can see the socio-economic impact in their life that ensures ***customer retention***.

III. Collective Need

A. Community Budget

Community Budget is an important driver to drive the rate of adoption and ensure recoupment of costs. This is said because companies like ACE provide group loans. If one person defaults the community pressurizes him to pay up. Hence, this leads to an increase in the ***recoupment of costs***. On the other hand companies like Mansa Stoves believes that BoP population live in big families. Hence, people pool the money to buy the ICS. This option accelerates ***rate of adoption***.

MARKETING CHARACTERISTICS

I. Interpersonal communication

A. Awareness

This is an important driver for rate of adoption. Companies make the consumers aware on the cost savings feature, which drives the rate of adoption. Furthermore, once the consumers buy the product, social impact is achieved as they cook in less smoke leading to an improvement in health.

B.WTM advertising

Word to Mouth (WTM) advertising makes or breaks the product. If the WTM advertising is positive the product is readily adopted. However if the WTM advertising is negative the product will not be adopted. Hence, this has an effect on the ***rate of adoption.***

II. Atomized Distribution

A. Hub Model

Hub Model cannot be deemed as a driver. But distribution plays an important role to drive the rate of adoption and customer retention. Through this model consumers trust that spare parts and technicians are always available. Hence, even if the product stops working consumers will not stop using the product as it can be easily repaired. This ensures

customer retention and drives ***rate of adoption***

III. Pricing Mechanisms

A. Flexible Payments

The flexibility of payments adoption driver works well for both the ORM & the SRM. The rationale behind is that the money saved on fuel can be used to pay off the costs of the ICS. This helps consumers match their varying incomes. Hence, flexibility of payments has an impact on ***rate of adoption***. This will generate revenues for the company.

B. End user finance

The end user finance solves the problem of affordability of the BoP market. By maintaining partnerships with MFI's or NGOs companies ensure consumers are able to afford the ICS. Hence, end user finance affects ***rate of adoption***.

C. Warranty & After sales service

Warranty provides consumers the coverage and increases the trust amongst the consumers that if the product breaks down the company is there to fix it. After sale service primarily helps in adopting the product. The rationale behind is this previously bad quality products were provided to the consumers. These products broke down easily and due to lack of after sales and service consumers eventually stopped using the product. This can be seen in two ways due to lack of warranty & after sales service ***customer retention*** could not be achieved and hence social objective is lost. This is said because if consumers stop using the product they will go back to traditional cooking methods leading to an increase in smoke (health problems), long distances to collect wood (safety problems) and finally go back to paying 20-25$ (no monetary savings). Hence, this driver is important to both ***rate of adoption & retention of the consumers.***

D. Discounts

Discounts are a very important driver for consumer adoption irrespective of the type of revenue model employed by the company. This can be looked at in two ways. One discounts helps in driving ***rate of adoption.*** Because by using the buy one give one model the people belonging to the poorest of poorest sections of the society can be catered. Next, even by lowering your price guarantees no loss to the company as its makes up the cost by charging a higher price to the people belonging to the top of the pyramid or through carbon credits. Moreover, social impact is achieved as monetary savings take place in the long run.

PARTNERSHIPS

No drivers were recognized in this category. However, partnerships cannot be ignored as its key to driving the ***rate of adoption***, ***retention of customers*** & ***recoupment of costs***. Companies established in the Western market for example in this case Dutch companies targeting the African market are not aware of the regulations, traditions and adoption behavior of the people. Local Partnerships help in overcoming these barriers and has an

effect of rate of adoption, retention and recoupment of cost. This is said because through local partnerships, financing options can be provided. This helps in driving the rate of adoption. Furthermore, through local partnerships, warranty & after sales service can be provided to the consumers. This ensures ***retention and recoupment of costs***.

To conclude in order to achieve profitability and social objective, consumer adoption plays a very important role. Once the consumer adopts the product through the drivers' revenues increase. Furthermore, social impact is achieved once consumer adoption takes place. An interesting observation to be made is that when local people are included in the activities of the business, ***rate of adoption*** increases. But majorly social objective is truly achieved once consumer buys the product. Moreover, two other factors were discovered through these drivers. One is ***customer retention and the other is recoupment of costs***. Customer retention is important because if the customer stops using the product the enterprise fails to achieve social objective in the long run. Furthermore, recoupment of costs is important because if the consumer fails to pay the costs on time the company will not be profitable.

Hence, figure 31 depicts the framework effect of drivers on rate of adoption, retention & recoupment of costs. The framework can be elucidated from a holistic and detailed perspective. The holistic perspective provides the summary of the framework and detailed perspective goes into detail.

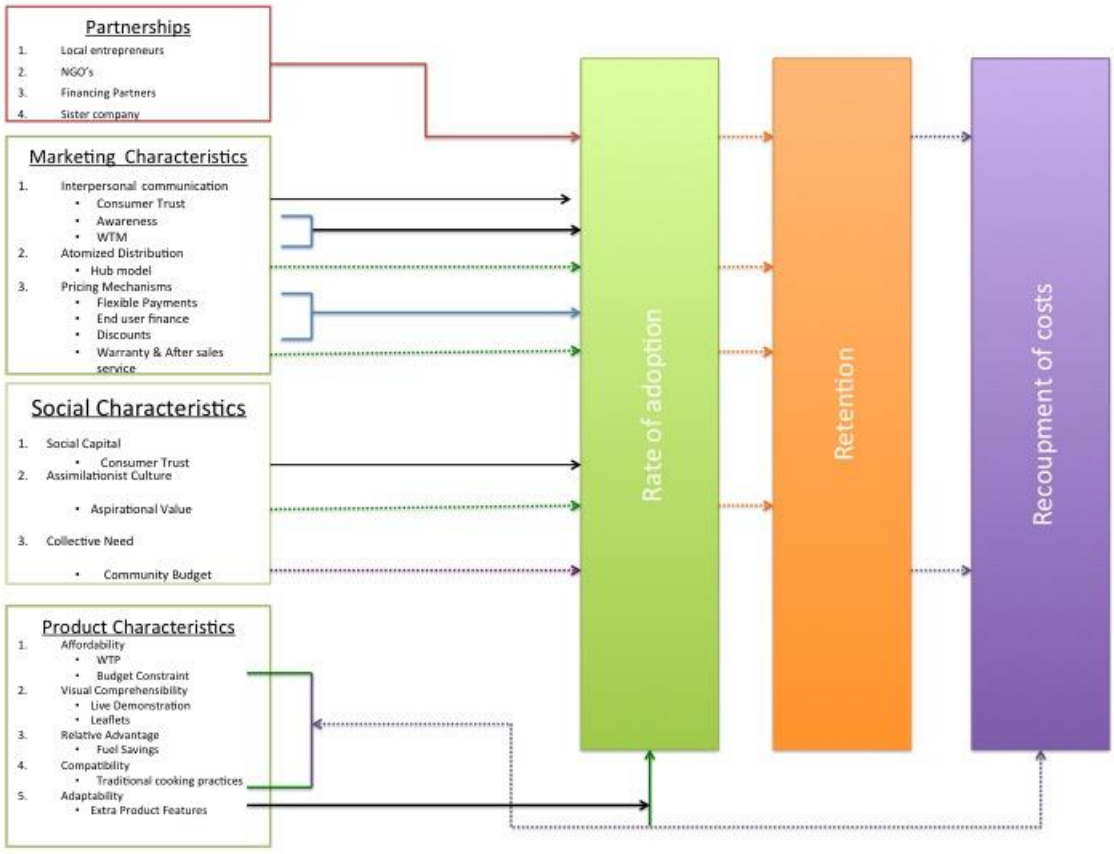


Figure 31:Effect of drivers on 3 factors

6.3 Discussion

This section deals with various things that are not mentioned in the research objective but mentioned during the study. This section does not yield answers to the research questions but enables a discussion on the results of this thesis

6.3.1 Types of BoP market and the ICS technology

It is observed within the three cases they targeted the African rural market. Within the BoP market various different income levels exist. Furthermore, it was observed that it wasn't possible to cater to the poorest sections of this market. All three cases mentioned that government aid is required to a large extent to cater to people belonging truly at the Bottom of the pyramid. Hence we can classify the customers in various segments, which the ICS are catered too: Peri-Urban, rural villages, rural settlements and refuge camps. Peri-urban refers to areas around big cities. Rural Villages refers to areas away from peri-urban areas and cities. Rural settlements refer to places that are hard to reach and further away from the two areas mentioned above. Finally refugee camps make the last segment. Refugee camps UNHCR stated that there was 59.5 million people displaced due to wars and conflicts. In Africa alone the record in 2014 states that around 3 million people have been displaced(UNHCR Global Trends, 2014). This marks the last consumer segment that lacks access to energy.

The three companies Mansa Stoves, ACE & SimGas predominantly targeted rural villages. However, Mansa Stoves & ACE target peri-urban and rural villages, while SimGas targets rural villages. Furthermore, the three companies target 2 different types of technologies to the consumers. Mansa Stoves & ACE use gasification technology to the consumers, while SimGas offers a farm solution to its consumers. Additionally, ACE provides additional features such as charging points etc. Therefore from the reasons mentioned above we can say that particular types of technologies are needed for particular type of income levels. This is said because farm solutions offered by SimGas that cost 600$ is suitable for the rural villages dependent on farming as a source of income. The long-term benefits of SimGas are viable for rural villagers as it improves the quality of crops. Yet, this solution is not viable for consumers who are not dependent on farming as an occupation.

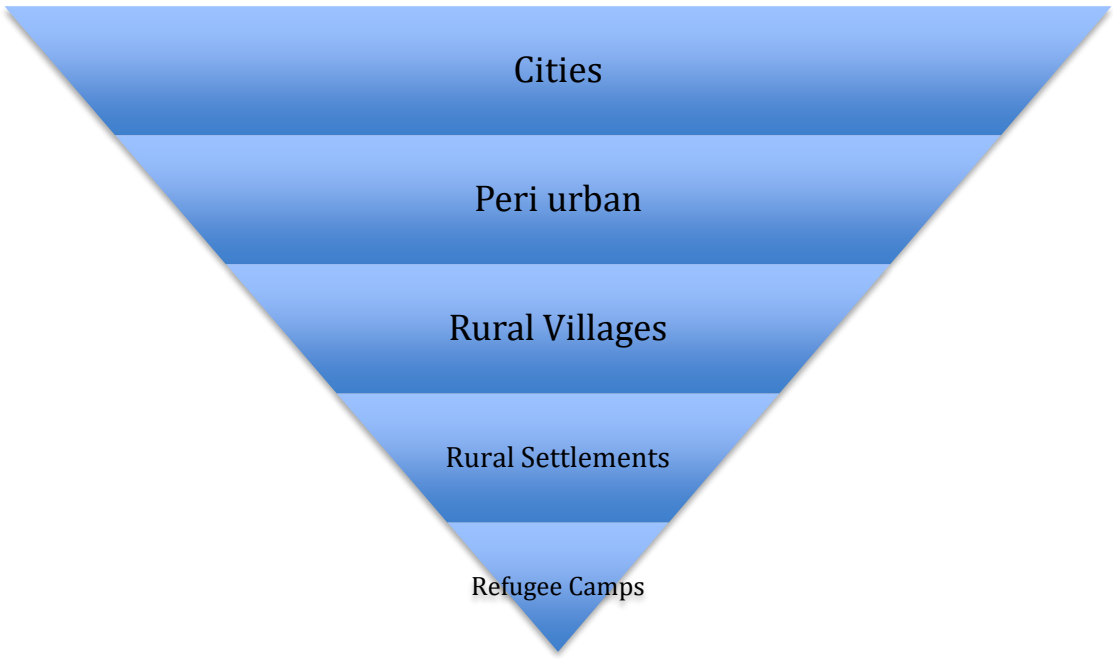


Figure 32:Different markets within BoP

Hence, additional research is required to look at the link between the market segments-type of ICS-profitability & social objective.

6.3.2 Revenue Model V/s Business Model

A key point to note through the study was whether to use revenue model or a business model to analyze the BoP market. In order to gain revenues from the BoP market in Africa the social enterprises need to build a distribution, sales and include local people in their value chain activities through partnerships. Therefore, if partnerships are one of the important factors that enhances adoption then our conclusion about revenue model is a subset of a business model is not valid in our study. For example if we take Haefliger (2013) framework a business model is essentially comprises of 4 elements. Customer identification customer engagement, value chain linkages can be in the form of partnerships or collaborations to tap into different markets. Basically, how are you going to deliver the created value? Lastly is **monetization**, how does your firm make money.

However, the money generating (revenue model element) cannot be explained without the help of the other three elements. The partnerships or value chain linkages suggests collaborations with various stakeholders to delver value to your customer. This study used adoption drivers that covered multiple facets of a business and did not only concentrate on the revenue aspect. Hence, study of a business model would have been better to analyze generation of profits and social impact of an enterprise.

6.3.3 Consumer Financing mechanism and dependence on adoption

In-house financing is considered to be the best option by the consumers while adopting the ICS. Yet, most companies do not have the capital to provide in house financing to the consumers. Most consumers prefer not taking loans from MFI's due to high interest rates. According to SimGas, most MFI's do not deem to have a good reputation amongst the

consumers. Consumers prefer to use in house financing options provided by companies. To over come the problem of high interest rates, end user financing can be taken through group loans. MFI's can provide group loans on a large scale through which consumers can share the interest rate and the burden does not fall on one family. It is reported that women have excellent repayment record through community budget. However, women lack the knowledge to apply for these loans. Companies can educate consumers about applying for loans.

Furthermore, collaborations with NGOs like Kiva help the company to get capital and the customer is able to afford the product. This can be said to be in house financing through partnerships. This is an excellent system but cannot achieve scalability in the long run. This is said because; the number of people lacking access to clean energy is larger than the number of willing people actually providing capital through this way. Therefore, various financing partnerships are required to solve the issue of scalability and affordability.

6.3.4 Social impact

This thesis identified four different types of social impact that are created through ICS. These are health, safety, monetary and income generating opportunity. The safety aspect of social impact is achieved only when ICS deters women to travel long distances for wood. However, as discussed in section 6.3.1 this might not hold true for people belonging to peri-urban regions. This is said because it is determined by a lot of factors such as type of fuel used. If people belong to the peri-urban region there might be a possibility that they buy the fuel (charcoal). Hence, women might not have to travel long distances for fuel that eliminates the possibility of risk or safety factor of using a traditional cooking stove. But, this thesis did not differentiate on the type of area or the type of fuel used, but provided a holistic view on the same. Future research can aim to find a link between the type of technology, type of fuel and its relation to the four social impacts.

Moreover, this discussion will focus more on the income generating opportunity. According to a report by Hart *et al.* (2013) 72% SME's that incorporated local people in the value chain reported profits. Though, post the case analysis it was observed that three cases do incorporate local people in their value chains but in small numbers. Furthermore, locals especially women were involved either only in design or sales through these companies. In order to truly achieve social impact (income generating opportunity) companies should:

- Use locals especially women in all aspects of the business. Women can be included in production processes that contain manufacturing parts locally. Furthermore women can be used to install the stove in local households. NGOs such as TIDE, employ village level entrepreneurs to construct, install and sell cook stoves. This enables to make extra income and uplift their livelihood.
- To truly create a social impact, social entrepreneurs should thrive to create self-sustaining livelihood for the people. This will be achieved once locals are truly incorporated in value chain activities of a business. Hence, more number of people involved in the value chain will lead to greater adoption amongst masses. At the same time, to provide income-generating opportunities requires extra investment in the form of training which is a major barrier faced by enterprise.

6.3.5 Market development

Market development entails creating demand and strategies to increase consumer adoption(Martinot *et al.*, 2002). This subsection deals with comparing strategies employed by a big MNC such as Coca Cola with small medium enterprises such as Mansa Stoves BV, ACE, and SimGas. But why are we using the example of coke to discuss about ICS? Majorly for two reasons:

- As previously mentioned the biggest challenge faced by social enterprises is to reach the BoP. They live in remotest places that lack infrastructure and proper distribution channels. In the framework developed in this thesis, it was discovered that companies like SimGas use the hub model to target the BoP market. One key fact is that SimGas targets rural villages that are easier to reach than rural settlements or refugee camps. In order to scale up and truly achieve a social impact it will be required to reach a wider group of people. In other words companies would have to target rural settlements and refugee camps. Coming back to the comparison with a MNC like Coca Cola, a bottle of coke is available even in rural settlements. Key lessons can be learnt that can be implemented in the activities of social entrepreneurs.
- It was mentioned that one of the biggest barriers to sell ICS is the lack of affordability. Even though ICS is more expensive than a bottle of coke, it can be used as an example because Coke manages to sell even though it can be considered to be an expensive drink for the value delivered. Coke achieves targeting this group of people due to three reasons:

1. Real time data-

This aspect wasn't discussed in the thesis, as it did not fit in the scope of the study. But it has been bought up in this discussion because concepts such as big data are fast gaining importance for many industries. Hence, the importance of big data should not be ignored for cook stoves either. Coca Cola has a team called '**Knowledge & Insight'**. This team monitors real time data measure to track progress, puts it in the product and then to the market. Hence, it is a continuous feedback loop. Through this mechanism coke is able to detect if there is a drop in sales and fix it immediately(Gates, 2010).

ICS needs to find similar means to continuously detect and track progress of the sales in these areas. Through this mechanism continuous product improvement will be made which will cater to the true needs of the people that might have been overlooked in the previous learning phases. This can be related to the adoption framework developed through this thesis. The drivers can be used a basis to detect whether there was a drop is sales. For example; through the real time data it was discovered that one of the marketing driver, word to mouth advertisement is not being as effective as it should. Hence, real time data can be used alongside the drivers to find out the root cause of the problem.

2. Partnerships-

The study discovered that partnerships were missing from the framework developed by (Cheryl Nakata & Kelly Weidner, 2012). Mansa stoves, ACE & SimGas use partnerships in various ways. However, they fail to maximize the efforts through these partnerships. This is said because as mentioned is section 6.2.2, these companies are using partnerships only through one-way or the other. To solve the problem of reaching the rural areas

collaborations should be made with local entrepreneurs to increase the adoption rates and reach out to a larger number of people.

Similarly Coke taps into local entrepreneurial talent. They provide small loans to the local entrepreneurs and establish micro-distribution centers. The local entrepreneurs hire a sales team that sell coke to distant places, which are hard to reach through normal routes. The importance of partnerships has been discussed in the previous sections. Tapping the local people is an important driver that can be utilized by the company to increase sales.

3. Marketing campaign-

The study provided with drivers within marketing environment. Drivers for interpersonal communication within the marketing environment were established such as consumer trust, awareness, wtm. Coke taps on the aspirational value that was discussed in the previous section. The bottle of coke aspires people to have a better standard of living. For example: Coke slogan is "open happiness". They rely and relate happiness to owning a coke bottle. Furthermore, happiness means different for different societies. In South Africa they relate happiness with community respect. In South America they relate happiness with family life(Gates, 2010). Through this way BoP have a sense of belonging to the product, which drives consumer adoption. Similarly for the three case studies, Mansa stoves have a tag line the smiling cook, ACE has a tag line join our cooking revolution and finally SimGas has a tagline our power. How are they using this tagline to truly advertise the ICS? Are they localizing it in a way that people relate to it like coke did? Hence, the awareness driver found through this study can be related to the aspirational value. While making people aware about the need of the product they should want to aspire something more for the enhancement of the life. If companies can ensure their product helps them climb the socio economic ladder of the society it will ensure adoption. These lessons can be learnt from Coca cola.

The major drawback for social entrepreneurs unlike MNC (Coca Cola) to actually achieve the three factors mentioned above is financing. Even though we have established the fact the adoption increases revenues that attract financing, companies need to find innovative financing without the need to be dependent solely on consumer adoption. Because if the companies receive financing, they can invest in activities that enhance adoption.. Hence, it can be said to cyclic in nature. This has been depicted in figure 33. Financing can be achieved through investors such as venture capitalists or crowd funding. Nevertheless, adoption drivers discovered through the thesis cannot be ignored.

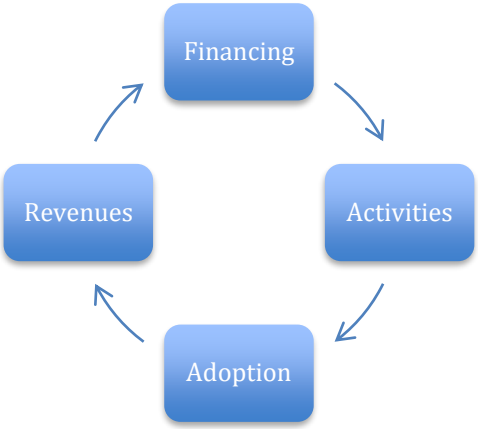


Figure 33:Cyclic nature of adoption

6.4 Recommendations

This section covers the recommendations from both managerial and academic perspective. The managerial recommendation talks about how companies can use this research to achieve both profitability and social impact. The academic recommendation discusses about the scope for future research. Hence, further research can be built from both theory and practical point of view.

6.4.1 Entrepreneurial Recommendations

The results of this thesis has resulted the following recommendations for present and future market players. The recommendations are given below:

1 Firstly, present and future market players should take into account the adoption drivers developed through this study while tapping this market.

2 Secondly, ***social impact*** is key to achieving higher adoption. This has been explained in detail in section 6.3.4. However, companies need to strive to ensure that not only their products but also the ancillary activities need to have an impact on livelihood. Companies need to ensure in order to achieve true social impact communities need to be uplifted and become self-sustaining. Providing jobs and incentives to people adopting the product can help achieve social impact.

3 Next while designing products, ***modular products*** would be best for this market. This has been said, because when catering to different markets around the globe, characteristics might be different for each country. Hence, to design a product from scratch would be a tedious and expensive procedure. By making the technology modular i.e. by adding features or eliminating features will enable the company to cater to a large group without too many design changes. Furthermore, consumers need products that are durable and robust, because products are used in a rough manner. In the long run, this will ensure customer retention.

4 Products should enable BoP consumers have monetary savings in the form of fuel savings or additional savings. For example: The biogas system offers monetary savings in the form of fuel savings. Furthermore, farmers can sell the fertilizer produced through the biogas and make a small profit. Next BoP consumer has an ***aspirational value*** to climb the socio-economic ladder. Hence, the product should be designed in such a way that it is attractive for the consumer to adopt it.

5 Through ***after sales service and maintenance*** continuous feedback can be obtained to ensure customer retention and future changes in the design can be incorporated. Live data is essential to understand customer preferences and needs that enable companies to truly cater to the BoP population. More information is provided in the discussion section.

6 ***Marketing characteristics*** should be given special attention in order to increase adoption. This could be by using local women to sell the products in the community. Companies can adopt innovative ways by giving a commission to the family who successfully recommends their product to the people in their village. Furthermore, while marketing the products in these areas companies should be aware as to what is deemed important for the people of that country. By using a local method to develop a marketing campaign will ensure consumer adoption.

7 ***Distribution*** is the biggest challenge faced by companies to reach distant markets. Hence, local entrepreneurs need to be trained to sell these products at places that are hard to reach. However, these entrepreneurs should also be trained to provide after sales service and maintenance. This results in a win-win situation to both the company and the BoP market. The company truly achieves profitability and social impact by providing jobs at the same time.

8 ***Carbon financing*** can be a key to achieving revenue through an additional revenue stream. As previously mentioned, carbon financing is indirectly dependent on consumer adoption. But at the same time by providing discounts entrepreneurs can increase consumer adoption. Entrepreneurs should look at different ways of earning revenues. By having multiple revenue streams companies can enhance scalability. This could be by targeting different types of market peri-urban, rural and by providing different products to the developed countries.

9 Another important implication is the importance of ***partnerships***. Having partnerships limits risk for the company. These partnerships could be in the form of NGOs or local entrepreneurs who can help reach the BoP consumers. Furthermore, while partnering with MFI's care should be taken to ensure that these institutions do not charge an exorbitant interest rate and the reputation of these MFI's should be taken into account while initiating the partnership.

10 Furthermore entrepreneurs that use an ORM need to find innovative pricing mechanisms to consumers that cannot afford the products upfront. These entrepreneurs are dependent on consumer adoption for increasing revenues. The drivers that influence the rate of adoption for the ORM are community budget and WTP.

11 The drivers that influence the rate of adoption for the SRM are ***flexible payments and end user finance***. These drivers ensure that consumers are able to afford the product over a period of time. Nevertheless, Africa is further ahead of India in terms of using mobile payments. This enables consumers in Africa to easily pay the cost of the product through mobile mechanisms. This enables recoupment of costs. However, consumers in India are far behind in using mobile payments. Hence, present and future entrepreneurs need to take this into account while targeting new countries. In a threshold the framework developed in the study should guide the future and present market players to truly achieve profitability and social impact at the same time.

6.4.2 Academic Recommendations

This section describes future research possibilities that were not covered by this study. Firstly, this study focused only on countries in Africa, which limits generalizability. Hence, the adoption drivers derived from this study could be extended in order to attain more generalizability. This could be achieved by studying various developing countries across the globe like China, Cambodia, Indonesia and India. This will validate and verify the drivers derived through this study. Furthermore, it will improve the list of adoption drivers in order for social enterprises to achieve both profitability as well as social impact.

Next comparisons can be made between different countries. For example a country in Africa might have different drivers than a country in Asia or South America. Comparisons can me made across the type of market or across the type of technology used. This could cover rural v/s peri-urban or ICS v/s SHS (Solar home system). Hence, an analysis can be performed that can truly determine the change in adoption drivers across these two criteria.

Furthermore, the framework resulted into discovering about the importance of partnerships and its effect on adoption. More research needs to done in the form of stakeholder analysis. How do these partnerships affect the adoption? Which stakeholder interaction results to a higher adoption rate? Hence, the causal relation of partnerships on terms of adoption can be explored in more depth.

Four types of social impact were discovered in this study. More research is required to check the various ways in which social impact could be attained. Income generating opportunity needs to given specific attention to check if there are other ways through which this can be achieved. If yes then what is in relation to adoption. Does adoption truly increase and to what extent does it increase? To answer this question a quantitative research needs to be conducted to make the framework more robust. A longitudinal study could be carried to check how the adoption drivers change with respect to the social impact.

Quantitative exploration results to a greater generalizability because it uses a larger sample size by statistical analysis. Which of these adoption factors have the most impact on profitability and social aspects? This can be achieved by building a hypothesis. For example: Does fuel savings lead to higher rate of adoption? Hypothesis should be developed for every driver to test whether these drivers actually have an impact on achieving profitability as well as a social impact.

Furthermore, the framework did not include post revenue phase. What happens with the revenues obtained by the company? Do the company scale the operations in order to achieve social impact in different parts of the world? If yes, what are the barriers they face while trying to attain scalability?

Chapter 7: Reflection

7.1 Chapter Introduction

Chapter 7 will be the last chapter of this thesis. Some insights from the personal level were found which are presented in this chapter. In the path to explore about adoption drivers many remarkable insights were discovered in the BoP market. The chapter provides a short discussion about reflections on research methodology. Next this chapter presents a brief assessment on the research quality and finally the research limitation is discussed.

7.2 Reflection on research methodology/process

The research process had three segments, which were interrelated to each other. First segment was the literature review. The literature review was very vast covering topics from the BoP, frugal innovation to social entrepreneurship and business models, revenue models and ICS.

Firstly, I started with trying to find revenue components that help enhance adoption. The first two companies I had an interview with were Stove Plus and TaTEdo. These interviews were conducted in the month of April. They were non-profit organizations that helped other enterprises cater to the BoP market. Furthermore, the information gathered through the interview did not yield specific information, which was needed for the study such as specific revenue models used by the company or components such as after sales service & warranty. Secondly the interview with TaTedo lasted only for 15 minutes. The time period was short to gather vast information. Therefore, these companies were excluded from the final list, as it did not fit the scope of the study

Second step was developing a framework. The initial model (revenue driver framework) had to be changed after interviewing the first company Mansa Stoves. Post the interview it was realized that revenue drivers are not the only drivers that influence adoption. But adoption is influenced by a number of factors within a business. Hence, this was an iterative process and the conceptual model by Cheryl Nakata & Kelly Weidner (2012) was found in May. This model fit with the interview to Mansa Stoves because it focused on three variables (marketing, product & social) of adoption. These three variables reflected the various factors that are looked at while conducting a business. Hence, this model was used as a basis for this study. Nonetheless, after the first interview with Mansa Stoves the first two were revised accordingly .The interviews with African Clean Energy and SimGas resulted in extensive data collection. The third step was case study analysis that included testing and extending the initial adoption drivers. This step was the most challenging, as extracting the data was complex.

It was a daunting task to contact companies, as I had no personal contacts that could be used for this study. The three cases in the study came from laborious research until I stumbled upon Global Alliance of Clean cook stoves end of April. This website was a boon in disguise as it gave me a list of companies involved in this sector. However, most of the companies were not willing to participate. It would have been great if social enterprises such as Envirofit and some Indian companies like Eco Chula or SustainTech were willing

to participate. This could have provided a greater depth to our findings as it would have facilitated the true challenges faced by social enterprises in Africa and India.

The interview with companies turned out to be short given then nature of the research. Through literature on ICS and product adoption at the BoP some starting points could be achieved. However, to talk in depth about each driver that covers all aspects of the business in 45 minutes – one hour turned to be too short. Next, it was discovered that most often companies confuse the concept of revenue model to that of a business model. Most companies use the two synonymously. Hence, before the start of the interview the two terms had to be clarified to the interviewee.

Next, there was plenty of literature available on barriers faced while disseminating ICS, financing options used by companies for example: carbon financing, end user financing. However, there was hardly any data available on revenue models. This made the research challenging as the data attained was very dense which made triangulation process an arduous task

Lastly, there was evidence that impact on livelihood was achieved with the help of the ICS. However, the definition of impact on livelihood differs from company to company. All the three companies were of the opinion that impact on livelihood was evident as the technology helped to reduce smoke and time to collect the firewood, which improved the health and saved time of the women respectively. On further probing the companies provided more information about the actual social impact such as the income generating opportunities. It would have been better if only the adoption aspects of the BoP market would have been selected. In that way the study would be limited and become less complex.

7.3 Evaluation of Research Quality

Yin (2002) states that the foremost criteria to evaluate the quality of an empirical study are construct validity, internal validity and external validity and reliability. The results of the thesis will be validated and tested against each of the stated criteria.

7.3.1 Construct Validity

Construct validity alludes to the extent of accuracy to which the effective measures of the concepts that are studied. In this thesis construct validity was legitimized through the literature review and the data gained through the case study analysis.

Through the literature review it was noted that traditional cooking practices was given utmost importance to increase adoption. However, from the study it was realized that traditional cooking practices should be given importance up to a certain level, where the producer needs to push the technology so that adoption takes place. Another key thing to note was that incumbent literature stated that prices of the ICS should be kept as low as possible. This did not tally with the data obtained from the case study as the companies kept the prices higher than advised by the UN. However, aspects such as flexibility of payments, consumer trust did tally with the incumbent literature. Besides, adoption

drivers- social impact profitability framework was never developed in different sources of literature. Construct validity was difficult to achieve due to the exploratory nature of the thesis. Furthermore, additional research is required to make the study

7.3.2 Internal Validity

Internal validity is when the researcher is trying to validate the causal relationship between two variables x & y (Yin, 2002). Internal validity is difficult to attain for an exploratory type of research.

7.3.3 External Validity

External validity alludes to the degree to which the results of the thesis can be generalized beyond the immediate case study (Yin, 2002). Multiple case study approach aids to increase generalizability. Therefore, three cases were chosen to verify and validate the initial conceptual model to align in the context of Dutch companies targeting African market. This brings us to the question to what extent can the adoption drivers be generalized.

In order to enhance the external validity steps were taken to ensure that Dutch companies were selected that target the African Market. Next they should be a for profit and a social enterprise. Furthermore, even though the companies cater to a different type of ICS technology they provide efficiency in cooking stoves. Hence the list of adoption drivers to attain profitability can be generalized across ICS segment.

According to A. Chaureya *et al.* (2009) who suggests that service revenue model is better to increase adoption does not hold true for this case. The results of the thesis show that profitability is achieved through the ownership model as well. Hence, the selection of the revenue model does not determine the company's attaining revenues. But, the adoption drivers especially the partnerships and the fact that the product is robust that it does not need after sales service to achieve profitability. What is interesting to note that Mansa Stoves does not use external financing to achieve an increase in revenues. Hence, they are totally dependent on consumer adoption (the drivers) for achieving profitability. Most of the adoption drivers that were found in the case study can be generalized to some extent of other RET's. This is said because every business looks at marketing, social and product features & partnerships. Lets check to extent can the results be generalized:

- Adoption driver impacts revenues that help companies achieve profitability can be generalized for the ICS sector. Having said that it is to be noted that 2-3 billion people lack access to clean cooking energy. Hence, this is an enormous market that new companies can tap on which increases generalizability.
- For marketing word to mouth advertising, consumer trust & awareness are even needed for products such as solar home system. Because advertising coming from the consumer directly is always more effective than billboards or radio. Further research indicates that the BoP consumer trusts their community more when purchasing a product. These drivers will remain constant even for other products.
- Next, flexible payments, end user finance, discounts & warranty and after sales service. These drivers will remain constant for large products such as solar home system or a sanitation product. On the other hand it might not be a driver for

smaller products for a lower price such as Unilevers OMO sachets. Hence, these drivers will be more applicable for expensive and products that need after sales service such as ICS or solar home systems. This reduces the generalizability.

- Aspirational value will increase generalizability because however big or small the size of the product will not matter in this case. This is said because every consumer aspires to climb the socioeconomic ladder and if the product provides them with this opportunity it will automatically increase the chances of adoption. This driver can be said to be increase generalizability. Community budget might not be a generalizable driver because again it depends on the price, size of the product. This will not be required if an OMO sachet is being sold to this group.
- Finally drivers such as fuel savings and traditional cooking practices are exclusively for ICS. Hence, these drivers decrease the generalizability. On the other hand drivers such as WTP & Budget constraint can still be considered to be important for even products such as an OMO sachet. Drivers such as live demonstrations & leaflets are needed to educate the consumer to use the product in a right way. This driver can be said to increase generalizability. The adoption drivers can provide a stepping-stone to companies targeting the markets in various countries. Some adoption drivers related to product features might changes according to the product. For example, traditional cooking practices will different in Asia and in Africa a hence the product will have to be tweaked to incorporate consumer habits.

However, having said that these drivers attract the low-income consumers to adopt ICS it should not be very different to other parts of the world where this population has the same needs. Of course payment system in Arica will be different in Asia as people in Africa use mobile payments that might be difficult to achieve in India where mobile payments are not so widely used. To conclude these drivers can be generalized up to a certain extent. Nevertheless this can provide a starting point for other technologies as well.

Thus future research should aim to extend the framework and add more drivers that include other countries and technologies in Asia and South America as well.

7.4 Research Limitation

This sub-section explains the research limitations of the study. This thesis intended to extend the model developed by Cheryl Nakata & Kelly Weidner (2012). The framework developed by this study provides a comprehensive list of adoption drivers. Furthermore, it relates the adoption drivers to revenues. Moreover how exactly do these social entrepreneurs achieve an impact was also explained. This was related to adoption and how and why it is important to achieve social impact to increase adoption was determined in the model. Hence, the contribution to science is to develop a framework that is a first of its kind in literature.

The thesis only looked at 3 case studies. Even though the cases tried to tap a number of countries within Africa, the framework developed might not be representative enough for the markets in Asia or South America. Hence, the results can definitely not be generalized. More research should be conducted across the BoP market in different developing

countries. Next out of the three case studies two used the service revenue model and one used the ownership revenue model. Therefore, it would have been better to have more case studies that could have covered both types of revenue models. This would have made the findings about revenue models more concrete and generalizable. Next the three companies provided ICS to the peri-urban and rural villages. These companies however failed to provide ICS the people living truly at the BoP (rural settlements & refugee camps). This was mainly due the fact that reaching them was a bug hurdle. Further, even if the companies enabled flexible pricing mechanisms for this group, the prices should be as low as 1$ in order to facilitate to this market. This would lead to companies not achieving profits and having a sustainable long-term future. Companies such as SimGas were of the opinion that to target that market group would require help from the government. Therefore future research could be looked at companies specifically targeting rural settlements and refugee camps. The framework developed for this study can be used to check whether the drivers hold for that particular group or would they change?

Then further research is required to look at what drivers influence what type of social impact. The word social impact has various meanings. This thesis defined the four types of social impact. However, further research needs to be done on how the fourth type of social impact (income-generating opportunities) affects adoption. Additionally, which drivers affect the income generating opportunities needs to be studied. Moreover, the study looked only from the perspective of the ICS and the drivers that influence an increased adoption for the said product. Hence, results of the framework might not hold for example solar home lighting systems.

Besides, all the cases that have been selected are companies that are comparatively new and they themselves are trying out different approaches to this market. Hence, using a longitudinal study can solve the limitation. Mansa Stoves BV was started operations in 2015,ACE was founded in 2014 and SimGas was founded in 2009.

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Appendix

A1. Interview Questions

I. Company Information

No.	Question
1.	Established in
2.	Industry (Service, Products etc.)
3.	Market Segment (Rural market/BoP). Household income?
4.	Office Location
5.	Small or Medium Enterprise
6.	What prompted you to create this company?
7.	Market Position
8.	Technology used (Biogas/Improved efficient of the cooking stove/solar stove)
9.	Was your company founded due to the transition that took place from a donor driven approach to a market driven approach?
10.	Did you or do you receive subsidies or any financial incentives? Please tell me the arrangement?

II. Business Model

No.	Question
1	What are your business models & value proposition?
2	Customers
3	Channels of Communication
4	Collaborations
5	Do you adopt any business model collaborating with any financing institutes?

III. Financing

No.	Question
	Sources of financing? Bank loans, MFI, venture money, crowd funding?
	To obtain financing from the banks how important are revenues?

IV. Revenue Model & Barriers to adoption

No.	Question
1	Choice of revenue model? Why? Does your current revenue model facilitate profits?
2	Is your company profitable?
3	How important is profits related to scalability & Replicability?
4	Do high costs of ICS discourage consumers from purchasing the product?
5	Barriers to adoption?

V. Social Impact

No.	Question
1.	What is the impact on livelihood especially with your product?
2.	Is there a link between impact on livelihood and adoption of your company?
3.	What are the major barriers you face with respect to adoption?

VI. Adoption Drivers

What is your opinion on adoption drivers?

Seven point likert-scale (Vagias, 2006) is used to define the position of each driver according to the opinion of the experts. During the interview process, the experts will be asked to fill out the questionnaires by using Google form. During the interview, the experts are allowed to asked for clarification of drivers

Can you please rate how applicable are these adoption drivers on a scale of 1 to 5.

- 1= Not relevant
- 2= Slightly relevant

- 3= Moderately relevant
- 4= Very relevant
- 5 = Extremely Relevant

Please mention HOW & WHY you included these drivers to increase revenues?

Drivers	Not Relevant	Slightly relevant	Moderately relevant	Very relevant	Extremely Relevant
	1	2	3	4	5
Consumer Trust					
Budget Constraint					
WTP					
Traditional Cooking Practices					
Flexible Payments					
End User finance					
Discounts					
After Sales Service					

A2. Initial List Case Study Companies

Sr. No	Company	Responded positively	Justification for removal or insertion for case study analysis

1.	African Clean Energy	Yes	For profit and based in The Netherlands hence included
2	Mansa Stoves	Yes	For profit and based in The Netherlands hence included
3	SimGas	Yes	For profit and based in The Netherlands hence included
4	TaTedo	Yes	Not for Profit hence excluded
5	Stove Plus	Yes	Not for Profit hence excluded
6	GUTS	Yes	Based in India hence excluded
7	Vikram Stoves & Fabricators	No	-
8	Mimi-Moto	No	-
9	Essmart	No	-
10	Eco Stories	No	-
11	Eco Chula	No	-
12	Prime Stoves	No	-
13	Alpha Renewable Energy	No	-
14	Jiko Africa	No	-
15	Toyola Energy	No	-
16	Clean Cook	No	-
17	BioLite Stove	No	-
18	MatriBhumi Urja	No	-
19	SustainTech	No	-
20	Envirofit	No	-
21	Green Bio energy	No	-
22	Social Enterprise	No	-

A3. Final List Case Study Interviews

Name	Company	Location	Type
Paul Engelsmaan (Founder)	Mansa Stoves BV	Dordrecht, Netherlands	Personal Interview
Ruben Walker (Co Founder)	African Clean Energy	Amsterdam, Netherlands	Personal Interview
Dorine Peolehelkee	SimGas	Hague, Netherlands	Personal Interview

(Business Developer)

A4. Case Data

The case data shown below is different from the interview because some drivers have been added post the interview with the companies. Hence, some drivers have no indication about the company's response.

- 1= Not relevant
- 2= Slightly relevant
- 3= Moderately relevant
- 4= Very relevant
- 5= Extremely Relevant

Drivers	Mansa Stoves BV	ACE	SimGas
Product Characteristics			
1. Affordability			
• **WTP**	5	5	5
• **Budget Constraint**	2	2	5
2. Visual Comprehensibility			
• **Live Demonstration**	5*	5	5
• **Leaflets**	N/A	N/A	5*
3.Relative Advantage			
• **Fuel savings**	5	5	5
4.Compatibilty			
• **Traditional cooking practices**	5	3	3
5.Adaptibility			
• **Extra Product Features**	1	5	2
Social Characteristics			
1. Social Capital			
• **Consumer Trust**	5	5	5
2. Assimaltionalist Culture			
• **Aspirational Value**	N/A	N/A	**5***

3.Collective Need			
• **Community Budget**	5*	2	1
Marketing Characteristics **1.Interpersonal Communication**			
• **Consumer Trust**	5	5	5
• **Awareness**	5*	5	5
• **WTM**	N/A	N/A	5
Atomized Distribution			
• **Hub Model**	N/A	N/A	5
3.Pricing Mechanisms			
• **Flexible Payments**	1	4	5
• **End user finance**	1	5	5
• **Discounts**	5	2	4
• **Warranty & After sales service**	1	5	5

*→Drivers added post interview

A5. Key differences between cases

Characteristics	Mansa Stoves BV	ACE	SimGas
Type of ICS	Gasification	Gasification	Biogas System
Customers	Peri-Urban	Rural	Rural
Cost of the product	60$	100$	600$
Partnerships	Local Entrepreneurs, NGO (Yep! Africa)	NGO (Kiva)	Sister Companies
Type of revenue model	Ownership	Service	Service
Type of financing provided to consumer	No financing	In house financing with the help of Kiva	In house financing
Revenue Streams	• Consumer adoption • Providing services to	Consumer adoption	• Carbon financing & • IPR

	the local entrepreneur • Buy one give one model		• Providing services to the sister company
Social Impact (Income generating opportunity)	Included women in the design of the stove	Included women to sell the stove	Included women to sell the stove