NTNU – Trondheim
Norwegian University of
Science and Technology

Critical components of business models for renewable energy based rural electrification

Joana Catarina Correia
Monica Novik Tennfjord

NTNU School of Entrepreneurship
Submission date: July 2014
Supervisor: Lars Øystein Widding, IØT
Co-supervisor: Vivek Sinha, IØT

Norwegian University of Science and Technology
Department of Industrial Economics and Technology Management

NTNU
Det skapende universitet

MASTERKONTRAKT
- uttak av masteroppgave

1. Studentens personalia

Etternavn, fornavn **Correia, Joana Catarina**	Fødselsdato **08. jan 1988**
E-post **joanacat@stud.ntnu.no**	Telefon **40554389**

2. Studieopplysninger

Fakultet **Fakultet for samfunnsvitenskap og teknologiledelse**
Institutt **Institutt for industriell økonomi og teknologiledelse**
Studieprogram **NTNUs Entreprenørskole**

3. Masteroppgave

Oppstartsdato **05. feb 2014**	Innleveringsfrist **02. jul 2014**
Oppgavens (foreløpige) tittel **Critical components of business models for renewable energy based rural electrification**	
Oppgavetekst/Problembeskrivelse We will use our results from the project report, and investigate the theme of early stage entrepreneurs delivering rural electrification in developing countries in relation to business models and their components. The master thesis will be started i february due to that the hand-in date of the project report had been pospone. This due to work with the start-up at The School of Entrepreneurship, NTNU.	
Hovedveileder ved institutt **Førsteamanuensis Lars Øystein Widding**	Medveileder(e) ved institutt **Vivek Sinha**
Merknader **1 uke ekstra p.g.a påske.**	

4. Underskrift

Student: Jeg erklærer herved at jeg har satt meg inn i gjeldende bestemmelser for mastergradsstudiet og at jeg oppfyller kravene for adgang til å påbegynne oppgaven, herunder eventuelle praksiskrav.

Partene er gjort kjent med avtalens vilkår, samt kapitlene i studiehåndboken om generelle regler og aktuell studieplan for masterstudiet.

Trondheim 02.06.14
Sted og dato

Joana Catarina Correia
Student

Hovedveileder

Originalen lagres i NTNUs elektroniske arkiv. Kopi av avtalen sendes til instituttet og studenten.

NTNU
Det skapende universitet

MASTERKONTRAKT
- uttak av masteroppgave

1. Studentens personalia

Etternavn, fornavn	Fødselsdato
Tennfjord, Monica Novik	**20. mar 1989**
E-post	Telefon
monicate@stud.ntnu.no	**48217131**

2. Studieopplysninger

Fakultet **Fakultet for samfunnsvitenskap og teknologiledelse**
Institutt **Institutt for industriell økonomi og teknologiledelse**
Studieprogram **NTNUs Entreprenørskole**

3. Masteroppgave

Oppstartsdato	Innleveringsfrist
05. feb 2014	**02. jul 2014**
Oppgavens (foreløpige) tittel **Critical components of business models for renewable energy based rural electrification**	
Oppgavetekst/Problembeskrivelse We will use our results from the project report, and investigate the theme of early stage entrepreneurs delivering rural electrification in developing countries in relation to business models and their components. The master thesis will be started i february due to that the hand-in date of the project report had been pospone. This due to work with the start-up at The School of Entrepreneurship, NTNU.	
Hovedveileder ved institutt **Førsteamanuensis Lars Øystein Widding**	Medveileder(e) ved institutt **Vivek Sinha**
Merknader **1 uke ekstra p.g.a påske.**	

4. Underskrift

Student: Jeg erklærer herved at jeg har satt meg inn i gjeldende bestemmelser for mastergradsstudiet og at jeg oppfyller kravene for adgang til å påbegynne oppgaven, herunder eventuelle praksiskrav.

Partene er gjort kjent med avtalens vilkår, samt kapitlene i studiehåndboken om generelle regler og aktuell studieplan for masterstudiet.

Trondheim, 01.06.14

Sted og dato

Horia Nenajdenko

Student

Hovedveileder

Originalen lagres i NTNUs elektroniske arkiv. Kopi av avtalen sendes til instituttet og studenten.

NTNU
Det skapende universitet

SAMARBEIDSKONTRAKT

1. Studenter i samarbeidsgruppen

Etternavn, fornavn **Correia, Joana Catarina**	Fødselsdato **08. jan 1988**
Etternavn, fornavn **Tennfjord, Monica Novik**	Fødselsdato **20. mar 1989**

2. Hovedveileder

Etternavn, fornavn **Widding, Lars Øystein**	Institutt **Institutt for industriell økonomi og teknologiledelse**

3. Masteroppgave

Oppgavens (foreløpige) tittel **Critical components of business models for renewable energy based rural electrification**

4. Bedømmelse

Kandidatene skal ha *individuell* bedømmelse
Kandidatene skal ha *felles* bedømmelse ☒

Trondheim 02.06.14
Sted og dato

Joana Catarina Correia
Joana Catarina Correia

Hovedveileder

Monica Novik Tennfjord
Monica Novik Tennfjord

Originalen oppbevares på instituttet.

Prephase

This master thesis is written as part of the authors Master of Science degree in Entrepreneurship at the Norwegian University of Science and Technology (De Boer). The thesis is based on a literature review and a multi-case study.

The master thesis is a part of the Center for Sustainable Enery Studies (CenSES), which is a national research center for sustainable energy. Due to the CenSES program the authors was given the opportunity to investigate rural electrification businesses in India. On this trip the three case companies Mera Gao Power (MGP), Onergy and Applied Solar technology (AST) was interviewed, in addition to ASTs two partners TARA and Nidan.

We would like to thank our thesis supervisor, Associate Professor Lars Øystein Widding at the Department of Industrial Economics and Technology Management, for his guidance and support throughout the research. In addition we would like to give our sincere gratitude to PhD Vivek Sinha for his enthusiastic involvement and constructive guidance. The thorough guidance given to us by Widding and Sinha has had an important impact on our research.

We wish to thank our case companies by the representatives; Nikhil Jaisinghani CoFounder and CEO of MGP, Piyush Jaju Cofounder and CEO of Onergy, Julia LaFleur intern at Onergy, Sudipta Dawn Operational manager at Onergy, Rajiv Parti Consultant at AST, Chaitanya Sure Deputy Manager at TARA, Ratnish Verma program manager at Nidan for taking the time to talk to us and providing us with valuble information about their business.

Further we wish to thank Anil Gupta, Professor at the Indian Institute of Management, Rahul Sharma, from The Energy Resource Institute (TERI), and Development Alternatives, represented by Shrashtant Patara, for taking the time to talk to us and given us a better understanding of the rural electrification market in India.

Trondheim 07.07.14.

Joana Catarina Correia

Monica Novik Tennfjord

Abstract

The research question in this thesis is *"What are the critical business model components to prioritize in order for an early stage company to become viable when delivering renewable energy to the rural population of developing countries?"*. The research is conducted within the field of commercialization of renewable energy in developing countries. The research was chosen based on the authors desire to contribute to increase the success rate of emerging and existing renewable energy firms.

Electricity is central to nearly every major challenge and opportunity that the world faces today, and creates a room of opportunity for emergent and existing entrepreneurs. Still, as many as 1,4 billion people of the world's population live without access to electricity and 2,5 billion people rely on traditional biomass for cooking and heating. Most of who are people living in rural areas. In response, the United Nations have initiated collaboration in order to *achieve universal access to modern energy services by 2030.* As the public sector do not access the financial resources needed in order to meet this goal, the private sector plays a significant role. With $37 billion dollars being spent on poor-quality energy solutions each year, there is a great potential for entrepreneurs to run sustainable companies delivering widely needed innovative solutions. However, with rural renewable electrification being an emerging field of industry, and with the challenging conditions of this market, there is a need to build innovative business models in order to succeed.

The authors have employed qualitative research with use of an exploratory multi-case study design, basing the investigation on literature and the Indian case companies: Mera Gao Power (MGP), Onergy and Applied Solar technology (AST). The authors interviewed the CoFounder and CEO of MGP, the CoFounder and CEO of Onergy as well as two additional employees and the long term employee of AST, ASTs manager of the Speed project, as well as their two partners, TARA and Nidan. From a literature review the authors have designed a theoretical approach including empirical data for the identification of critical business model components.

The challenges with rural electrification, which are closely linked with the characterstics of the rural population in developing countries, can be categorized in the following: economic, legal, social and institutional challenges. For the entrepreneur it is important to design the business models in such a way that it responds to the external challenges. By applying business stage and business model theory, through looking at early stages and business model components in relation to the external challenges, the authors have developed a set of propositions as the answering the research question. The overall critical elements are shown to be partnership, investments and offering that enable customers to pay. Further the authors have identified additional elements that are also important in order for the entrepreneur to succeed. These are related to the offering and access of human resources. The identification shows that the criticality may be distinguished based on the entrepreneurs' goals.

The most important contribution of this research is to present how entrepreneurs need to prioritize their effort at an early stage in order to succeed when providing renewable energy to the rural population. Rural electrification is an emerging field of study and there has been limited focus on how offering meets the needs of the rural poor which in necessary in order to succeed in these markets. The authors believe that by presenting the critical and important elements of a business model in rural electrification the entrepreneur can get a guideline for designing a viable business. The

finding of this study may facilitate further research by testing the propositions on more case companies from additional developing countries, providing a range of renewable energy solutions.

Sammendrag

Forskningsspørsmålet i denne oppgaven *er "Hvilke forretningsmodellkomponenter er kritisk å prioritere i en tidlig fase for å oppnå en bærekraftig bedrift når dens virke er å levere fornybar energi til rurale områder i utviklingsland?»* Forskningen er gjennomført som en del av forskningsfeltet *kommersialisering av fornybar energi i utviklingsland*, og gjennomføres basert på forfatternes ønske om å bidra til å øke suksess raten til fremvoksende og eksisterende bedrifter som leverer fornybar energi.

Elektrisitet står sentralt i nesten alle store utfordringer og muligheter som eksisterer i verden i dag, og er med det med på å skape muligheter for entreprenører. Fortsatt lever så mange som 1,4 milliarder mennesker uten tilgang på elektrisitet, og 2,5 milliarder av verdens befolkning er avhengige av tradisjonell biomasse for matlaging og oppvarming. De fleste av disse menneskene bor i rurale strøk i utviklingsland. FN har initiert et samarbeid med mål om å oppnå universell tilgang på moderne energitjenester innen 2030. Da offentlig sektor mangler betydelige finansielle ressurser for å oppnå dette målet, er det helt sentralt og nødvendig at den private sektoren bidrar. Årlig brukes det 37 milliarder dollar på lavkvalitets energiløsninger, noe som illustrerer at det eksisterer et stort potensial for entreprenører som ønsker å bygge og drive bærekraftige bedrifter i disse markedene. Likevel, bransjen bringer også med seg store utfordringer for entreprenører, som impliserer at det kreves gode og innovative forretningsmodeller for å klare å lykkes.

Forfatterne har gjennomført kvalitativ forskning basert på en litteratur studie og en utforskende flercasestudie. Casene som brukt er tre ulike indiske selskap; Mera Gao Power (MGP), Onergy og Applied Solar Technology (AST). Forfatterne har intervjuet entreprenøren bak og daglig leder i MGP, entreprenøren bak og daglig leder i Onergy i tillegg til to av deres ansatte, og ASTs leder av Speed projektet i tillegg til deres to partnere TARA og Nidan. Ved å gjennomføre en litteraturstudie har forfatterne kommet fram til en teoretisk framgangsmåte som inkluderer den empiriske informasjonen hentet fra casebedriftene, for identifisering av kritiske forretningsmodellkomponenter.

Utfordringene ved rural elektrifisering kan kategoriseres som økonomiske, politiske, sosiale og institusjonelle utfordringer. For entreprenører er det viktig å utforme en forretningsmodell som svarer på disse utfordringene. Ved å anvende karakteristikker ved en gitt del av utviklingsløpet til bedriften i tillegg til forretningsmodellteori har forfatterne utviklet et sett med retningslinjer for entreprenøren som svarer på forskningsspørmålet. De kritiske elementene har vist seg for å være partnerskap, investeringer og tjeneste/produkt som kunden kan betale for. Videre har forfatterne identifisert elementer som er viktige for at entreprenøren skal lykkes. Disse er relatert til tjeneste/produkt og menneskelige ressurser. Identifiseringen har vist at hvilke elementer som er kritisk avhenger av entreprenørens mål.

Det viktigste forskningen kan bidra med er å presentere hva entreprenøren skal prioritere i en tidlig fase for bedriften for å oppnå suksess gjennom å tilby fornybare energiløsninger til den rurale befolkningen i utviklingsland. Rural elektrifisering er et fremvoksende forskningsfelt som har hatt et

begrenset fokus på hvordan tjeneste og produkt kan møte behovene til de fattige. Forfatterne tror at ved å presentere de kritiske og viktige elementene av en forrentningsmodell i denne bransjen, kan de bidra til å hjelpe entreprenøren med designe en bærekraftig forretningsmodell. Resultatene av forskningen er også ment for å kunne fasilitere videre forskingen. Dette kan gjøres gjennom å teste de gitte retningslinjene på flere casebedrifter i ulike utviklingsland.

Table of Content

List of tables and figures

Part I Introduction to study

1. Introduction

The population of developing countries lack access to electricity

Electricity is a crucial area for development, but still, a large portion of the world's population live without access or the resources to access electricity. Despite intensified efforts, for instance through the United Nations (UN) Millennium Goals, still as many as 1,4 billion people of the world's population live without electricity, and 2,5 billion peple rely on traditional biomass for cooking and heating (IFC, 2012) (UN, 2014). Nearly 95% of these live in Sub-Saharan, Africa and Asian developing countries (see figure 1) (Javadi et al., 2013). As stated by Wilson et al. (2012) "electricity underpins health services, education and livelihoods in many ways, such as refrigerating vaccines, providing light and information technology, powering small-scale machinery and lighting kiosks". This is supported by the UN who state that energy is central to nearly every major challenge and opportunity the world faces today. It shows that electrification is crucial in order to reach the UN Millennium Goals, such as "to eradicate extreme poverty and hunger", "to reduce child mortality", "achieve universal primary education" and "to combat HIV/AIDS, malaria and other diseases". In response the UN have initiated a collaboration, lead by 20 UN agencies, in order to achieve *universal access to modern energy services by 2030* (UN, 2014).

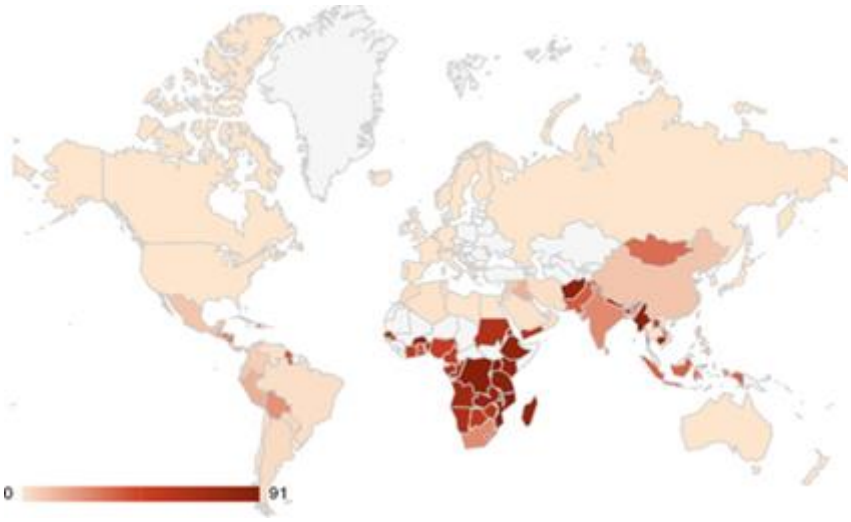


Figure 1: Show percentage of population living without electricity (Javadi et al., 2013)

Lack of access to electricity is especially profound in rural areas[1]. Bhattacharyya's (2006) research regarding India shows that other sources of energy rather than electricity are profoundly used. He found that 72% of the Indian households were dependent on traditional sources of energy, such as

[1] **Rural area** is defined as a region, which is not urbanized and with low population density. Other than these the most critical aspects in the rural areas are less access to energy sources, lack of education, health and welfare (Javadi et al. (2013))

firewood, and almost 90% of them were living in rural areas. This shows that in order to meet the UN goal of *universal access to modern energy services by 2030,* it will be necessary to intensify the efforts around the rural areas of developing countries.

How can entrepreneurs help increase the availability of electricity?

The public sector in developing countries lack the resources needed to be able to deliver electricity to their rural population. Because of this the private sector plays a significant role. Even though efforts at both national and international levels are made, there remains a significant shortfall in the volume of investments needed to achieve universal energy access (IFC 2012). The IFC report (2012) presents that in order to reach this there is a cost of $48 billion per year globally, while there is only $14 billion available for the public sector to spend on this annually. This financial gap needs to be filled, and with the right business models and enabling conditions the private sector can be a good agent in doing exactly so (IFC 2012).

There is a great potential for entrepreneurs to run sustainable businesses delivering widely needed innovative solutions for electricity, which may improve people's quality of living. Even though 65 % of the world's population earns less than $2000 each year, the size of these markets represents a huge potential, which today remains largely untapped (Prahalad & Hammond, 2002). As much as $37 billion are spent each year on poor-quality solutions, to meet poor people's lighting and cooking needs (IFC 2012). This represents an opportunity for the private sector to deliver better alternatives by running sustainable businesses.

As mentioned above, most people living in rural areas of developing countries have limited funds (Prahalad and Hammond 2002). However, for many rural customers access to electricity is primarily a question about availability and/or quality of the available solutions, instead of price. Bhattacharyya's (2006) research shows that in rural areas the level of energy access was independent from income level, which shows that the lack of access to electricity affects everyone in rural areas equally. Still, due to the limited funds of most people living in such areas, entrepreneurs have to find solutions fulfilling the consumers' need and requirements, within their price range. According to Urmee et al. (2009) renewable energy systems represent the most environmentally friendly and cost-effective means of providing electricity for those living in rural communities or regions of developing countries. This implies that renewable energy systems are favourable solution for entrepreneurs seeking to grow a business delivering rural electrification.

For entrepreneurs to be able to create a successful business delivering electricity to rural population they need to design a good business model. Companies commercialize new ideas and technologies through their business models, and the same idea or technology taken to market through two different models will have different potential when it comes to economic outcomes (Chesbrough 2010). This does not mean that a good business model is a guarantee for success, but still it is a crucial part of how to be able to reach business success, as companies are more likely to be profitable with an effective and efficient business model (Teece, 2010).

Business models are complex as they consist of different components. Entrepreneur will have to decide between many choices in order to design a business model where the components work well together (Morris, Schindehutte, & Allen, 2005). According to Casadesus-Masanell and Ricart (2010) business models are composed of different choices and consequences that determine the logic of the firm, the way it operates and how it creates value for its stakeholders. When making such choices, the entrepreneur addresses elements such as offering, resources and competition, which connects to

different business model cmoponents. There exists numerous ways to combine such components, and creating a successful business model is a challenging process (Morris et al., 2005).

Based on what is stated above the rural electrification market of developing countries clearly has need for better energy solutions as well as having an economic potential for entrepreneurs. It is the rural population that represents the greatest need for clean energy. For entrepreneurs entering this market, as in any market, it is important to design a business model that corresponds to the customers demand, the market and the company's resources. As stated by Chesbrough (2010), business model innovation is vitally important, and yet very difficult to achieve. He emphasises the importance of identifying and implementing the right business model, when building a business. With rural electrification being a challenging market, due to characteristics such as poverty and scattered population (IFC, 2012), this market is challenging to succed in and it is therefore important to implement the right business model as enhanced by Chesbrough (2010). Based on the external conditions in these markets is necessary to make the right choices that respond to these factors and to have the right priorities in order to become successful from the start of the company.

Actualization of research and problem statement

The aim of this study is to help entrepreneurs make the right choices and prioritize their efforts at an early stage of their company in order to become successful. In order to do this the study seeks to identify the critical business model components for early stage companies which delivers renewable energy to the rural population of developing countries, and to provide entrepreneurs with guidelines about how to prioritize their efforts with regards to the business model components.

Even though there is a growing need for the private sector to invest in the market of rural electrification, and there is a great potential of the market, it is still hard for entrepreneurs to succeed within this market. This is mainly because of two reasons. The first of them relate to the special characteristics of the market, which creates challenges for the entrepreneurs. Former research within the field of rural electrification refers to a range of challenges that entrepreneurs are faced with when entering this market. One example is the consumers' low ability and willingness to pay (Zerriffi, 2011). Another is the lack of local skilled workers (Javadi et al., 2013), which is closely linked to a third challenge; the low educational level of the population in these remote areas (IFC, 2012). Secondly the market of rural renewable electrification is still young, and entrepreneurs are faced with little direct competition. While this in some way represents an advantage, it also means that there are few successful companies to look to and learn from for the emerging entrepreneurs. Due to this, entrepreneurs need to develop business models in a largely unchartered territory. This study is an attempt to develop a systematic approach to linking the challenges in rural electrification to business model components in order to help early stage entrepreneurs face the challenges of rural electrification, focusing their efforts in such a way that they are able to prioritize the most critical elements.

Business strategy is a well established field of research, while the study of business models is a maturing field of research based on the number of published articles the last decades. A number of reseachers has buildt their work on the basis of these two fields and they may also be linked to the field of *rural electrification,* which is a young field of research. The first apperence of the words *rural electrification* in an article was in 1990, and in total only 232 of such articles were published between 1990 and 2011. 80% of them, between 2001 and 2011. The literature was largely populated with the same focus; in-depth technological and country specific research, which does not help develop

replicable models for rural electrification across boundries. Additionally, one out of few characteristics that clearly distinguish between success and unsuccessful innovation, whether the technology meets the needs of the users, were mostly excluded, as most research up to 2007 lack such a user-centric focus (Schillebeeckx, Parikh, Bansal, & George, 2012).

Schillebeeckx et al. (2012) have built their research of *rural electrification* around business model logic. Based on their extensive literature review, they state that this is a young tradition. They build their toolkit for rural electrification projects around business model logic, but they still lack looking at this in relation to certain stages of business development. Churchill and Lewis (1983) state that companies pass through five stages, and that through these stages they face similar stage specific problems. Based on this statement it is interesting to look at what is important at each stage of a business, for projects or companies delivering rural electrification.

As identifying and implementing the right business model is crucial for success (Chesbrough, 2010) (Teece, 2010) it is interesting to investigate hvow business models can be successful in an early stage of a business. Additionally, as the field of research is young, initiating this reseach for the first stage of business allows further research to be built upon what is done. In order to build guidelines for entrepreneurs that can be used across boarders the authors will look at the market of rural electrification in general, identifying the main challenges experienced across boarders. This will form the foundation for what is important to prioritize, and through linking this to business model theory, it can be derived what business model components that are critical to focus on at an early stage in order to succeed in the delivery of rural electrification.

The authors will in this report answer the following research question:

"*What are the critical business model components to prioritize in order for an early stage company to become viable when delivering renewable energy to the rural population of developing countries?*"

Findings and method

This study concludes that some business model components are critical within a specific stage of business. Based on an extensive literature review and an explorarory holistic multiple-case studies', such critical components have been identified for early stage companies delivering renewable rural electrification in developing countries. These findings are summed up in 3 propositions, which are derived through an outside-in analysis in chapter 9 and presented in chapter 10. The analysis was based on factors of the rural electrification market, which are external challenges to the companies. These external challenges were linked to suitable business model choices and consequences in order for the entrepreneur to respond to the challenges. Further, the choices and consequences were related to the priorities of early stage businesses and it was considered whether the consequences were rigid or not, as a rigid consequences makes it difficult to go back from the choice that is made (R. Casadesus-Masanell & Ricart, 2010). Finally subcomponents were linked to choices and their consequences, and the once that were affected by rigid consequences and related to early stage priorities were considered to be critical. These critical subcomponents are what formed the foundation for the propositions.

Structure of report

The structure of this report is devided in four main parts:

- *Introduction and method:* the part gives an introduction to the need for rural electrification as well as the entrepreneurs' role in this and the need for this research. The research method of is also presented in this part.
- *Theoretical approach of indentifying critical business model components:* the theoretical background for the relevant theories as well as a presentation of the theoretical approach to answer the research question is given.
- *Identification of critical business model components:* the process of identifying critical business model components is executed in this part, including case-descriptions, presentation of external challenges and the analysis.
- *Discussion and conclusion:* the study is ended by discussing the execution of the study as well as the findings, resulting in a set of 3 propositions. Additionaly, the conclusion is presented indicating the studys relevance for further research.

2. Method

Research is a purposeful and systematic way of finding answers to research questions, and to conduct it there exist different kinds of research methodologies. In this study the authors have chosen to answer the research question by conducting qualitative research and basing the design on an exploratory holistic multiple-cases research design (Yin, 2014). As a foundation for analysing case data, grounded theory is included as part of the method (Flick, 2009).

The aim of this chapter is to present the choice of method and the reasoning behind it. It will be presented in the following order: research design, scope of the study, data collection and analysis, and its limitations.

2.1 Research design

Why exploratory qualitative research and case study?

When choosing research method Yin (2014) state that three conditions affect this decision; type of research question, the extent of control a research has over actual behavioural events and the degree of focus on contemporary events. In relation to this he presents the following table:

Table 1: Presenting different methods for case study research (Yin, 2014) .

Method	Form of research question	Requires control of behavioural events?	Focuses on contemporary event?
Experiment	How why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival Analysis	Who, what, where, how many, how much?	No	Yes/No
History	How, why?	No	No
Case study	How why?	No	Yes

Additionally, Yin states that some types of "What" questions are exploratory, and that for such studies any of the five methods can be used. Such questions are suitable when the goal is to develop pertinent hyphotesis or propositions for further inquiry.

The authors have chosen to perform an *exploratory, holistic, qualitative case study* due to the following reasons:

- Preliminary research done by the authors on the topic showed that rural electrification using renewable energy is a relatively new phenomenon; Because of this and because of the nature of the research question being a "*what"* question, the authors have chosen to perform an *exploratory* multiple-case research design.

- When conducting a case study there exist both embedded and holistic case studies. This study will perform a holistic study as the global nature of the case companies is examined (Yin, 2014).

With rural electrification being an emerging area of research and practice, there exist few companies within this field and thereby little history creating archives. This excludes many methods; survey, archival analysis or history, as well as quantitative research. Additionally, experiment as method was excluded, due to the limitiation of this study, considering both the time limit and the authors' location in Norway.

Literature and cases

The authors' goal with this paper is to study business model development within the market of rural renewable electrification, through combining a literature review with a case study in order to develop a better understanding of this emerging field. The study aims to contribute in building guidelines for entrereneurs establishing and growing companies delivering rural electrification in developing countries.

According to Yin (2014), the path of any case study starts with a thorough literature review and thoughtful posing of research questions or objectives. This was conducted in this study, investigating literature and framing the research question while preparing the collection of data from case companies. Additionally, literature enhances the internal validity of a case study, and it becomes particularly important as the study rests on a limited number of cases (Eisenhardt, 1989).

Case studies can involve either single or multiple cases (Yin, 2014). This study will make use (Eisenhardt, 1989) of multiple case studies as the author's wishes to create a broader foundation for the research. Many case examples identified in literature origins from Asia, and in India the need for electrification is especially high, with 72% of Indian households relying on traditional energy sources. Additionally, the authors received financial support to join a research trip to India, and therefore it was also pragmatic to select Indian case companies for this study.

Results

The output of this study, considering critical business model components, will be presented as propositions. These are meant as guidance for early stage entrepreneurs in the rural electrification market, and will set ground for further research. It is proposed by the authors to conduct further research, testing these propositions based on more cases, and conducting an inside-out analysis in addition to the outside-in analysis. This would enable researchers to look at companies', relating their strengths and weaknesses in addition to opportunities and threaths, creating a more overall picture of situation for entrepreneurs within the market of rural electrification. A discussion of this is presented in chapter 10.3.

2.2 Scope of the research

The study will seek to answer the research question within the following scope:

- *The scope of this study is limited to look at developing countries.* Lack of access to electrification is a widely spread problem, affecting the rural population of numerous developing countries as shown in figure 1. This study gives guidance to entrepreneurs entering these markets, answering what to prioritize at an early stage of their business development.
- *The scope of this study is limited to look at local entrepreneurs within the developing countries.* There is a need to reach the poorest and to effectively contribute to sustainable local development. Even though multinational or established national companies may have more resources, they lack the competencies to succeed in the local market (E. a. Z. Wilson, L., 2009). In fact, some scholars suggest that to succeed, multinational companies (MNC) need to partner with local organizations (Seelos, 2007). Wilson (2009) state that smaller local firms are commonly the ones that reach the poor more effectively, due to their in depth knowledge of the local market. Therefore it is interesting to investigate how local entrepreneurs can succeed with rural electrification. These local entrepreneurs may or may not be physically present in the rural area where the solution is delivered, but they have the advantage of knowing the local market and the culture (Scott & Bruce, 1987).
- *The scope of this study is limited to focus on rural electrification in terms of renewable energy off-grid systems.* Such systems are *household-level devices and systems* and *community-level mini-utilities* (IFC, 2012). Renewable energy off-grid systems are considered the most cost-effective and environmentally friendly way of providing electricity for those living in rural areas in developing countries (Urmee, Harries et al. 2009). Such energy solutions should therefore form a good basis in order for entrepreneurs to create a financially successful business. Additionally environmental degradation is a big concern, and renewable energy solutions are therefore highly relevant. As entrepreneurs delivering such energy solutions are surrounded by and operate under the same external conditions, they are considered to be faced by many of the same or similar challenges, and are investigated together in the study.
- *The scope of this study is limited to look at early stage businesses.* Even though companies are different, they still experience common problems arising at similar stages in their development. These problems can be related to different business model components, and they are characteristic for the individual business stages (Churchill, 1983). Due to this it is natural to limit the study to focus around one business stage. As discussed above, the rural electrification market need new private entrants, and due to these circumstances, the scope of this study is to look at early stage businesses. Scott and Bruce (1987) defines these new entrants as small businesses charachterized by the following:
    - Management is independent, and usually the managers are also owners.
    - Capital is supplied and ownership is held by an individual or small group.
    - Area of operations is mainly local. Workers and owners are in one home community.

2.3 Data collection and analysis

As presented above, Eisenhardt (1989) and Yin (2014) both underpins the importance of building cases studies on literature. This was conducted in this research, and below both the data collection from literature and cases will be described, followed by a description of the analysis.

2.3.1. Literature review

Literature relevant in order to answer the research question of this study has been derived from reports, books and articles. Table 2 gives an overview of the different types of literature that have been studied. The first column present the type of literature that was studied, the second column answers why this literature was studied and the third column discusses the importance of the literature and its relation to the research question.

Table 2: An overview of the literature screened in this study.

Type of literature	**Why?**	**Importance and relation to research question**
The context of electricity supply regarding rural population in developing countries.	To get an overview of the status of energy supply to the rural population in developing countries in the context of energy supply. To identify experiences/conditions/challenges that has led to successful or unsuccessful projects.	Describes the need for rural electrification in developing countries, as well as what energy solutions that is being used today as substitutes for better renewable options. To identify what can be done by public and private sector in order to improve the conditions.
Business models theory.	To get an overview of business model definitions defined by different scholars, and to choose what definition to include in the study. To get an overview of what business model components there are and how they are defined by different scholars, and to choose which components to use further in the study. To learn how entrepreneurs should and can design their business model in order to face challenges and succeed, and how to know what components that are important and why.	To understand the different aspects of business models, and how business models should be looked at and designed in order to succeed. To learn how to link the components to the different parts of the business model. Contributes to prioritieze the components, and thereby helps to identify critical components.
Solutions for renewable rural electrification production.	To get an overview of what different solutions that exists for delivering rural electrification in developing countries, as well as non-renwable substitutes that are being used today. To learn about the characteristics of the different solutions, which help identify and understand challenges related to the delivery of different solutions.	The offering of a business is directly linked to the business models subcomponents, and may affect several of the other components. Therefor it is valuable to get an understanding of the different systems delivered. The product/service is the foundation for what entrepreneurs can provide in order to create value for the consumers in rural electrification markets.
Look at cases with delivery of rural electrification in developing countries.	To identify challenges with rural electrification, and examples of how such challenges can be sucessfully solved.	Essential in order to identify what are the important challenges to meet in the market of rural electrification. This will help identify what components of a busineses model that need to be prioritized or which specific decisions needs to be made.
Organizational and Strategic Management	To get insight into what companies have to relate to in terms of internal and external factors, and how analysis based on these factors can be performed. To get knowledge of business stages, how the priorities of a company change as it move through these stages and to know what is important for early stage businesses.	Help designing the process for the analysis and identify which elements that need to be included. Gives a basis when analysing the strategic decisions and challenges of rural electrification in order to reach the answer of the research question.

The litereature review has used sets of keywords within the different types of literature and using the scope of the study as filteres. This has been combined with a 'snowballing' process, where relevant articles were identified using reference lists of key articles found from searches.

2.3.2. Cases

Case selection and planning

The case selection and planning was devided in three stages consisting of

- Online searches
- Talking to industry experts in India
- Selection of case companies and plan for data collection based on step 1 and 2.

In more detail, the authors first conducted online searches based on broad criterias of selection; local businesses delivering off-grid renewable rural electrification in developing countries. Performing the searches resulted in a list of potential companies, who were contacted by telephone and e-mail. In the selection of relevant cases the authors emphasized successful cases that had won awards for their work within rural electrification.

As a research trip to India was planned the autors had the opportunity to meet some experts in rural electrification and an experienced professor with knowledge of the rural markets. They helped in order to gain a better understanding of the field and its challenges as well as to help narrow down on the right case companies. These actors were Development Alternatives, Professor Anil Gupta and TERI. A summary of them and their relevance is given in table 3:

Table 3: Actors meet by authors in India.

Actor within rural electrification	Localization for meeting	Description of actor
Development Alternatives (DA)	Delhi, India	Development Alternatives is a non-profit research and action organization. They have been delivering sustainable livelihood eco-solutions to poor and marginalized people for 30 years. They work to secure every citizens ability to live a secure, healthy and fulfilling life in harmony with nature, in order to create a sustainable livelihood in large numbers. (DA, 2014a). Through TARA, that forms part of the Development Alternatives Group, Development Alternative connects as a central actor within the SPEED project, who seeks to integrate the demand for rural electrification and the need for cell towers to get of diesel. Through some meeting with Development Alternatives the authors was introduced with several rural electrification projects, some of which were performed as a collaboration between TARA and the case company, Applied Solar Technologies (DA, 2014b).
Professor Anil Gupta	Ahmdabad, India	Dr. Anil Gupta is Professor in the Centre for Management in Agriculture at the Indian Institute of Management. He is the founder of Honey Bee Network and a fellow of the World Academy of Art and Science. Additionally he holds the Executive Vice Chair of the National Innovation Foundation (Gupta, 2014). Through decades of experience, Dr. Gupta has become a guru for researchers and entrepreneurs, and is relevant to meet in order learn from his experience and network in relation to the rural market of India. The authors had the chance to discuss the case company, Mera Gao Power (MGP)

		with Dr. Gupta, who recommended them as a case company due to their successful commercialization and growth within rural electrification.
TERI, The Energy Resources Institute,	Delhi, India	TERI was registered in 1974 in Delhi, and is a research institute that works towars global sustainable development, creating innovative solutions for a better tomorrow. Trough their work they have gathered experience from many projects of rural electrification, and strive to help such initiatives develop into a rural success (TERI, 2014). Also TERI mentioned MGP as an interesting case company to study due to their success in rural electrification. TERI had initiated contact with the founders of MGP in order to learn from their work for further projects.

Ideally one should add cases until theoretical saturation is reached, but in practice research is often conducted within some form of limitations, such as time and money (Eisenhardt, 1989). As a result of that, the authors had to make considerations in order to choose between case companies. Pettigrew (1990) state that when studying a limited number of cases, it is beneficial to focus on extreme examplars. The following criterias was emphasized when choosing the case companies:

- The company had some interesting experiences and had shown some success within the field of rural electrification.
- Availability of company was considered, in relations to its location and the limits of the study.
- The company agreed to participate in the study.

Based on these main criterias the following three case companies were selected: Mera Gao Power (MGP), Applied Solar Technology (AST) and Onergy. The cases differ from each others in terms of several important elements, such as offering, location and partnerships, but all of them fall below the scope of this study. They do deliver renewable off-grid electricity to the rural population of a developing country, and had unique and interesting experiences that the authors wanted to include in the study. Onergy and MGP had at this stage passed the early stage of business, but was assumed to remember their early stage and to be able to reflect on their previous situation and experience. A summary of these companies is presented in table 4.

Table 4: A brief description of the case companies.

MGP	Onergy	AST- speed project
MGP is a for profit enterprise founded in 2010 which builds, owns and operates micro grids in Uttar Pradesh. They provide off-grid villages with dependable lightning and mobile phone charging and have provided this solution to more than 100 000 people in 20,000 households. All their activities are executed in-house.	Onergy is a for profit social enterprise established in 2009. They provide decentralized energy solutions to underserved households in West Bengal with a wide range of solar solutions from basic stand alone products to home systems. They have provided their solutions to more than 120 000 people. Onergy execute their activities with the help of NGO and MFI partners.	This project is collaboration between Applied Solar Technologies and Development Alternatives trough TARA, which was initiated in 2012, and forms part of the Speed project. The project aims to electrify Diara Rasulpur, a rural area in Uttar Pradesh. They provide batteries for lightning and phone charging, and collaborates with the local NGO; Nidan. The project is still in an early stage.

Collection of data

Case studies typically combine data collection methods (Eisenhardt, 1989). This study has combined the use of interviews with observation. All case companies were interviewed, and in relation to AST

their partners TARA and Nidan were also interviewed. Additionally the authors had a two days field trip to Diara Rasulpur, the location of ASTs project.

For all case companies interviews were performed, and recorded by a digital audio recorder. They were based on open ended questions, as the authors did not want to influence the responses directly. The questions revolved around the following themes, which had its connection to theoretical pointers on how such a research question, could be answered:

- Goal
- Early stage
- Business model choices made, and reason for this
- Resources
- Challenges
- Importance/Criticality of choices, consequences, resources and challenges

Additional adjustments can be made to data collection instruments, such as the addition of questions to an interview protocol or questions to a questionnaire. These adjustments allow the researcher to probe emergent themes or to take advantage of special opportunities which may be present in a given situation (Eisenhardt, 1989). When conducting the interviews such adjustments were made, in the way that additional and follow up questions where asked when the subject revealed something that was particularly interesting.

Through connecting with AST and TARA the authors got the chance to travel on a two day field trip to Diara Rasulpur, the location of their project, with Chaitanya Sure from TARA. This also gave the opportunity to observe and learn more about the project interviewing all three partners, including AST, TARA and the local NGO, Nidan. In this situation the authors took advantage of controlled opportunism, explained by Eisenhardt (1989), in order to alter the data collection through adding questions and observations.

Table 5 summarize the basic information of who was interviewed, where and with which interviewee. The questionnaire that was planned for the different interviews, adding on the follow-up questions can be studied in Appendix B.

Table 5: A presentation of what company and person that was interviewed and at what location.

Company	**Location**	**Interviewee**
MGP	Delhi, India	Nikhil Jaisinghani, CoFounder and CEO
Onergy	Kolkata, Indial	Piyush Jaju, CoFounder and CEO Julia LaFleur, Internship Sudipta Dawn, General Manager of Operational
AST (TARA) (Nidan)	Delhi Delhi, Diara Rasulpur Diara Rasulpur	Rajiv Parti, Consultant, AST. Chaitanya Sure, Deputy Manager-Energy Services, TARA Ratnish Verma, State Program Manager, Nidan

2.3.3. Analysis

One of the challenges with qualitative research is that it generates a lot of data (Bryman, 2008). The authors chose to structure the process into different steps in order to perform the analysis. The steps were: *transcription, individual analysis, discussion of data,* and *linking data to relevant theory.*

Transcription

As this is an exploratory study, the interviews should be transcribed in their entirety, so that the resulting transcriptions could be "mined" for themes that were not immediately obvious (Weiss, 1994). This was performed by sharing the work load between the researchers, and the transcriptions of each interview consisted of one document.

Individual analysis

In order to perform an analysis of the transcripted data the grounded theory model, thematic coding was applied. *Thematic coding* is applied as a multi-stage procedure with respect to the comparability for the analysis (Flick, 2009). That way, conceptually relevant categories were formed, in order to compare between the cases. As the use of more investigators builds confidence in the findings and increases the likelihood of surprising findings the thematic coding was performed individually by the authors. This adds additional comparability of the analysis, as not only the cases can be compared within the derived themes, but also the themes can be compared and discussed amongst the authors. By chosing to do this separately the creative potential of the study increases, as team members often have complementary insight which add to the richness of the data, and our different perspectives increase the likelihood of capitalizing any novel insight which may be in the data. And last, the convergence of observations from multiple investigators enhances confidence in the findings (Eisenhardt, 1989).

When performing the coding the authors mixed the use of predefined and emerging themes. The predefined themes were closely linked to the authors' theoretical knowledge about business models and their components, while the emerging themes derived from analysing the interviews and reflecting upon the answers given by the interviewees.

Discussion of themes and data

As the analysis of data was performed individually, the process was followed by a discussion between the authors, identifying common and distinct thoughts, and discussing and agreeing on these in order to complete the analysis.

First the authors searched together for patterns between the two set of themes. What were discovered were great similarities in the perceptions of the interview data, while some differences due to formulations and different choices of gathering data for themes were identified. The similarities, as well as the deviation of themes and formulations, were used as the base for the discussion in order to set common themes analysis. As this was done the authors could use the categorization to look for cross-case patterns. Using such categories is important in order to perform a good cross-case analysis (Eisenhardt, 1989). The themes helped simplify the discussion as the authors could relate the data with their individual perceptions to their common themes. This helped as it forced the scholars to go beyond initial impression, in the process of identifying common thougths between cases, and according to Eisenhardt (1989) that is likely to generate a closer fit with data. This relation to theory was also somewhat ensured as some themes were predefined based on the authors' theoretical background and perception of what would be important findings.

Linking data to relevant theory

Throughout the discussion and comparison of cases it was discovered both interesting similarities and distinctions between the cases, that was related to theoretical findings from the literature review. As the literature review of the study was performed as a basis, the authors had a theoretical background in the different types of theory that was considered interesting with regards to the research question. This theory was used in order to relate the different data to the types of literature, as well as to connect it together through iterations of discussions. As the interviews were performed with one observator and one responsible of the quesitonnaire the authors could make use of different observations and thoughts, which improves the creativity of the process and the linking of the theory (Eisenhardt, 1989). Throughout the study this linking of data to relevant theory was a process involving numbers of iterations going back and forward as different links between types of theory and cases was discovered along the way.

2.4 Limitations

One should understand and openly acknowledge the strengths and limitations of case study research (Yin, 2014). Such strengths and limitations can be related to both the use of the literature review in relation to the case study, the case studies themselves, as well as the characteristics of the research project. The strengths considering choice of method have been discussed above, and the limitations in relation to it will be discussed in chapter 10. In addition to this the research project itself was conducted under some limitations.

The study was conducted within the following limitations:

- **The study was limited with regards to use of time and resources.** As the study was conducted by students as a part of the master thesis TIØ4945 at NTNU, there were limitations in regards to time available to perform the research.
- **The study was limited to the investigation of cases in only one country.** In this research project there was limited financial support restricting the field trip to India as well as that the time and ability to travel within India.

Part 2 Theoretical approach for identifying critical business model components

3. Business models

The world today is rapidly changing, where new information, technology and competition affect companies' opportunities and threats every day. With the fast moving industries, complex environment and increasingly uncertain economic environment the business model concept can help companies better make decisions and adapt to change (Osterwalder, 2004). As presented in chapter one, the aim of the report is to identify critical business model components for delivering renewable electricity in developing countries. For this reason the authors of the paper finds it necessary to look at the importance of business model design and therefore definitions of business models. Further it is necessary to identify business model components and factors that affect the design of a good business model.

3.1. Business model design

Business model design is a key decision for a new firm (Zott, 2010). Designing a business model for an idea or a technology is a challenge, which is discussed amongst numerous scholars. One of them is Chesbrough (2010) who states that business model innovation is vitally important, and yet very difficult to achieve. He emphasises the importance of identifying and implementing the right business model, stating that the same idea or technology taken to market with two different business models will yield two different economic outcomes, and that the economic value of a technology remains latent until it is commercialized via a business model.

Teece (2010) talks about business model design. He states that "the issues related to good business model design are all interrelated, and lie at the core of the fundamental question asked by business strategists - how does one build a sustainable competitive advantage and turn a super normal profit?". He presents the elements of business model design as the following five, which all are important when dealing with the issues mentioned.

- Select technologies and features to be embedded in the product/service.
- Determine benefit to the customer from consuming/using the product/service.
- Identify market segments to be targeted.
- Confirm available revenue streams.
- Design mechanisms to capture value.

This is the normative way of designing business models, which is criticized by Casadesus-Masanell and Ricart (2010). They do not consider any categories or variables in their view of business model design. The scholars see business models as composed out of two different sets of elements: first, the concrete choices made by management about how the organization must operate, and second, the consequences of these choices. Further they distinguish between the two types of consequences; flexible and rigid. Flexibel consequences are sensitive to the choice that generates it.

Rigid consequences are the opposite as they do not change rapidely with the choices that it is generated from.

The choices and consequences of the business model are important for the entrepreneurs to keep in mind when designed their business model. Another important statement with regards to business models and its design is that it needs to be designed flexible enough to enable the company to efficiently re-shape strategic choices that outline the business logic according to market demands (Trimi & Berbegal-Mirabent, 2012).

Designing a business model is challenging and in difficult surroundings, such as rural electrification in developing countries, this process may be even more challenging. Therefore it is interesting to investigate which elements of the business model that becomes critical in this context. To do this it is necessary to identify a process that can result in the identification of critical components and therefore we find Casadesus-Masanell and Ricart (2010) as most relevant. Due to the importance of business model design there is a need to first understand what a business model is and the next section will present definitions from several scholars.

3.2. What is a business model?

A wide range of scholars have presented their definitions of a business model but despite of this there is no widely accepted definition on what a business model is. Having read various definitions the authors have concluded that most business models share some similar features. According to Lecoq et al. (2006) “Business Model refers to the logic of the firm, the way it operates, and how it creates value for its stakeholders”. Their definition is related to Teece (2010) which states that: “A business model defines how the enterprise creates and delivers value to customers, and then converts payments received to profits“. Shafer, Smith and Linder (2005) defines a business model as “A representation of a firm’s underlying core logic and strategic choices for creating and capturing value within a value network”.

Casadesus- Masanell and Ricart (2010) are two authors that present an emergent way to look at business models. They define business models as concrete choices and the consequences of these choices. By looking at the choices and consequences that are generated from these choices they identify how different business model design have different specific logics of operation and create value for their stakeholders.

This emergent way of thinking of business models will be used in this paper. This view can be used to identify choices and consequences that the entrepreneur must make to create value when delivering rural electrification.

Having the business model definition in place, it is further necessary to investigate what different scholars have identified as business model components.

3.3 Business model components

Several authors have presented their perspectives on business models components however there is no consensus over the key components of a business model. The literature research has shown that the number of components mentioned varies from three to nine. In the literature three elements are usually distinguished: the product/service proposed to customers, the way the company is organized

as to deliver the product/service to its customers, and the revenue model (Yunus, Moingeon, & Lehmann-Ortega, 2010).

Casadesus-Masanell and Ricart (2010) present that a business model does not consist of specific elements but of choices and consequences. The scholars critize this normative view of components and argue that these approaches implicitly impose bounds on what a business model is. The authors make use of Casadesus-Masanell and Ricart (2010) view, however due to the traditional view of business models components the authors have investigated three scholars normative view.

Morris et al. (2005) conducted a research based on other scholars' perspectives on components, and as a result of their research they presented a framework consisting of six components. Morris et al. present six questions that underlie a business model.

- Component 1. Factors related to offering: How do the company create value?
- Component 2. Market forces: Who do the company create value for?
- Component 3. Internal capability factors: What is our source of competence?
- Component 4. Competitive strategy factors: How do the company competitively position themselves?
- Component 5. Economic factors: How does the company make money?
- Component 6. Personal/investor factors: What are the company's time, scope and size ambitions?

Yunus et al. (2010) on the other hand has suggested that a business model consists of three components; Value proposition, value constellation and profit equation. A value proposition should answer the question: Who are our customers and what do we offer to them that they value? A value constellation should give an answer to the question: How do we deliver this offer to our customers? The question does not only involve the firm's value chain but also its value network with its players such as suppliers and partners. The last component, profit equation, is the result of the combination of the value proposition and constellation. This is the financial translation of the other two and includes how value is captured from the revenues generated through the value proposition, and how costs are structured and capital employed in the value constellation.

Another acknowledged researcher in the field of business models is Alexander Osterwalder. In his work (2004) he identified four main areas that constitute the essential business model issue of a company:

- Product: What business the company is in, the products, and the value propositions offered to the market.
- Customer interface: Who the company's target customers are, how the company delivers these products and services, and how it builds a strong relationship to them?
- Infrastructure management: How the company efficiently performs infrastructural or logistical issues, with whom, and as what kind of network enterprise.
- Financial aspects: What is the revenue model, the cost structure and the business model's sustainability.

The business model components presented by the different scholars are quite similar in what they emphasize on. The components have been compared and the similarities and dissimilarities are

presented in table 2 (for a detailed comparison see Appendix A). The components regarding creating and delivering value, and financial aspects are equally described as business model components by these scholars. The comparison of the business model components shows that the components of Morris et al. (2005) has a wider scope and therefore includes components that Yunus et al. (2010) and Osterwalder (2004) lack. Their wider scope makes it interesting to use the components of Morris et al. (2005) in the identification of critical components.

Table 6: Companison of business model components from different scholars.

Morris et al. (2005)	**Yunus et al. (2010)**	**Osterwalder (2004)**
Factors related to offering	Value proposition/value constellation	Product/ Customer interface
Market factors	Value proposition	Customer interface
Internal capability	Value constellation	Infrastructure management
Competitive strategy factors	-	-
Economic factors	Profit generation	Financial aspects
Personal/investor factors	-	-

As previously presented this paper will use the emergent view of business models as choices and consequences presented by Casadesus- Masanell and Ricart (2010). Morris et al. (2005) presents six main decisions where they further present decision variables framed as questions that entrepreneurs need to answer through their business model (see Appendix A). Answers to these questions will be the choices the entrepreneur will make. From this the authors see a connection between the emergent view of Casadesus-Masanell and Ricart (2010) and Morris et al. (2005) normative view. This connection will be used to illustrate for the reader how the choices and conseqences, identified by the authors, are connected to the traditional components of business models.

In order to do this connection to it is necessary to divide the components into subcomponents to show what part of each component that are affected by the choices and consequences. Entrepreneurs delivering rural electrification needs to make specific choices in order to succeed and due to the wide scope of the components of Morris et al. (2005) the components needs to be divided in order to do the linkage. Additionally, to be able to compare the specific choices made across the cases in this research it is necessary to make specific connections to business model subcomponents.

The comparison of the component by Morris et al. (2005) and Osterwalder (2004) in table 7 is used to break up the six decisions areas by Morris et al. (2005) to the subcomponents and to label the subcomponents. By comparing the scholars business model components the authors introduce the subcomponents of Morris et al (2005).

Table 7: Business model components.

Six decision areas by Morris et al.	**Main areas by Osterwalder**	**Business model components; the building blocks by Osterwalder**	**Description**
Factors related to offering	Product/ Customer interface/Infrastructure management	*Value Proposition*	A *Value Proposition* is an overall view of a company's bundle of products and services that are of value to the customer.
		Distribution Channel	A *Distribution Channel* is a means of getting in touch with the customer.
		Value Configuration	The *Value Configuration* describes the arrangement of activities and resources that are necessary to create value for the customer.
Market factors	Customer Interface	*Target Customer*	The *Target Customer* is a segment of customers a company wants to offer value to.
		Relationship	The *Relationship* describes the kind of link a company establishes between itself and the customer.
Internal capability factors	Infrastructure Management	*Capability*	A *Capability* is the ability to execute a repeatable pattern of actions that is necessary in order to create value for the customer.
		Partnership	A *Partnership* is a voluntarily initiated cooperative agreement between two or more companies in order to create value for the customer.
Competitive strategy factors	-	*Competitive strategy*	The *Competitive Strategy* the entrepreneur intends to use to achieve advantages over competitors.
Economic factors	Financial Aspects	*Cost Structure*	The *Cost Structure* is the representation in money of all the means employed in the business model.
		Revenue Model	The *Revenue Model* describes the way a company makes money through a variety of revenue flows.
Personal/investor factors	-	*Investment model*	The entrepreneur's time, scope and size ambitions. This can be a subsistence model, income model, growth model or speculative model.

These components derived from breaking down the six decision areas from Morris et al. (2005) will be used in the identification of critical business model components. The decision areas presents questions that an entrepreneurs need to answer in order to develop his business model. The answers

to these questions will affect the business model component. It therefore is interesting to see how the entrepreneur can do this in a way that the business can be viable. To do this the authors find it necessary to investigate what a good business model is in order to see how the entrepreneur can succeed.

3.4 What is a good business model?

A good business model begins with the insight into human motivations and ends in a rich stream of profits (Margretta, 2002). The scholar present how a good business model should give answer to the following questions: Who are the customers? And what does the customers value? In addition it should give answer to questions that the management must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost? This view is closely connected with Morris et al. (2005), which presents a good business model as giving the suitable answers to the six main decision areas, which in return gives superior returns to the firm.

Casadesus-Masanell and Ricart (2007) have identified three characteristics of a good business model. These are the following: Is the business model aligned with the company goals? Is it self-reinforcing? Is it robust? Alignment to goal refers to the business model choices, which generate consequences that move the organization towards achieving its objectives. It is important to understand that in most cases goals are consequences and not choices. Reinforecement refers to choices that complement each other well, and reinforcement that help the business gain strength over time can be presented as virtuous cycles. Robustness refers to the ability of the business model to sustain its effectiveness over time. The robustness is connected to how a company fend off threats (Casadesus-Masanell and Ricart, 2007).

Designing a good business model is challenging, but also vital in order to succeed (Chesbrough, 2010). When designing the business model one must consider external threats that might affect the performance of the business. In addition it is necessary to investigate what factors that can have an influence on the business model design. What these factors are for an early stage entrepreneur in rural electrification will be introduced in the following section.

4. Factors that influence the design of a good business model

Different problems arise in different stages of a company (Churchill, 1983). Further, the environmental factors have an impact on a firm´s success (Leidecker & Bruno, 1984). Due to the scope of the research and the external challenges an entrepreneur will have to face when delivering rural electrification it is necessary to investigate how these factore influence the business model design.

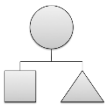
4.1 Early stage priorities

As a business develops it moves through different growth stages (Scott & Bruce, 1987). Going through these stages, companies experience that the organizational practices such as the importance of various responsibilities and tasks vary with time. In relation to this the entrepreneur will experience a change in how the business is managed and what problems the company faces. Even though companies are different, they do experience common problems arising at similar stages of their development (Greiner, 1998) (Churchill, 1983) (Levie, 2010).

Most models addressing business growth support the theory saying that businesses pass through distinctive stages as they develop (Levie, 2010). Some of the scholars presenting such a theory are Churchill and Lewis (1983). Their research develops and presents a five stage model, describing how small and growing businesses develop through the stages of; Existence, Survival, Success, Take-Off and Resource Maturity. Building further on their and others' research were Scott and Bruce (1987), presenting the stages as; Inception, Survival, Growth, Expansion and Maturity.

Scott and Bruce's (1987) first stage is Inception, and according to them the stage is mainly characterized by direct supervision as the role of top management, entrepreneurial and individualistic as management style, unstructured organizational structure and negative cash generation. The key issues they discuss within this stage are to obtain customers and economic production, as there is a necessity to try to generate a positive cash flow. These issues are strongly related to the issues of Churchill and Lewis' (1983) first stage; existence. They described each stage by five management factors, and mention that the key factors determining success at this stage are the business' resources and cash, the owner's ability to do and the matching of the business' and personal goals. Their management factors of the existence stage are presented in table 8.

Table 8: Stage 1: Existence, in relation to management factors (Churchill and Lewis, 1983)

Management factor	**Stage 1: Existance**	**Comment**
Management Style	Direct supervision	The organization is still simple, and the owner is very central and does everything; all important tasks, main supplier of energy and direction. In the same time he is supervising subordinates, who should at least have average competence. Systems and formal planning are minimal to nonexistent, while the company's strategy remains alive.
Organizational structure		
Extent of formal systems	Minimal	
Major strategic goals	Existence	
Owner's involvement	 *with the grey circle representing the business and the white circle representing the owner	

According to Churchill and Lewis (1983) the main problems of the business at this stage are to obtain customers and deliver the product or service that they are contracted for. The key questions with regards to these main problems are the following three:

- *"Can we get enough customers, deliver our products, and provide services well enough to become a viable business?"*

- *"Can we expand from that one key customer or pilot production process to a much broader sales base?"*
- *"Do we have enough money to cover the considerable cash demands of this start-up phase?"*

Based on what is stated above, it can be acknowledged that companies face different problems, based on their business stage. Churchill and Lewis' specify how some problems are the most important within the company's first stage. The authors of this study recognize that some elements of a business model can be more critical than others within one business stage. On the other hand the authors are critical to the fact that Churchill and Lewis (1983) do not mention that a company have to select what technologies and features to be embedded in the product or service within this stage. As mentioned in chapter 3, Chesbrough (2010) emphasises the importance of identifying and implementing the right business model. When Teece (2010) presents his five issues related to developing the business model design, the first one the lists is *"Select technologies and features to be embedded in the product/service"*. A natural and necessary part of starting a business is to decide upon its offering, which will affect the companies business model in many ways, for instance through its cost structure. Due to this the *selection of product or service* can naturally be included as one of the first issues an early stage business has to address. Selection of product or service will therefore be included in this study as a general early stage issue.

Matching business' and personal goals are one of the key factors to success . This is connected to one of Morris et al. (2005) business model components, which are the personal/investor factors. This component includes how the goal of the company affect which business models the management will adopt. Morris et al. (2005) presents four different investment models to choose from based on the company's current ambitions:

- Subsistence model: The goal is to survive and meet basic financial obligations
- Income model: Investment done by the entrepreneur to the point where the business is able to generate on ongoing and stable income stream.
- Growth model: Finds significant initial investments and reinvestment in an attempt to grow the value of the firm to the point where major capital gain for investors is generated.
- Speculative model: Short time frame where the objective is to demonstrate venture potential before selling out.

This shows how the entrepreneur needs to make a decision for what the goal of the company should be. Accordingly, the business model should be designed in such a way that it meets the early stage priorities, in order to succeed. In addition the entrepreneur will have to take the external factors into account and how external factors will affect the business model design.

4.2 External factors

In strategic management theory several authors have presented theories on how managers can analyse their company's abilities and the environment the company will operate in. The macro-environment, in the form of technological advances or social trends, often triggers changes in an industry's life-cycle through encouraging or enabling the development of new products (Haberberg 2008). De Wit and Meyer (2010) present two perspectives, the Outside-in and Inside-out perspective. The first perspective looks at the environment first-hand and from there identifies how a company

should operate while the latter focuses on the company's strengths and how it based on that takes a market position.

External factors will affect the firm's innovative performance and the effects of the external factors vary depending on the industry in which the firm operates (Vega-Jurado, Gutiérrez-Gracia, Fernández-de-Lucio, & Manjarrés-Henríquez, 2008). Due to the effect of external factors on a firm's performance, it is interesting to investigate how these factors can affect business model components. According to Barney (1991) strategy models that are mainly based on external factors make the unrealistic assumption of firm homogeneity, and Barney stresses the importance of paying attention to the firm's resources. Every company has their set of resources and the results from an internal analysis will vary with the firm being analysed. Based on Barney's statement an Inside-out perspective is necessary in addition to the outside-in analysis. While the authors acknowledge the importance of Barney's perspective, given the time and resource limitations it was not possible to do an in-depth analysis of individual company´s resources and our research is primarily based on an outside–in analysis approach. However, some aspects of the differences between the three companies is captured through our discussion of their priorities with respect to their goals and ambitions as reflected in the discussion on personal investor factors presented in subsection 3.5.1.

Within the field of strategic management PESTEL is a general tool, serving across industries, used by companies to analyse the environment they are entering or working in. According to Haberberg and Rieple (2008) managers must have an understanding of the environment in which it operates in in order to face the challenges to come and formulate strategies for the future. An analysis can tell about how routines were created and decisions were made, and how fast the business and market is changing with time.

Further Haberberg and Rieple (2008) state that PESTEL gives an understanding of the wider environment, that affects both the population as a whole and the organization that serve it, and has the power to affect the demand, distribution and prices of products and the competition within the industry delivering them. PESTEL is based on six factors; political, economic, social, technological, legal and environmental. An explanation of these is summarized in table 9. All of the factors in some way or the other affect the way a company should be run, and the decisions that are to be made.

Table 9: PESTEL factors summarized (Haberberg and Rieple, 2008).

Factor	**Explanation**
Political	Related to local and national administrations, political parties and international bodies.
Economic	Greatly involves consumers spending power, as well as factors affecting it, such as economic growth, unemployment and interest rates. Affecting the economic factors are also supply and demand of key inputs such as oil and metals.
Social	Consumers social and cultural background, accompanied by numerous of trends, are highly affecting industries through the choices they make, both when it comes to how they spend their money and how they choose to use their influence.

Technology	The way consumers and organizations act and interact have changed drastically, and are still changing as the accessibility, capacity and quality of intelligent electronics increases.
Legal	Regional, national and international regulatory and legislative frameworks affect both what entrepreneurs and businesses can offer their customers and how they can operate.
Environmental	The environmental factors are driven from the physical environment, and may affect the economic activity. An example is global warming. These factors are strongly related to the other PESTEL factors.

Conducting an environmental analysis will identify the forces that may impact a company's performance (Leidecker & Bruno, 1984). Identifying challenges in the environment that can affect a firm's performance may lead to the identification of information that is critical or important to the success of the business. According to Leidecker and Bruno (1984) critical success factors are those characteristics, conditions, or variables that when properly sustained, maintained or managed can have a significant impact on the success of a firm competing in a particular industry. In this research the authors will identify which choices an entrepreneur delivering rural electrification can make in order for the choices to have a significant impact on the firm´s success. These choices will be the responses to the external challenges found by doing an environmental analysis. Further the authors have analysed three cases, which will be included in the external analysis as an industry analysis. Bringing in the case study will strengthen the literature review through either confirming or adding on to the challenges identified in literature.

5. Identification of critical components

For the entrepreneur to succeed with rural electrification, the entrepreneur will need to design a good business model, which takes into account the factors that will challenge its design. To respond to the factors that will challenge the design, the entrepreneur will have to make specific choices, which generate some consequences. Some of these choices and consequences may be more critical than others, as companies passes through several stages of business, facing different problems in each stage (Churchill, 1983). The authors acknowledge that every business model component is vital, as stated by Morris et al. (2005). Still, it is found interesting to investigate how the stage related priorities of Churchill and Lewis (1983) can be meet through making good business model decisions.
Therefore, the authors will pursue the statement of Churchill and Lewis (1983), with the goal to identify critical business model choices and consequences for early stage local businesses delivering renewable rural electrification to developing countries. It will also be derived how these may be linked to the subcomponents, derived in chapter 3, representing the traditional view of business model components.

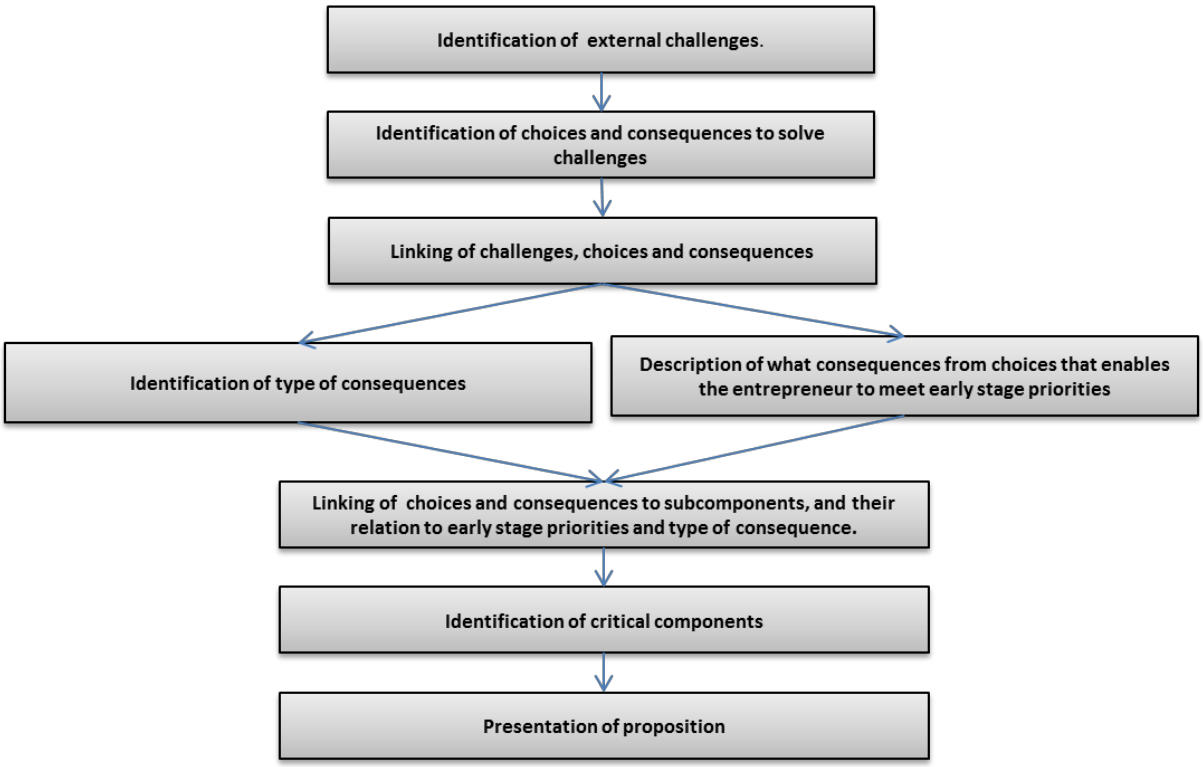


Figure 2: The process of identifying critical business model components

An illustration of the chosen procedure for conducting the analysis is shown in figure2. The decision criteria in this process are the early stage priorities and rigid/flexible consequences.

The challenges derived from the outside-in analysis based on a literature review and the case studies form the basis of the analysis. The challenges are necessary to face in order for the entrepreneur to succeed in the delivery of renewable energy to the rural population of developing countries.

As previously presented all business models are composed of two different sets of elements: choices made and the consequences of these choices (Casadesus-Masanell and Ricard, 2010). When making choices in order to design a business model, entrepreneurs must take in consideration the external factors affecting their company. Importantly they must design their model in order to face the challenges that may oppose their line of business. Due to this the authors have identified the choices entrepreneurs have to make in relation to their business model in order to overcome the rural electrification challenges they are faced with as well as the consequences of these choices. Further, the authors have distinguished between flexible and rigid consequences to identify which choices that the entrepreneur can easily come back from, and the consequences that will be hard to change when the business model choice is made. Even so it is important to highlight that no consequences is purely flexible or purely rigid (Casadesus-Masanell and Ricard, 2010) but it is a matter of degree.

Choices and consequences are linked based on causality theory, which is the unidirectional view of cause-and-effect relationships (Baum, 1994). With use of the choices and consequences the external challenges are linked to each other challenges and this way identifying choices and consequences based on cases and literature may be the solution for several of the external challenges. These linkages will result in a causal loop diagram.

The analysis proceeds by relating the challenges, choices and consequences to the early stage priorities (which is one of the two decision criterias) based on Churchill and Lewis (1983) key questions for success in the early stage existence. The key questions are the following as previously presented:

- "Can we get enough customers, deliver our products, and provide services well enough to become a viable business?"
- "Can we expand from that one key customer or pilot production process to a much broader sales base?"
- "Do we have enough money to cover the considerable cash demands of this start-up phase?"

And Teece (2010):

- "Select technologies and features to be embedded in the product/service"

From the key questions the authors have derived at a list for the early stage priorities:

- Get enough customers
- Deliver products
- Provide well enough service
- Expand to new customers
- Get enough money to cover costs
- Provide suitable solution

The reasoning for this is that in order to link the early stage priorities to the specific choices in such a way that makes it clear which of the early stage priorities is being affected the authors have chosen to divide the key questions into key points.

Further the choices and consequences will be linked to the subcomponents of a business model. The identification of rigid and flexible consequences (which is the second decision criteria) will be used to determine the criticality of the subcomponents affected. The rigid consequences will be distinguished based on whether they have a positive or a negative affect on the early stage priorities. The consequences that are rigid and have a negative or positive affect on the early stage priority will be considered critical for the entrepreneur to focus on; getting the choices that generates this kind of consequence right.

Part III Identifying critical business model components

6. Introduction to rural electrification

There exists different ways of serving electricity to rural population in developing countries. IFC (2012) presents three ways in which companies are providing improved energy access, two of which fall below the scope of this study:

- Household-level devices and systems
- Community-level mini-utilities
- Grid, outside the scope of this study.

The purpose of this chapter is to give a short introduction of the different rural electrification solutions within the scope of this study.

6.1 Household-level devices and systems

Household-level devices and system includes solar lanterns, solar home systems, and improved biomass cooking stoves. They are often the most cost-effective option for rural population. The industry of these systems and devices has attracted private sector in Africa, Asia and Latin America, due to the barriers to entry being fairly low (IFC 2012).

An overview of the devices and systems that are currently on the market, delivering electricity to rural population in developing countries is presented in table 10.

Tabell 10: Overview of household-level devices and systems (IFC, 2012)

Device/system	Characteristics of device/system
Solar Lanterns	Priced at $20 to $50, and are often the most affordable way for poor consumers to improve lighting services.
Rooftop solar home systems (SHS)	Can provide sufficient power for a household or a small retail business. Priced at $300 to $500.
Biomass cookstoves	Offer improved fuel consumption of 30 to 50 %, which reduces operating expenditures drastically. Reduced indoor and environmental air-pollution. Priced at $5 to $25.
Solar Kits	Are portable systems that allow households to run multiple lights and charge small devices. Require no installation or regular maintenance. Priced at $100 to $200.

6.2 Community-level mini-utilities

Community-level mini-utilities are small, decentralized mini-grid businesses, called “mini-utilities”. These are found in poor areas across the developing world, delivering electricity to household and productive use, at $0.20 to $0.50 per kilowatt hour (kWh), often allowing families to meet basic energy needs for less than what they currently spend. The mini-utilities are often powered by hydro or diesel generators, but are increasingly using biomass, solar and wind energy, generally delivering from 30 kilowatts (kW) to 500 kW (IFC 2012).

The external factors affecting a company depend on the industry in which it operates (Vega-Jurado et al., 2008). The delivery of renewable rural electrification through household-level devices and systems and community-level mini-utilities is reckoned to be faced with the same or similar challenges related to external factors as they are operating within the same market and affected by the same environment. Although the environment is the same one can assume that to what degree the challenge affect the entrepreneurs delivering different solutions will vary due to the nature of the solution and to the different challenges. Churchill and Lewis (1983) state that, within the companies' first stage of development there are some main issues that face all companies. This underpins that the companies that find themselves within the scope of this study are affected by the same issues and challenges due to their stage and the market they operate within.

In the following, this report will provide the reader with a more in depth introduction to rural electrification through the presentation of three indian case companies operating within the market of renewable rural electrification.

7. Case description

This study has included empirical study in form of three Indian case companies delivering rural electrification in India. These companies are Mera Gao Power (MGP), Applied Solar Technologies (AST) and Onergy. As described in the method the data collection is done through interviews with open ended questions. The purpose of this chapter is to give an introduction to the different the companies and their business models.

The three cases each have their unique goals and since the goals is one of the key factors of success as presented by Churchill and Lewis (1983) their goals will be presented here, se table 11. Due to the relation between the goal and the investment models, presented by Morris et al. (2005), each goal is related to the corresponding investment model.

Table 11: Goals of the companies and their corresponding investment model.

	MGP	**Onergy**	**AST- Speed project**
Focus/goal	Provide service grid villages with basic priority energy services. The business model is fixed when it comes to product offered and should scale up quite quickly with 3-4 year repayment period	Promote decentralised energy products, to meet the need of rural customers independent of sector and find ways to provide social economic benefits	Give the rural people power so they can educate themselves and improve their life. This will be done through rural development.
Investment model (Morris et al. 2005)	**Growth model**: Goal to grow the value of the firm to the point that it generates capital gain for investors.	**Income model**: Investment to the point that the business is able to generate on going and stable income stream.	**Income model**: Investment to the point that the business is able to generate on going and stable income stream.

The cases business model and comparison of their model is presented in table 12-16. The data is gathered from interviews, whose questions can be found in Appendix B.

Factors related to offering

How do we create value?

Table 12: Case companies' factors related to offering.

Subcomponent	MGP	Onergy	AST
Value proposition	Micro grids that provide basic power of lighting and phone charging. The solution provides 9 hours of power end 2 lights	Started with providing solar lanterns. After request from the customers they added solar home systems to their offering. Adding the new solution to the product portfolio made it necessary to provide consumer credit.	Provides batteries with two lightning bulbs and a mobile phone charger. The bulb has 7 hours of power.
Distribution channel	Electricity line distribution. Branch office 10-15km of every village, which do installation.	Distribution of solutions from renewable energy centre (REC), office located near the villages, with help from the NGO partner.	Physical distribution with one distributor delivering the batteries on scooter. Experience struggles with the entire logistics of delivery. The villages are scattered so the distances can be large.
Value configuration	The offices near the villages do the installation, maintenance and after sales service. In each village they perform an engagement session, which the branch manager is responsible for. The session of 45-60 min contains information about their solution.	They have NGO and MFI partners. NGO and MFI helps with getting the products to the market, selling the products and distribution. MFI is an important partner in order to provide consumer credit. After sales services is identified as important activity observing that other companies failed in providing this service.	Tara does the development awareness campaigns and Nidan do the execution. Nidan does community mobilizing and education. AST do the technical work.

Market forces

Who do we create value for?

Table 13: Case companies' market forces.

Subcomponent	MGP	Onergy	AST
Target customers	Villagers living in off-grid villages in Uttar Pradesh who lack electricity for basic needs.	Poor people in rural areas in West Bengal who are using non-renewable energy solutions like cold and kerosene.	Rural people who do not have access to clean renewable energy.
Relationship	Do not work specifically with this. It comes from their value creating activities.	Gain trust and relationships trough their NGO and MFI partners.	Gain trust with the customers through their partner Nidan.

Internal capability factors

What is our source of competence?

Table 14: Case companies' internal capability factors.

Subcomponent	MGP	Onergy	AST
Capability	They have local branches consisting of branch managers, construction staff, collectors and maintenance electricians, which responds in short period of time.	They have local office with one REC manager, technicians and sales person. They do maintance, after sale services.	Project manager and technical person which does the maintenance and have expertice in solar technology.
Partnership	No partnerships. Expertise is build in-house.	NGO and MFI partners.	TARA and NIDAN partners.

Competitive strategy factors

How do we competitively position ourselves?

Table 15: Case companies' competitive strategy factors.

Subcomponent	MGP	Onergy	AST
Competitive strategy	Compete with the non-renewables by designing an offering at low costs, which in turn gives the consumers the solution at low price. See phone charging as an important part of their product in order to convince customers.	By providing some products at an affordable price and providing consumer credit to their customers.	Providing a simple solution for the consumer and contributing to the social and rural development.

Economic factors

How do we make money?

Table 16: Case companies' economic factors.

Subcomponent	MGP	Onergy	AST
Revenue model	Customers pay a connection fee which includes one week of power. Then there is a weekly fee. They have received private investment.	Customers pay up-front for lanterns. For home systems the customers get loans from MFI to pay. Received some subsidies.	Customers pay a pre-registration fee than a Monthly fee. Donor funded.
Cost structure	Costs related to system vary based on size, which again is based on number of customers. And salary costs.	After going from providing just lanterns to home systems they increased their costs. And salary costs.	Invetsments cost and salaries.

Within early stage all ca se companies have experienced working in small teams where the management style was direct supervision as presented by Churchill and Lewis. As shown the case som companies employ different business models based on their goals. These companies have all experienced external challenges in rural electrification. In the following subsection the authors will present the environmental challenges which have been identified in the literature and trough interviews with the case companies.

8. Challenges with rural electrification in developing countries

The purpose of this chapter is to give an overview of the challenges related to rural electrification based on literature and the cases investigated in this study. These will form a basis for identifying critical business model components as stage related challenges reasons why some components may be more critical than others (Churchill and Lewis, 1983). The challenges will be presented within four categories. The study makes use of categorization to give the reader a sense of what type of challenges that is presented. In addition the challenges in each category can give an indication of which of the six components presented by Morris et al. (2005) that the challenges affect. What is discovered is that several challenges within each factor can also be related to challenges within the same factor. The categories are derived from literature and presented in chapter 8.1. The challenges are presented in chapter 8.2.

8.1. Categorization of challenges

Challenges related to rural electrification in developing countries can be classified into different categories. This is previously done by several scholars based on their research (Urmee et al., 2009) (Beck, 2004) (Javadi et al., 2013). One widely known theoretical example of such a categorization in relation to external factors is PESTEL (Haberberg and Rieple, 2008), that was presented in chapter 4.2.

The authors have identified a strong relation between several of the PESTEL factors and the categorization of challenges made by different scholars. Additionally the categorization made by the different scholars can be related to each other. Table 6 presents the PESTEL factors, in addition to the categorization made by Urmee et al. (2009), Beck and Marinot (2004) and Javadi et al. (2013), all of who identifies challenges in rural electrification.

Urmee et al. (2009) presents their categorization in relation to challenges identified in two different cases from Bangladesh and Fiji that are described in their article. On the other hand Beck and Martinot (2004) give a more general description of the challenges faced by rural electrification, presented within their three broad categories. Their last category is called market performance, but as the category contains the main challenges that the other scholars label financial and institutional, it is generalized by the authors to fall under the same category. Finally, Javadi et al. (2013) have through a literature review identified challenges of rural electrification, and given a categorization of these, based on several case studies.

Tabell 17: Categorization of challenges

PESTEL	**Urmee et. al.**	**Marinot & Beck**	**Javadi et. al.**
Political			
Economic	Economic	Economic	Economic
Social			
Technical	Technical (classified, but no challenges identified)		
Environmental			
Legal	Policy and legal framework	Legal and regulatory	Legal
	Financing and institutional capacities	Financial and institutional (market performance)	Financial
			Institutional
	General (classified, but no challenges identified)		

Based on a comparison of PESTEL and the categorization done by the scholars, and due to the nature of the challenges identified throughout the literature study, the authors have chosen to base the categorization of challenges on the following factors:

- Economic
- Legal
- Social
- Institutional

The reasoning behind, the choice of categories is given below.

Economic

The economic and the financial factors, derived by the scholars presented in table 17, are strongly related and such challenges are therefor gattered in one category, *economic*. The economic factor includes access to subsidies, capital costs (both initial and future), transaction costs and pricing policies. While the financial factor includes access to credit for both consumers and investors and access to necessary information in order to make sound economic decisions (Javadi et al., 2013, Urmee et al.,2009). The PESTEL economic-factor relates to the scholars content mentioned above of both the economic and the financial factor and the reason why can be demonstrated (Haberberg, 2008). One example of this link is the challenge of financing. Urmee et al. (2009) presents lack of

subsidies and lack of credit as challenges belonging to two different categories, economic and financial. In the same time he summarizes both under the economic category as lack of financing. In similar ways the content of the two categories affect eachother, and the authors have chosen to combine the categories and present the challenges below the economic and financial category as economic challenges. The category is viewed as important as most challenges identified in literature fall below it.

Legal

The category of legal challenges is another category presented by all scholars in table 6. Urmee et al. summarizes the category to include issues of inadequate legal frameworks and onerous requirements for small entrepreneurs. This is equivalent to what is defined by PESTEL (Haberberg, 2008). The category is chosen as several challenges identified by these scholars fall below the factors of content. One example is the lack of necessary legal framework in developing countries, which according to the scholars is an important prerequisite for entrepreneurs in order to deliver rural electrification (Beck and Marinot, 2004; Urmee et al. 2009).

Social

The third factor chosen to be used by the authors, social, is based on the relation between the PESTEL explanation of the social factor, and several of the challenges identified relevant to the factor and the study (Haberberg, 2008, Urmee et al., 2009, Javadi et al. 2013, Marinot and Beck, 2004). The author's observation is that the different scholars identify challenges within the category, but fail to address them as social challenges. For instance Javadi et al. (2013) focus greatly on the rural population's lack of education, which according to Urmee et al. (2009) leads to wrong use and lack of maintenance of the systems delivered. This combined provides the challenge of lack of both awareness and education amongst the rural population, which is discussed in the introduction of this thesis. Challenges like these make the social aspect of the entrepreneur's situation important to investigate.

Institutional

The institutional category relates to the company's assembly of and access to human resources, and their capacity and knowledge (Javadi et al, 2013; Urmee et al., 2009). Urmee et al. (2009) and Javadi et al. (2013) are the only scholars from those presented in table 6 that mention institutional, but there is a point to include this category. The offering and delivery of rural electrification involves working in remote areas characterized by a population with a low educational level (Urmee et al, 2009). Entrepreneurs are in need of creating a set of resources which enables them to do their work at such locations. There is for instance a need to improve the consumers awareness and educational level with regards to rural electrification (Urmee et al, 2009). When trying to build such resources the entrepreneurs are faced with challenges based on the external forces related to accessing workers and local partners. The authors has derby decided to include the category.

The remaining factors presented in table 17 will not be used in the presentation of challenges, due to their lack of relevance in relation to identified challenges. In the following, challenges relevant to this study are presented, based on the categorization presented above.

8.2. Challenges in relation to rural electrification and its environment

Entrepreneurs are faced with a wide set of challenges when building a company delivering rural renewable energy. This chapter will present these challenges and address how they affect the

company's business model design. The concrete business model choices and consequences regarding how the challenges are faced will be presented and discussed further in the analysis of this study, in chapter 9. In the presentation of challenges both literature and empirical data will be used, and the challenges are categorized in the following four categories; economic, legal, social and institutional.

8.2.1. Economic

Zeriffi (2011) presents three main economic issues related to rural electrification, which are supported several scholars (Javadi et al. 2013; Urmee et al., 2009). These are:

- The rural population's ability to pay
- The technical costs
- Access to financial resources

This chapter will present and discuss economic challenges based the structure of these three.

Low ability to pay

One of the main challenges when providing electricity in rural areas is the population's low ability to pay (Zerriffi 2011). In order for an entrepreneur to create a successful business he needs to design a business model enabling the customers to pay for the provided energy solution. The problem with most renewable energy systems is that they require high up-front costs and the rural population do not have the resources for up-front payment, as they lack access to credit (Newsom, 2013) (Urmee et al., 2009). In fact, rural poor are already spending money on energy solutions, but they are not spending it on the healthiest or cleanest products and services (E. a. Z. Wilson, L., 2009). According to Newsom (2013) it is more likely that users of energy will choose solutions that are cheap in the short term. This shows that the rural population are already spending money, but due to their low ability to pay they are choosing unhealthy energy options, such as kerosine, that they can manage to pay on a day-to-day basis.

The consumers can not afford making the investment that a renewable energy solution would require, and the entrepreneurs need to make business model decisions enabling the consumers to finance the investment cost. Wilson (2012) states that tariff arrangements, product pricing and strategic application of subsidies are all critical when ensuring that a product or service is affordable and at the same time covering the costs of production and maintenance, while Urmee et al. (2009) adds the importance of the consumers access to credit.

In most arguments, the case companies of this study agree with the scholars. All cases acknowledges that the consumers low ability to pay is a big challenge, stressing the issue of pricing their solutions based on the purchasing power of the consumers. This is done by pricing the product or service on a licence basis having the consumers to pay an amount on a regular basis. As the entrepreneurs are spending time for their return on investment, they indirectly offer consumer credit on the investment cost. Onergy additionally makes use of MFI partners, enabling the customers to invest in their solar home systems. On the contrary the cases do not have available subsidies directly lowering the price of the product and are not affected by tariff arrangements.

High investment cost

The renewable energy solutions have different costs, as they are based on different technology and are serving different needs (table 10 and 18). Most devices or systems have a high initial investment cost, while it provides productive use for the consumers at a low price (IFC, 2012). The high

investment cost becomes a challenge for the entrepreneur due to the consumers low ability to pay (Zeriffi, 2011), and the company will need to find a strategy that enables them to cover these costs until they eventually are covered by the consumers.

Table 18: Household-level devices and systems, and community-level mini-utilities initial costs (IFC, 2012)

Device/system	Initial costs
Solar lanterns	Medium
Rooftop solar home systems (SHS)	High
Biomass cookstoves	Low
Solar Kits	High
Community-level mini-utilities	High

To make an example, a solution such as a solar home system can have an initial cost as high as $500 (IFC, 2012). If having to finance this for a period for a number of customers, the demand for capital will be high. Based on the high initial costs due to technical investments the entrepreneur must do considerations with regards to what product or service the company should serve, what financing they can access through investments, subsidies or partners, and what kind of costs the company can afford to cover.

All case companies have pointed out the companies need to cover initial investments based on the consumers low ability to pay, but they still have faced the challenge in different ways. MGP have made a decision to own the system themselves, having a return on investment on three year. AST also own their system, but are charging a deposit for the battery devices they distribute. This up-front payment they see as necessary for the customers' commitment and respect for the device, but it still is a challenge as villagers struggle to be able to pay that as a one time up-front payment. Onergy find themselves in a situation distinct from the other companies, as they are offering a range of products, some of them demanding a much higher investment cost than other. They make use of MFI partners to tackle the challenge when selling the products with high investment costs. Otherwise they focus on selling basic solutions that is affordable for the consumer alone.

Lack of financing

For local entrepreneurs accessing finance is vital due the consumer's low ability to pay and high investment costs. This becomes challenging as the access to finance in developing markets is a major barrier, both for the end-customers and the commercial entrepreneurs (Zeriffi, 2011, Newsom, 2013). The entrepreneur will have to work purposely to acquire finance either through private or public investments or through subsidies.

Private investors do not invest in the market of rural electrification as it involves high risk (Javadi et al., 2013). Additionally a significant barrier to private investment in low-income energy markets is the need to generate an acceptable rate of return (Wilson E. 2013). The investment from private sector is believed to be vital for a programs' long-term sustainability, and for these reason different approaches has aimed at encouraging private sector participation across developing countries (Yadoo, 2010). In Kenya dealer networks offer consumer credit schemes, covering the entrepreneurs investment costs, for solar home systems, while in India and Sri Lanka investments has contributed to an emerging retail markets for local energy service companies. Investors like commercial lenders, social venture capitalists, local development banks, philanthropists and international development

agencies can play a strategic role in helping to catalyse commercial approaches to improved energy access (IFC 2012). For this reason it is important to local entrepreneurs to investigate their options when it comes to private financing. The case companies Onergy and MGP both started their business with need for financing, finding it challenging.

Raman, Murali, Sakthivadivel and Vigneswaran (2012) state that governmental financing providing financial incentives and subsidies to entrepreneurs is essential due to the heavy initial investment costs in rural electrification. According to Zeriffi (2011), absence of subsidies will constrain the entrepreneur to have to deal with rural consumers ability and willingness to pay. Zeriffi distinguishes subsidies by capital cost and consumption the following way:

- Capital cost subsidy: This form of subsidies can be technology dumps like giving solutions for free, low interest loans, grants or payments as a part of technology programs.
- Consumption subsidies: This aim to reduce the regular costs of obtaining electricity services and may involve free electrical programs or reduces tariffs.

The first subsidy will reduce costs of capital investments either by the end consumer of by a service or technology provider, while the second will reduce the consumers' regular costs while still providing the entrepreneur with the needed income. When receiving such subsidies the entrepreneur may have to follow certain requirements in order to receive the financial support. Either of these subsidies can be essential to local entrepreneurs. In order to balance between the consumers energy needs and the entrepreneurs' financial need the government should have an effective tariff and subsidy regime in place, but still this is an area of improvement. Both Onergy and MGP confirms the lack of subsidies in India, stating that they had to find other financial solutions in order to build their company and provide their services.

According to Tsai (2004) microfinance has emerged as a potential solution for bridging the gap between the supply and demand for rural finance. Microfinance gives access to finance for low-income households (Rao, Miller, Wang, & Byrne, 2009), enabling the entrepreneur to cut high investment costs, as the microfinance institution are providing the credit instead. Both in India and China, microfinance has included subsidized loans in government supported poverty alleviation programs and various donor and nongovernmental organization (NGO), but still there is a lack of access to credit for consumers (Urmee et al., 2009). In India the microfinance institutions in the market include not-for-profit institutions, mutual benefits cooperative societies and for profit non-bank finance companies (Rao, Miller et al. 2009). According to Rao et al. there are primarily two kinds of microfinance models:

- Self-help group model: consists of self-selected groups that collect the members' savings and provide loans out of the pot funds created.
- Grameen Bank model: gives loans to eligible members.

As pointed out one of the key challenges to rural electrification is the population's ability to pay. Local entrepreneurs need to have this in mind when designing their business model. The entrepreneurs need to cover their costs and secure their revenue stream. In order to cover the gap between what is needed financially and what the public can provide, there is a need for financing both from the public and private sector (IFC 2012). This remains a challenge as public financing alone is not adequate to meet the needs of rural electrification, while private investment is often limited (Charles M. Haanyika, 2008).

8.2.2. Legal

The lack of policy and legal framework as well as the improper use of subsidies are two of the main challenges with rural electrification in relation to the legal category (Urmee et al. 2009). These two challenges form the basis for this chapter, and will be discussed in relation to related issues affecting the entrepreneurs' business model.

Lack of policy and legal framework

The government's role in the expansion and affordability of rural energy is to formulate policy and establish supportive legal and institutional framework (C. M. Haanyika, 2006). Still, current energy policies in developing countries such as Bangladesh, do not favour the promotion of renewable energy systems, and the legal and regulatory framework does not support the development of market oriented rural electrification programs (Urmee et al., 2009). According to Zomers (2003), the poor results of a number of rural electrification projects in developing countries are due to the uneconomically low tariffs, lack of operational autonomy and in some cases extreme political interference. These issues have an important impact on the success of rural electrification projects, as the role of the government in making a supportive framework is eminent (Javadi et al., 2013).

According to Urmee et al. (2009) Bangladesh's lack of policy and legal framework is an important reason why less than 40% of the population are missing access to electricity. This shows how important it is that the national government provides appropriate enabling environment. Even though many developing countries have implemented different policies to bring electricity to rural areas, there are several cases like the one in Bangladesh (Javadi, et al. 2013).

Which political party that runs the country or region can also negatively impact the success of rural projects. In Sri Lanka the powerful national energy authorities and agencies focused on energy planning only at a national level due to their commercial orientation. Issues related to sustainable and clean energy could only be addressed at a decentralised level which made it necessary for decentralised planning. The problem was that this form of planning was non-existing in Sri Lanka as the provincial energy ministry did not have the vision or the mandate to think beyond rural electrification. This caused rural projects to fail (Urmee et al. 2009).

As the scholars above, MGP addresses the government's lack of a participating role in rural electrification. They tell that they initiated a cooperation with the local politicians in one of their first pilot villages, thinking that MGPs openness towards them and by this getting the politicians support would work in their favour. What they did not expect was that this would turn into a challenge. When a new political leader was elected they demanded bribes in order for MGP to continue their work, which created a need for MGP to change their strategy.

Improper use of subsidies

The renewable solutions compete against other energy solutions which the consumers already are familiar with. This becomes a challenge for the entrepreneur when they have to compete with other subsidized energy solution, such as kerosene, which steer consumers away from renewable energy solutions (Barnes D., 1996). This is a highly inefficient use of subsidies when the goal is to promote renewable energy products and services. Even though subsidies can be an invaluable tool for providing services to the poor, it can also distort the market and limit the success of otherwise commercially valuable offerings (IFC, 2012).

This way the government may negatively influence the entrepreneurs providing renewable energy solutions. In order for entrepreneurs to succeed with rural electrification the government needs to have a clear policy objective supported by effective strategies (C. M. Haanyika, 2006). The rural electrification policy should be integrated with national energy planning initiatives and rural development.

This challenge is confirmed by MGP, who mention that when establishing the pricing model of their business model they had to consider the pricing of substitutes and the related subsidies. For instance consumers receive subsidies for a certain amount of kerosene each month. This provides MGP with a challenge when it comes to pricing and profitability, as they have to design their model based on how much money rural consumers on an average spend on kerosene each month, withdrawing the value of the subsidies.

8.2.3. Social

The main challenges derived from scholars and cases within the social category relates to the consumers, their awareness and education, willingness to pay and trust for towards the entrepreneurs. This chapter will present the three challenges of lack of awareness and education amongst customers, low willingness to pay and lack of trust amongst consumers.

Low willingness to pay

According to Zeriffi (2011) entrepreneurs are constrained by the consumers' low ability and willingness to pay. ASTs partner TARA confirms this, explaining how they struggle with the consumers willingness based on mainly four things:

- Awareness factors:
    - The consumers lack of education, and thereby knowledge about the benefits of renewable energy solutions.
    - The consumers alignment with the thought that such services as energy should be free government support.
- Cultural factors:
    - The consumers habits of using traditional energy solutions such as kerosene.
    - The practice of traditional gender roles where the men make the decisions with regards to procurements, while the women and children of the household are those in need of the energy solutions.

This shows that the entrepreneur does not only need to enable the customers to pay, but also make the necessary choices with regards to their business model design and actions in order to make the consumers willing to pay for the solution.

Lack of awareness and education amongst customers

The consumer's lack of awareness and education affect the entrepreneurs' business model design in two ways, with regards to:

- Technology and benefit awareness amongst consumers, and thereby potential customers.
- Satisfaction of current customers.

This technology awareness as well as enhancing product quality assurance and to create quality standards is necessary when carrying out a rural electrification project (IFC 2012).

Improve consumers' awareness with regards to technology and benefits of solution

Even though there are long term benefits with renewable solutions, it is important to educate the consumers about this due to the rural populations' lack of education, in order for the entrepreneurs to acquire customers amongst the rural population. This must be done with regards to technology and benefits. Creating awareness will make customers able to see how the solutions are good choices in order to improve their quality of life (Javadi et al., 2013, Newsom, 2013).

This need for creating awareness represents a challenge for the entrepreneur due to the characterictics of the rural population, and as it adds upon regular marketing jobs a company need to do (Raman, et al. 2012). The challenge becomes apparent as these entrepreneurs are often running small companies where the area of operations is mainly local, also with limitations in terms of workers (Scott & Bruce, 1987). With few and localized resources as well as limited financial resources it is challenging to reach these masses with general knowledge of the renewable energy solution.

Improve customers' knowledge of how to experience full value of the energy solution

In order for users of rural electrification systems to experience full value, the providers need to educate them (Newsom 2013). Including this in the service of the company is a crucial success factor of the project, but solving this in a good way with the right balance of use of resources is challenging (Urmee, et al. 2009).

Two rural electrification projects, delivering home solar systems in remote areas in Fiji and Bangladesh, illustrates how teaching customers how to use systems correctly and when maintenance service is needed can do to the result of the project (Urmee et al. 2009).

The Fijian case was believed to be successful, but the surveys showed that 80% of the systems were not working due to components failures. No monitoring, maintenance service or spare parts were available at the project location, and some householders had bypassed the system, overload use of their batteries. Additionally those responsible of installation, maintenance, monitoring and tariff collection were not monitored. Communities had not been consulted before the systems were installed and no training was provided to the users on system use and simple maintenance (Urmee, et al. 2009). In contrary the case from Bangladesh showed how these issues could be dealt with in another way. Throughout the project they consulted users before installation, disseminated knowledge about how to use and maintain the systems in addition to providing access to maintenance support and spare parts. The project lead to a great success, with the entrepreneurs being confident due to their 100% positive customer feedback. This example illustrates the importance of creating necessary awareness and knowledge as well as the need for the right after sales services.

All cases studies tell that they are faced with the same challenges due to lack of awareness and education. This affects both their choice of marketing, teaching and after sales services. Onergy mentioned one example where they were met by villagers using solar panels as a serving tray when serving coffee. Accessing necessary resources and building systems that enables the business to create awareness and to provide customers with necessary training is a challenging process met by the entrepreneurs, standing as an important success factor for rural electrification projects.

Lack of trust amongst customers

The challenge of lack of trust amongst consumers was not identified throughout the literature review, but with two of the three case companies, Onergy and AST. They addressed the need for a

local partner due to the population of rural villages lack of trust in new entrants in their local community. They described this trust as challenging to build, but necessary in order to succeed in acquiring customers. Thereby they see it necessary with a local anchoring in their projects, affecting how they develop their business model with regards to acquiring resources and activities. In the contrary MPG state that they face no trust issues entering new communities and villages.

8.2.4. Institutional

The institutional category addresses the assembly of and access to human resource. The main challenge within this category is the lack of local skilled workers both in relation to hiring workers and getting partners (Javadi et al., 2013).

Lack of local skilled workers

As the entrepreneurs within the scope of this study have to perform their operations in remote areas, with a population characterized by low education they face a challenge with regards to hiring skilled people or partnering with local organizations. Skilled workers are not willing to work in rural areas unless they get substantially greater pay and special benefits, and local workers and community based organizations need an increasing level of awareness and knowledge in order to perform the activities of the entrepreneurs (Javadi et al., 2013). Either way the entrepreneur have to make a decision upon how to gather the resources needed in order to perform the activities of the company.

Facing this challenge, developing the company's business model design there are several things the entrepreneurs have to take into consideration. If deciding upon moving or training workers extra costs will emerge. While if deciding to use a local organization as a partner may also provide challenges in terms of level of education (Javadi et al., 2013). Partnering with an organization will require training, and still the entrepreneurs' level of control is low. Activities may be performed wrongly and feedback from the market may stop with the partner and not reach the entrepreneur. Due to such things the entrepreneur may experience a loss of tacit knowledge. Still, empowering rural people, letting them be a part of shaping the course of local development are in favour of the rural electrification (Yadoo 2010).

All case companies of this study agree that the issue of lack of skilled workers is a great challenge, which they have chosen to solve in different ways. For instance AST chose to hire a local entrepreneur to perform their distribution. According to Prahalad and Hammond (2012) distribution is a highly important job when doing business in rural regions, and AST got to experience this first hand. The combination of them solving an energy solution in need of daily distribution, and a partnership that did not work led to loss of current customers and struggles with acquiring new customers.

8.2.5. Main challenges of rural electrification summarized

Table 19 summarizes the main challenges identified in relation to rural electrification in developing countries related to the specific macro-environmental factors; economic, legal, social and institutional. These challenges are based on the literature review and the case companies of this study, and the classification done by the different scholars and cases is shown in the table.

Table 19: Summary of main challenges related to rural electrification, and the scholars and cases presenting these.

Category	Challenges within rural renewable electrification	Scholars and cases
Economic	Low ability to pay	Javadi et al., 2011, Zeriffi, 2011, Newsom 2013, Urmee et al., 2009, Wilson, 2009, MGP, AST, Onergy.
	High initial investment costs	Javadi et al., 2013, Urmee et al., 2009, IFC, 2012, Zeriffi, 2011, MGP, AST, Onergy, Nidan.
	Lack of access of credit for consumer	IFC, 2012, Zeriffi, 2011, MGP, 2014, AST, 2014, Onergy, 2011, Nidan.
	Lack of financing for the entrepreneur	Zeriffi, 2011, Newsom, 2013, Javadi et al., 2013, Wilson E., 2013, Yadoo, 2010, IFC, 2012, Raman and Murali et al. 2012, Onergy, MGP, Tsai, 2004, Rao et al. 2009, Urmee et al, 2009, Haanyika, 2008.
Legal	Lack of supportive policy and legal framework	Urmee et al., 2009, Haanyika, 2006, Zomers, 2003, Javadi et al., 2013, MGP.
	Improper use of subsidies	Urmee et al., 2009, Barnes D., 1996, IFC, 2012, Haanyika, 2006, MGP.
Social	Low willingness to pay	Zeriffi, 2011, Tara, 2013.
	Lack of awareness and education amongst customers	IFC, 2012, Javadi et al., 2013, Newsom, 2013, Raman et al., 2012, Scott and Bruce, 1987, Urmee et al., 2009, MGP, AST, Onergy.
	Lack of trust amongst customers	Onergy, AST, MGP.
Institutional	Lack of local skilled workers	Javadi et al., 2013, Yadoo, 2010, MGP, AST, Onergy, Prahalad and Hammond, 2012.

The ten challenges derived in rural electrification within the four environmental factors, economic, legal, social and institutional, will be made use of in the following chapter, forming the basis of the analysis of identifying critical business model components. The challenges need to be faced by the entrepreneurs through the choices made in relation to their business model. How this can be done, and how it relates to Churchills early stage priorities and the business model subcomponents derived from Morris et al. (2005) is presented in the following section.

9. Critical components

This chapter aims to execute the process of identifying the critical business model components for an early stage entrepreneur, delivering renewable energy to the rural population of developing countries. The process is described table 20.

Table 20: The executed process of identifying critical business model components.

Step	What is executed?	Why is it executed?
A	Identification of choices and consequences from literature and cases. The consequences are framed in such a way that it gives the reader an indication of which early stage priority is being affected.	In order for the entrepreneur to respond to the external challenges it is necessary to know which choices that needs to be made.
B	The challenges with its the choices and consequences are linked in a causal loop diagram.	The connection is made to see how the choices/consequences for one challenge may affect another challenge and its choices and consequences.
C	Identified rigid and flexible consequences and which consequences that are negatively or positively affecting the early stage priorities.	In order to identify which choices and consequences that are critical and which are important the authors have looked at rigidity and flexibility of consequences. In addition it has been identified how the choices and consequences meet the early stage priorities.
D	Introducing subcomponents by identifying the connection between the choices and consequences.	To arrive at the critical subcomponents the subcomponents must be introduced.
E	Proposition development	In order to facilitate further research propositions of the critical business model components are proposed.

9.1. Identification of business model choices and consequences based on the challenges of rural electrification (Step A)

As presented in chapter 3, every organization has a business model, which consists of choices the management must make and the consequences of these choices. The choices and consequences are what determine the logic of the firm, the way it operates and how it creates value for its stakeholders (Casadesus-Masanell and Ricart, 2010). This first step of the analysis of identifying the critical business model components makes use of this theory.

The authors seek to present only the relevant choices and consequences with regards to the challenges the entrepreneurs must work with when designing their business model. This limitation is chosen as nothing meaningful can be concluded by considering choices and consequences in full richness of detail when conducting an analysis of an organization's business model (R. R. Casadesus-Masanell, John E., 2007). An analysis of an organization´s business model that takes into consideration every choice and every consequence is impractical. For this reason the authors have made a consideration of relevant choices and consequences which is based on findings in literature and the three case studies, MGP, AST and Onergy. For instance all cases addresses how they in order to solve the challenge of *lack of local skilled workers*, must either choose to train local workers or get access to skilled workers through partnerships.

When performing the analysis, early stage priorities are being used as one of the decision criterias as the research question aims to identify critical business model components in an early stage. The early

stage priorities can be linked to the consequences, and thereby also the choices. By doing this linking, it can be evaluated whether a consequence of a choice help to reach one or more of the early stage priorities, or whether it has a negative affect on the priorities. In order to illustrate this for the reader, the formulation of the consequences is formulated in such a way that it indicates which of the following six early stage priorities is affected:

- Get enough customers
- Deliver products
- Provide well enough service
- Expand to new customers
- Get enough money to cover cost
- Provide suitable offering

The choices and consequences are presented in figure 4 to 8, in relation to the challenges. As some of the challenges require the same choices to be made in order to solve the challenge, they are presented in the same figure and discussed together.

Figure 3: Illustrates how the content of figure 4-8 is presented

Low Ability to Pay and Improper Use of Subsidies

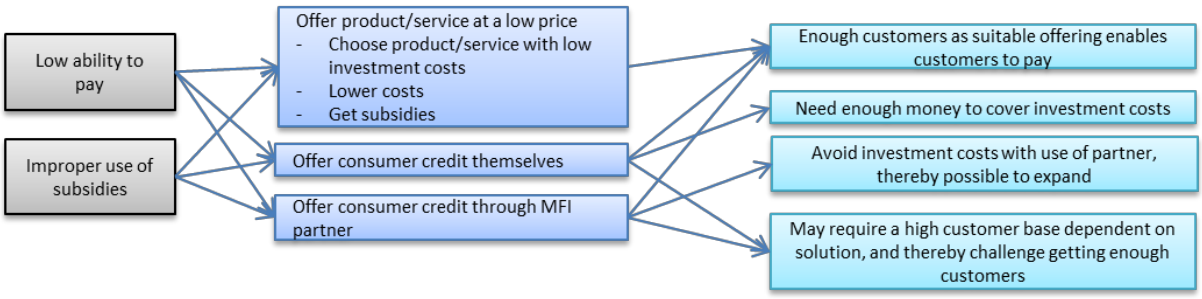


Figure 4: Presenting the choices and consequences of the challenges "*low ability to pay*" and "improper use of subsidies".

Rural population's low ability to pay is according to Zerriffi (2011) one of the main challenges when providing electricity to these areas. The reason for this is that there is a lack of access to credit for consumers in developing countries (Urmee et al., 2009). In order for the entrepreneur to generate revenue, the customers' ability to pay is crucial. He needs to ensure the customers purchasing power by finding a way to cover the gap between supply and demand for rural finance. Still, when developing a strategy for pricing, the entrepreneur does not only face this challenge. Many developing countries' goal is to promote renewable energy solutions. Governments still provide subsidies to consumers using traditional energy solutions. This leads to an improper use of subsidies as entrepreneurs delivering renewable energy need to compete with other subsidized non-renewable solutions (Barnes D., 1996; IFC, 2012). Entrepreneurs alone can not change this, but they still need to face the challenge in relation to the consumers' low ability to pay, as the choices for

solving these challenges are the same. This means developing a strategy enabling the customers to pay and to compete with the subsidized non-renewables. The entrepreneurs' possible choices for doing this are presented in figure 4. It is also indicated which consequences that may lead from making the different choices.

One obvious choice for the entrepreneur is to offer a product or a service at a low price at a level the consumers can manage, and which competes with the substitutes. This will enable customers to pay, increasing the entrepreneurs' sales volumes, helping reach the early stage priority of enough customers. In order to be able to provide such a low price the entrepreneur is dependent on either having subsidies or cutting costs. IFC (2012) presents, different devices can be sold at different prices, and basic solutions such as solar lanterns can be sold as low as $20 each. Selling such simple stand-alone products the entrepreneur will have low investment costs. Still in order to provide these low prices the entrepreneur must focus on keeping costs in general at a minimum. Getting subsidies may also enable the entrepreneur to keep the prices at an acceptable level.

Other solutions such as solar home systems and solar kits cost are more expensive (IFC, 2012). Providing such solutions require more effort from the entrepreneur in order to face this challenge. Most renewable energy systems require high up-front costs, and the entrepreneur need to give the consumers the resources needed in order to make the up-front payment (Newsom, 2013). This is also necessary in order to compete with traditional energy solutions, which often do not require high initial costs. If choosing to provide such a product the entrepreneur can face these challenges by offering consumer credit, which can be offered either by the entrepreneur or by a partner. If the entrepreneur chooses to provide this himself then the need for investment gets increased due to the cover the costs, which are associated with providing such service. If using a partner, the entrepreneur avoids the great liquidity demand of having to offer this service, lowering the entrepreneurs demand for financial liquidity, which again makes it easier to expand. Either of which, providing customer credit may require high customer base. As presented, home systems are quite expensive and if the purpose is to provide consumer credit to cover the investment costs than the entrepreneur will have to get a required number of customers. If this is not possible it will have a negative affect on the entrepreneurs entry to the market.

A partner offering credit would typically be a Microfinance Institution (MFI), who works to increase the purchasing power of rural population, through microfinance and providing consumers with an opportunity to make beneficial investments. The case company Onergy does exactly this, making use of an MFI partner to provide customers with the credit to invest in Onergy's products. MGP, on the other hand, have chosen to provide the credit themselves. In each village they install their micro-grid their customers pay back the investment done by MGP in 3-4 years.

There are presented three ways of competing with substitutes and enabling customers to pay. What is common with all three is that they help the entrepreneur get enough customers through selection a suitable offering to fit their choice. One thing that may oppose this is if the entrepreneur decides to provide a solution that requires a certain number of customers in order to make installations, such as a big solarpanel serving many households. This may delay installation, and thereby also income, in the wait for a sufficient number of customers.

High Initial Investment Costs and Lack of Financing for the Entrepreneurs

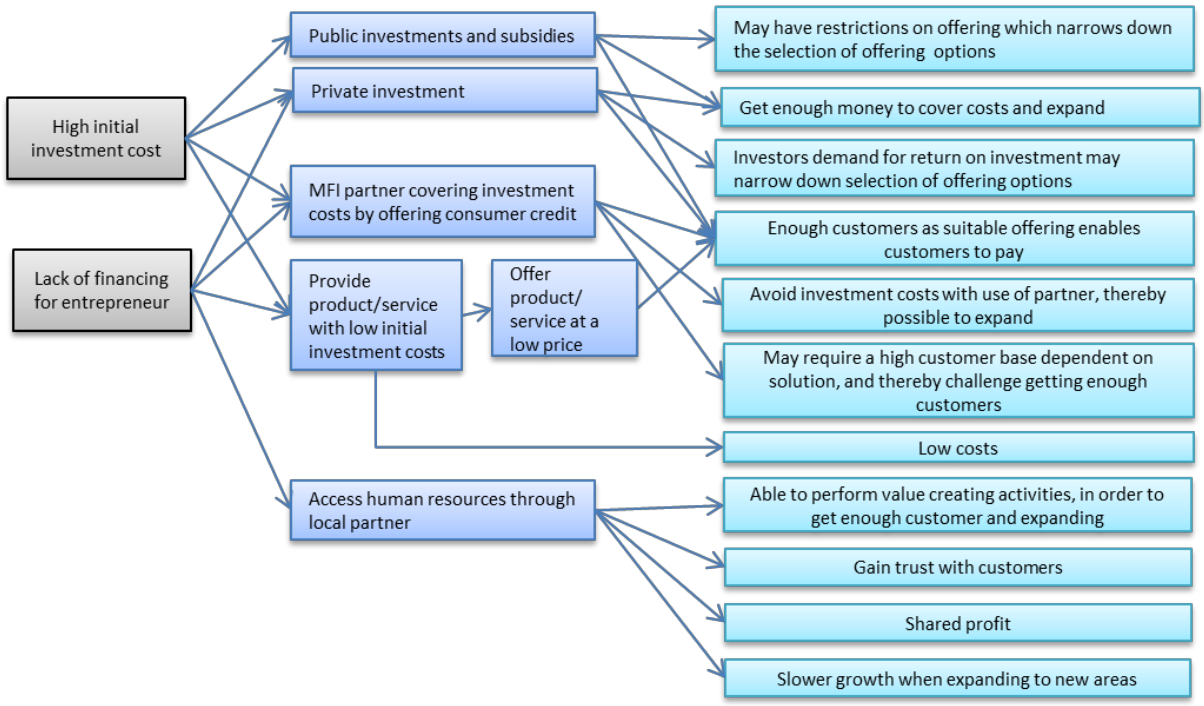


Figure 5: Presenting the choices and consequences of the challenges *"high investment costs"* and *"lack of financing for entrepreneurs".*

Rural electrification involves heavy initial investments (Raman, et al., 2012). These investment costs pose a barrier for entrepreneurs due to the lack of capital in developing markets (Newsom 2013). The entrepreneur needs to make a decision about how to cover this high initial investment costs due to technology investments as well as other costs of establishing and running a company. Due to the consumers' low ability to pay, the entrepreneur cannot rely on them to cover the investment. Entrepreneurs can raise public or private financing. Other choices can be to use MFI partner to cover the investments by offering consumer credit or to choose to offer products or services requiring low investment costs. Additionally he can choose to partner with a local partner in order to access resources and at the same time avoid salary costs. These choices and its consequences are presented in table 5, and are discussed below.

Raman et al. (2012) state that, governmental financing is essential due to the heavy investment costs in rural electrification. On the downside such public financing are often framed within certain guidelines, narrowing down the entrepreneurs options (Zeriffi, 2011), thereby affecting the choice of suitable offering. If affected by such guidelines, the entrepreneur may need to lower his prices, lowering the company's profit, as the restrictions may force either a specific offering or other guidelines on the entrepreneur. Alternatively investments from the private sector can be important in order to face this challenge. According to Wilson (2013) getting private investment is a challenge due to the fact that generating acceptable rate of return in low-income energy markets is difficult. In order for the entrepreneur to get this investment he needs to make choices when it comes to the offering, that allows an acceptable return on investment, focusing on high profit due to low costs

and/or high price. Raising money makes it possible for the company to cover costs, make the initial investments and expand faster in terms of revenue and number of consumers reached. The case company MGP has successfully managed to get investors, due to their focus on low costs and scalabilit.

If the entrepreneur is not able to raise money, or chooses not to, there are still two options. Both in which let the entrepreneur avoid investment costs. The first option is to partner with a MFI, in order to cover the investment costs and give the customers access to finance (Rao et al., 2009). This enables the entrepreneur to expand faster due to the low need for financing. The last option of the entrepreneur is to provide simple stand-alone products with little demand for investments (IFC, 2012). This can be priced low, enabling customers to pay, but the entrepreneur must still focus on keeping costs low in order to profit from selling such products. Both options for avoiding initial investment costs meet the challenges of costs and financing, enabling customers to pay for the provided energy solution and making the company able of benefit from high volumes.

In addition to the investment costs related to technology investments, the entrepreneur will face additional costs related to especially human resources, as value adding activities need to be performed. If not choosing to or being able to raise money, one option for the entrepreneur is to cut costs through accessing human resources through partnering with a local organization.

Lack of Supportive Policy and Pegal Framework

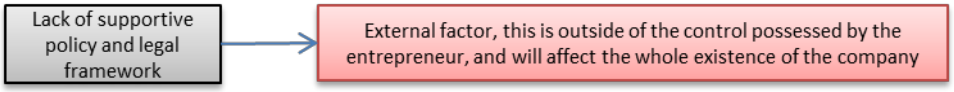


Figure 6: Presenting how the entrepreneur can respornd to the challenge "*lack of supportive policy and legal framework*".

The government's role in the expansion and affordability of rural energy is to formulate policy and establish supportive legal and institutional framework (C. M. Haanyika, 2006). Still the existing framworks of developing countries do not support the development of market oriented rural electrification programs (Urmee et al., 2009). As entrepreneurs cannot change the policy and legal framework themselves they have to work according to it. It is a general system that will affect the whole existence of the company and the whole process of the business model design. Therefore each entrepreneur needs to take into consideration this factor when looking to deliver rural electrification.

Low Willingness to Pay, Lack of Awareness and Education Amongst Customers and Lack of Skilled Workers

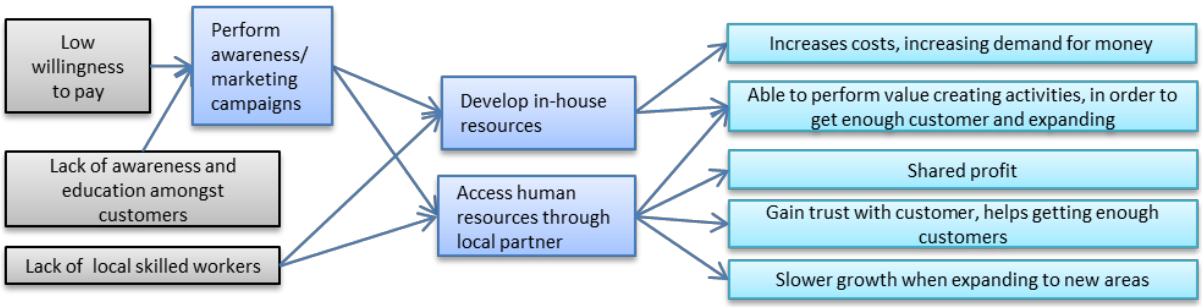


Figure 7: Presenting the choices and consequences of the challenges *"low willingness to pay, lack of awareness and education amongst customers"* and *"lack of local skilled workers".*

The three challenges of low willingness to pay, lack of local skilled workers and lack of awareness and education amongst customers are closely linked, as the options for facing the challenges are the same. According to TARA, the consumers' low willingness to pay is based on cultural factors, as well as the consumers' lack of awareness. As the entrepreneur cannot change the culture of the consumer, he needs to solve the willingness by educating the customers, creating awareness. When recruiting customers, additional education about the solutions' technology and need for maintenance is important, due to the low educational level of the rural population (Newsom, 2013, Urmee et al., 2009). AST state that, in order to perform this job of creating awareness and education the entrepreneur need human resources. All cases confirm that this becomes an issue when the access to skilled workers in the rural areas is limited due to the low education level in these areas. When solving the challenge of lack of local skilled workers, the other two related challenges need to be kept in mind, as there is a need for workers to perform awareness and marketing campaigns as well as educating the customers about the energy solution. Due to this there is especially necessary with technical skills.

The case companies state that in order for the entrepreneur to access workers he can choose from either developing the needed competence in-house or to access it through a local partner. Hiring workers is a challenge due to the combination of it being hard to raise financing, and that such workers either need to be trained locally or moved to the rural location, both increase the costs and affecting the financial need for the company. Alternatively a choice is to access resources through local partnerships such as AST and Onergy. This can also enable them to create awareness and educate through value creating activities, and can in the same time help gain trust amongst the customers, as the local partner is known to the consumers. On the negative side the local partners often only operate in one area, making it necessary to establish a new partnership if expanding to new areas which slows down the process of expansion. This may affect the growth rate of the company, in addition to force the entrepreneur to share the company's profit.

What ever the entrepreneur chooses, accessing workers will greatly contribute to reaching several of the early stage priorities as the work they do help provide the needed service and deliver the product. Due to performing this job well the company will gain more customers, helping them reaching enough customers and expanding.

Lack of Trust

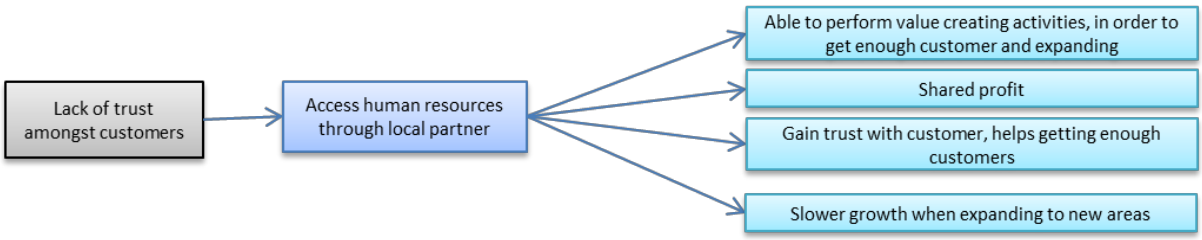


Figure 8: Presenting the choices and consequences of the challenge *"lack of trust amongst consumers".*

As discussed above accessing human resources is an option to gain trust from consumers. The challenge of *lack of trust amongst consumers* was identified only by Onergy and AST. They mention the challenge as necessary to be faced in order to operate in rural areas. Further they state that this trust can only be accessed through choosing to have a local partner. This local anchoring do according to them help in the process of creating awareness and acquiring customers through gaining trust, and that way being able to reach enough customers. What is interesting when studying this challenge is that MGP, which is the company that has expanded the most, say that they do not use partners and that they have not experienced any trust issues. This conflict of reasoning may indicate that there are additional factor affecting the relevance of this challenge. The authors perceive that in this case the goal of the company is important. MGP see villages, as clusters of potential customers were they provide standard solutions at a low price, while Onergy and AST look at the rural areas where they operate as project of longer horizon. These two cases do not only plan for electrification, but for rural development, and thereby experience a greater need for trust.

As the first step of the process of identifying critical components we linked challenges in rural electrification with the choices they present to entrepreneurs and how the consequences of these choices may impact their achievement of early stage priorities. In the following subsection the challenges, choices and consequences will be linked in order to create an overall picture of the entrepreneurs early stage business model design options. This linkage will then be put in relation to how the early stage priorities are achieved and the business model theory of rigid and flexible consequences, on the way to identifying critical early stage business model components.

9.2 Linking challenges in a causal loop diagram (Step B)

The choices and consequences for each choice for the external challenges have been presented. There is a relationship between choices and consequences and this occurs over time. Looking at the external challenges, their choices and consequences it is possible to see that their dynamics generate a linkage. Ricart and Casadesus-Masanell (2007) present what is called causal loop diagram, which shows how different element of a business model relates to each other through a causal loop. By implementing this theory the authors will present a causal loop diagram for business models in rural electrification, demonstrating how challenges, choices and consequences are linked to each other. This linkage help the authors view all the challenges and their link to choices and consequences together, which helps to identify the different choices and consequences, may affect each other and

the external challenges. Figure 9 presents this linking, and the small figure in the left bottom corner of the figure explains how the content of the model is organized. In the following the authors will present an explanation for why the linkages are being made.

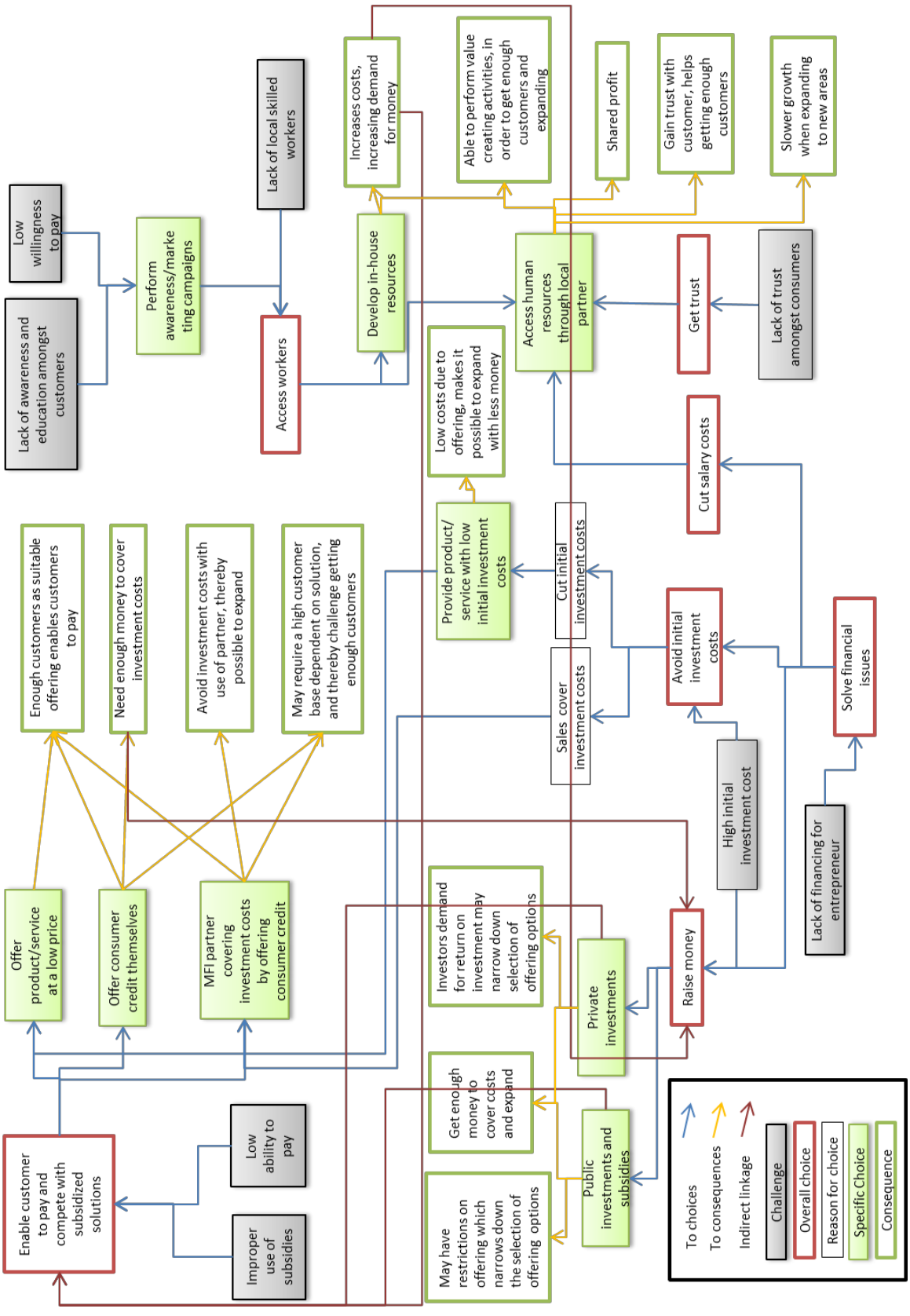


Figure 9: Causal loop for business model representation in developing countries.

The choices and consequences for the external challenges are represented in the causal loop in figure X. The authors have identified that some external can be met by the same overall choices. The external challenges improper use of subsidies and low ability to pay are two challenges the entrepreneur can respond to by competing with subsidized solutions and that will enable the customer to pay. If the entrepreneur chooses to meet these challenges by providing consumer credit himself it will lead to the necessity of raising money, causing a loop, as they need to cover investment costs. This is indicated by the red arrow between the consequence of need to cover investment costs and the overall choice of raise money.

Getting finance is a challenge itself due to the lack of financing for the entrepreneur as a result of the requirements the entrepreneur needs to fulfil. Even though getting investment in this market is a challenge there still is possibility to raise money by raising public or private investment. By receiving subsidies the entrepreneur can offer his solutions at a low price, which the consumer are able to pay. Raising finance is also an overall choice that can help the entrepreneur meet the challenge of high initial investment cost, enabling them to price at a level that customers can pay. Other ways of solving the financial issues is by avoiding costs. This can be done both by avoiding investment costs and salary costs. This will then again affect the entrepreneur's choices when it comes to offering and use of manpower as demonstrated in the figure. The lack of finance is connected to the high investment costs, which can be linked to the same choices, except the one addressing salary costs. If the entrepreneur is able to raise money, he will also be able to enable customers through pay through either low prices or consumer credit. This is indicated by the red arrows from private and public investments.

The three challenges of; lack of awareness and education amongst customers, lack of local skilled workers and low willingness to pay, can all be solved by addressing the same choices. One of the specific choices the entrepreneur can make, to develop in-house resources, results in increasing the costs due to hiring and training workers. Due to this the consequences of increased costs is also linked to the entrepreneurs overall choice to raise money. If the entrepreneur chooses to face these three challenges by entering a partnership with a local organization it will also help solving the forth challenge, lack of trust amongst consumers, in addition to the previous three, gaining thrust amongst consumers through the partner.

9.3. Causal loop diagram with type of consequence and early stage priorities (Step C)

When designing the business model the entrepreneur need to be full aware of how sensitive the consequences are to the choices that generate it. It is necessary for the entrepreneur to know which choices that are easy or difficult to get back from. The question that has been asked to identify the type of consequence is the following: If the entrepreneur changes the choice he has made how quickly will the consequence be changed? If the consequence is flexible it means that the consequence is sensitive to the choices that generate it while rigid means that the consequence do not change rapidly with the choice that generate it (Ricart and Casadesus-Masanell, 2007). Each of the consequences derived from responding to the challenges have been evaluated due to this. The evaluation is shown and explained in table 21, and are also indicated in figure 10.

Table 21: Rigid and flexible consequences.

Consequences	Rigid/ flexible	Description
Enough customers as suitable offering enables customers to pay	Flexible	If the entrepreneur do not offer consumer credit or a product at a low price which the consumer is able to pay for the entrepreneur will immediately experience a decrease in volume as the consumers will not afford to buy their solution.
Need enough money to cover investment costs	Rigid	If you stop offering consumer credit for upcoming customers you still need the liquidity to cover the credit that you have given to current customers. This costs will remain, but you will not add on further credit.
Avoid investment costs with use of partner, thereby possible to expand	Flexible	Once the entrepreneur stop using the MFI partner he will need to cover the initial investment costs of new customers.
May require a high customer base dependent on solution, and thereby challenge getting enough customers	Rigid	Offerings based on consumer credit are often more extensive, such as solutions delivering electricity to several households or entire villages. These may require a certain number of customer. If the entrepreneur will stop providing consumer credit, he thereby must change his offering. It will be a time consuming process, and thereby the consequence is rigid.
May have restrictions on offering which narrow down the selection of offering options	Rigid	The entrepreneur builds the offering based on the public requirements and thereby the entrepreneur can not change his offering over night to generate higher profit. Additionally you stop receiving money/loan, which gives an extra challenge in order to get a higher profit.
Get enough money to cover costs and expand	Rigid	Getting financing can help the entrepreneur cover his investments costs and operating costs. Ones the money is raised it will be difficult for the entrepreneur to go back on that choice.
Investors demand for return on investment may narrow down selection of offering of selection	Rigid	Private investors demand a certain profit on their investment. In order for the entrepreneur to genereate the necessary profits he may need to consider his offering, which may negatively affect the entrepreneur if his personal goal do not fit with the required offering.
Low costs, due to offering makes it possible to expand with less money	Flexible	If the entrepreneur were to change his offering from a product with low investment costs, such as simple stand alone products, to some other offering the change of offering can occur rapidly as stand alone products does not require big installations.
Increases costs, increasing demand for money	Flexible	Once the entrepreneur stop having hired workers, his increased salary costs disappear.
Able to perform value creating activities, in order to get enough customer and expanding	Flexible	At once the entrepreneur stops his cooperation with a partner or fire his hired workers his ability to perform the value adding activities disappear.

Shared profit	Flexible	If you stop using a partner, you do not need to share your profit. You may have a contract, but regardless the entrepreneur will not keep paying for a job the partner is not doing.
Gain trust with customer, helps getting enough customers	Rigid	You build trust over some time, and it does not disappear once the entrepreneur stop using a partner
Slower growth when expanding to new areas	Rigid	If the entrepreneur decide to not use his partner he will not expand faster before he has build the needed in-house competence to perform the same job, or before he found a new partner.

In addition to evaluating whether consequences are rigid or flexible the authors have made use their key points of the early stage priorities derived from Churchill and Lewis' (1983) and Teece (2010) to ask the following question:

When the entrepreneur has made a certain choice how does the consequence of that choice help the entrepreneur achieve the early stage priorities?

In order to meet the early stage priorities the consequence should be positively affecting the early stage priorities. If the consequence is rigid it means that it will not rapidly go away if the choice that generate it is not preformed properly. This is the ideal situation for the entrepreneur. If the consequence is flexible it means that the consequence will rapidly change ones the choices that generate it is changed. These choices are important to get right.

The consequences that do not meet the early stage priorities can be come critical if they are rigid. For the entrepreneur these consequences means that it will take time for him to get around to make the choices that generates the consequences that do help him achieve the early stage priorities. The ones that are flexible will be easy to change and are therefor not considered critical.

Addressing the early stage priorities help identifying what challenges and choices are crucial to work with for an early stage company delivering rural electrification in order to reach the priorities of early stage. Table 22 will present the linkage. If the consequence affects an early stage priority negatively this is shown by representing it with the colour red. What is derived from this table is illustrated in figure 10, and will be made use of in the further analysis.

Tabell 22: Consequences' affect on the early stage priorities.

Consequences	Early stage priorities	Description
Enough customers as suitable offering enables customers to pay	Get enough customers Provide suitable offering	Selecting an offering that meets the customers' ability to pay enables the entrepreneur to get high volume, which is related to getting enough customers.
Need enough money to cover investment costs	Get enough money to cover costs	By providing consumer credit themselves the entrepreneurs will need to get financing to cover the liquidity needed due to investment costs. By making the choice that leads to this consequence the entrepreneur can only meet the early stage priority by getting investment.
Avoid investment costs with use of partner,	Expand to new customers	If using an MFI partner or selling energy solution requiring low investment costs, financially he will need less capacity if increasing his

thereby possible to expand		customer base.
May require a high customer base dependent on solution, and thereby challenge getting enough customers	Get enough customers	If the entrepreneur is providing a solution that requires a certain amount of customers in order to make installations, it may be that he can not increase his customer base even though he has some potential customers, if the number of potential customers is below the required number.
May have restrictions on offering which narrow down the selection of offering options	Provide suitable offering	The requirement that comes with public investments may affect what offering the entrepreneur can provide to the consumers such as area specific solutions based on area conditions.
Get enough money to cover costs and expand	Expand to new customers Get enough money to cover costs	Getting financing can help the entrepreneur cover his investments costs and operating costs. Ones the money is raised it will be difficult for the entrepreneur to go back on that choice.
Investors demand for return on investment may narrow down selection of offering of selection	Provide suitable offering	Private investments may have affect on what the entrepreneur can provide. Investors require return on their investments and in order for the entrepreneur to provide this return he needs to design his offering I such way that it can generate the necessary profits in a given time period.
Low costs, due to offering makes it possible to expand with less money	Provide suitable offering Expand to new customers	Lower costs limits the entrepreneurs selection of offering to the simpler solutions. In addition the lower costs may lead to the ability to expand easier due to the money needed to expand is less than with high costs solutions.
Increases costs, increasing demand for money	Get enough money to cover costs	As the choice of developing in-house resources increases the companies salary (and maybe training) costs, the entrepreneur will experience an increased need for financing.
Able to perform value creating activities, in order to get enough customer and expanding	Get enough customers Provide well enough service Deliver well enough Expand to new customers	Access to skilled worker leads to the ability to perform the activities that creates value. With workers in place the entrepreneur can provide a service and deliver their offering well enough to their customers. In return this may lead to the entrepreneur getting the customers required to become viable. In addition having access to workers means having the manpower required to expand.
Gain trust with customer, helps getting enough customers	Get enough customers	For some entrepreneurs, trust is a prerequisite in order to gain customers. For these, the trust gained from customers will therefore contribute to get enough customers.
Slower growth when expanding to new areas	Expand to new customers	The use of a local partner may affect the entrepreneurs' ability to expand his business to new areas. Based on the areas the partner is represented the entrepreneur may 1) need to establish new partnerships if their current partner is not represented in the new area or 2) only expand to areas where their current partner is represented. Either way this will affect expands possibilities.

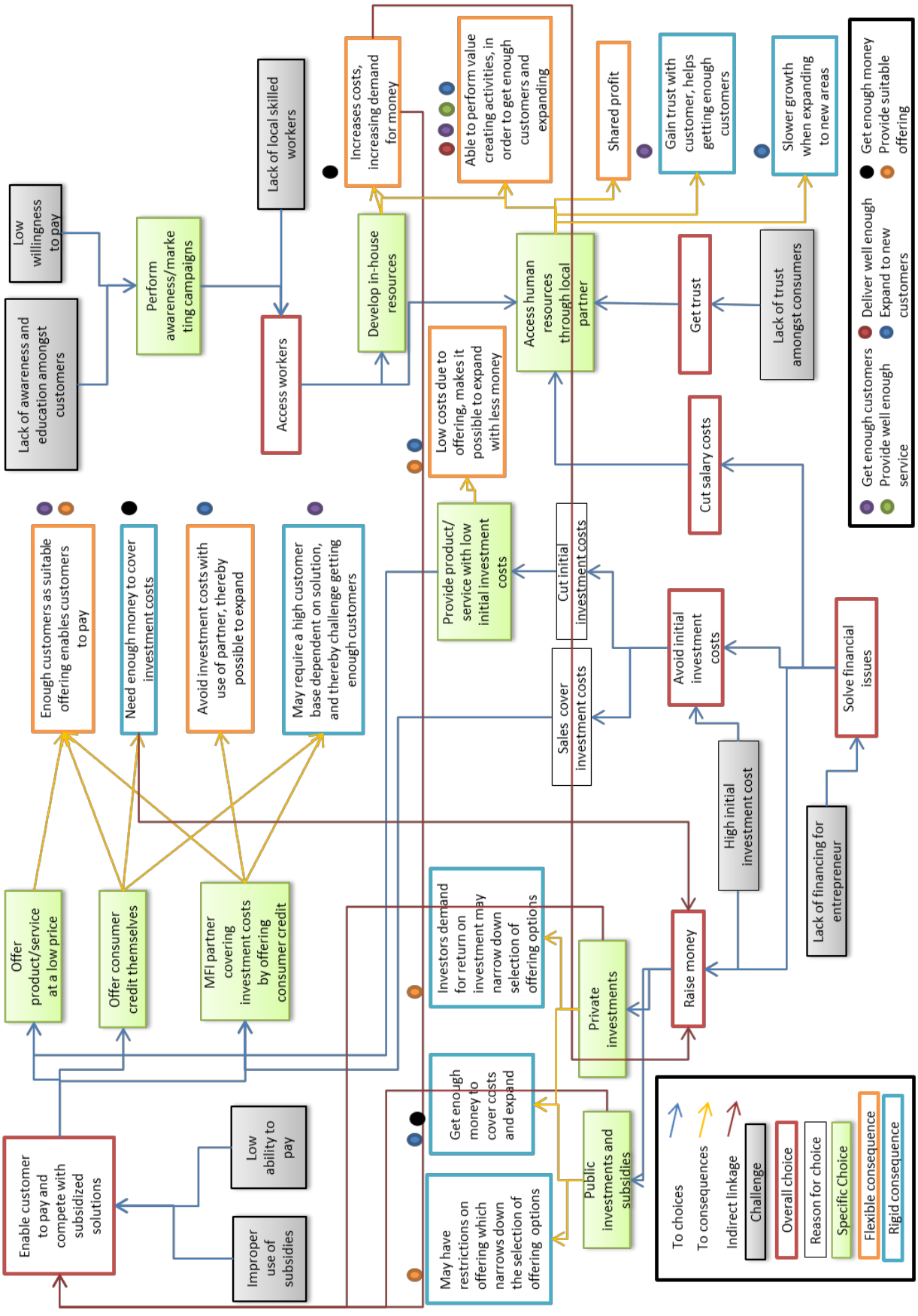


Figure 10: Causal loop for business model representation in developing countries, including representation of type of consequences and early stage priorities.

9.4. Business model components into choices/consequences framework (Step D)

Introducing business model subcomponent

After identifying, which early stage priorities is achieved by the consequences generated from the specific choices and the identification of which of the consequences as flexible or rigid, the authors have identified the subcomponents that are related to these. The linkage is shown in table X.

Based on the consequences' rigidity and flexibility and whether they affect the early stage priorities positively and negatively the authors have identified the choices and consequences that are critical. As presented, the authors will introduce the subcomponents that are affected from the choices and consequences. The reasoning behind this is the untraditional view of business models as choices and consequences presented by Casadesus-Mansanell and Ricart (2010). Therefor the authors want to make the connection to the traditional way of looking at business models and introduce the subcomponents.

Table 23: Identifying business model subcompoents related to the choices and consequences.

Priority	Overall choices	Choice	Consequences	Flexible /rigid	Subcomponent
Get enough customers	Enable customers to pay and compete with subsidized solution	Offer product/service at a low price	Enough customers as suitable offering enables customers to pay	Flexible	Value proposition Revenue model
		Consumer credit Themselves MFI partner	Enough customers as suitable offering enables customers to pay	Flexible	Value proposition Revenue model Partnership
			May require a high customer base dependent on solution, and thereby challenge getting enough customers	Rigid	Value proposition Revenue model
	Access workers	In-house	Able to perform value creating activities, in order to get enough customer and expanding	Flexible	Capability Value configuration
		Partner	Able to perform value creating activities, in order to get enough customer and expanding	Flexible	Partnership Value configuration
			Gain trust with customer, helps getting enough customers	Rigid	Partnership Relationship
Provide well enough service	Access workers	In-house	Able to perform value creating activities, in order to get enough customer and expanding	Flexible	Capability Value configuration
		Partner	Able to perform value creating activities, in order to get enough customer and expanding	Flexible	Partnership Value configuration
Deliver	Access workers	In-house	Able to perform value	Flexible	Capability

well enough			creating activities, in order to get enough customer and expanding		Value configuration
		Partner	Able to perform value creating activities, in order to get enough customer and expanding	Flexible	Partnership Value configuration
Expand to new customers	Raise money	Private investments	Get enough money to cover costs and expand	Rigid	Revenue Model
		Public investments and subsidies	Get enough money to cover costs and expand	Rigid	Revenue Model
	Access workers	In-house	Able to perform value creating activities, in order to get enough customer and expanding	Flexible	Capability Value configuration
		Partner	Able to perform value creating activities, in order to get enough customer and expanding	Flexible	Partnership Value configuration
			Slow growth when expanding to new areas	Rigid	Partnership Investment model
	Avoid initial investment costs	Provide product/service with low initial investment costs	Low costs, due to offering makes it possible to expand with less money	Flexible	Value proposition Costs structure
Get enough money to cover costs	Raise money	Private investments	Get enough money to cover costs and expand	Rigid	Revenue Model
		Public investments and subsidies	Get enough money to cover costs and expand	Rigid	Revenue Model
	Enable customers to pay and compete with subsidized solution	Consumer credit themselves	Need enough money to cover investment costs	Ridig	Revenue model Costs structure
	Access workers	In-house	Increases costs, increasing demand for money	Flexible	Cost structure Capability
Provide suitable offering	Enable customers to pay and compete with subsidized solution	Offer product/service at a low price	Enough customers as suitable offering enables customers to pay	Flexible	Value proposition Revenue model
		Offer consumer credit Themselves MFI partner	Enough customers as suitable offering enables customers to pay	Flexible	Value proposition Revenue model Partnership
	Avoid initial investment costs	Provide product/service with low initial investment costs	Low costs, due to offering makes it possible to expand with less money	Flexible	Costs structure Value proposition
	Raise money	Private investments	Investors demand for return on investment may narrow down the entrepreneurs selection of offering options	Rigid	Value proposition
		Public investments and subsidies	May have restrictions on offering which narrows down the entrepreneurs	Rigid	Value proposition

			selection of offering options		

The linkage to the subcomponents is done by identifying how the choices and consequences fit with the description of each business model subcomponent presented by chapther 3. Table 24 presents the explanation for the connection.

Table 24: Description on the linkage between choices/consequences and subcomponents.

Subcomponents	Description of relation between subcomponents and choices and consequences
Value proposition	The entrepreneur creates value to the customers by providing an offering that is of value to the customers. In this case the entrepreneur can provide a product at a low price and/or consumer credit in order to enable the customers to pay.
Relationship	Through a local partnership the entrepreneur can gain trust by the customers and this way establishes a link between him and the customers.
Capability	By hiring workers the entrepreneur is choosing to have the ability to execute a repeatable pattern of actions in-house.
Partnership	By choosing to initiate cooperative agreement with a local partner to gain trust with the customers and/or get access to workers the entrepreneur is getting the ability to create value for the customer through partnership.
Value configuration	The ability to create value is done through the arrangement of activities and resources that are necessary to create value to the customers.
Cost structure	Choices that affect the cost structure for the entrepreneur will the product/service offering which can be low cost product or consumer credit provided by the entrepreneur and the in-house capability such as salary costs.
Revenue model	The entrepreneur can make money by providing product/services the customers are able to pay for and can get money trough investments.

As previously presented early stage priorities and the flexibility/rigidity of consequences are the decision criteria in this research. In order to say which subcomponent that is critical in an early stage, the authors have made use of type of consequences that meet early stage priorities and the rigid ones that do not meet the early stage priorities. To determine the criticality of the choices and consequences the authors have made use of the rigid consequences.

Flexible consequence and positive affect on early stage priorities: The flexible consequences that meet the early stage priorities are summarized in table 25. The choices that generate these consequences are important for entrepreneur to make in order to meet the early stage priorities. The choices relates to providing an offering the enables the customers to pay, provide a solution with low investment costs and get access to workers either through developing in-house or get a partner to do the value creating activities. These consequences help the entrepreneur achieve the early stage priorities of getting enough customers, provide suitable offering, deliver products and provide well enough service well enough and expand to new customers.

Table 25: Flexible consequences that have positive affect on early stage priorities.

Early stage priority	Choices	Consequences	Subcomponents
Get enough customers, Provide suitable offering	Offer product/service at a low price Consumer credit Themselves MFI partner	Enough customers as suitable offering enables customers to pay	Value proposition Revenue model
Get enough customers, Deliver well enough, provide well enough service	In-house Partner	Able to perform value creating activities, in order to get enough customer and expanding	Partnership Capability Value configuration
Expand to new customers, Provide suitable offering	Provide product/service with low initial investment costs	Low costs, due to offering makes it possible to expand with less money	Costs structure Value proposition

Rigid consequence and positive affect on early stage priorities: This means that that the consequences will not change rapidly with the choices that generate it. The choices related to getting a local partner to gain trust with customers and raising investments to get enough money to cover costs and expand, which are presented in table 26. Since these consequences have a positive affect on early stage priorities of getting enough customers, expand to new customers and get enough money to cover costs these choices will positively affect the entrepreneurs business in a longer term.

Table 26: Rigid consequences that have positive affect on early stage priorities.

Early stage priority	Choices	Consequences	Subcomponents
Get enough customers	Partner	Gain trusts with customers	Customer relation Partnership
Expand to new customers	Private investments	Get enough money to cover costs and expand	Revenue Model
Expand to new customers	Public investments and subsidies	Get enough money to cover costs and expand	Revenue Model
Get enough money to cover costs	Private investments	Get enough money to cover costs and expand	Revenue Model
Get enough money to cover costs	Public investments and subsidies	Get enough money to cover costs and expand	Revenue Model

Rigid consequence and negative affect on early stage priorities: These are the consequences that the entrepreneur needs to look out for, see table 27. By making the choices that generate these consequences the entrepreneur will end up in a situation that can not be changed rapidly. The choices that generate these consequences are choices that are critical for the entrepreneur to get right the first time. These choices are related to offering consumer credit, getting a partner and raising investments. These are consequences affects the priorities of getting enough customers, the ability to expand, getting enough money to cover costs and providing a suitable offering negatively.

Table 27: Rigid consequences that have negative affect on early stage priorities.

Early stage priority	Choices	Consequences	Subcomponents
Get enough customers	Consumer credit Themselves MFI partner	May require a high customers base dependent on solution	Value proposition
Expand to new customers	Partner	Slow growth when expanding to new areas	Partnership Investment model
Get enough money to cover costs	Consumer credit themselves	Need enough money to cover investment costs	Value proposition Costs structure
Provide suitable offering	Private investments	Investors demand for return on investment may narrow down the entrepreneurs selection of offering options	Value proposition
Provide suitable offering	Public investments and subsidies	May have restrictions on offering which narrows down the entrepreneurs selection of offering options	Value proposition

The choice of offering consumer credit can have a negative effect for the entrepreneur dependent on the type of solution. If providing a solution that may require getting a high customer base prior to the installation, by not getting the required number of customers the entrepreneur will not get enough customers leading to the non ability to introduce his offering to the market. Further another choice, which affects the offering, is investment. Both private and public investments may have some say in the offering the entrepreneur can provide. It can either be affected by the need to design the offering in such way that makes it possible for the entrepreneur to return the investment or public restrictions may narrow down the offering options. By choosing to provide consumer credit himself the entrepreneur will increase the costs leading to the need of getting more money to cover the costs. Another important choice to highlight is the choice of engaging in partnership. The choice of outsourcing some or all of the value creating activities may lead to a slower growth.

The critical choices and their rigid consequences are summarized in table 28 where the red ones have a negative affect on the early stage priorities and the green ones have a positive affect.

Table 28: Critical choices, due to their consequences in rural electrification.

Choices	Consequences	Subcomponents
Access human resources through local partner	Gain trusts with customers, helps getting enough customers Slow growth when expanding to new areas	Partnership Customer relation Partnership Investment model
Private investments	Get enough money to cover costs and expand Investors demand for return on investment may narrow down the entrepreneurs selection of offering options	Revenue Model Value proposition
Public investments and subsidies	Get enough money to cover costs and expand May have restrictions on offering which narrows down the entrepreneurs selection of offering options	Revenue Model Value proposition
Offer consumer credit through MFI partner	May require a high customers base dependent on solution, and thereby challenging to get enough customers	Value proposition
Offer consumer credit themselves	May require a high customers base dependent on solution, and thereby challenging to get enough customers Need enough money to cover investment costs	Revenue model Costs structure

These choices are critical for the entrepreneur delivering rural electrification. These therefore need to be his primary focus. The choice of getting a local partner has a rigid positive and rigid negative consequence. The entrepreneur can gain trust with the customer and he can experience slow growth. For entrepreneurs employing a growth model as presented by Morris et al. (2005) the slow growth consequence will have a negative affect on the company. The choice of investments will have a positive affect due to getting enough money to cover costs but it can also set restrictions on the type of offering the entrepreneur can provide. For entrepreneurs that may have their mind set on what they want to provide based on the company´s goal raising money may interfere with that. Further providing consumer credit may require a number of customers based on the type of solution. This means that for an entrepreneur that will offer a home system and provide consumer credit he may need to get a set number of customers in order to provide his solution. Not getting this number of customer will negatively affect his company.

Additionally the authors have identified important choices that have flexible consequences. These choices are important for the entrepreneur to make in order to meet the early stage priorities, see table 29. These choices are important for the entrepreneur to enable the customers to pay, to access to the necessary manpower and to be able to expand with less money.

Tabell 29: Important choices and consequences in rural electrification.

Choices	Consequences	Subcomponents
Offer product/service at a low price	Enough customers as suitable offering enables customers to pay	Value proposition Revenue model
Consumer credit Themselves MFI partner		
In-house	Able to perform value creating activities, in order to get enough customer and expanding	Capability Partnership Value configuration
Partner		
Provide product/service with low initial investment costs	Low costs, due to offering makes it possible to expand with less money	Value proposition Cost structure

The process of identifying the critical business model components has lead to the identification of five critical choices and consequences and 5 important choices and consequences. This distinction of choices and consequences will help the entrepreneur prioritize his focus when delivering rural electrification. The authors will discuss these findings and from that develop general propositions. Further the case companies will be viewed in light of the propositions.

Part IV Discussion and conclusion

10. Discussion

This chapter aims to discuss the deriving of findings, the findings themselves, what that could have been done differently with regards to the method, and what is the contribution of this study as well as its limitations.

10.1. Deriving findings

This subchapter discusses the choices of research question and the process for answering the question.

Research question

It is possible to critique this choice of research question as literature describes how the components of business models are linked closely together, and need to function as a whole. Morris et al. (2005) enhance how all components are vital, and that each component affects other components. This indicates that one can not choose to prioritize the components, as they have to be studied together. The authors acknolwledge the importance of all components, and their interrelation, but still state that some of them should be prioritized within a specific business stage, due to how the specific state related problems met by all companies (Churchill and Lewis, 1983).

Process

The process of deriving the findings is devided into 9 steps. Within each step there has been made assumptions that may have affected the findings. These steps and assumptions are presented in table 30. In the following the assumtions possible affect on the findings is discussed.

Table 30: Describing steps of analysis in relation to assumtions made.

Step	Description of step	Assumtion
1	Designing research quensiton	Some business model components may be more critical than others within early stage of business.
2	Identification of external challenges within the field of rural electrification.	External challenges can affect the criticality of business model components. The external challenges identified are the most important challenges affecting entrepreneurs within the field of rural electrification.
3	Identification of choices and consequences to solve challenges, also relating consequences to early stage priorities.	Challenges may be solved by making specific choices that has consequences. Choices and consequences form the business model.
4	Linking of challenges, choices and consequences	Challenges may be linked to each other as they have some common choices and consequences
5	Identification of type of consequences	Consequences are either rigid or flexible.
6	Description of what consequences from choices that enables the entrepreneur to meet early stage priorities	Early stage priorities may be linked directely to consequences
7	Linking of choices and consequences to subcomponents, and their relation to early stage priorities and type of consequence.	Subcomponents can be linked to choices and consequences
8	Identification of critical components	Something is critical if the consequences is negatively affecting early stage priorities and rigid, or if it is positively affecting early stage priorities and is rigid.
9	Presentation of propositions	The criticality may depend on the companys goal.

Table 30 show that there is a list of assumtions that has been made throughout this study, in order to derive the findings and answering the research question. What is important to state is that even all assumtions are derived from and supportet by literature, there always exist scholars that have credible arguments enabling them to critique what is derived by other scholers. Due to this discussion amongst scholars it is possible to find literature stating that it is not possible to make the assumtions needed in order to conduct this study, or that some assumtions that are used should have been changed.

When concucting the analysis the author have derived challenges, choices and consequences, and linked these to each other as well as early stage priorities, type of consequences and subcomponents. The work has been performed based on a literature review and case studies. Throughout this process the authors may have affected the results through their individual way of reasoning and through their personal interpretations. As such exercises are performed throughout several steps of the process, it may have affected the analysis in such a way that for example there are missing relevant choices or consequences, or that a linkage have been conducted while missing important arguments. Due to what is described here and in the paragraph above, the process may have affected the findings of this study.

10.2 Findings

This subchapter aims to discuss the findings of this study, relate them to the cases studied and then to present propositions based on the findings in order to guide entrepreneurs in the building of early stage businesses delivering rural electrification in developing countries.

10.2.1. Deriving propositions based on findings and discussion (Step E)

In chapter 9, the findings were derived and presented in two ways:

- In relation to the two set of business model factors: *choices* and *consequences*.
- In relation to the traditional business model component, devided into *subcomponents*.

By using the business model definition of Casadesus-Masanell and Ricart (2010) in the following discussion of the findings, the authors will be able to present more specific guidelines for what is critical to focus on in a company's early stage delivering renewable rural electrification, in addition to what is important to focus on. This will allow the authors to derive propositions suggesting specific choices and consequnces that should be the entrepreneur's primerely focus. The findings of this study are presented in table 31 and 32 below, where table 31 presents the critical choices and consequences and table 32 presents the important choices and consequences. The content of these tables forms the basis for the propositions derived in the following.

Table 31: Critical choices and consequences to address:

Critical Choices	**Critical Consequences**
Access human resources through local partner	Gain trusts with customers, helps getting enough customers Slow growth when expanding to new areas
Private investments	Get enough money to cover costs and expand Investors demand for return on investment may narrow down the entrepreneurs selection of offering options
Public investments and subsidies	Get enough money to cover costs and expand May have restrictions on offering which narrows down the entrepreneurs selection of offering options
Offer consumer credit through MFI partner	May require a high customers base dependent on solution, and thereby challenging to get enough customers
Offer consumer credit themselves	May require a high customers base dependent on solution, and thereby challenging to get enough customers Need enough money to cover investment costs

Tabell 32: Important choices and consequences to address.

Important Choices	**Important Consequences**
Offer product/service at a low price	Enough customers as suitable offering enables customers to pay
Offer consumer credit: Themselves or with MFI partner	
Develop in-house resources	Able to perform value creating activities, in orderto get enough customers and expanding
Access resources through partner	
Provide product/service with low initial investment costs	Low costs, due to offering makes it possible to expand with less money

PROPOSITION 1

The proposition is presented in relation to developing a business model, delivering rural renewable electrification in developing countries. It consists of several sets of choices and consequences that need to be considered in relation to its corresponding challenges. Set 1-3 are considered to be critical, while set 4-6 are considered important.

The following choices are **critical**, and should be the primary focus, due to their rigid consequences that may affect early stage priorities both positively and negatively.

1. CONSIDER ENTERING A PARTNERSHIP

a) ***Consider entering a partnership with a local actor*** *in relation to the following consequences:*
    a. *Contributes to gain trust with customers, helps getting enough customers.*
    b. *Contributes to slow growth when expanding to new areas.*

2. CONSIDER HOW TO RAISE MONEY

a) ***Consider raising private investments*** *in relation to the following consequences:*
    a. *Contributes to get enough money to cover costs and expand*
    b. *Demand a return on investment, which may narrow down the selection of offering options.*
b) ***Consider raising public investments and subsidies*** *in relation to the following consequences:*
    a. *Contributes to get enough money to cover costs and expand*
    b. *May come with restrictions on offering, narrowing down the selection of offering options.*

3. CONSIDER OFFERING CONSUMER CREDIT

a) ***Consider offering consumer credit through a MFI partner*** *in relation to the following consequences:*
    a. *May require a high costumer base dependent on solution, and thereby challenging to get enough customers.*
b) ***Consider offering consumer credit themselves*** *in relation to the following consequences:*
    a. *May require a high costumer base dependent on solution, adding the challenge of getting the required number of customers in order to sell or install the solution.*
    b. *Require enough money to cover investment costs.*

The following choices are **important**, and should be the part of the focus, due to the consequences affecting early stage priorities positively.

4. CONSIDER THE OFFERING

a) ***Consider offering product/service at a low price*** *in relation to the following consequence:*
    a. *Contributes to getting enough customers, as it enables customers to pay.*
b) ***Consider providing product/service with low initial investment costs*** *in relation to the following consequence:*

b. *Contributes to low costs due to the offering, making it possible to expand with less money.*

5. CONSIDER OFFERING CONSUMER CREDIT

a) ***Consider offering consumer credit either themselves or through a MFI partner*** *in relation to the following consequence*
   c. *Contributes to getting enough customers, as it enables customers to pay.*

6. CONSIDER HOW TO ACCESS HUMAN RESOURCES

a) ***Consider developin in-house resources*** *in relation to the following consequence:*
   d. *Enable performing of value creating activities, in order to get enough customers and to exand.*
b) ***Consider access resources through partner*** *in relation to the following consequences:*
   e. *Enable performing of value creating activities, in order to get enough customers and to exand.*

To summarize proposition 1 in terms of subcomponents, the following subcomponents are critical, and should be the primary focus when developing a business model in order to deliver rural renewable electrification in developing countries.

a) **Revenue model**
b) **Value proposition**
c) **Partnership**

Further it is important to have these components in place:

- **Value configuration**
- **Capability**

In order to identify whether some parts of proposition 1 depends on certain aspects the authors chooses to look at it in relation to the case companies. As the study employs a limited number of cases, the case companies are chosen due to them being extreme exemplars (Pettigrew, 1990). The authors will illustrate their main difference through presenting their goal. Further, Morris et al. (2005) points to how the goal affects which investment model the company will adopt. Thereby, their investment model provides an illustration of their difference. Based on this the goals and the investment model of the three case companies, presented in chapter 7, is repeated in table 33, and will be discussed below in relation to *proposition 1.*

Tabell 33: Repetition of the case companies' goal and related investment model.

	MGP	**Onergy**	**AST- Speed project**
Focus/goal	Provide service grid villages with basic priority energy services. The business model is fixed when it comes to product offered and should scale up quite quickly with 3-4 year repayment period	Promote decentralised energy products, to meet the need of rural customers across whatever sector and find ways to provide social economic benefits	Give the rural people power so they can educate themselves and to improve their life. This will be done btriugh rural development.
Investment model (Morris et al. 2005)	**Growth model**: Goal to grow the value of the firm to the point that it generates capital gain for investors.	**Income model**: Investment to the point that the business is able to generate on going and stable income stream.	**Income model**: Investment to the point that the business is able to generate on going and stable income stream.

Summerized the three cases may be grouped in two based on their goal, MGP by itself and Onergy and AST together:

- MGP has a goal of providing basic lightning and phone charing to rural people and to grow the value of their firm while
- Onergy and AST have a goal to contribute to rural development and generate stable income.

In the further discussion the authors use these groups' goals in order to evaluate whether something from proposition 1 is goal dependent.

Goal: growth

MGP is the only case company of the three that has employed a growth model. Their objective was growth from day one, and therefore they needed to design their business model aligned with their goal. In order for them to achieve their goal of growth, they decided to design the offering that the customers were mosty willing to pay for:

"We wanted to focus on priority energy services because when people buy basic power they use a little bit of power for the things that mean a lot to them. They also use a lot of power of for things that mean little to them. To accomadate the large loads that have bery little value makes the micro grid operations economically inviable. So we designed a micro grid that provided basic power of lightning and phone charging and still would generate enough revenue in order to repay the initial investment in short periode of time".

- Nikhil Jaisinghani, CEO MGP

They conducted a market research identify what specific solution the rural people were willing to pay for and the power load this required. In order for them to scale up quickly it was important for them to identify the solution that they were going to provide to the consumers and stick with that offering for each village they were entering. This illustrates the importance of selecting the suitable offering.

MGP is a good example of how a company can design their offering in such a way that it helps reach the goal of growth.

An important factor for growth is getting the necessary investment to expand. MGP received a substantial venture capital investment. This allowed them to make necessary investments, covering the costs themselves and thereby enabling the customers to pay through a license model. The authors consider this to serve the same purpose for the customer by offering what they identify as the consumer credit themselves and this way covering the investment costs. Additionally MGP own their system themselves, allowing them to keep charging a licence as long as the service is offered. For MGP this venture capital financing source has been vital in order to have a successful growth model.

MGP started of by having two types of partnerships. One was with a local NGO and the other was with an EPT (engineering permited construction), that was responsible of providing the technical solution. MGP experienced difficulties with these partnerships because they were not doing the work as they were supposed to. MGP experienced one of the threats of sustainability; slack (Ricart, 2004). Ricart et al. (2004) presents that protection for this threat is the right mix of incentives and monitoring. One can argue that for a growth model the need to monitore the partners may inhibit the growth. For MGP this was the case and they realized that in order for them to expand they needed to devleop the in-house human resources. The two other cases studies in this research presents partnerships as an important aspect in order to gain trust with the consumers and be able do the awarness and education. When asking the CoFounder of MGP if they have experienced any issues with trust he answered the following:

"We have no issues with trust with the consumers. I think that is one of the things that people say so everyone thinks that it is true and assume that it is true. We tought we needed to get a local NGO to do the engagement but I think that this is just one of the assumptions that people never really have tested".

- Nikhil Jaisinghani, CEO MGP

Due to their unfortunate experience with partnership they realized that they needed to get necessary resources in-house. Therefore they decided to hire Cofounder Sandeep Panda, who had the expertice of getting rural people to pay. By adding this expertice in the team they got the necessary knowledge and skills in-house, in order to keep on hiring and training staff.

MGP presents the two important activities in these markets; after sales services and payment collection. Due to their licence model they are highly dependend on the systems reliability for them to generate their income. Therefore having the right after sales service with their trained workers responding to customers in short period of time is essential for their company. Additionally having the right payment collection is crucial. MGP experienced this when they had hired a payment collector to do the payment collection in his own village. MGP has a policy saying that if the customers do not make the payment the day it is due, they get disconnected. The issue occurred when the collector would let his friends in the village prospone their payments. This experience made MGP realize that they had to hire someone from outside the village to do the collection.

MGP is considered a well suited case company representing growth as an investment model, as they through their business model have experiences rapid growth, as presented by the CoFounder:

"I said in 2011 that our goal is to hit 15 villages by the end of 2012, and we ended up putting our system in 150 villages by the end of 2012".

- Nikhil Jaisinghani, CEO MGP

Evaluating the case of MGP in relation to proposition 1 shows that, almost all sets of choices and consequences are considered important, also when applying a growth model. The deviation is considered to rely on partnership and the importance of in-house capabilities. This is presented in proposition 2. To summarize, companies delivering rural electrification in developing countries, employing the growth model, need to reevaluate proposition 1 in light of proposition 2 below.

PROPOSITION 2

The proposition is presented in relation to developing a business model, delivering rural renewable electrification in developing countries. It is applicable if the goal of the company is growth, and has to be looked at in relation to proposition 1. Based on proposition 2, there need to be performed two changes. The first set of choices and consequences presented in proposition 1 will need to be replaced by the set of choices and consequences presented below, while the sixth need to narrow down the options to fit what is presented below.

When the goal is growth, the following choice is **critical**, and should replace set 1 from proposition 1.

1. CONSIDER NOT ENTERING A PARTNERSHIP

*a) **Consider not entering a partnership with a local actor** in relation to the following consequences:*

a. Contributes to slow growth when expanding to new areas.

When the goal is growth, the following choice is **important**, and therefore the sixth set of choices and consequences form porpostion 1 need to be revised to the following:

6. CONSIDER DEVELOPING HUMAN RESOURCES IN HOUSE

*a) **Consider developing in-house resources** in relation to the following consequence:*

a. Enable performing of value creating activities, in order to get enough customers and to expand.

The two important activities that needs to be performed correctly is payment collection and after sales services.

To summarize the affect proposition 2 has on criticality, it removes parthernship as a critical subcomponent:

- **Partnership;** not critical when applying a growth model, as partnership inhabits growth.

Further it is especially important to have the following component in place:

- **Capability;** developing in-house capabilities, as the company is not accessing human resources through a partner.

Goal: rural development

AST and Onergy both employ an income model and have the same goal on rural development. Onergy started off with providing simple lanterns before they introduced home systems. Today they are providing a range of products, and have adapted their pricing model by offering consumer credit through a MFI, when providing solutions with high investment costs, such as solar home systems. AST on the other hand has chosen to offer a standard solution, without consumer credit, by setting the price at an acceptable level for the consumer. Still they have plans to expand their services beyond rural electrification.

Having knowledge about the rural population, and gaining trust amongst the local villagers has been important for AST and Onergy. For Onergy it was important to get parterships in place as the CoFounder Piyush Jaju presents:

"Right from the start we were clear that we needed partnerships because we did not have the propor understanding of rural areas. We needed a strong grassroot partner who is trusted by the consumers and who we could work together with. Particularily in working in rural areas it is almost impossible to do the work yourself, at least to start with".

- Piyush Jaju, CEO Onergy

They needed the partnership with NGO to get access to their customer base and to set up their office in the NGOs premises. AST also say that having a local partersnhip is important in order to gain trust:

"We needed to partner up with someone who has worked in the area who is trusted. Otherwise to break into rural markets entirely on your own you need at least five years"

- Rajiv Parti, consultant AST

For both the cases, as for MGP, financial resources have been necessary in order to cover the considerable cash demand. For AST, being part of the speed project which is a donor funded project, money has not been an issue. For Onergy on the other hand, getting the necessary financing was challenging. They started of with their own saving and some support from family. Later on, when they were able to show good work on the ground, they started attracting public support through grants and subsidies. For Onergy attracting financing was critical in order for the company to proceed in scaling up, building more capacity, training, establishing processes and product development. This shows how crucial it is to get financing.

Finding the right people in order to perform all the needed activities has been important for Onergy. They invested a lot of resources in facing the challenge of finding and attracting the right people:

"Once the financing was sorted out we started investing a lot of time in finding the right kind of workers and training them. So, financial and human resources are the most important things".

- Piyush Jaju, CEO Onergy

AST also have experienced the same challenges when the locally hired entrepreneur, performing the daily rutine of distribution, quit his job, negatively affecting the distribution.

As with MGP, Onergy and AST have also talked about the importance in after sales services and payment collection. Onergy presents how they identified the importance of after sales services after seing how other companies failed due to their lack of providing this service. AST presents how finding the right payment collection is necessary to get in place.

As with MGP, the authors observe that AST and Onergy highlight all the mentioned choices and consequences that were presented in proposition 1. What AST and Onergy particularly mention the need for a local partner.

PROPOSITION 3

The proposition is presented in relation to developing a business model, delivering rural renewable electrification in developing countries. It is applicable if the goal of the company is *rural development*, and has to be looked at in relation to proposition 1. According to the two case companies AST and Onergy, having a local partner is not only a choice, but a necessity. In light of this the first set of choices and consequences from proposition 1 need to be revicesed to the following.

When the goal is rural development, the following choice and consequences is **critical**, and therefore the first set of choices and consequences form porpostion 1 need to be revised to the following:

1. ENTER A PARTNERSHIP

*a) **Enter a partnership with a local actor** in relation to the following consequence:*

a. Contributes to gain trust with customers, helps getting enough customers.

To summarize the affect proposition 3 has on the criticality of subcomponents is that it goes from saying that partnership is important to consider, to partnership is necessary to have in order to succeed with rural development:

- **Partnership;** necessary in order to gain trust with customers.

10.3. Discussion of method

The authors have based the analysis process on doing an environmental analysis presenting how companies can design their business model in such way that it respond to the external challenges. As previously presented there are scholars that do not agree with this approach. Like Barney (1991) states that strategy models, which are only based on external factors, make the assumption of a firm homogeneity. From this statement one can say that it is importance to include the firms' internal resources. One possibility could be to conduct an inside-out analysis (De Wit and Meyer), in addition to the outside-in analysis, identifying the companies strengths and weaknesses and how to allocate these in the best possible way in order to succeed. Identifying the firms' initial resources and knowledge would lead to an in-depth analysis which in turn would have given a better understanding of what the critical business model components are for different set of resources.

The authors have only looked at three cases due to the limitations of this research. Even though the three cases are different in their goals and the status of the project, introducing more cases would have given the research a deeper indication of what is critical for entrepreneurs delivering rural electrification in developing countries. Conducting the analysis only based on three case studies may have resulted in loss of important elements or challenges that an entrepreneur in these markets may experience. In addition the research have only studied case companies in India, all of which deliver solar based energy solutions, while aiming to identify critical components for delivering all kinds of

renewable energy solution to rural the rural population of all developing countries. Based on this there is an assumption there that entrepreneurs will experience the same challenges in all developing countries, delivering all kinds of renewable energy solutions. Even though there are a lot of similarities, in some countries external conditions and rural culture may be different, which indicates that in some countries the critical business model components may deviate from the ones identified in this research. Still, what strengthens the evidence of this study is that the challenges identified, that form the base of the analysis, are derived from literature, discussing cases from several developing countries. These challenges were all confirmed by the Indian case companies, while only one challenge was added by cases and not from literature.

When choosing cases, two of them were companies that had already gone trough the early stage of business. This required that the interviewee recalled their former early stage situation and their challenges. Conducting such retrospective data collection may have affected the interviewee, as he or she is at a later stage where one has learned from experience. Then it may be difficult to clearly remember the challenges or how other vital things was perceived and responded to.

The data collection was conducted through interviews and observations. When doing interview it is important that the investigator ask good questions in such way that the interviewees understand the questions (Yin, 2014). The researchers prepared for each interview and created interview guides, but even though time was invested in the preparation, the cultural differences and environmental conditions may have had some impacts on the data collection. The interviews were conducted in English, which is not the native language of the authors. The cultural and language differences between the Norwegian researchers and the Indian interviewees may have lead to some questions being interpreted in another ways than the investogators intended. In addition, the environmental condition of some interviews was unfortunate due to the lack of enclosed offices, which lead to interviewes being held in cafes and in workplaces. This condutions have resulted in some of the recordings having inferior quality which in turn can have impacted the transcription.

10.4 Contribution of research

There is a gap between the UN Millenium goal of *universial access to modern energy services by 2030* (UN, 2014) and the public sectors work of rural electrification, as previously presented. In order to fill the gap the private sector, and thereby entrepreneurs, have an important role (IFC 2012). The authors have presented propositions that indicate how an entrepreneur entering the rural electrification market should prioritize his efforts. Rural electrification research is an emerging field of study where the focus on how technology and offering meets the needs of the rural population has been mostly excluded (Schillebeeckx et al., 2012). In order to succeed with rural electrification and achieve the UN goal there is a need of more research that present how entrepreneurs entering this market can succeed by meeting the needs of the rural poor. The propositions derived from this study may indicate that it is possible to identify critical business model elements within one stage of business development, in the delivery of rural electrification. However the authors acknowledge that in order to add some certainty to this, the propositions need to be testet properly by several case studies. The authors believe that the investigation of how entrepreneurs should prioritize their efforts at an early stage can contribute to facilitate further research.

Renewable rural electrification is still only an emerging industry. Due to this, entrepreneurs that are building companies in order to provide the rural population with clean energy, have few successful

examples to look to and learn from. Therefor there is a need for them to build confidence in their work and learn from other sources of guidance. By conducting this research, the authors have identified information that is useful when developing and evaluating business models in rural electrification. By presenting specific choices and consequences the entrepreneur can see exactly what needs to be done and prioritized in order for him to succeed. This guideline, which also distinguishes between the entrepreneurs' goal, will enable him to design a suitable business model to build a viable and successful company.

11. Conclusion

In previous chapter the authors have presented the finding and the proporsitions of this study, answering the following research question:

What are the critical business model components to prioritize in order for an early stage company to become viable when delivering renewable energy to the rural population of developing countries?

The process for answering this research question was developed trough literature and case studies. Critical business model components for rural electrification have been identified and three porporsitions is proposed. These present what the entrepreneur primarely has to focus on in order to succeed.

The propositions are based on the business model view of Casadesus-Masanell and Ricart (2010), where the components of a business model consist of two elements; choices and consequences. The connection between the choices and consequences, and the traditional view of subcompoents derived in this study have been identified and presented.

The propositions show that the criticality of choices and consequences is affected by the goal of the company, and differ depending on whether the goal is growth or rural development. Due to the limitations of this study there have only been investigated three Indian case companies. As it is shown that the criticality is goal dependent it would be interesting to investigate more cases with various goals, in addition to add cases from other developing countries. Taking the research forward is also important in order to get deeper in the identification of critical business model components which can give the entrepreneur an even better understanding of what he should prioritize in the early stage of his company. This can be done by conducting an inside-out analysis, in addition to the external analysis performed in this research. By studying more cases through further research, a foundation may be developed that the entrepreneur can look to when considering what choices and consequences that are critical for his company with its goal and set of resources.

A summary of the propositions is given below. The table summarizes critical and important choices and consequences included in the propositions, demonstrating the general priorities, and the necessary changes of priorities in relation to the goal of the company.

Table 34: Findings summarized in propostion 1-3.

Degree of importance	Set of choices and consequences	**PROPOSITION 1: The general priorities**
CRITICAL	1	Consider entering a partnership as it helps gain trust with customers, and thereby getting more customers. May lead to slow growth, inhibiting expanding.
	2	Consider raising private or public investments or subsidies as it covers costs and allows expanding. May come with specific restrictions or requirements narrowing down options for selection of offering.
	3	Consider offering consumer credit to customers themselves of through a MFI partner. May require a high customer base, dependent on solution, and may demand money to cover investments.
IMPORTANT	4	Consider what offering to provide. Low price enables customers to pay, and thereby getting more customers, while low initial investment costs makes it possible to expand with less money.
	5	Consider offering consumer credit to customers themselves of through a MFI partner as it enables customers to pay and contributes to getting enough customers.
	6	Consider how to access human resources. Both in-house resources and a partner enable performing value adding activities in order to gain customers and expand.
Degree of importance	**Choices and consequences**	**PROPOSITION 2: When the goal is growth**
CRITICAL	Change previous set 1 to:	Consider not entering a partnership as it contributes to slow grow inhibiting expanding.
IMPORTANT	Revise previous set 6 to:	Only consider developing human resources in-house as it enable performing value creating activities in order to gain customers and expand.
Degree of importance	**Choices and consequences**	**PROPOSTIION 3: When the goal is rural development.**
CRITICAL	Revise previous set 1 to:	Enter a partnership with a local partner as it contributes to gaining trust with customers, helping to get enough customers.

References

Barnes D., F. a. F., W., M. . (1996). Rural Energy in Developing Countries: A Challenge for Economic Development.

Barney, J. (1991). Firm resources & sustained competitive advatnage. *Jurnal of management*.

Baum, J., A., C. and Singh, J. V. (1994). *Organization-Environment Coevolution; in Evolutionary Dynamics of Organizations*: Oxford University Press, N.Y.

Beck, F. a. M., E. . (2004). Renewable energy policy and barriers global environment facilities.

Bhattacharyya, S. C. (2006). Energy access problem of the poor in India: Is rural electrification a remedy? *Energy Policy, 34*(18), 3387-3397.

Bryman, A. (2008). Social Research Methods. *Oxford University Press*.

Casadesus-Masanell, R., & Ricart, J. E. (2010). From Strategy to Business Models and onto Tactics. *Long Range Planning, 43*(2-3), 195-215.

Casadesus-Masanell, R. R., John E. (2007). Competing through business models. *Working paper*.

Chesbrough, H. (2010). Business Model Innovation: Opportunities and Barriers. *Long Range Planning, 43*(2-3), 354-363.

Churchill, N. C. L., V. L. (1983). The Five Stages of Small Business Growth. *Harvard Business Review*.

DA. (2014a). from http://devalt.org

DA (2014b).

De Wit, B. a. M., R. (2010). *Strategy Process Content and Context* (4th ed.): South Western Cengage.

Eisenhardt, E. M. (1989). Building Theories from Case Study Research. *Academy of Management Review, 14*(4), 532-550.

Flick, U. (2009). *An Introduction To Qualitative Research* (4 ed.): SAGE Publications.

Greiner, L. (1998). Evolution and revolution as organizations grow. 1972. *Harvard Business Review, 76*(3), 55-60, 62-56, 68.

Gupta, A. (2014). [Professor at the Indian Institute of Management].

Haanyika, C. M. (2006). Rural electrification policy and institutional linkages. *Energy Policy, 34*(17), 2977-2993.

Haanyika, C. M. (2008). Rural electrification in Zambia: A policy and institutional analysis. *Energy Policy, 36*(3), 1044-1058.

Haberberg, A. a. R., A. (2008). *Strategic Management - Theory and Application*: Oxford University Press.

IFC. (2012). From Gap to Opportunity: Business Models for Scaling Up Energy Access. International-Finance-Corporation: International-Finance-Corporation.

Javadi, F. S., Rismanchi, B., Sarraf, M., Afshar, O., Saidur, R., Ping, H. W., & Rahim, N. A. (2013). Global policy of rural electrification. *Renewable and Sustainable Energy Reviews, 19*(0), 402-416.

Lecoq, X., Demil, B., and Warnier, V. (2006). , Le Business Model, un Outil dänanlyse strategiqu. *LÉxpansiom Management Review, 123*, 50-59.

Leidecker, J. K., & Bruno, A. V. (1984). Identifying and Using Critical Success Factors. *Long Range Planning, 17*(1), 23-32.

Levie, J. a. L., B., B. (2010). A Terminal Assessment of Stages Theory: Introducing a Dynamic States Approach to Entrepreneurship. *Entrepreneurship Theory and Practice, 34*(2), 317-350.

Margretta, J. (2002). Why business models matter. *Harvard Business Review*.

Morris, M., Schindehutte, M., & Allen, J. (2005). The entrepreneur's business model: toward a unified perspective. *Journal of Business Research, 58*(6), 726-735.

Newsom, C. (2013). Can renewable energy turn Nigeria's lights on? International Institute for Environment and Development: International Institute for Environment and Development.

Osterwalder, A. (2004). *The business model ontology: A proposition in a design science approach.* University of Lausanne.

Pettigrew, A. M. (1990). Longitudinal field research on chalnge theory and practice. *Organization Science, 1*(3), 267-292.

Prahalad, C. K., & Hammond, A. (2002). Serving the world's poor, profitably. *Harvard Business Review, 80*(9), 48-+.

Raman, P., Murali, J., Sakthivadivel, D., & Vigneswaran, V. S. (2012). Opportunities and challenges in setting up solar photo voltaic based micro grids for electrification in rural areas of India. *Renewable and Sustainable Energy Reviews, 16*(5), 3320-3325.

Rao, P. S. C., Miller, J. B., Wang, Y. D., & Byrne, J. B. (2009). Energy-microfinance intervention for below poverty line households in India. *Energy Policy, 37*(5), 1694-1712.

Ricart, J. E., Enright, M., Ghemawat, P., Hart, T. and Khanna, T. (2004). New frontiers in international strategy. *Jurnal of International Business Studies, 35*(3), 175-200.

Schillebeeckx, S. J. D., Parikh, P., Bansal, R., & George, G. (2012). An integrated framework for rural electrification: Adopting a user-centric approach to business model development. *Energy Policy, 48*, 687-697.

Scott, M., & Bruce, R. (1987). Five stages of growth in small business. *Long Range Planning, 20*(3), 45-52.

Seelos, C. a. M., J. (2007). Profitable Business Models and Market Creation in the Context of Deep Poverty: A Strategic View. *Academy of Management Review, 21*(4), 49-63.

Shafer, S. M., Smith, H. J., & Linder, J. C. (2005). The power of business models. *Business Horizons, 48*(3), 199-207.

Teece, D. J. (2010). Business Models, Business Strategy and Innovation. *Long Range Planning, 43*(2–3), 172-194.

TERI. (2014). The Energy Resources Institute.

Trimi, S., & Berbegal-Mirabent, J. (2012). Business model innovation in entrepreneurship. *International Entrepreneurship and Management Journal, 8*(4), 449-465.

Tsai, K. S. (2004). Imperfect Substitutes: The Local Political Economy of Informal Finance and Microfinance in Rural China and India. *World Development, 32*(9), 1487-1507.

UN. (2014). The United Nations. from http://www.unfoundation.org

Urmee, T., Harries, D., & Schlapfer, A. (2009). Issues related to rural electrification using renewable energy in developing countries of Asia and Pacific. *Renewable Energy, 34*(2), 354-357.

Vega-Jurado, J., Gutiérrez-Gracia, A., Fernández-de-Lucio, I., & Manjarrés-Henríquez, L. (2008). The effect of external and internal factors on firms' product innovation. *Research Policy, 37*(4), 616-632.

Weiss, R., S. (1994). Learning from strangers: the art and method of qualitative interview studies. *New York: The free press*.

Wilson, E., Wood, R., G. and Garside, B. (2012). Sustainable markets - Sustainable energy for all? Linking poor communities to modern energy services. International Institute for Environment and Development: International Institute for Environment and Development.

Wilson, E. a. Z., L. (2009). Power to the poor: sustainable energy at the base of the pyramid. International Institute for Environment and Development: International Institute for Environment and Development.

Yadoo, A. a. C., H. (2010). The value of cooperatives in rural electrification. *Energy Policy, 38*(6), 2941-2947.

Yin, R. K. (2014). *Case Study Research, 2014* (5 ed.): SAGE Publications.

Yunus, M., Moingeon, B., & Lehmann-Ortega, L. (2010). Building Social Business Models: Lessons from the Grameen Experience. *Long Range Planning, 43*(2-3), 308-325.

Zerriffi, H. (2011). *Rural Electrification - Strategies for Distributed Generation* (1st ed.): Springer.

Zomers, A. (2003). The challenge of rural electrification. *Energy for Sustainable Development, 7*(1), 69-76.

Zott, C., Amit, R. (2010). Business model design: an activity system persoective. *Long Range Planning, 43*(2-3), 216-226.

Appendix

Appendix A

Morris et al. (2005)	Decision variables by Morris et al. (2005)	**Osterwalder (2004)**	**Yunus et al. (2010)**
Component 1, Factors related to offering: How do we create value (select from each set)	-Offering: primarily products/primarily service/heavy mix -Offering: standardized/some customization/high customization -Offering; broad line/medium breadth/narrow line -Offering: deep lines/medium breadth/narrow line -Offering: access to product/product itself/product bundled with other firm's product -Offering: internal manufacturing or service delivery/outsourcing/licensing/reselling/value added reselling -Offering: direct distribution/indirect distribution (if indirect	Product: What business the company is in, the products, and the value propositions offered to the market. Customer interface: how the company delivers these products and services	What do we offer to the customers that they value? How do we deliver this offer to our customers?
Component 2, Market forces: Who do we create value for? (Select from each set)	-Type of organization: btb/btc/both -Local/regional/national/international -Where customer is in value chain: upstream supplier/down stream supplier/government/institutional/wholesaler/retailer/service provider/final customer -Broad or general market/multiple segment/niche market -Transactional/relational	Customer interface: Who the company's target customers are, and how it builds a strong relationship to them?	Who are our customers?
Component 3, Internal capability factors: What is our source of competence? (Select one or more)	-Production/operating systems -Selling/marketing -Information management/mining/packaging -Technology/R&D/creative or innovative capability/intellectual -Financial transaction/arbitrage -Supply chain management - Networking/resource leveraging	Infrastructure management: How the company efficiently performs infrastructural or logistical issues, with whom, and as what kind of network enterprise.	How do we deliver this offer to our customers?

Component 4, Competitive strategy factors: How do we competively position ourselves? (Select one or more)	-Image of operational excellence/consistency/dependability/speed -Product or service quality/selection/features/availability -Innovation leadership -Low cost/efficiency -Intimate customer relationship/experience	-	-
Component 5, Economic factors: How we make money? (Select from each set)	-Pricing and revenue sources: fixed/mixed/flexible -Operating leverage: high/medium/low -Volumes: high/medium/low -Margins: high/medium/low	Financial aspects: What are the revenue model, the cost structure and the business model's sustainability.	Is the financial translation of value proposition and constellation and includes how value is captured from the revenues generated through the value proposition and how costs are structured and capital employed in the value constellation.
Component 6, personal/investor factors: What are our time, scope and size ambitions? (Select one)	-Subsistence model -Income model -Growth model -Speculative model	-	-

Appendix B

Interview guide for interviews with MGP, Onergy, AST, TARA and Nidan

Formalities:
Name:
Role in the company:
Background:

General information about the company:

- Can you please give us a brief description of the company?
- Who initiated the foundation of the company?
- When was the company founded?
- What is the goal of the company?
- What was the background for starting the company/project?
- How many villages have you served up till now?

Early stage in the companies

(asked in the present tence to AST, TARA and Nidan, as they were still in the early stage of their project)
How did you go about developing you business in the first villages?

Challenges:

- What challenges did you face in the early stage of you company?
- What do you see as the main challenges?
- How did these challenges affect your business model?
- How did you respond do these challenges?
- What could you have done differently?
- What choices did you make and which consequences did you experience?
- Which challenges were critical from you to overcome?
- Did any situations occur that made you realize that this was critical?
- How did you overcome these?

Offering:

- What offering(s) did you provide?
- How did you choose the technology for your offering?
- Did you offer any additional services?
- Why did you provide this offering?
- Have you changed your offering? If so, why?

Investments:

- Did you get any investments?
    - Public investments
    - Private investments
- What did you need investments for?

- How did the investment affect your company?

Capability:

- How many people were you in the beginning?
- How did you get additional manpower?
- What were the expertise/skills of the original and added people?
- Did you find skilled workers?
- Did you have to train workers?

Customers:

- Who are your customers?
- How did you get customers?
- How did you get them to pay for your offering(s)?
- Did you experience challenges with getting the customers to pay?
- How did you decide the price for your offering?
- Did you identify what the customers were willing to pay for and if so, how?
- Did you experience any challenges with acquiring customers?
- Did you experience loosing customers?
- Did you experience any trust issues when entering with your project in the rural area(s)?

Distribution:

- How did you distribute your products?
    - Through partner
    - In-house
- Hoe was the distribution process for your company?
- Did you face any challenges with the distribution process?

Partners:

- Did you use partners in the early stage of your company?
- Why did you use the partner?
- What are their activities?
    - Production
    - Distribution
    - Consumer finance
    - Marketing
    - Awareness
    - Services
    - Sales

Special for ASTs partner TARA:

- Can you give a brief description of how this Speed project started (as you were involved from the start)?
- What is you role in the project?

- Why did you decide to start the project on Diara Rasulpur?
    - How are the conditions there?
- Did you take part in what kind of offering to provide?
- What is the role of Nidan?
- What activities do you do?
- What have been the main challenges in this project?
- How have you contribute to tackle the challenges?
- How has the communication been between the three parties in this project?

Special for ASTs partner Nidan:

- Can you give us a brief introduction to your organization?
- What is your role in the project?
- Why are you involved in the project?
- Were you involved with the planning of the project?
- How do you create awareness amongst the villagers?
- How do you educate the customers?
- Which activities do you have full decision power over?
- What kind of relation do you have to the customers?
- How do you contribute to acquiring new customers?
- What do you believe is important in order to succeed with such a projects as this?
- What main challenges have you experienced?
- How has the communication been between the three parties in this project?