Diffusion of innovation at the bottom of the pyramid: the impact of a payment system on the adoption of electricity in rural Uganda

JONAS EDER
CHRISTOPHER MUTSAERTS

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Abstract

This thesis analyses how a payment system affects the diffusion of renewable electricity in rural Uganda. A case study is used provided by a start-up company named Pamoja Cleantech. This company is about to sell electricity, which is generated by biomass-based gasification, to a low-income community. Several households are already connected to the established mini-grid while the majority is still not served. A chasm has been identified between the users in the rural village. The reason for this gap between adopters is the high connection fee and a lack of transparent communication. Therefore, diffusion theory has been used to analyse the impact of several payment-related solutions that could close this chasm. First of all, a set of critical factors have been identified concerning general electricity adoption in the case. Those are reliability, trust, transparent communication and satisfying the needs of the local people. Additionally, it has been shown that a payment system, tariffs, and investment costs must satisfy specific requirements in order to be effective, efficient, and positively affect the rate of adoption. These are requirements such as dealing with the cultural incompetence of people being able to save money and to overcome their understanding to have electricity as a status symbol. Therefore an existing technology with its infrastructure is proposed to use: mobile banking. Since this technology has already penetrated Uganda, its convenience to use and satisfaction is high. Additionally, it has advantages such as saving time, security, reliability, and not much space for fraud. This thesis is based on a theoretical framework that is empirically tested and will provide a description of this specific situation in Uganda. Also, it proposes several management recommendations for the company in order to convert adduced threats into opportunities and strengthen their current inclusive business model.

Keywords: Diffusion of innovation, crossing the chasm, bottom of the pyramid, renewable electricity, payment system, Uganda
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# Nomenclature and Abbreviations

## Nomenclature

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>EUR</td>
<td>Euro (currency)</td>
</tr>
<tr>
<td>km</td>
<td>Kilometer</td>
</tr>
<tr>
<td>km²</td>
<td>Square Kilometer</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt hour</td>
</tr>
<tr>
<td>UGX</td>
<td>Ugandan Shilling (currency)</td>
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<tr>
<td>USD</td>
<td>American Dollar (currency)</td>
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<td>W</td>
<td>Watt</td>
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## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>AB</td>
<td>Aktiebolag</td>
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<tr>
<td>AfDB</td>
<td>African Development Bank Group</td>
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<tr>
<td>APL</td>
<td>All Power Labs</td>
</tr>
<tr>
<td>B2B</td>
<td>Business to Business</td>
</tr>
<tr>
<td>BOP</td>
<td>Bottom of the Pyramid</td>
</tr>
<tr>
<td>CREEC</td>
<td>Centre for Research in Energy and Energy Conservation</td>
</tr>
<tr>
<td>EPBS</td>
<td>Electricity Prepayment Billing System</td>
</tr>
<tr>
<td>ESCO</td>
<td>Energy Service Company</td>
</tr>
<tr>
<td>GEK</td>
<td>Gasifier Experimenters Kit</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographical Information System Uganda</td>
</tr>
<tr>
<td>HPS</td>
<td>Husk Power Systems</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>REA</td>
<td>Rural Electrification Agency</td>
</tr>
<tr>
<td>KYFA</td>
<td>Kanaamansi Youth Farmers Association</td>
</tr>
<tr>
<td>LC</td>
<td>Local Committee</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>---------</td>
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</tr>
<tr>
<td>MDG</td>
<td>Millennium Development Goals</td>
</tr>
<tr>
<td>MEMD</td>
<td>Ministry of Energy and Mineral Development</td>
</tr>
<tr>
<td>MSI</td>
<td>Millennium Science Initiative</td>
</tr>
<tr>
<td>MTN</td>
<td>Mobile Telephone Networks</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>P2P</td>
<td>Person-to-Person</td>
</tr>
<tr>
<td>REA</td>
<td>Rural Electrification Agency</td>
</tr>
<tr>
<td>SIDA</td>
<td>Swedish International Development and Cooperation Agency</td>
</tr>
<tr>
<td>UBOS</td>
<td>Ugandan Bureau Of Statistics</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
</tr>
<tr>
<td>UIRI</td>
<td>Ugandan Industrial Research Institute</td>
</tr>
<tr>
<td>UMEME</td>
<td>Ugandan Electricity Distribution Company</td>
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1 Introduction

Making electricity accessible in rural areas in Uganda has a large positive impact on welfare, health, education and sustainability of livelihood (Mahat, 2004; Kanagawa & Nakata, 2006; World Bank, 2008). Connecting these populations to the national grid is not feasible because of two reasons; firstly it is from an economical perspective unattractive to extend grid power line to remote areas and secondly the capacity of the grid is also limited. A solution for this problem could be the deployment of decentralised power generators, preferably those that are driven by sustainable technology and use clean fuels provided by energy service companies. Similar innovative systems have shown great success in other sub-Saharan countries in terms of improving the quality of life, education and stimulation of local entrepreneurship (Musinguzi et al., 2011).

The central theme for this thesis is diffusion of innovation. Rogers (2003) defines diffusion as: “The process in which an innovation is communicated through certain channels over time among the members of a social system.” While the innovation itself is electricity with a mini-grid that makes electrification accessible for private households, this thesis focuses on analysing the most important aspects on the user-side, which is the way payments are made. We define payment system as an overall concept capturing (1) the way transactions are made, (2) tariffs and pricing structure, and (3) the investment costs for customers, as shown in Figure 1. These supporting payment aspects should aim to facilitate diffusion and usage of electrification in a suitable and beneficial manner.

The used case is a pilot project site in Uganda where a bio-mass based power plant provides electricity for a mini-grid solution. The first local households just got connected to the established mini-grid and there exists no payment solution yet hence electricity is free. Qualitative research will show how local community appraises these various payment solutions and how they affect the diffusion of electricity.

The aim of this study is to analyse the impact of the supporting payment system on the diffusion of the electricity. The income of the people living in rural Uganda is low and mostly below 1,500 USD per year which corresponds to 1,168 €.1 This makes them according to Prahalad & Hammonod (2002) part of the bottom of the economical pyramid. Improving the lives of these billions of people and converting them to customers can be lucrative business. This thesis therefore also contributes to the bottom of the pyramid, even if there is still a long way to elevate poverty. The transfer of new technologies – suitable or not – always tends to take more time than estimated (Sriwannawit & Laestadius, 2013).

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1 Here and in the following a conversion rate of 1 € = 1.28415 USD (oanda.com, 19.05.2013) is used
The outcome of this thesis is two-folded: an academic perspective it aims to make the reader understand the dynamics of a local community in Uganda and creates a framework for how the elements of diffusion are decisive for successful implementation and adoption in this special case. Renewable generated electricity can be communicated through specific channels within a social system and will be adopted in different kind of ways, whereby the tariffs and the supporting payment system can be severely influential. Since the availability of electricity will address a potentially large pioneer market, the thesis determines which factors of suitable payment aspects can positively influence the rate the adoption. In this research we differentiate between two different kinds of usages within a rural off-grid community: electricity as a productive tool and domestic usage for household activities.

There is one overall research question, which is derived from sub-questions. These sub-questions are divided in three categories: electricity, payment, and diffusion. The results are derived by participative observation and empirical field research in Uganda. The research question of this thesis is:

What factors affect the diffusion of renewable electricity in off-grid areas in rural Uganda?

To answer this research question, several sub-questions have been created: general questions and diffusion related questions. Where general sub-questions are: (1) Why does the local community want to have electricity (2) Which substitutes for electricity exist and for which purposes does a renewable mini-grid system is a better solution (3) How can productive usage be encouraged? In the diffusion of innovation area the sub-questions are: (4) Which payment solutions exist at this point in time in similar business models (5) How do a the payment system and tariffs influence the adoption of mini-grid electricity, what characteristics does it require to be adopted by local community and (6) How do the three different elements of diffusion, the innovation, communication channels and social system, influence the adoption?

On the practical side this thesis aims to provide Pamoja Cleantech AB (henceforth Pamoja) with an overview about how a suitable payment system can be carried out for their services. Moreover, it contains recommendations to the company concerning the most suitable solution for the pilot plant but also points out the lessons learned for future locations.

This thesis addresses the following structure: after the introduction, a chapter concerned with the background provides insights into the current electricity situation in Uganda, and the company that provides the case is introduced. In the methodology part, the different methods being used to study and analyse the case study are described. Next, the theoretical framework gives the reader an understanding of the scientific literature which is relevant in the area of diffusion of innovation. This part is followed by an extensive case review. In the analysis part, the results from the applied methods of the case study are in context of the theory described and discussed. Finally the conclusions and management recommendations are drawn.
2 Background

“Today, countries like Uganda are still 90% unserved by electricity. […] Do we expect Africans to wait for grid electricity to incrementally reach people or are there disruptive innovations that can provide off-grid renewable energy to rural Africans in scalable ways? […] Today, Africa is mostly unserved by power grids but given innovation possibilities, are there not scalable ways to introduce renewable energy to millions of people who are completely unplugged from the global economy today?”

Walji (2008), the former head of several global development initiatives and today’s director of the World Bank Institute’s Innovation Labs, claims in this quote that a lack of electricity is hampering development in Uganda. In order to get a deeper understanding of this interconnection, this chapter provides after a brief introduction of the country, its current political and economic situation, and an overview of the energy and especially electricity situation in Uganda. Then, the impact of this setting for the society and especially for the business environment and development in rural Uganda is explained. The final subchapter sets the company of the later explained case in this framework.

2.1 Economic and political situation in East-Africa and Uganda

Africa is said to have many opportunities to become a promising continent. Life conditions of its population have improved tremendously the recent years and this trend seems to continue. Unfortunately, African statistics often show unreliable figures; however their development suggests that in overall the countries in sub-Saharan Africa make good progress (The Economist, 2013). Table 1 provides a brief overview focusing on East Africa’s countries and their GDP, population and regime.

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP (average annual % change 2002-2012)</th>
<th>Population estimate in million (2012 or latest available)</th>
<th>Regime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanzania</td>
<td>6.9</td>
<td>43.0</td>
<td>Hybrid</td>
</tr>
<tr>
<td>Kenya</td>
<td>4.6</td>
<td>42.1</td>
<td>Democracy</td>
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<td>4.1</td>
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Table 1: Overview East-Africa’s GDP change, population and regime (World Bank, 2013)

Uganda is a landlocked country in East Africa with 35.6 million inhabitants and a total area of 241,550 km² (UBOS, 2012). This results in a density of 148 persons per km² which is even for an Eastern African country quite high. The Human Development Index in 2011 ranks Uganda position 161/187 (UNDP, 2011) which indicates that its people are compared with the rest of the world at the lower end in terms of life expectancy, health and income. One reason for this low ranking is that landlocked nations are considered to be the poorest among all countries of Africa. A lack of decent transportation infrastructure disperses these countries especially in terms of trade from the rest of the world. However, improving this lack and therefore decrease transportation barriers would not only result in a fortune for Africa, another positive side effect would also be that violence and undermining of the government might diminish (The Economist, 2013).
Another reason for the current conditions is that the tyranny in Uganda in the 1970s under Idi Amin was destructive for the country’s economy. Still, it underwent economic transformation since the government of Yoweri Museveni came to power in 1986 (Reinikka & Collier, 2001). In fact, much has been done on political level especially between 1996 and 2006 in order to fight poverty and led in the following years under multi-party politics to prosperity (Hickey, 2013). Not only the real GDP that represents not the monetary but the real value of goods and services increased tremendously, but also the population. In 2011, the total fertility rate was 6.2 children per woman resulting to a growing rate of around 3.2% annually (UBOS, 2011). In only the 20 years between 1990 and 2010, both inhabitants and GDP per capita doubled: population from 17.7 Billion to 33.4 billion while the income per capita in constant prices increased from 303,998 UGX to 607,217 UGX (AfDB, 2011a) which is a raise from 90,80 € up to 181,36 €.²

2.2 Energy and electricity conditions in rural Uganda

In 2010, only 3.8% of the rural population had access to electricity to lighten their houses, whereas 41.2% in the urban areas (UBOS, 2010). This is even more dramatically since in 2012, a majority of 85.3% of citizens lived in rural areas (UBOS, 2012). The two priorities of the Ministry for Energy and Mineral Development of Uganda (MEMD, 2012) are right now to (1) increase electricity generation capacity and transmission networks and (2) increase access to modern energy services through rural electrification and renewable energy development. Besides this strategy Obermaier et al. (2012) also suggest enabling new customers to increase their electricity consumption since many of them are not connected to a grid but only use it as e. g. to charge their mobile phone. Also, there are ambitious goals set by the rural electrification agency (REA) to reach universal access to electricity by 2035 while they already failed achieving their goal to reach 10% in 2012 (REA, 2006).

As shown in Figure 2 the primary energy sources in Uganda are with more than 90% based on biomass (fuel wood, residues, charcoal). The amount pared with these kinds of sources had tremendous influence on the woodlands in the recent decades. Between 1990 and 2010, 37.3% of the forest has been cut down (UN, 2012).

Nowadays, electricity is only produced by renewable energy sources, since Uganda has no power plants running by nuclear power or coal and oil products. As can be seen in an overview in Figure 3 the main electricity source is hydroelectricity. Only those are connected to the grid that live in larger communities near to the existing grid between towns, since there the investment costs to get connected are affordable (World Bank, 2008). For a map with the national grid of Uganda see Appendix A: Figure 8.

² Here and in the following a conversion rate of 1 € = 3.348,05 UGX (oanda.com, 19.05.2013) is being used
The lack of available and affordable electricity has large impact on people living in rural Uganda. The willingness to pay is high and exceeds usually the average supply cost (World Bank, 2008). Still, benefits of rural electrification are mostly captured by the non-poor. Since the costs of off-grid electrification technologies have kept on decreasing since the 1970s, these solutions started to move simultaneously to the centre of attention in areas difficult to reach with grid (World Bank, 2008). The benefits are multi-sided: on the one hand there are benefits from devices which worked with petroleum, kerosene, and diesel engines before. On the other hand there are the households with education benefits from higher educational attainment by the children, time saving from household chores, productivity from home business, gender equality, increased agricultural productivity, improved health as result of improved indoor air quality, reduced fertility, and public goods benefits as increased security (World Bank, 2008).

The basic criticism on rural electrification is that it by itself will not irrigate fields, apply fertilizer, or produce industrial goods. Rural electrification should therefore always be placed in the context of integrated development programs to have a substantial impact in the countryside (Barnes, 1988). One approach is the consideration of community-driven mechanisms. The involvement of local institutions and producer organizations increases the public awareness for new services (World Bank, 2008). Also, new ways of thinking about energy for rural and poor people have to be established. Already Barnes and Floor (1996) argue that it is important to have an approach of involvement of the local community, donors, stakeholders, and investors. To make this happen, a high local investment in terms of time but also money is necessary. They argue that this market approach has to be supported by technical assistance, training and extension services.

2.3 Impact of electricity on development and business in rural Uganda

Rural electrification is considered to be a key strategy for poverty alleviation and sustainable development (Obermaier et al., 2012). The Millennium Development Goals do not directly cover energy services such as access to electricity and modern cooking fuels. Still, investing in electricity is crucial in a practical way for achieving the health and education goals, as well as for powering machines to increase income (Sachs, 2005). Maleko (2006) states that “the availability of the electricity services is one of the factors facilitating the decision of local entrepreneurs to invest in income generating activities such as milling machines, wood works, and welding workshops”.

![Figure 4: Development of real GDP end energy consumption per year, data: AfDB (2011b) and AfDB (2012)](image)

In fact, electricity contributes to development and welfare and those two are according to scientific literature (Kebede et al., 2010; Jamil & Ahmad, 2010) strongly correlating. The study of Kebede et al (2010) concludes that the GDP in Sub-Saharan Africa is one of the lowest in the world and points out
that one main reason is the countries’ economic development being dependent on energy consumption which is lacking behind. As can be seen in Figure 4, Uganda is in the recent years as stated by Hickey (2013) going through a positive development.

Renewable energy is contributing to improved standards of living but also to modernization of agriculture in Uganda (Turyareeba, 2001). In fact, it can be assumed that biomass will continue to be the main energy source and by converting this source to modern energy such as electricity this can in future be beneficial for businesses and value-creating entrepreneurs (Karekezi & Kithyoma, 2002). This is also measured empirically: according to an enterprise survey electricity is the main obstacle for firms in Uganda (World Bank, 2008). 64% of the surveyed firms in the country see electricity a barrier, while it is only 37% for whole Africa. Other major obstacles such as taxes (11%), access to finance (7%), and corruption (3%) are way below this number.

Also a more recent study of Kooijman-van Dijk and Clancy (2010) about electricity access for rural enterprises considers that this kind of utilities have the potential to play a key role in the development of local enterprises. Doing so it is not only necessary for those providers to be a supply-sided infrastructure company, but they also have to stimulate their market by engaging themselves in the demand side. Kooijman-van Dijk and Clancy (2010) argue that by encouraging, supporting, and even investing in business development they can help the clients to generate additional income which is necessary to pay for the services and even increase the demand which creates a “win-win” situation.

Based on this recommendation, it is not easy to point out locations which are most suitable for establishing off-grid solutions. The World Bank (World Bank, 2008) suggests for cost effectiveness a long distance to the existing grid, a big size of population with an average community income that makes electricity affordable, and last but not least productive potential for value-generating usage. A study of Vine (2005) comes to the result that there are certain barriers for energy service companies (ESCO) in developing countries, such as (1) residential and agricultural sectors are less attractive than industrial, commercial, and municipal (2) there is unfamiliarity in energy performance contracting of its potential customers and that (3) there is a lack of financing and energy-efficient technology for making use of the electricity. These barriers make it especially difficult to enter the market in rural Uganda, which is mainly based on the agriculture sector and individual farmers (UBOS, 2012), where businesses get commonly only started because of family traditions, and their finance is to 80% based on personal savings (Katwalo & Madichie, 2008). Additionally, Bastakoti (2003) states in his study about rural electrification that the usage that goes beyond lightning, radios and other home-applications are slow to emerge and hence the argument of Koojman-van Dijk and Clancy (2010) is true but takes a lot of time and efforts.

2.4 Pamoja Cleantech AB

Pamoja Cleantech is an ESCO providing electricity with bio-gasification power plants to people living in rural areas without access to the national grid. According to their business model, their customers are households, machines and devices of small entrepreneurs, and telecom tower base station owning companies which suffer in rural areas from power-outs and mostly run with diesel generators (for the business model, see Appendix B: Figure 10). In practice, the business model is going to differ from site to site according to the demand. At some sites the electricity which is generated is distributed via a mini-grid to all its customers, while at other sites it is just connected to the machines or telecom towers close by excluding the households. Pamoja promotes to have an inclusive business model which means to be beneficial for the local community in terms of providing electricity services, creating employment and increasing income. Pamoja is aiming to be a social business which means being outside the profit-seeking world and solving a social problem (Yunus & Weber, 2010). Also, it
is only self-sustaining in terms of covering the own costs, eventual economic surpluses are spent in
growth. Sources of money can be either foundations, wealthy philanthropists or others that want to
make a difference in other people’s lives. The company is divided in two distinctive groups: Pamoja
Stockholm is concerned with the strategy and business activities, whereas the team in Uganda focuses
on the operational activities.

The power system of Pamoja is derived from the fact that the technology of their power plants which
is gasification can be an economically attractive and cleaner alternative to diesel generated electricity
in East Africa, considering increasing fossil fuel prices. However to be competitive, a stable and
sufficient power demand is necessary (Buchholz et al., 2012). The goal of Pamoja is to enable local
populations to develop new businesses and services and to empower rural healthcare modules. Also,
farmers sell them their agricultural residues to generate additional income. In order to make the system
even more sustainable, Pamoja is considering do start own agroforestry in order not to contribute to
the cutting down of forests. One side product of the power plant is bio char which can be used as
fertilizer or for producing char coal briquettes. The long-term goals of Pamoja are to establish 60
power plants in rural areas all over Uganda within the next years by exploring the opportunity to
convert their business model to a franchise concept.

By collaborating with a lot of different stakeholders Pamoja maintains a high knowledge transfer.
Their academic partners are Centre for Research on Energy and Energy Conservation (CREEC) at
Makerere University in Kampala which helps to find suitable sites and gives inputs around the
technology, the Royal Institute of Technology in Stockholm from where on regular basis students and
researchers contribute with their manpower and expertise, and the Center for Social Entrepreneurship
at Stockholm University which provides consultation around business development, legal aspects, and
housing. Pamoja also works with two main industrial suppliers Husk Power Systems (HPS) and All
Power Labs (APL) with the GEK-Gasifier that supply them with two different kind of bio-mass based
power plants (32 kW and 10 kW) and know-how. Also, they collaborate with the Swedish
International Development and Cooperation Agency (SIDA) for advice and funding, and the NGO Vi-
Agroforestry that has expertise working with farmer cooperatives.
3 Research Process

For the methodology a qualitative research method is adopted in order to understand the dynamics and complexity of the case and to research the problem in its natural surroundings. Furthermore, while there has a lot of research been done about rural electrification in general, there is only little knowledge available about payment implications on the user-side. Since the chosen field of research is in addition to this explorative phase additionally quite complex, delineation and containment is required. Qualitative research is most suitable when the focus is on discovering the meanings seen by those being researched and when the aim is to understand the view of the world which they have (Jones, 1995). Therefore, qualitative research is for the field study which has been conducted most applicable and has been collected as primary data. The reasons are that data that can be found in and about Uganda is not always reliable, and that our field of research suggests getting first-hand experience. Otherwise the only solution would have been to recruit someone to collect data for us what we have considered as to be less reliable. Also, we were worried that there would be an information loss when collecting data indirectly.

Since the framework for diffusion of innovation already exists, a deductive research method is used. In a top-down process first the theory is introduced, and then the research for the case is conducted. In the following part the empirical results are embedded into the theoretical framework in order to proof how it is applicable but also what special characteristics the particular case has, before finally the conclusions and recommendations are drawn. Still, the research process is not completely linear in terms of the methods being used. While the interviews and the survey are conducted in sequence as described before, the observation phase for the case already started from the very beginning of the whole process. Also, the research (sub) question(s) that are based on the case and the theory have been adapted according to the changing circumstances and research outcomes of the case. This chapter defines and explains the mentioned different methods and provides insights in why they have been used, how they have been developed, and what kinds of limitations restrict the research.

3.1 Methods

A case study is used which is suitable when one investigates to answer specific research questions and seeks for different kinds of evidence in the case (Gillham, 2000). In order to collect data, five different methods are used: a literature study (secondary data) and qualitative methods (primary data) constructed as (1) expert interviews and (2) focused interviews, (3) a survey and (4) participative observation. The case study is focusing on the payment aspects that Pamoja is confronted with on the customer side where individuals, households, institutions are involved. These aspects are already briefly described in the introduction and will be more detailed specified in the description of the case.

The literature research is aiming to bring the reader up-to-date with current literature on the topic (Cronin et al., 2008). The search and selection strategy was first to get an overview about research being done in the topic by reading related papers and the theory they addressed. The theory that appeared to be most suitable is the diffusion theory of Rogers (2003) that contains the elements (1) innovation (2) communication channels (3) time and (4) social system that are the components that become crucial factors for the diffusion of electricity when looking at its payment system.

The total diffusion process stretches out over different influences of (cross-cultural) actors. A various number of individuals have been chosen to be part of the research in order to have an as clear picture as possible and to understand as many circumstances as possible in order to be able to identify and select the most critical and relevant factors for this thesis. Table 2 shows the individuals that have been chosen to be part of the four research methods being applied for the case. A more detailed
overview of the interviewed and surveyed persons can be found in the Appendix C: Table 7 and Table 8.

<table>
<thead>
<tr>
<th>Methods</th>
<th>Individuals</th>
<th>Amount of individuals assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Expert interview</td>
<td>Persons with different expertise and kind of views, including</td>
<td>12, whereof 2 [A], 2 [B], 4 [C], and 4 [D]</td>
</tr>
<tr>
<td></td>
<td>[A] Workers and [B] academia stakeholders of Pamoja,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[C] individuals of institutions and companies in Uganda,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[D] individuals with experience in rural electrification</td>
<td></td>
</tr>
<tr>
<td>(2) Focused interview</td>
<td>Actual and potential adopters that are residents in the village</td>
<td>31, including 3 opinion leaders</td>
</tr>
<tr>
<td></td>
<td>with the pilot power plant of Pamoja</td>
<td></td>
</tr>
<tr>
<td>(3) Survey</td>
<td>Project staff of Pamoja, first [E] the workers in the office in Sweden, then</td>
<td>25/31, subset method (2)</td>
</tr>
<tr>
<td></td>
<td>[F] of the operating workers in Uganda, then [G] stakeholders (electricians,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>construction workers) that operate for Pamoja in the village, and [H] the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>individuals and households living in the village</td>
<td></td>
</tr>
<tr>
<td>(4) Participative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>observation</td>
<td>Project staff of Pamoja, first [E] the workers in the office in Sweden,</td>
<td>4 [E], 3 [F], 4 [G], &gt;100</td>
</tr>
<tr>
<td></td>
<td>then [F] of the operating workers in Uganda, then [G] stakeholders (</td>
<td>individuals and &gt;50 households [H]</td>
</tr>
<tr>
<td></td>
<td>electricians, construction workers) that operate for Pamoja in the village,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and [H] the individuals and households living in the village</td>
<td></td>
</tr>
</tbody>
</table>

| Table 2: Individuals being studied by the research methods |

3.1.1 Description and suitability

*Expert interview*

The expert interview form is used in the empirical social research in order to give an experts opinion that is according to Flick (2009) less about the persons but rather about their capacities as experts in this field of research. He states that an expert interview is less suitable as a single but rather as complementary method, as in our case to the observation and focused interviews. A problem for expert interviews is the definition of what makes the person an expert. Meuser and Nagel (2004) define an expert as someone who (1) in some kind of way carries responsibility for the draft, implementation or control of a problem’s solution or (2) who has privileged access to information about relevant populations, social situations and decision processes. While for the expert interviews from Table 2 counts for the individuals from [A] and [D] to belong to the first group (1) of the definition, the interviews conducted with the individuals from [B] and [C] are part of the second one (2).

For this thesis, this method is used in form of a systematizing expert interview, which according to Flick (2009) “can be used to collect context information complementing insights coming from applying other methods”, since this is the case for this thesis. For an expert interview, a guide is important which makes sure that the conversation does not get lost in topics that are of no relevance (Meuser & Nagel, 2002). Therefore, the topics of each expert interview got structured according to expertise of the individual.

*Focused interview*

The focused interview is developed by Merton and Kendall (1946) and has been chosen to interview the villagers in the local community because it fits best into the situation where the research is conducted. According to Flick (2009) it is suitable to study subjective perceptions in different social groups, which means for this thesis a differentiation of the villagers of the local communities
according to the groups of Rogers’ adoption curve. The research questions focus in this kind of interview lies “on the impact of concrete events or the subjective handling of the conditions of one’s own activities” (Flick, 2009).

Flick (2009) states that the original aim of the focused interview was to provide a basis for interpreting statistically significant findings and that there are four criteria about how to conduct an interview: (1) non-direction (2) specificity (3) range and (4) the depth and personal context shown by the interviewee. Non-direction (1) is achieved by using several forms of questions such as unstructured, semi-structured leaving the question opened, or where the reaction is defined and the concrete issue is left open and structured questions where question and answer are defined. First unstructured questions are asked, and structure increases during the interview (Flick, 2009). Specificity (2) means the principle of not being too detailed but also not too general in the question. Merton and Kendall (1946) state that it is important for questions to be explicit enough to provide a suitable answer but still stay general enough to let the interviewee chose the structure of the answer. Range (3) means that the questions are chosen in a way securing that all relevant aspects and topics are taken into account, and that the interviewees have the chance to add own topics and ideas (Flick, 2009). Depth and personal context (4) of the interviewee is finally that not to achieve only simple answers, but that the interviewer understands the background and stimulus of the interviewee (Merton & Kendall, 1946). The purpose here is to create a situation where we try to find out what the interviewee thinks. Different (indirect) questions are used to exclude incoherent answers.

Survey

According to Bickmann and Rog (2009) a survey is usually used to collect quantitative or numerical information about the studied population. Information is collected about only a fraction of the population instead of every member. Surveys are usually used to measure public opinion in terms of subjective feelings, and in order to understand consumer preferences and interests (Bickmann & Rog, 2009).

Participant observation

This method is by Jorgensen (1989) defined as “a field strategy that simultaneously combines document analysis, interviewing of respondents and informants, direct participation and observation, and introspection”. Since the data collection is mainly based on communication, openness is essential (Flick, 2009). According to Spradley (1980) participant observation requires the researcher to become directly involved as participant in peoples’ daily lives which allows the researcher to understand the meanings and interactions as an insider. Since it is important that the results of participant observation are recorded, a log of the activities and experiences is recommended during the observation in order to ensure not to leave out details (Spradley, 1980).

The requirement of Spradley (1980) has been fulfilled since we were working together with the staff of Pamoja, their stakeholders on site and also have been working and interacting with the population in the village of the case. Also, observing in the village contributes to the overall research by understanding more about the individuals and households on a less formal way, and hence also increased the reliability of the results of the focused interviews, e.g. for checking the stated income of the household from seeing how the houses look like, what kind of furniture and how many rooms they have, and how many animals or how much land they own.
3.1.2 Design and execution

Expert interview

The interviews were only designed semi-structured based in order to give the expert the necessary degree of freedom. Since the interviewed persons all had different kind of expertise (see Appendix C: Table 7), the topics that have been talked about always have been selected and the questions adjusted for each single expert. The six topics being used were (1) electricity (2) social system (3) adoption (4) payment system (5) tariffs (6) entrepreneurial activities. The answers have been noted down and then were analysed on repetition of certain statements or evidence with the results from the theory, interviews, and survey.

Focused interview

The structure has been constructed based on four overall topics for all villagers (see Appendix C: Table 9) and an additional one for the opinion leaders (see Appendix C: Table 10) which are important players in the social system according to Rogers (2003) theory of diffusion. First, general information about the interviewee and its household is collected. The second part is concerned with knowledge and insights of interviewees given electricity as the topic. Thirdly questions are constructed about payment, tariffs and pricing. The last section is focussed on adoption. The identified opinion leaders are in an optional fifth part questioned about whether they really fulfil the criteria of being an opinion leaders and secondly about their influence in the village.

The process of designing the final focused interview has undergone multiple phases. After constructing questions as described above, verification and validation has been sought. Therefore the interview guides have been reviewed by several researchers from academia and tested on individuals in the village twice. Also, the focused interviews have been translated to the local language and were conducted on field with two local translators in order to decrease language barriers and unassertive answers. Also, the interviewees have been carefully selected in order to get information from all various kinds of villagers. The data collected from the interviews has been analysed by transcription and coding. This is carried out by identifying relevant passages and parts, and by naming and grouping those passages.

Survey

Every person that was interviewed with a focused interview also received a survey (see Appendix C: Table 11) that was translated in the local language and handed out after the interview. Besides collecting additional opinion and consumer preferences, the surveys were also conducted in order to verify the provided answers from the focused interviews. The surveys were left with the interviewed persons to give them time to fill them out individually and collected a few days later. Out of the 31 surveys handed out, 28 have been filled out by the surveyed people. Since three were submitted in a not understandable way, only 25 of them could get used for the analysis.

Participant observation

The participant observation data collection is accomplished from taking field notes as recommended by Flick (2009). Since we have been interns of Pamoja and closely collaborated with the staff, we were able to understand many dynamics of the company. In detail, we observed: (1) how the company internally conducts business, (2) how the ‘field’ which is the village actually looks like and (3) how
the company, its stakeholders in the village, and the villagers themselves interact. This included understanding how all those individuals are thinking, behaving, and communicating with each other.

3.2 Limitations

The methodology is constrained by multiple factors such as (1) time (2) language barriers and cultural barriers such as (3) blurring of information and (4) different perceptions.

Due to a (1) time restriction of conducting field research, there can be shortcomings in depth of the research. A social process such as diffusion takes more than the eight weeks of time that were available for the research. Therefore we decided to exclude the ‘time’ element of Rogers (2003) definition. Furthermore the interviews for the field studies are in most of the cases not statistically significant for the whole village.

There also occurred language and cultural barriers. The majority of the people in rural Uganda (2) speak Luganda or Swahili, but barely any English. In order to bridge this gap we used as described local translators, but although we explained them how to do objective interviews it cannot be verified whether they always translated literally correct and did not leave out given information. In addition, people in rural areas in Uganda tend to (3) blur information. Previous research of Pamoja and CREEC showed that often-incorrect information has been provided. To reduce to possibility on this we tried to create an atmosphere of knowledge sharing as recommended by McDermott and O’Dell (2001) by introducing ourselves and explaining what the research is about. Also, we included ‘shadow’ questions. This means that they were asked the same questions reversed and asked at a different time during the interview and in the survey. Also (4) some of the villagers saw us as strangers that want to bring some costly and maybe complicated payment system, which might result to more careful and discreet answers. In order to decrease this barrier we visited the village several times before we conducted the interviews, walked through, chatted with the villagers, and worked as semi-electricians in their houses with the wiring in order to gain trust.
4 Theoretical framework

In order to establish the boundary conditions of this thesis, and to avoid vagueness and to achieve the purpose of the thesis, innovation, innovation in developing countries, diffusion, the chasm, the bottom of the pyramid, and characteristics of different payment systems and tariffs have to be clearly defined. This section provides insights into the scientific literature written in these areas. This research focuses on the diffusion of this innovation since the innovation encompasses a series of processes which describe how it diffuses in a social system. Innovation theory, with focus on developing countries, is described because innovations are differently perceived when applied in a developing country. An innovation is often not completely new, but only enabling access to people in developing countries is be enough to consider it as an innovation there. The diffusion theory of Rogers (2003) is used to gain insights in this social process in rural Uganda. It could describe similarities or differences with when the theory is applied in the Western world. Interrelated with diffusion theory is the chasm, there could occur a chasm between groups of adopters in a social system depending on the novelty of an innovation. Since Pamoja is targeting a specific segment of potential users, the bottom of the pyramid theory is discussed. Finally we use literature on the payment system to give the reader an understanding which features it entails.

4.1 Innovation in developing countries

This sub-section briefly defines and explains innovation, its context in the developing countries and especially how payment solutions are considered to be helpful to affect the rate of adoption of the discussed innovation; the availability of renewable electricity. An innovation should not only be perceived as a single product breakthrough, but also as a process-one that involves the development and application of new knowledge and skills, rather than being an easily identifiable event (Hobday et al., 2011). According to Schumpeter (1935), innovation must increase overall value due a positive change; it has to be perceived significant different from what was there before to have a positive value. As a consequence this could result in increased productivity and efficiency, which is a crucial source for an improving a wealthy economy. Rogers (2003) recognizes an innovation as “an idea, practice or object that is perceived as new by an individual or other unit of adoption”.

According to Schumpeter (1934) innovation entails the following definitions:

- “The introduction of a new good, that is one with which consumers are not yet familiar, or of a new quality of a good;
- The introduction of a new method of production, which need by no means be founded upon a discovery scientifically new, and can also exist in a new way of handling a commodity commercially;
- The opening of a new market, that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before”

Based on Schumpeter’s (1934) definition we can discuss how innovation in developing countries applied and what kind of local conditions and barriers have to be considered. Often an innovation from the western world is not new in developing countries but new in a sense where it becomes available and accessible. For this study it should be clear that the concept of innovation encompasses technological innovation, as given from the examined case.
Aubert (2005) argues that the promotion of innovation in developing countries faces a set of barriers such as low education levels and bureaucratic organizational structures. Also, a lack of logistic infrastructure is slowing development and diffusion of innovation down. Wüstenhagen et al. (2007) state that new energy technologies are, when transferred to developing countries, bound to infrastructures that make them more complex for diffusion of innovation than other products. A possible reason for this could be the misinterpretation or incompatibility with values of the targeted social system. This is aligned with a study on the social perceptions of a technological innovation implemented in rural Mexico which shows that the adoption process of such an innovation is slow and often requires many successive attempts in order to influence people’s thinking. Troncoso et al. (2007) point out in this study that is important that a specific implementation program considers returning on a community later on in time in order to give the late majority also a chance for adoption.

4.2 Payment systems in developing countries

Given the case of Pamoja, it is necessary to describe the theoretical insights on payment systems in context to developing countries in order to get a better understanding. A payment system is built up from the following components: (1) the tariffs which have different features and a certain pricing structure that affect the use and consumption, and (2) the transaction itself. Still, payment systems and tariffs are interrelated and there are certain solutions that are better complements than others.

4.2.1 Tariffs and pricing

The tariff structure of a payment system for rural electrification should have several characteristics. Inversin (2000) suggests as tariff and pricing objectives to (1) have a low tariff for basic electricity for the poorest (2) maximize the number of consumers (3) incorporate flexibility especially when customers do not have a regular income stream (4) encourage the productive use of the power and (5) encourage use of electricity at peak times. A restriction is according to Rolland and Glania (2011) that for the sake of project sustainability the tariffs have to be constructed on a way that the project does at least break even, but in the better case is even financially viable. Break even means that the tariff is designed to ensure just enough revenues to cover the operating, maintenance and replacement costs. These types of projects usually require that overhead costs and initial investments are covered by other financial means, for instance subsidies. A financially viable tariff has to cover all system components costs and has to bring sufficient return to attract private investors (Rolland & Glania, 2011).

There exist two different kinds of tariffs: power-based and energy-based. In power-based tariffs customers have a fixed power limit. One solution is that the electricity provider has an agreement with the consumer to use only certain devices as e.g. two 10 W bulbs and a small radio, however this system is easy to abuse (Inversin, 2000). That is why usually load limiters are installed. According to Inversin (2000) the most important advantages of a power-based tariff is that the payment is simpler and the installation is cheaper. The amount of money can be paid on a regular basis, and no time-consuming reading of expensive meters is necessary. As main disadvantages Inversion (2000) addresses restricted electricity availability, increased opportunities for fraud because there is no control without meters, and uneconomical use of electricity. The price for the consumers will not change according to the usage, so the consumers have flexibility so reduce their bill in times with lower income and there is also no incentive to switch off lights and devices. Also, there is only the manual possibility to disconnect (and later reconnect) consumers that do not pay in time what brings extra maintaining costs.
In energy-based tariffs the bill is determined by the quantity of energy used by the consumer, which requires the installation of an electric meter. The advantages are that these tariffs are flexible and encourage energy conservation and usage of more energy efficient devices (Inversin, 2000). Despite that meters can help detecting fraud, there exist even time-of-day meters which can with different prices discourage consumption at peak times and increase use of off-peak power. However, there are also drawbacks (Inversin, 2000). Mainly they are cost-related because of meter reading, accounting and billing. Also, a load limiter is still necessary to prevent the supply from overload. Another problem is that consumers may have difficulties to understand the prices and the meters which can result to a high bill. This is why prepayment meters are very useful for energy-based tariffs in order to decrease costs for meter reading, billing and avoiding overdue accounts (Rolland & Glania, 2011). Also, for larger consumers costs of a meter are according to a study in Zimbabwe easily covered and the better solution (Inversin, 2000).

The pricing of power-based and the energy-based tariffs can be proportional but also progressive or regressive. Progressive pricing is based on a price which increases over-proportional with a higher power level or energy. Regressive costing is just the opposite: the more the consumer buys the less expensive each unit gets. Obviously, households which spend less money for electricity would benefit from a progressive pricing model while households spending more money for electricity benefit from regressive pricing. Although it depends on the natural and individual preferences of the households how much of their income they want to spend on electricity, the pricing according to a progressive or regressive model can influence these preferences. According to microeconomics, private households try to optimize their gains. Constraining the use of energy to pricing, households would aim for the substitute with the cheapest price. The demand curve for electric lightning compared to kerosene lightning shows that the total household expenditure for a certain amount of light without electricity is usually higher than the price that has to be paid for the same service level of light with electricity (World Bank, 2002). This can have an impact on the amount of electricity that will be consumed since the new electrified households might according to their preferences either spend less money than before while using same as much lightning or they might even increase the amount of money spent for lightning because additional lightning costs now less.

4.2.2 Payment systems and money transfer

A payment system allows a user (payer) to transfer money to a supplier (payee). A payment system should aim to bring the lowest possible additional costs while being in the optimal case accessible for everybody. In 2009, only 5% of the Ugandan population had a bank account (Landau, 2009). According to Popack et al. (2009) people have to walk long distances to walk their bank account to make withdrawals or pay bills. This is why new systems are necessary, e.g. have real-time access to the virtual bank account using a mobile phone (Poback et al., 2009).

A market research study of Kabbucho et al. (2003) about the reasons and ways of sending money in Uganda and other Eastern African communities says that there is weak financial infrastructure which is heavily cash-based. Their research states that it is a challenge to walk around collecting big amounts of cash. Kabbucho et al. (2003) come to the conclusion that accessibility, reliability, efficiency and timeliness, sufficient service network, and affordability are the most important requirements for money transfer.

There exist different solutions for money transfers that are specific for both tariffs. In general there are two main factors that have impact on the technology that has to be used. The first factor is time of payment which is either in fix time periods or irregular, for example with pay-as-you-go systems. Periodic payments make sense for power-based tariffs while pay-as-you-go systems are only suitable
for energy-based tariffs since they require a meter. Periodic payments can occur before or after use of the electricity, while pay-as-you-go implies to be a prepaid system. While a pay-as-you-go system is completely flexible, also the payment for a periodic tariff does not need to be carried out on regular basis but is also possible to transfer the money with certain occurrences, that could in rural regions be the periods of harvesting when consumers have money.

The second factor is the way money is transferred which can be by cash or different electronic solutions. In Uganda, about 72% of the bills and fees that have to be paid to companies, institutions and schools are still paid cash (Godoy et al., 2012) which makes it more difficult to diffuse electronic systems because people might have problems to handle them. However, collecting cash is on long-term more time consuming and can also lead to higher complications when consumers refuse or cannot pay. Adapting an electricity prepayment billing system requires installing meters which is only viable if the financial resources for the undertaking are available and the potential benefits are higher than the costs of implementation (Mwaura, 2012).

<table>
<thead>
<tr>
<th>Tariff</th>
<th>Cash</th>
<th>Electronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power-based (fixed periodic)</td>
<td>Monthly bills to be collected by the supplier</td>
<td>Consumers pay fix bills individually, supplier needs to control</td>
</tr>
<tr>
<td>Energy-based (Pay-as-you-go)</td>
<td>Needs a supplier ‘station’ where consumers can come to load up their account</td>
<td>Consumers can load up their account independent, supplier has to do nothing</td>
</tr>
</tbody>
</table>

Table 3: Complementing tariffs and payment systems

While for cash payments individual solutions can be found together with the community, electronic money transferal often requires a partner. The payment can be done by bank account, mobile phone, or an additional device. In rural Uganda paying with bank accounts will not be adopted easily since only 5% of the populations have one (Landau, 2009). In rural Uganda 50% of the individuals owns a mobile phone, 26% can at least use the mobile phone of someone else but 24% has no access at all (Godoy et al., 2012), which opens a possible solution. For example the company SharedSolar that operates in Southern Uganda has implemented a mobile phone scratch card solution where consumers make prepayments for decentralized PV electrification (SharedSolar, 2013). An example for an additional device would be the company Insensus that operates since 2008 with mini-grid suppliers in Senegal, providing extra electricity cards that can be loaded up with money and transferred into any private household’s meter. Insensus even uses a stacked pricing method for which a certain amount of kWh per time unit which has been agreed on in the contract can be extended by additional kWh’s for a premium price (Inensus, 2013).

Mobile banking is a service that allows individuals to make financial transactions using cell-phone technology. Kenya is one of Africa’s countries that have seen the most rapid widespread growth of mobile banking since its introduction in 2007 as a service in the developing world (Jack & Suri, 2011). In Kenya the figures for person-to-person (P2P) transactions are impressive; over 1.6 billion USD worth of transactions has been made through the M-PESA system (Mas & Morawczynski, 2009). The benefits of using mobile banking for the M-PESA case in Kenya are the following; (1) easy and quick customer registration, (2) simple and transparent retail pricing, (3) free deposits and no minimum balance (4) the ability to send money to non-users and (5) enabling ATM withdrawals.

According to Jenkins (2008) mobile banking is able to facilitate the financial sector which produces enormous potential for development. Access to mobile banking creates an opportunity to help poor
people to reduce poverty on two ways. First, access provides them to obtain savings or other credit, which enables them to invest it in income generation and asset creation. Second, they help reduce vulnerability to unexpected events such as accidents, illness theft or drought. In addition to this, poor people are often forced to rely on informal financial services. These may be unsafe or expensive (Jenkins, 2008).

The excitement around mobile banking in the payment space can be explained by the interaction between three different aspects, each of which contributes to the emerging actor-network (Mauer, 2011):

1. “increasing interest among financial and communication service providers in enhancing fee-based revenue;
2. awareness that information and communication technology can reach deeper into global south than many other institutions and industries in terms of infrastructure requirements (tangible aspects);
3. increased attention given to microfinance (Manji, 2010).”

4.3 Diffusion of innovation and the chasm

Diffusion of innovation is the main theme of thesis. The term diffusion is derived from the Latin word diffusio, meaning: to spread out. Hence diffusion of innovation is about the way innovations spread out. This subsection discusses the theoretical foundations of diffusion theory of Rogers (2003) and is built up according to the four elements innovation, communication channels, time, social system, and additional its extension to the chasm. The time element is here described to complete the theory; as being said, it has not been considered for the case and in the analysis.

4.3.1 Diffusion theory

There are definitions of different scholars on diffusion theory such as to be “the process of the market penetration of new products and services that is driven by social influences, which include all interdependencies among consumers that affect various market players with or without their explicit knowledge” (Peres et al., 2010) or “the acceptance or first usage of an innovation and the actor’s decision-making process that results in adoption” (Van den Bulte & Lilien, 2003). As stated these definitions are quite broad and mainly applicable on marketing strategies. Therefore we chose Rogers’ (2003) theory which is developed by studying rural innovations. It says that “diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system”. As stated, diffusion depends largely on communication. Communication is referred as the interaction by which two or more persons share information and possibly knowledge to achieve the same understanding. If communication is not transparent this has implications for diffusion.

Innovation

The characteristics of the innovation, as perceived by individuals or populations, help to explain the different rates of adoption. Relative advantage (1) is measured in economic return, but social prestige factors such as convenience and satisfaction to users play also an important role. It indicates the advantage the innovation supersedes compared to the previous one (Greenhalgh et al., 2004). Compatibility (2) is the degree to which extent an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters. If an idea is not compatible with its required values and norms of a social system, it will not be adopted as rapidly as a compatible innovation (Oldenburg & Glanz, 2008). Complexity (3) is the degree to which an innovation is
difficult to understand and use. Some innovations are readily comprehended by most members of social system, while others consume time to gain understanding and are therefore adopted more slowly. Trialability (4) is the degree to which an innovation may be experimented on a limited basis for its users. Rogers (2003) contends that new ideas or techniques that can be tried on a limited basis reduce uncertainty for potential adopters, and this experience may be particularly important for early adopters who do not have the benefit of other organizations’ experience to draw upon (Ducharme et al., 2007). The last characteristic is observability (5), which describes the extent to which the results of an innovation are visible to other actors. Visibility stimulates peer discussion of a new idea between individuals or within a community (Rogers, 2003).

Communication channels

Communication is the process through which participants create, receive and share information with one another in order to reach a mutual understanding (Rogers, 2003). There are two main communication channels described by Rogers (2003): the mass media and interpersonal channels. This last one is more effective in persuading a unit of a social system to accept a new idea (Rogers, 2003).

As mentioned before, diffusion of innovation is a highly social process. There is a distinction made between channels of communication that can be homophilious or heterophilious. The first one is defined as human communication between individuals, which is based on similar values in belief, education or socio-economic status (Rogers, 2003). On the opposite side there is a degree of heterophily: the communication where two or more individuals interact differently in terms of mentioned values. One distinctive problem in diffusion of innovation is that the participants or individuals usually are heterophilious (Rogers, 2003).

Time

The time attribute is an important element of diffusion. Without time there is no possibility for verification or justification. This time dimension is involved in (1) the innovation-decision process by which an individual passes from first knowledge of an innovation until its adoption or rejection, (2) the degree of innovativeness of a person compared to the other members of the system and (3) an innovation’s rate of adoption in a system measured as the number of members of the system who adopt the innovation in a given time period (Rogers, 2003). The innovativeness is categorized by the following groups: (1) innovators, (2) early adopters, (3) early majority, (4) late majority and (5) laggards. The rate of adoption is the relative speed with which innovation is adopted within a social system (Rogers, 2003).

Social system

Rogers (2003) defines a social system as a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal. Units in a system are not identical in their behavior. That is the reason why there is a structure in a system. Rogers (2003) defines this structure as the patterned arrangements of units (individuals) in a (social) system. Rogers (2001) states that a critical mass is reached when enough individuals have adopted the innovation so that its further adoption becomes self-sustaining. The critical mass is one reason why, after a relatively slow start, the rate of adoption of an innovation in a system takes off to form the familiar S-shaped curve.

In the diffusion process, not every individual has the same influence. Opinion leaders are the most influential in terms of spreading in relation to the innovation either positive or negative information. Often opinion leaders belong to the most innovative individuals in the system. They are important
players when the innovation is in the evaluation stage. Then there are individuals who influence client’s innovation decisions in a direction deemed desirable by a change agency (Rogers, 2003). These individuals are change agents and often use opinion leaders to diffuse innovations within social communities (Rogers, 2003).

There are three different possibilities how an individual considers a decision about whether the innovation shall be adopted or not. The first is the optional innovation decision. This one refers to the choice to adopt or reject an innovation made by an individual, independent from the other units of the system. Secondly, there is a collective innovation-decision. This decision refers to the choice made by the consensus of a community. The last type is the authority decision: choices to adopt/reject an innovation that are made by relatively few individuals that have formal power, status or technical expertise (Rogers, 2003).

4.3.2 The chasm

As mentioned in the previous part on diffusion of innovation, Rogers (2003) states that the innovativeness of an individual compared to the innovativeness of other members of the system is an important factor in terms of timing for the adoption of an innovation. As discussed, Rogers (2001) classifies different adoption percentages linked to different names of the adoption groups within a social system. Innovators are cosmopolites that also act and have contacts regional and globally, whereas early adopters rather tend to be localities. This second adopter category, more than any other, has the highest degree of opinion leadership in most systems (Rogers, 2002).

![Figure 5: Adoption curve (Rogers, 2003)](image)

According to Moore (2002) there could appear a gap between the innovators and early adopters on the one side and other early adopters, the early majority, the late majority, and laggards. These two groups are divided into (1) visionaires and (2) pragmatists (Moore, 2002). The gap, which is shown in Figure 5, is called “the chasm” and occurs when a technology product or service cannot be translated into a major new benefit (Moore, 2002). Early adopters could possibly create bad references for the early majority. Innovations have to cross the chasm, which is referred to passing from being promising pilots to become mainstream products or services (Mulgan, 2006).

This theory is according to Moore (2002) only applicable for disruptive or discontinuous innovations. Disruptive innovation is defined (Bower & Christensten, 1995) as a an innovation that creates a complete different market and ‘disrupts’ the old one. Initially a disruptive innovation is supposed to compete with a already existing technology or innovation, but eventually it will take over the entire market (Bower & Christensten, 1995; Burgelman et al., 2008). Moore (2002) states that
misinterpretation of the difference between an incremental (continuous) and radical (potentially disruptive) innovation are a leading cause for unsuccessful implementation of innovation.

4.4 The bottom of the pyramid

For sustaining energy, resources and innovations the Bottom of the pyramid (BOP) must become a key element to the central mission of every firm (Prahalad, 2010). The main objective of these companies should activate, inform, and involve the poor as customers. Poverty reduction can result from co-creating a market around the needs of the poor (Prahalad, 2010; Prahalad & Hammond, 2002). Prahalad and Hammond (2002) have constructed a pyramid to assess which can be assessed whether people belong to the BOP or not. If they earn or have a purchasing power of equal or less than $1,500 per year they are considered to be in the BOP.ESCO’s could specifically target this segment. The projected revenue stream is for this segment not based on high margins but on a large number of customers. Globally it is estimated that there are four billion people of the world’s population part of the bottom of the pyramid.

Prahalad (2010) argues that selling products and services to the poor can be profitable and reduce global poverty. However, there are several disadvantages for large companies serving the poor people; for instance the costs for serving markets at the bottom can be very high (Karnani, 2007). One of the reasons is that people at the bottom of the pyramid are often dispersed and culturally heterogeneous (Karnani, 2007), which makes it complex and costly to reach these segments on a distributional level. Weak infrastructure-aspects such as transport, communication channels, media and legal issues are said to make it even more costly. Karnani (2007) also states that the only way to fight poverty is by raising the real money of poor people, either by lowering the prices the poor have to pay, or by raising the income that they earn.
5 Case study

The case used in order to analyse the impact of payment on the diffusion of renewable electrification in rural Uganda is the small-scale pilot power plant in the village Tiribogo. Since the power plant in Tiribogo is the first system installed by Pamoja, there is no payment system yet. Therefore it is an objective to investigate how the payments should be designed in order to support the adoption of electricity. Besides this main case, we have been able to visit two other pilot sites dealing with renewable electricity of CREEC. These visits are referred as sub-cases.

5.1 Tiribogo

Tiribogo is a small village in the Muduuma parish about 40 km from Kampala when following the main road to Mitiyana. The village starts at the northern side of the main road and consists of 150 to 200 houses with about 700 inhabitants (Kanaailuly & Ssikayazi, opinion leader interview). The national grid that is established along the main road leads about one kilometre into the village (see Appendix B: Figure 9). The inhabitants of the village are mainly farmers that generate their income from crops that are harvested seasonally. At this moment the main crops are maize, bananas and pineapples. Furthermore several farmers hold chickens, mainly for producing eggs. These products are sold in the village, near the main road or in Kampala. The local language is Lugandan. The village has a primary school, a few small shops, two food stands and one bar. For everything else the villagers have to go a few kilometres to the Muduuma trading centre being located at the main road.

When Pamoja was searching for a suitable site for their pilot project, they conducted in collaboration with CREEC a feasibility study in spring 2012. The outcome of the study showed that the willingness and ability to pay of the local community would be sufficient to break even and that the project had great potential in substituting former electricity sources such as diesel generators by renewable electricity from the power plant for productive and domestic usage (Pamoja Cleantech, 2012).

The installation the power plant started in September 2012 and is operational since March 2013. This pilot project is part of the “Sustainable renewable energy business in Uganda” project managed by the Norwegian NGO Norges Vel and financed by the Nordic Climate Facility. Pamoja has been contracted to operate this power plant. The power plant is positioned at a distance of approximately two kilometres from the national electricity grid. The mini-grid which has been established goes about two kilometres far along the streets of the village and hence directly ends next to the national grid. Since it is the pilot project, it is also an exemption on the future sites. In this case, there is no telecom tower. This means that the 32 kW power output produced by the plant are planned to be used by the local community and agricultural cooperatives only. The power plant is maintained by two operators and runs right now by agricultural residues such as maize cobs and coffee husks from the local farmers. In order to achieve a successful utilisation of the electricity, Pamoja is just in the beginning of looting out possibilities to design a suitable payment system with fair tariffs for its users. This can only be accomplished by understanding the dynamics of the social system and the needs of the villagers.

At this stage, Pamoja connected the first houses to the mini-grid. The connection fee is based upon two components; first there is a price of 100,000 UGX for the connection from the house to the grid and secondly the price for internal wiring the house which is at least 150.000 UGX. This second fee is variable depending on its projected future power usage i.e. how many bulbs and sockets the household wants to get installed. The internal wiring has to be constructed first, for safety issues. The minimum price for the total connection fee is therefore 250.000 UGX. The prices are not ultimately decided yet (see Appendix B: Figure 11). In order to have a suitable and stable demand, a lot of devices and machines with a high consumption are necessary. This is why Pamoja tries to enable local
entrepreneurs to make use of the electricity. The local community has to be made aware of the new possibilities.

As described in the research process in Table 2, 31 villagers have been interviewed and actual situation in the village has been observed in detail.

5.2 Sub-cases

As described in the background Pamoja is closely collaborating with the researchers of CREEC that are also working in the field of renewable and clean electricity technology. CREEC is currently also operating several projects of which two have been inspected in order to identify potential solutions but also challenges which could appear similarly for Pamoja’s pilot project. The first sub-case is the so called “solar kiosk” nearby the town of Kabanga. The second sub-case is a PV mini-grid installation in the trading centre of a small town called Nakasengere.

**Kabanga**

The solar kiosk of Kabanga is a small container that has two 500-Watt solar panels installed on top of it. The kiosk is run by a site-manager who is a local and has been trained by CREEC to know the basics about electricity, pricing, and accounting. The kiosk offers the following services: internet, scanning and printing, phone charging and remote light borrowing and charging. It is situated near a school, where the principal of the school has played an important role in its establishment. The site-manager has been interviewed according to the research process (see Appendix C: Table 7).

**Nagasengere**

The solar-based mini-grid that CREEC has established in this small town in the district of Kiboga is also a 1 kW system. It is situated in the middle of a marketplace with around 30 shops. So far, only four shops could get connected to the grid. There are three challenges to overcome for CREEC and the site manager: First, the funding for this MSI project has been cancelled. This means CREEC has no money to control, maintain or increase the power of the market place. Secondly, due to a mistake of the supplier the wrong inverter has been delivered and hence only half of the total capacity of 1kW is inverted to the batteries and can be used. The last challenge is the monitoring of the payments and consumption which showed to be difficult since there are no meters installed and there is only a gentlemen agreement in which customers pay according to the devices they pretend to use. We interviewed the site manager, one shop owner who is connected to the grid and one shop owner that is not (see Appendix C: Table 7).
6 Empirical findings and analysis

This chapter shows the results from the field research conducted in Uganda as well as from the observations made while working with Pamoja in Stockholm. Furthermore the results are analysed in their associated theoretical context. First, the revealed characteristics of the social system and its impact on the rate of adoption are discussed. We differentiated this sub-chapter into the justification of the chosen site, social structure, social status, and how opinion leaders and change agents play a role. Secondly, the findings on the examined communication channels are shown and a conceptual sketch of these channels is drawn. Thirdly, the characteristics of the innovation to be diffused are discussed according to their influence on the rate of adoption. It starts with findings on its relative advantage, and follows up with compatibility, complexity, trialability and observability.

6.1 Mapping the social system and its impact on diffusion

This subsection reviews the features of the social system. As diffusion is a highly social process, the structure of a targeted system is important to take into account. Moreover, users in this social system are not identical in their behaviour.

We have constructed based on the outcome of questions on income (villager interview) and in collaboration with Mutebwa and Ninsiima (expert interviews), a framework where we classify the villagers or the social system of Tiribogo in four distinctive groups (see Appendix C: Table 12). Based on the information from the interviews and the observations we clustered residents independently from whether they are already connected or not in four distinctive groups (A = richest, D = poorest).

<table>
<thead>
<tr>
<th>TIER A</th>
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<th>TIER C</th>
<th>TIER D</th>
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<tr>
<td>Households interviewed</td>
<td>4</td>
<td>8</td>
<td>13</td>
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<td>Households connected</td>
<td>4</td>
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Table 4: Relation between income and adoption of electricity (villager interviews)

One clear outcome of Table 4 is that the income of the interviewee’s household is strongly related to its willingness or ability to adopt. Rogers (2003) states that the time element of the diffusion process is allowing research to classify adopter categories. We did not take the time element into account for our study since we do not know what happened before or after we conducted our research. Still, this result clearly indicates that income is the deciding factor for adoption. Therefore, these four groups can be linked to Rogers’ (2003) adoption curve in Figure 6, including the chasm.

Figure 6: Adoption curve (Rogers, 2003) with distinctive income groups of the sample (villager interviews)
As shown in Figure 6 there could emerge a gap in the current situation between the two groups of adopters because of a barrier for potential users to start adopting the new technology (Moore, 2002). For this case one barrier seems to be insufficient income, but this does not exclude additional factors that will be pointed out in the following (i.e. lack of availability, social status, other financial issues, reliability and communication). The degree to which these factors are perceived could increase or decrease the distance between the different adopter groups. Furthermore, the right management of the identified factors by the supplying ESCO will decrease the chasm as well. This will result in the maximisation of connected consumers.

**Justification choice power plant site**

That this specific village is chosen as the pilot site because of personal contacts of the opinion leader Ssikayazi with the Pamoja staff, and as being said in the description of the case because a study conducted by CREEC and Pamoja showed that the village has high potential. However, original contact became established due to one more reason: the minister of trade, industry and cooperatives, Amelia Kyambadde is member of the parliament and comes from the Muduuma parish which also Tiribogo is a part of. This means that on a political level, the way the Ugandan government perceives a foreign business installing a green technology is depending on the progressive character of this lady. If she decided not to agree upon this pilot project, it would not be established. Therefore it is important for Pamoja to deliver a reliable technology and a working management system to drive it. Next to this political reason, Bechtel (expert interview) has provided us with a model CREEC (2011) is using for the assessment and execution of their electrification projects. In the centre of the model there is the demand which means that people must be able to pay for it and use electricity productively. The model evaluates four main blocks around it including the technology, the type of fuel, the human factor and the application of the whole system. Only after this crux for developing a successful project the four outer shells have to be considered: technical viability, social impact, economics and environmental impact (see Appendix B: Figure 12). Bechtel (expert interview) makes a general side note that in terms of development, research is often too focused on the four outer shells. Scientists tend to forget which part in the end counts in order to make progress: the demand and its four core domains.

The assessment of our case shows that the choice for Tiribogo over the others is attributed to its management structure, the self-initiative in the village, the available amount of fuel and demand for productive usage. The site selection report (Pamoja Cleantech, 2012) states that: “The richest man in the village is the main advisor in the organisation. He has poultry of about 10,000 chickens and is willing to provide the space for the plant. The predominant biomass available is maize cobs. The village has a grinding mill currently run on a diesel generator. They are using kerosene lamps for lighting the seven poultry businesses, shops and households.” Additionally Buchholz (expert interview) states that if it is about choosing a site, the demand for industrial production is crucial. It will not work without this productive demand. Additionally he mentions: “If there is no industrial activity, you should not choose that site”.

**Social structure**

There are two formal organisations active in the village: the local committee (LC) which consists out of nine members including the chairman Kanaakukya and the secretary Ssekibujjo, and the Kanaanansi Youth Farmers Association (KYFA) has about 30 members (Kanaakukya, opinion leader interview) with the important advisor SSikayazi who has been identified as the richest man as mentioned before. As we tried to figure out who and more interestingly how specific people are influential we came to some interesting results. 24 out of 31 interviewees stated that the chairman of
the LC is the most influential person in the village (villager interview). As we recognized, this chairman is not very different from other villagers in terms of age, income or social class. After asking more follow up questions concerning his chairman position and also according to his own statement (Kanaakukya, opinion leader interview), we came to the result that he is in that position because the villagers trust him. This is especially important because he does not only make decisions about happenings in the village together with the LC but also acts as problem solver among the people (Kanaakukya, opinion leader interview). A minority of the interviewees state that also the secretary of the LC is influential, but explicitly say that he has no formal power. As we realized this person is indeed differently from the average standard in the village. He was one of the first to get connected to the mini-grid (Ssekibujjo, opinion leader interview) and helps Pamoja by collecting money in cash from the villagers for the connection fee. Also in terms of income, he is one of the wealthiest farmers in the village. Another outcome in terms of decision power in the households is that different genders assess it differently: only one of the interviewed women who is living together with her husband states she has power, while out of the men living together with their wives eight out of twelve state that they both have power to decide upon things in the household (villager interview). This means that although men want to give the impression that decisions are made together, women rather feel as if they did not have same as much decision power in the household as the husbands.

Social status

Buchholz (expert interview) mentions that in Uganda having electricity is also influencing the social status of an individual. He gives an example of how he witnessed people displaying their televisions in the opened front door in order to show passing people on the street that to be able to afford a television. Next to this we have observed that the secretary Ssekibujjo, one of the strongest supporters of electricity and a local opinion leader, has a technically unnecessary grid pole on his property to show his power and willingness to innovate. Additionally his household is already using around 500 W of power which he wants to show other residents by using a television and several bright lights outside the house. We have also noticed that the people do not think it increases their status to have just one or two light bulbs. In fact, among the 16 households being interviewed that had electricity there was none that only had one or two bulbs (villager interview).

Opinion leaders and change agents

From theory, opinion leadership is the degree to which extent an individual is able to influence other users’ attitudes or behaviour informally in a desired way with relative frequency (Rogers, 2003). A change agent is defined as an individual who influences clients’ innovation decisions in a direction deemed desirably by a change agency (Rogers, 2003). Therefore change agents are often opinion leaders as well.

We have identified a number of opinion leaders and classified them into three categories: top-down starting with the national and global opinion leaders. An example of a national opinion leader is Amelia Kyambadde, who is a member of the parliament. She able to influence the adoption of the innovation strongly residents of the village are walking in promotional t-shirts and sweaters which say to vote for her. As we have seen that African countries are sensitive to corruption, she is an important actress in the process. Also the king of Buganda is identified as an opinion leader. This person is more able to exert indirect influence instead of formal power on all interacting actors. Both these two national leaders are also change agents because they are able to influence the innovation decisions of Pamoja’s clients and are not necessarily providing information and other advice. They are both able to influence both regional, local opinion leaders and the end users. The characteristics of these leaders
have been identified as the following, national leaders are able to validate and create legitimacy with the new technology and its related potential uses. This is where the creation of awareness should start. Secondly, we have identified a number of opinion leaders on a regional level. These are political leaders from the Muduuma parish with whom the chairman of Tiribogo interacts. Moreover there can also be individuals of the operating staff of Pamoja as in this case the project manager Katende. There are also individuals from collaborating institutions such as a researcher from CREEC having another energy project in the village or people that monitor the progress from Makerere University and UIRI. This results in obtaining an influential position in the system. The characteristics of these leaders are: able to provide users with technical advice, able to deliver know-how to users and able to translate the innovation into relevant practice. Thirdly, a group of local opinion leaders has been identified that are representatives of the local committee and the KYFA: first the chairman Kanaakukya, but then as well the secretary Ssekibujjo and the advisor of the KYFA, Ssikayazi. Also the two power plant operators who are change agents on the same time have an impact on villagers’ perception. Influence on adoption is derived from trust, shared experience and are driven by decisions to try and reject or adopt. Based on interviews and observations we can conclude that the closer the opinion leaders and change agents are to the user, the more influence they are able to exert. This is why the change agents that get installed should if possible also be locals (Lugeya, expert interview; Batereka, expert interview).

The local opinion leaders are also innovators or at least early adopters; all three of them are connected and encourage other villagers to follow their example. These mentioned opinion leaders could potentially also influence the adoption of a specific type of payment system. Observations show they have good knowledge in different kinds of fields: farming (Ssekibujjo and Ssikayazi). They are both exposed to a degree of external communication since they are often in trading centres near the main road or in Kampala (villager interview). Additionally they both state that mobile money is a solution, which could be used for transferring money, and it is easy to implement (villager interview). Also from theory (Inversin, 2000), a specific tariff should encourage for instance the productive usage of the power. Ssikayazi (opinion leader interview) states: “I want to buy a maize milling machine […] also a mash machine for chicken and animal food, which I will use to sell the service to other villagers […] and I am looking for a water pump”. For example, this productive usage would require a power-base tariff over an electricity-based tariff. The money will be paid on regular base and it dis regards the need use of special meters.

6.2 Conceptual sketch of the communication channels

The village is exposed to external communication, both interpersonal as well as mass media. The majority of the interviewees have a radio in the household. These radios work on non-rechargeable batteries that are on long-term expensive. Others have stated to receive news and other general information through mobile phones, television and newspapers. News concerning the power plant is communicated by the operators of the power plant, other people in the village (such as neighbours) and by village meetings. If we focus on these interpersonal channels, the way the residents create and share information about the power plant in order to reach mutual understanding is highly interpersonal. The effectiveness of communication towards end-users depends on choosing a clear and transparent message to be communicated and also choosing the right channels.

The communication structure in the village is built up from the following components: there are two organisations in the village that have influence on the decisions being made in the village. These are the LC, whose members are elected by the residents, and the KYFA. The KYFA is the farmer’s cooperative, which consists of a group of farmers in the village e.g. the secretary and the chairman of the local committee are also a member of the KYFA. According to the chairman Kanaakukya (opinion
leader interview) those two organizations are not rivals but supporting each other. While the KYFA shares expertise with the LC and villagers that have requests, the LC is promoting to join the KYFA towards the farmers. The LC organises village meetings where villagers are triggered to participate in. We were invited to one village meeting at the end of our stay. We had interviewed before more than half of the people attending to this meeting. Also a group of researchers from Makerere University that participated also in all the former meetings about the power plant confirmed that there was never so much attendance. These meetings are not scheduled on fixed dates. The communication between the company in Uganda and users is mainly established through both channels the LC and the KYFA as can be seen in Figure 7. Next to these channels, interviews have showed that communication is also established through the two operators of the power plant. We have seen that due to a lack of communication through the existing channels, the users have established their own channel through the operators. There is a lot of trust in one of them, since he is from a neighbouring village.

![Figure 7: Overview communication channels about electricity, with distinction between mass media and interpersonal regarding users](image)

Figure 7 displays the three existing interpersonal channels of communication by which the users are exposed to external information. As observed and stated in the graph, the communication is a linear process towards the (potential) users. Whenever Pamoja wants to transfer information to its end users, it has to be communicated over two levels before reaching them. Since they are not able to directly communicate to the villagers, it could create blurred and inconsistent information. Since the company is based in Sweden and therefore at times present in Uganda, we have observed several problems that affect the adoption.

As will be pointed out in the following section on complexity and trialability, the people are not aware of any pricing structure (after three months) for neither their projected usage nor the fact that they receive electricity for free at this moment in time. This is a clear example of the lack of clear and consistent information. We also found out when we questioned for instance the connection-fee prices
with the villagers that often they had ‘heard’ from different sources different prices. This inconsistency of communication would create in the western world a lot of disorder, distrust and complexity to understand. In rural Uganda it does not seem to be completely unusual for the people. As one villager states: he is not really curious for a pricing structure but when someone wants money he wants to negotiate with him – which is for all other kind of trading a common thing in Uganda (Ssennoga, villager interview). Additionally Bechtel (expert interview) states with a clear example how prices are determined in Uganda. The price of a product or service depends on the purpose the buyer will use it for. Furthermore a couple of interviewees who are already connected have said that they do not know who to call for questions/emergencies or advice about using it (villager interview). There is no central contact person in the village approachable for these issues. This confirms the inconstancy of information.

Electricity would be charged differently how it is used i.e. it could be more expensive for business activates per unit than for domestic in-house usage. Therefore almost everything is negotiable. Bechtel also states that the mind-set in the cities is changing; the up-coming middle class is tired of discussing pricing. The people in rural areas are following often quickly, the perceive happenings in the city as modern and will therefore adopt it (Bechtel, expert interview). Pamoja has to explain them that payments for electricity are not to be negotiated, but that there exist fixed prices similar to a telecommunication contract. If the residents are not informed of the fixed pricing and want to negotiate their prices, it could slow down the rate of adoption or even completely counteract it that could result in a failure.

Kimera (expert interview) is pinpointing that also small companies should use multiple channels to reach its customers. He mentions a communication channel that additionally can be very influential for creating awareness, which is through the king of Buganda. The royal house has no formal power as in a constitutional monarchy, but there are still cultural and traditional leaders that are highly influential. Kimera (expert interview) also addresses two other powerful channels: schools and religion. He mentions that one of Africa’s biggest enemies is corruption, a lack of political commitment and artificial money streams created by western companies. They pretend to invest money from the western world in developing countries in companies, which are created by them. The money is physically transferred from A to B and is being redirected back to the large multinationals that had initiated this charity. Also CREEC is experiencing problems with financial resources. CREEC is depending on funding from the MSI to provide support for their already established facilities. As observed at both sites in Nakasengere and Kabanga, due a lack of financial resources CREEC is not able anymore to support and monitor their research on-site.

When we investigate the interpersonal communication between users more deeply, the interviews show that the degree two or more users interact is both homophilous as heterophilous in certain attributes. Figure 7 also displays the important people to people (P2P) feedback loop. This personal information sharing and creating is highly effective. The social system of targeted users has both homophilous as heterophilous characteristics, while the latter seems to overweigh, as shown in Table 5.

The individuals belong to the same village, but do not live very close to each other and are sharing also different interests. All interviewees are farmers but are willing to adopt electricity to start small enterprises. Rogers (2003) states that homophilous communication is more likely to be effective since it is easier to achieve mutual understanding. It is important that the fact of the overweighting heterophilous variables has to be taken into account, when Pamoja wants to reach its customers both indirectly and directly. Communication to end users through mass media could become more
interesting when Pamoja wants to scale up its number of power plants in the forthcoming years to other rural areas in Uganda, or maybe beyond.

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<tr>
<th>Homophilous characteristics</th>
<th>Heterophilous characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>All farmers; eight have second jobs</td>
<td>Catholic, Protestant, Muslim and Born Again</td>
</tr>
<tr>
<td>All female interviewees were married. The men are maintaining the decision power in the family.</td>
<td>Varying from: (per month)</td>
</tr>
<tr>
<td></td>
<td>D: &lt; 15 EUR</td>
</tr>
<tr>
<td></td>
<td>C: 15 EUR – 30 EUR</td>
</tr>
<tr>
<td></td>
<td>B: 30 EUR – 120 EUR</td>
</tr>
<tr>
<td></td>
<td>A: 120 EUR &gt;</td>
</tr>
<tr>
<td>Lugandan is the local language, some younger people speak English</td>
<td>Interviewees average 7 years in school:</td>
</tr>
<tr>
<td></td>
<td>18 people primary school, 9 secondary, 2 without education</td>
</tr>
<tr>
<td>[7] Household size</td>
<td></td>
</tr>
<tr>
<td>2 - 12 persons</td>
<td></td>
</tr>
</tbody>
</table>

**Table 5: Overview of homophilous and heterophilous characteristics among interviewees**

### 6.3 Characteristics of the innovation

This section describes how the perception on the five characteristics of the considered innovation and its supporting payment aspects affects and predicts the rate and the way of adoption. The rate of adoption is defined as the relative speed by which an innovation is adopted by members of the targeted system. It is a mathematical indicator of the slope of the adoption curve (Rogers, 2003). Electricity is not completely new for the villagers, but the new technology that Pamoja brings to the village, which is the availability of the technology via a mini-grid, reduces the investment costs required to achieve the electricity dramatically. Therefore it is a radical innovation, where the core concept is overturned and the linkages between the core concepts and its components are changed (Abernathy & Utterback, 1978). Since it might over time even revolutionizes the former market for electricity in the village it could even be a disruptive innovation (Bower & Christensen, 1995), but since the research has only be done at a certain moment in the beginning of the project this cannot be confirmed (yet). We differentiate between electricity and payment system outcomes in the following five attributes of innovation.

**Relative advantage**

Literature shows that relative advantages for using electricity, compared to conventional energy sources, are potentially improvements in five categories such as (1) functionality, (2) welfare, (3) health, (4) educational, and (5) sustainability related development (World Bank, 2008; Mahat, 2004; Kanagawa & Nakata, 2006). The outcome of the villager interviews shows that the interviewed residents have a quite clear vision on the advantages of using electricity. Also, they understand the necessity of a specific payment system with certain tariffs.

Using electricity is beneficial to them because of a functional advantage (1) that simplifies life: for instance 13 villagers point out in the villager interviews that light from electricity is of a higher quality compared to the light produced by kerosene candles, and electricity can be used for a broad variety of...
devices (villager interview). Moreover, the majority of the interviewees state that they would like to use electricity to start business (2) in the village. These entrepreneurial activities which are expected to get started vary in their size and purpose. On the one hand people want to start businesses that increase life quality for leisure purposes such as fridges, lights for shops and bars, as well as TVs for. Others want to start small-scale businesses and named saloons, mobile phone charging or popcorn machines and video-clubs (cinemas) that are not available in the village itself yet and hence save the time for going to the next trading centre at the main road. However there are also more advanced ideas: some rather rich and innovative villagers (Ssekibujjo, Ssikayazi and Wokyamozi, opinion leader/villager interview) are also planning to buy machines for maize processing, welding, chicken mash, breeding lamps for poultry, and even water pumps. It is not clear though if the interviewees understand that by substituting their daily farming activities with starting shops will generate more money for them. It does not necessarily have to generate more money than farming. There are already shops in the village, which possibly influence these entrepreneurial minds of the community since it will increase competition. There will be a point in time where it is not economically viable to start more businesses because the demand is, especially for common ideas such as cooling drinks, charging phones or saloons already, satisfied by then. The small number of villagers that would like to use electricity for tools and machines that bring out new products or increase the value of existing ones that can be sold on the market. They are therefore the ones that truly increase development and hence most important and have to be supported (Bechtel and Buchholz, expert interviews). Eleven of the questioned interviewees mention and understand that using electricity could also be beneficial to health (3) when used as a substitute inside the households for lightning and cooking. One said for example: “Electricity reduces bad gases produced by firewood and kerosene lamps” (Nabalama, villager interview). Kyeyune (villager interview), a woman that sends her children to a private school, also states that she needs electricity for education (4): “...for my kids to read books at night”. A couple of interviewees (Nakato, Kiser and Ssikayazi, villager/opinion leader interview) also state that they like the electricity from the power plant because local biomass is used (5) to generate electricity. This indicates that they are aware of the fact that Pamoja Cleantech produces biogas from an environmental responsible perspective: “It saves forests and it is better for the environment” (Katumba, villager interview). A few villagers realized that Pamoja addresses a closed and sustainable production cycle where the community has direct benefit. One connected old farmer did not have any electric device in his house and was also not planning to buy one in short-term. On the question why he afforded electricity he said: “I just paid for the electricity because I want to support this development in our village” (Musoke, villager interview). Complementary on this development topic, seven interviewees state that the power of Pamoja is good for development and that the people will start to buy from shops and construct more. Two villagers add that “It will attract also people from neighbouring villages, four families have moved here” (Lugoloobi and Nasanga, villager interview).

Due to a lot of power-outs over the past years/decades from the national grid power (UMEME3), people have lost faith in the reliability of the generated electricity of the national supplier (Wokyamozi, villager interview). This fact is important to consider Pamoja Cleantech because it emphasis that reliability is important for the interviewees. In fact, in general companies are even used to run their machines with diesel generators and accept the higher costs (Bbale, expert interview) for not being dependent on UMEME. This is aligned with what the site-manager in Nakasengere (Lugeya, expert interview) states that his customers of the solar kiosk that are willing to pay more to get their phone charged from the solar kiosk, compared to the cheaper diesel engine charging only five hundred meters away from the kiosk.

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3 UMEME is Swahili and means „lightning“
Next to these benefits or advantages on electricity, out of the 31 interviewees, 28 state (villager interview) that they do not see any problems with using electronic payment transaction especially not with mobile money. Additionally 16 out of 31 interviewees are already using mobile banking to pay school fees, bills for farming activities and to send money to family and friends (villager interview). This is also in line with Mwaura (2012), who mentions that the adoption of an electronically prepayment billing system has higher benefits than the costs for implementation. Advantages of using mobile banking to pay for electricity are according to interviewees: “it saves time, compared to walking to a specific place to pay in cash” (Gizza, Nakinto, Ndegire, Nakauesa and Nasanga, villager interview), “it is convenient and easy to use” (Ttabandeke, Wokyamozi and Kyeyune, villager interview) and “…mobile money service is safe and reliable” (Namatovv, villager interview). These advantages confirm that they see the advantage of using the service compared to a cash transaction. Nakato (villager interview) states that, since mobile operators are franchisees, “Someone in the village should start a mobile money business.” Kiser (villager interview) mentions that “…using the service is not difficult”, but points out that “…some people in the village need to be educated how it exactly works, by Pamoja.” These advantages are aligned with those stated by Mas and Morawczynski (2009). Furthermore, half of the interviewees (villager/opinion leader interview) mention they would like to pay according to electricity (pay as you go) based tariff. Reason they address are; “you only pay for what you consume” (Kanakuya, Ssekibujjo, Gizza, Wokyamozi, Ssennoga, Ttabandeke, Nabalam, Kiser, and Luboloobi, villager/opinion leader interview) and “my income varies” (Ndegire, Musoke, Nakinto and Matabaaluka, villager interview). Ssikayazi (opinion leader interview) indicates that a power based tariff is only a solution for the short term and that on the long term Pamoja must install meters which are able to measure kWh.

Compatibility

Electricity is compatible with the existing values, past experiences and needs of the adopters and there were no signs of problems out of a cultural perspective. In fact, out of 24 people giving their opinion on the statement: “Electricity is not important for my household” (villager survey) nobody answers with “totally agree” and only one person answers with “partly agree”, while all the rest disagrees. As mentioned, all residents have been exposed to electricity before; in fact, all of the interviewed households have mobile phones (villager interview) and also many other electrical devices that are running by electricity, which indicates compatibility with existing practices. Since electricity is now provided by a mini-grid, the rate of adoption depends on other factors such as reliability and pricing.

One outcome of the interviews is that the connection fee is a barrier for adoption. A couple of interviewed villagers (Ddungu, Namatovv, Matoro, Sseennoga, and Ttabandeke, villager interview) argue that the reason why they are not connected yet is purely financial and therefore highly personal: “…lack of money, it is too expensive”. When we asked an additional question on why the villagers think so few people are connected, they all point in the same direction: a lack of financial resources to pay the connection fee. Moreover, as some interviewees (Ssennoga and Lugoloobi, villager interview) state, they want to negotiate the price of the connection fee. According to the answers of the villagers, the average income of the interviewees per month is 199,200 UGX per household. We are not able to generalise this for the whole village since it is not statistically significant. Also, it can be estimated that half of the households in the village have to live from incomes of 100,000 UGX per month or less (see Appendix C: Table 12). For them, the money for the connection fee is the income of two to three months.
Besides the high price of the connection fee, there is another barrier: people in Uganda treat their disposable income differently than we are used to in the western world. Many tend to spend most of the money they earn on the same day they receive it. This is why employees in Uganda get usually paid on daily basis (Buale, expert interview). Only in the end of the harvesting season they might have some savings left. Also Buchholz (expert interview) states: “In fact, all villagers in Uganda want to have electricity. A problem is that they are not good at saving money. They do not plan far in advance; this is also the reason why micro credits are so successful in this kind of countries”. Also the operator of the mini-grid Batereka (expert interview) in Nakasengere experiences this when trying to collect the money for the monthly bills: “In the beginning, the money of the customers was never available when I wanted to collect it. Now I notify them two times before each month is over so that they can prepare the money for me.” The facts of the compared high connection fee and the missing capacity of Ugandans to save money potentially could slow down the whole process of adoption. The fee for the connection is not compatible with the majorities’ income. Not having the competence to save money excludes already the option to charge bills post-paid.

A comparable study of Verma (2013) in which also a gasifier from the same supplier (Husk Power Systems) is used in India shows that the connection fee indeed is an important barrier to overcome. In this case, there was no connection to make it accessible to every household. This problem has been identified to be one of the main reasons why so far only fifteen houses have been connected in the operating last three months. The villager interviews have the same outcome: only two of the 31 interviewed persons do not state that money is an issue why people are not connected yet. As mentioned above, not being able to pay for the connection fee is problematic when we think about the responsibilities an inclusive business as the one of Pamoja has towards the people living at the bottom of the pyramid. According to the inclusive business model they should include low-income communities in a sustainable way. This means poverty can be reduced by including all individuals of these low-income communities in its value chain. For our case it should include all residents, especially the poorest.

Complexity

When we checked the knowledge of the residents concerning electricity, its related costs, and how they should be charged for the electricity they used, we came to some interesting results. First, the majority of the interviewees describe electricity as: “a source of energy that gives us light” while some also add: “... and makes life easier” (village interviews). They are also aware that electricity substitutes conventional energy sources such as firewood, candles and kerosene lamps. A couple (Kibirige and Nakinto, villager interview) of interviewees also mention that it is cheaper than these substitutes and also expect that it will be cheaper than electricity from the national grid. The interviews suggest that the laggards in adoption are not lagging behind in the social system in terms that they experience electricity as something difficult and need time to gain understanding before adopting. Only eight people mention other reasons than money (villager interview) but besides ignorance and being afraid they rather mention opportunity costs or that there are simply no poles next to the houses.

Secondly, the knowledge in the field of costs related to power usage per device is insufficient. As we investigated, the residents of the village are expecting to pay much less than the prices planned by Pamoja. The correlation between the consumption and the price seems not to be completely clear for everybody; especially the people seemed not to be aware how much electricity each device consumes. We were able to observe that several houses got 40 Watt bulbs installed. When asked for the reason, villagers stated that it is because they provide the best light; they were not aware that not every light
bulp will cost same as much money. This misunderstanding could be a serious threat to Pamoja Cleantech and could slow down the adoption process. It is complex for them to understand that they should use a 9 Watt bulb, which is energy saving and cost saving as well.

Pamoja Cleantech has derived from their baseline study four different tariffs, which according to the study fit to the incomes and willingness to pay of the residents (see Appendix B: Figure 11). This system would function as a flat-line tariff where they pay the amount of money per month. We investigated the relation between the amount and types of devices they want to use and if this corresponds with their income and willingness to pay. Most of the interviewees (villager interview) want to use more power than they actually can afford, based on the data on their income. Some understand that a television consumes more power than a light bulb but they are not aware of how much more power, and eventual how much more money it would cost them. That is the reason that they all want many devices, on average in total between 100 and 150 watts consuming, but all want to pay only 10,000 UGX for it. This outcome indicates the residents are not well informed about how prices are derived from their usage.

The majority of the interviewees prefer a pay-as-you-go payment system where they pay energy-based. This means that their kWh-usage has to be measured and according to these numbers should get charged. One of the addressed reasons is: “…you only pay for what you consume because my income varies, this way I can track my usage” (Kibirige, Kisero, Lugoloobi, Namatovy, Ssekibujjo, Ssenngoga, and Ttabandeke, villager/opinion leader interview). A minority of interviewees say that they would like to pay according to a power based system and also have reasons why it would be more convenient for them, i.e.: “You know in advance how much you pay, it is more simple and more reliable because for a pay-as-you-go system you do not always have money ready to pay” (Gizza, Musoke, Ndegire and Ssenbulya, villager interview). This last statement is aligned with the findings from the interview with the representatives of Warid M-PESA, one of the mobile banking providers. The people in Uganda are used to spend their money differently: “A system where you would receive an invoice at the end of the month just does not work here; people do not have the money at the end of the month” (Kimathi, expert interview). Also Bbale (expert interview) states that private people do not get credit but only companies and rich, reliable farmers. This is also a challenge for UMEME. They have recently developed and implemented a system where people buy scratch cards with energy credit, type in the unique number in their meter and can use power according a meter which projects money instead of remaining kWh. When the meter reaches its limit, it trips off. This system therefore requires a meter that is able to embed all these features which makes the system quite expensive. Then there is also another problem with these meters; they are fraud sensitive and quite easy to trick (Kimathi, expert interview). Furthermore, 28 interviewees state that using mobile banking would be no problem while 17 of them even point out its advantages such as saving time, safety, and easier to implement. Only two people are sceptical. Not every interviewee is using mobile banking already, but they all think it is easy to learn and could be suitable to pay with (villager interview). Additionally Buchholz (expert interview) thinks that mobile banking is a solution that fits, because: “It is very transparent and there is almost no room for cheating”. As observed, the interviewees had some difficulties with understanding some of the questions, especially those concerned with the tariffs and pricing. It indicates there is a need for bridging this gap of understanding. This could be reached by having a meeting before any instalments or connections where all villagers are triggered to gain understanding in how and how much they will pay for electricity.
**Trialability**

Before households get a connection to Pamoja’s mini-grid, they have to get the internal wiring first, in order to prevent any accidents with open wires and direct exposure to electricity. To create awareness Pamoja offers the electricity until now for free. The connection-fee still has to be paid first. This means that households that are not able to pay the fee at this point of time cannot benefit from this offer. The experience with this ‘trial period’ from the resident’s perspective is not as good as was expected. Despite the availability of power, they are unhappy with the unreliable power supply during the day. They have been promised to get electricity from 17:00 up to midnight. Often this was not the case and the power plant started at a later time. As Kimera (expert interview) noted: reliable information is important for Ugandans “There must be certain times communicated and then must be made sure that electricity is really available then”. In fact, a couple villagers (Nakinto, Kanaakukya, Nakato, Nansamba, villager/opinion leader interview) use the opened question in the end of our interview to point out that the power plant is not working on a reliable way to the promised hours. Also the villager survey shows that 22 of 24 surveyed people totally agree that there should be no power-outs. The bottleneck here is that Pamoja did not communicate this period of trial transparent to the villagers. If they had done this, they could have explained this project is a pilot, which means errors occur. The period of free supply gives both the company and residents the ability to test, learn, give feedback and improve the system. But as soon as the customers pay, the reliability has to change. The chairman (Kanaakukya, interview opinion leader) is worried that when people have to pay and electricity is not available and/or not working every day, Pamoja will get a problem in the village.

There is limited space for providing a trial base for the residents of Tiribogo concerning the introduction of a mobile money payment system. This could create problems with testing different tariffs and pricing mechanisms for users. As recognized in the interviews, it cannot always be assured if the interviewees really understood the options between the different tariffs. Not being able to provide such a trial period to users could be compensated by providing information in advance on these tariffs and pricing to eliminate all insecurity for both the users and the supplying company.

**Observability**

Both electricity and possible payment solutions are observable from inside the village as from outside. The benefits of the availability of electricity are clear for the community. All residents have seen and used electricity before outside their village and are therefore longing for it since a long time (Buchholz, expert interview). Although the national grid is not reaching to their village, some of them have shops at the main road being connected to the grid or family and friends living in areas that use electricity. This also counts for mobile money. Villagers are followers and if someone comes and tells them that mobile banking is modern and used in the cities, they like it and are willing to learn it because they also want to be modern (Bechtel, expert interview).

Inside the village the connected households also function as observation benchmarks for all the other residents inside community. In fact, 21 out of 23 surveyed villagers state that they completely agree to the statement that people without electricity that see it at other houses also want to have it (villager survey). When residents walk through the village, they have a more ‘tangible’ feeling with electricity than before seeing neighbours connected and lightning up their houses in the evening. This visibility stimulates peer discussions at village meetings concerning household usage and potential productive usage. Since the majority of the village are farmers, they are getting more aware of the possibility to use electricity for processing harvest more productive. The opinion leader Ssikayazi (opinion leader interview) states that with modern technology you can get things moving, as for electricity it will help the villagers to earn more money and gives new opportunities for business and development. For
instance; there are already a few small shops in the village. Currently one shop uses a diesel generator to light up its shop when the night falls. Electricity enables them to light up their shop without the high diesel costs, the constant noise of the engine and without the exhaust gasses of the combustion engine. Residents who were not able to invest in such a generator before can now use electricity to start a shop to cool drinks and sell them.

The observability of power plant can also have negative consequences on the rate of adoption; the residents living close to the power plant observe and complain about the generated dust or steam by using maize cobs, the noise the generator makes during operating hours and not treating the residue water of the cooling process. Especially this last one is clear observable for them. The water used to cool and condensate the tar is in direct contact with the gas. This means that the water pumped back in the basin is polluted with tar. Once in the month this water has to be refreshed. Currently the water is disposed in the field close to the power plant. No water treatment solution has been implemented yet, but is under investigation to mitigate this pollution. Solving this issue would also influence the opinion of the users positively since several interviewees stated that they care about the environment (villager interview).
7 Conclusions

Several factors have been identified that affect diffusion of rural electrification in Uganda. The research shows that the timeframe of the adoption curve could be very short since the innovation itself (electricity) is compatible with the values and beliefs of the social system, including the required mind-set of users, and electricity fulfils requested needs. People in rural Uganda in general seem to seek for electricity for a long time, only it is usually not available for an affordable price. Since the state is not capable to extend the national grid to rural areas all over the country, it has been shown that a mini-grid fed by a bio-gasifier system is advantageous in terms of price, reliability, and safety compared to the conventional energy sources such as diesel generators and kerosene lamps.

Three barriers have been identified that create a chasm between different adopter categories. First, Uganda is a culture where cash-flow-cycles are very short and most of the people are incapable to save money. Therefore costs, such as a connection fee that has to be paid as a whole amount at a certain point of time, hinder potential customers from adopting electricity. Secondly, electricity is at least for villagers in rural areas a status symbol. This makes it less attractive for the poorer people at the bottom of the pyramid to afford electricity since they do not want others to see that they can only afford a small amount of electricity. Thirdly, although electricity is compatible with the needs and values of the social system, electricity produced by a gasifier can be new to most of the potential users. Without explanation users first need first need a certain observation or trial period in order to explore and gain trust in such a new technology.

To overcome these barriers, awareness has to be created by using clear and transparent communication. On the one hand involving the community can be helpful to give a feeling of community-based ownership. On the other hand it is a problem if this purpose is not clearly communicated towards the social system and results in communication that has to be transferred over to many channels before the customers are reached. This creates the problem of blurred information for end-users and a missing feedback loop to the electricity provider. In a culture based on interpersonal but also informal communication where e.g. pricing is usually negotiated, this can result in troubles and makes it difficult to implement a transparent system. The case shows it can also result in distrust since citizens might imply that collaborators might unevenly benefit from their efforts.

As has been found out, the population in rural Uganda is striving for adopting all various kinds of goods, services and habits that they got to know from the cities, either directly or indirectly influenced by opinion leaders, that are available and achievable for them. Therefore using mobile banking is the most appropriate technology for implementation since it penetrated already the whole country and in those terms the infrastructure that are mobile banking agents already exist and the individuals are mostly already capable to use it.

When talking about how the bottom of the pyramid can benefit, the idea of implementing a non-linear tariff system has to be taken in account. The pricing structures should on the one hand aim to be low enough for poor households to afford electricity, and on the other hand high consumption of wealthy households should be more expensive. Higher prices for ‘luxury’ devices do not only help to overcome the status symbol issue, but also prevents that too much electricity is used domestically. Also, using electricity productively has to be supported by having a price that is below the costs of diesel engines. It should also be cheaper than the electricity provided for private households since otherwise there is a risk that electricity is not used for new businesses and development but for making leisure time more comfortable. By communicating with potential entrepreneurs and finding a solution with them to make use of the electricity, a community will develop and hence its members will become more valuable customers.
Management recommendations and future research

Based on the conducted research we are able to carefully construct a set of recommendations and advices for the company, Pamoja Cleantech. While the recommendations are in the scope of the research for Pamoja, the advices are rather opportunities that have been identified in order to improve their performance in the context of our observations and the academic purpose of this thesis: analysing the impact of a supporting payment system on the diffusion of the electricity. In detail there are first three recommendations on the payment system: (1) transactions, (2) tariffs and pricing, and (3) connection fee. Furthermore three additional advices have been constructed (4) optimise the pilot stage utilisation (5) communication with the customers (6) making more use of the ‘green’ competitive advantage. Secondly, the recommendations are followed up by some proposals for further research.

8.1 Management recommendations

Starting with (1) transaction we recommend to use mobile banking instead of the two alternatives of either implementing a cash-based system or purchasing a special system of the ones available on the market. As has been analysed, the people are already familiar with mobile banking and the mobile banking agents where cash is transferred, are available all over the country. Moreover it is a proven system that has no investment costs at all and is extremely fast and easy to implement which is important since there is also a very actual time constraint. This makes it clearly superior to any system that had to be purchased, is more difficult to implement and to adopt for the customers and is more error-prone. We identified the mobile banking provider MTN as most appropriate since it has a market leader position with the highest number of agents in Uganda and because there is no cheaper provides in terms of transaction fees. A cash-based system has to be avoided since first collecting money is for mini-grids problematic, because there is no transparency for the company and a lot of room for fraud. Additionally it needs at least one week of work and salary for a collector or puts additional time pressure on the on-site operators. Also, transporting the cash for electricity of a whole month with you is a risk that should not be underestimated.

For (2) tariffs and pricing we recommend for the pilot site on short-term power-based tariffs for that is paid monthly in advance. It should be prepaid because Uganda is not a post-paid culture. A pricing structure based on the devices being used is hardly to implement, to monitor and there is a high chance for fraud. The reasons for such tariffs are that the meters being installed so far do not support an electricity-based tariff and also because it is simpler to measure and create bills since in this solution nobody has to control the meters. When scaling up their activities Pamoja should aim at installing different meters from the current ones that make it possible to implement electricity-based tariffs, which is especially important for customers that consume high amounts of electricity. Electricity-based tariffs encourage energy saving, are known by the villagers as used by UMEME and also allow a most favourable pay-as-you-go solution by integrating the mobile banking solution with the meters. The price per load or unit of power should first be regressive and after a certain amount it should become progressive. The reason is that small amounts of electricity already provide a lot service while ‘luxury devices’ of rich people that consume a lot of electricity should become more expensive again. Costumers that use machines with high electricity consumption for productive usage should get offered cheaper special prices since they have to be encouraged and supported and this development is in the scope of Pamoja’s strategy.
The (3) connection fee is a barrier that negatively affects the rate of adoption. Since people in rural Uganda are not used to save money, Pamoja should either provide a micro-finance solution or time the installation of the grid to a harvesting season so that the households have sufficient money. Also, by providing information about the costs up-front the villagers are notified to start saving money in time. Since it is in the interest of Pamoja that everybody receives electricity as soon as possible in order to generate a stable income, the company should also take in concern to reduce or even abolish the investment costs on the user-side.

Pamoja is still in a start-up and pilot phase this means the company has a business model but it is not yet defined in detail established or ready to execute. According to the existing business model, Pamoja is aiming to provide electricity for productive usage, household usage, and to telecom base stations, or for combinations of these three customer groups. Although the (4) pilot project in Tiribogo is only aiming at private households and productive usage, it is very suitable to test and implement different solutions in order to find a good strategy for the future power plants. Therefore, before continuing with other projects Pamoja should first focus on the pilot site in order to experience and learn, but also to be able to show the stakeholders such as CREEC and their suppliers that they were able to implement the first system with success.

One result of the analysis is that a (5) clear and direct communication with the villagers has to be established from the very beginning of such a kind of project. The community has to be aware of the costs they will face in order to achieve electricity. This includes a pricing structure, contracts, the connection fee, and a contact person for the customers. Vague promises have to be avoided in order to prevent that rumours spread which blur reality. Informing opinion leaders and supporters of electricity is important, but not sufficient. By using interpersonal communication channels upfront in formal meetings and workshops, inconvenient situations and debates with the community can be avoided.

The company could use the (6) argument that they generate green electricity (e.g. biomass based) stronger towards its customers. It is currently not exploited or used to create awareness for the fact that the power plant is not just a big diesel engine but sustainable technology and running on renewables only. To create this awareness, the company can address that there are no similar places in Uganda where this technology is used. As we have seen, Ugandans are sensitive for such kind of information, and this could therefore be used to create positive attitude towards the power plant within the community.

### 8.2 Future research proposal

This study has attempted to integrate literature on diffusion theory into a single case study in Uganda. The research has shown many challenges but also opportunities that Pamoja faces. Future research based on this study could be seen as a repetition of this thesis at different points in time or conducted by different actors which will improve the validity of this study. Due to the time constraint of eight weeks, in which the field research has been conducted, the time element of Rogers (Rogers, 2003) has not been researched. Nevertheless the time element is even as important as the other three elements.

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Note: 4. $x \in \{10; 20; 30; \ldots\}$
and could complement it in its analysis. Moreover, the outcome of this study has drawn a map for the company how the innovation, communication and social system are interrelated and connected. As discussed there is a lot of overlap, which can be studied in the future concerning potential up-scaling projects of similar companies.

A potential future outcome could be that projects that are related to renewable electrification have similar characteristics influencing the rate of adoption of such an innovation. Potentially this could be used to understand the dynamics of, in this case Ugandan, social factors which are decisive to conduct business or target customers in an Eastern-African country. The outcome might not only be valid for this innovation but as well for other product or service innovations or other typologies of innovations in different sectors, as Rogers’ (2003) theory is only focusing on the rural sociology discipline.

A qualitative research is not always sufficient to construct a strong argument. Therefore, this research can be followed up by a more quantitative approach. Rogers’ (2003) theory has been extended with such a quantitative or mathematical approach by Bass (1969). It describes how new products diffuse and get adopted as a result of an interaction between users and potential users. It has mainly been used for product and technology forecasting, in marketing studies. The mentioned quantitative next step based on this research can be made in the near future.
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Appendix

Appendix A: Maps

Figure 8: Electricity utilities and grid of Uganda (GIS, 2012)
Figure 9: Map of Tiribogo with electricity infrastructure (Google Maps, 2013)
Appendix B: Graphs and Figures

Figure 10: Business Model of Pamoja (Pamoja Cleantech, 2013)

Figure 11: Pamoja’s potential pricing structure (Pamoja Cleantech, 2012)
Figure 12: CREEC electrification project model, sketched from Bechtel (expert interview)
### Table 7: Overview expert interviews

<table>
<thead>
<tr>
<th>Name</th>
<th>Time and Place</th>
<th>Position</th>
<th>Topics of the interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atuheire, Levinne Barbra</td>
<td>21.03.2013, MTN business centre, Kampala</td>
<td>Personal Assistant for G/M Sales at MTN</td>
<td>Mobile banking, Payment systems</td>
</tr>
<tr>
<td>Batereka, Godfrey</td>
<td>12.03.2013, Nakasengere</td>
<td>Site manager for the mini-grid of CREEC</td>
<td>Practical experience with maintaining a mini-grid</td>
</tr>
<tr>
<td>Bbale, Catherine</td>
<td>15.04.2013, Nateete, Kampala</td>
<td>Director of Kyaterekera Poultry &amp; Animal Feeds</td>
<td>Trading, Business in Uganda</td>
</tr>
<tr>
<td>Bechtel, Karsten</td>
<td>05.04.2013, Makerere University, Kampala</td>
<td>Head of Bioenergy at the Center for Research in Energy and Energy Conservation</td>
<td>Agriculture, Rural Development, Agroforestry, many years of experience about Ugandan culture and habits</td>
</tr>
<tr>
<td>Buchholz, Thomas (PhD)</td>
<td>13.04.2013, Muyenga, Kampala</td>
<td>Researcher at the University of Vermont, USA</td>
<td>Forestry and Sustainability of Bioenergy, Carbone-offsite Projects, off-grid Electrification</td>
</tr>
<tr>
<td>Kimathi, Brian</td>
<td>11.04.2013, WARID tower, Kampala</td>
<td>Head of Sales at Warid Pesa</td>
<td>Mobile banking, Payment systems</td>
</tr>
<tr>
<td>Kyambadde, Steven</td>
<td>12.03.2013, Nakasengere</td>
<td>Self-employed: computer services and phone repair shop owner</td>
<td>Necessity of electricity for business (not connected to mini-grid)</td>
</tr>
<tr>
<td>Lugeya, Michael</td>
<td>05.03.2013, Kabanga</td>
<td>Operative Manager of the Solar Kiosk of CREEC</td>
<td>Adoption of villagers of new electricity services</td>
</tr>
<tr>
<td>Mgíra, Steven</td>
<td>12.03.2013, Nakasengere</td>
<td>Self-employed: Retail shop owner</td>
<td>Advantages of electricity for business (connected to mini-grid)</td>
</tr>
<tr>
<td>Mutebwa, Sailous</td>
<td>15.04.2013, Tiribogo</td>
<td>Power Plant Operator in Tiribogo at Pamoja Cleantech</td>
<td>Life in Tiribogo</td>
</tr>
<tr>
<td>Ssekiwanuka, James Kimera (PhD)</td>
<td>15.03.2013, Kyebando, Kampala</td>
<td>Director of CALM Africa</td>
<td>International affairs, Development, Education</td>
</tr>
</tbody>
</table>
### Table 8: Overview interviews and surveys with villagers

<table>
<thead>
<tr>
<th>Name</th>
<th>Date and Place</th>
<th>Survey taken in account [y/n]</th>
<th>Connected? [y/n]</th>
<th>Conducted interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ddungu, Emmanuel</td>
<td>15.04.2013, Tiribogo</td>
<td>No</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Gizza, Annet</td>
<td>30.03.2013, Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Kanaakukya, Godfried (chairman, early adopter)</td>
<td>03.04.2013 Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td>Opinion leader villager interview</td>
</tr>
<tr>
<td>Katumba, Martin</td>
<td>16.03.2013, Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Kibirige, Henry</td>
<td>25.03.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Kisero, Livingstone</td>
<td>24.03.2013, Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Kyeyune, Amina</td>
<td>03.04.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Lugoloobi, Joseph</td>
<td>20.03.2013, Tiribogo</td>
<td>No</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Matabaaluka, Charles</td>
<td>03.04.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Matoro, Vincent</td>
<td>20.03.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Musoke, Godfrey</td>
<td>30.03.2013, Tiribogo</td>
<td>No</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Mussuma, Toe</td>
<td>03.04.2013, Tiribogo</td>
<td>No</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Nabalama, Jane</td>
<td>30.03.2013, Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Nagawa, Annet</td>
<td>20.03.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Nakauesa, Sarah</td>
<td>30.03.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Nakandi, Prossy</td>
<td>03.04.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Nakato, Maduna</td>
<td>03.04.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Nakatto, Florence</td>
<td>03.04.2013, Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Nakhgwhk, Nhsita</td>
<td>30.03.2013, Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Nakinto, Betty</td>
<td>25.03.2013, Tiribogo</td>
<td>No</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
<tr>
<td>Namaganda, Agnes</td>
<td>20.03.2013, Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td>General villager interview</td>
</tr>
</tbody>
</table>
INTRODUCTION

The new power plant and the people who work there belong to the company Pamoja. This is the first power plant Pamoja built up. The two master students Chris and Jonas are conducting research about the power plant for their thesis but also to help Pamoja to improve their services and doing so contribute to the community of Tiribogo. Thank you for answering the questions.

PART ONE: GENERAL INFORMATION

<table>
<thead>
<tr>
<th>Name</th>
<th>Place &amp; Time</th>
<th>Gender</th>
<th>Age</th>
<th>Profession</th>
<th>Highest Education</th>
<th>Religion</th>
<th>Household</th>
<th>Size of household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Namatovy, Janet</td>
<td>30.03.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td>General villager interview</td>
<td></td>
</tr>
<tr>
<td>Nansamba, Dimintria</td>
<td>03.04.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td>General villager interview</td>
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<tr>
<td>Nasanga, Maria</td>
<td>30.03.2013, Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
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<td>General villager interview</td>
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</tr>
<tr>
<td>Ndegire, Ileuen</td>
<td>30.03.2013, Tiribogo</td>
<td>No</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td>General villager interview</td>
<td></td>
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<tr>
<td>Ssekibujjo, Godfrey</td>
<td>18.03.2013 Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td>Opinion leader villager interview</td>
<td></td>
</tr>
<tr>
<td>(secretary, innovator)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ssennoga, Steven</td>
<td>30.03.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
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<td></td>
<td></td>
<td>General villager interview</td>
<td></td>
</tr>
<tr>
<td>Ssenabulya, Emmanuel</td>
<td>03.04.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td>General villager interview</td>
<td></td>
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<tr>
<td>Ssikayazi, James</td>
<td>15.04.2013, Nateete, Kampala</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td>Opinion leader villager interview</td>
<td></td>
</tr>
<tr>
<td>(first contact person of</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pamoja in the village,</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>advisor of KYFA, innovator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ttabandeke, Yosiya</td>
<td>30.03.2013, Tiribogo</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td>General villager interview</td>
<td></td>
</tr>
<tr>
<td>Wokyamuzi, Sammuel</td>
<td>30.03.2013, Tiribogo</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td>General villager interview</td>
<td></td>
</tr>
</tbody>
</table>

Table 9: Blank sheet of villager interview
PART TWO: ELECTRICITY USAGE

1. How would you describe electricity?

2. A) What kind of electrical devices do you think are important to have for households? Name from most to least important.

   B) Which one of those and other devices does your household already own

<table>
<thead>
<tr>
<th># in household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio</td>
</tr>
<tr>
<td>Charge mobile phone</td>
</tr>
<tr>
<td>Electric Cooking</td>
</tr>
<tr>
<td>TV</td>
</tr>
<tr>
<td>Lightning</td>
</tr>
<tr>
<td>Refrigerator</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

3. What kind of electricity usage can you think of to make money?

4. Can you imagine starting a business based on electricity like the one you just named on your own?
   If yes: What kind of? How far is the plan? If no: Why not?

5. If Pamoja would organise a workshop, would you attend?
   If yes: What should they explain there? If no: Why not?

6. What times of the day do you (not) need electricity and why?

PART THREE: PAYMENT, TARRIFs AND PRICING

1. Have you ever used electronic payment like with a mobile phone or bank account?
   If yes: What kind of? How frequent? What bank/mobile phone company (MTN, WARID, AIRTEL)? For what?
   If no: Why not?

2. Do you think it would be difficult if your household had to pay electronically, for example via mobile phone?
   If yes: Why? If no: Why not?

3. What would be the best way to collect money, if cash based? Who should collect it? Can you also imagine bringing it to a certain location?

4. There are general options on that payment can be based. What do you think is better and why?
   1) You pay a fixed certain amount of money per month and are then allowed to use a certain maximum amount of electricity all the time, depending on how much you pay.
   2) You only pay for the electricity which you actually consume, which can be measured be a meter, and can use whatever device you want.
5. If you would have to pay on a regular basis, in which time periods should this be?
   a) Once a week b) every second week c) once a month d) once every three months e) other

6. What should happen if the customers do not pay their bills in time?

7. How much is your household willing to pay per month? What kind of devices do you want to use for this amount?

8. If you look at these tariffs: What would you chose and do you think it is a fair price?
   a. 10,000 UGX per month for 25 W: one light and one socket (phone charger/radio)
   b. 15,000 UGX per month for 40 W: two lights and one socket (phone charger/radio)
   c. 20,000 UGX per month for 50 W: three lights and one socket (charger/radio)
   d. 40,000 UGX per month for 150 W: three lights, one socket (phone charger/radio) & a TV
   e. None of the above: Name another solution

---

**PART FOUR: ADOPTION**

1. Who has decision power in your household?

2. Why does your household already/not have electricity?
   If not: Are you planning to get electricity and what had to change for your household to get electricity?

3. Who has decision power in your village?

4. One of the advantages for using electricity from the power plant is that it is cheaper. Can you think of more advantages?

5. How, where and from whom have you heard that there is electricity in your village?

6. There are some people in the community that already have electricity and some that have not. What is the reason for people with electricity to have it? What is the reason for people without electricity not to have it?

7. How do you receive news and other information?

---

**Final Question**

1. Do you want to tell us anything more what we did not ask yet? Are there any problems or shortcomings you would like to talk about with us? Is there something you would recommend Pamoja to do?

---

**Table 10: Blank sheet of additional questions for opinion leaders**

**[OPTIONAL] PART FOUR: OPINION LEADER QUESTIONS**

1. People think you have over-average influence in the village. Would you agree to that? What makes you different?

2. Are you more exposed to external communication than other villagers?

3. Do you talk more to the different people in the community than the other villagers?

4. Would you describe yourself as more innovative and opened to new technology?

5. What do you think about electricity and Pamoja’s power plant?
Table 11: Blank sheet of villager survey

PART SIX: STATEMENTS

Name (First name and last name)

Please read the following statements slow carefully and mark in each line the field which you think is true with X. Please be very honest, only if you give your true opinion we will have good results. Make sure that it is clear to understand in which field the X is. Many of the questions are very difficult. It is only normal if you do not understand or have an opinion all of them. Just mark “No opinion / Do not understand” in this case. Please do not agree/disagree if you do not understand the sentence.

<table>
<thead>
<tr>
<th>Example: Having electricity is important for my household</th>
<th>Totally agree</th>
<th>Partly agree</th>
<th>Partly disagree</th>
<th>Totally Disagree</th>
<th>No opinion / Do not understand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Paying cash is a bad solution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The electricity must work every day (no power-outs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I would like to attend a workshop about electricity and how it works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I am planning to start a business that needs electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. It would be very important also to have electricity in the morning and/or noon time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. The community talks not much about the new grid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Certain people in the village have more influence than others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. These certain people think that electricity is very important</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Price is only one of many reasons why many houses in the community do not have electricity yet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Electricity will have no impact on the health of people</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. My household is able to pay a certain amount of money for electricity each month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. My household would prefer only to pay if we actually really use the electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. I feel myself enough informed about electricity and how it works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Electricity will increase the development of the community</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. Having electricity from 5 pm until midnight is sufficient for my household

16. The information of Pamoja about electricity, price and their services is unclear for me, they should inform better

17. Villagers with electricity recommend it to villagers without electricity

18. Households would be more willing to get electrification if Pamoja could sell them the devices (for example light bulbs)

19. Paying cash is a good solution

20. Having electricity is not important for my household

21. The new electricity is safer than former energy sources like diesel generators and kerosene lamps.

22. Pamoja informs me enough about the power plant, their services and prices

23. I think it is okay to pay the same amount of money each month, no matter how much electricity we really used

24. My household cannot afford the connection fee

25. The tariffs are too expensive for my household (actually 20,000 – 40,000 UGX per month)

26. Villagers without electricity who see it at other households also want to have it

27. There should be no power-outs, the power plant must run every day

Last questions

*Please fill in the numbers if you know and want to tell them.*

1. How much is your household’s income per month? ________ UGX

Only for people with electricity:

2. Do you know how much you will pay per month? ________ UGX

3. How high is the connection fee you paid? ________ UGX
<table>
<thead>
<tr>
<th>Tier</th>
<th>Description</th>
<th>Tier D – 30%</th>
<th>Tier C – 40%</th>
<th>Tier B – 20%</th>
<th>Tier A – 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work</strong></td>
<td></td>
<td>Small farmers (1/2 acre), mixed crops, often working for other people, very few cash crops to make little money</td>
<td>Farmers (~2 acre), mixed crops, additional food is sold locally, some cash crops, have some chicken</td>
<td>Farmers (3-4 acres) and another profession (e.g. small shop), have poultry and pigs, might even have a few cows, some employ a few people, some sell cash crops in town</td>
<td>Wealthy farmers (&gt;10 acres), employ people, sell food in own shops or in town, specialize on certain crops, have poultry, pigs and cows, some own agricultural machines</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td></td>
<td>Temporary houses, one room, sometimes live with other people, nearly no furniture, tadooba</td>
<td>Structures houses with several rooms, basic wooden furniture, some have radios, tadooba</td>
<td>Permanent houses with iron structure, middle class furniture e.g. couches, some solar systems, radios, some TV, tadooba and electric lightning, own shops</td>
<td>Big houses with floors and expensive furniture, TV, iron, solar systems, some even diesel generator, electric lightning</td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td></td>
<td>None</td>
<td>Some have motorcycles</td>
<td>Motorcycles, pickups</td>
<td>Trucks, pickups, cars</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td>Only primary or no education, not all children go to school</td>
<td>At least a primary education, children go to state schools</td>
<td>Mostly secondary school, children often go to private schools</td>
<td>Well educated, children go to boarding schools and even university</td>
</tr>
<tr>
<td><strong>Expenditures</strong></td>
<td></td>
<td>Basics (kerosene, mobile phone, barber, spices, soap, cloth), local brewed alcohol, can only go to governmental hospitals</td>
<td>Basics but more of it, can afford beer, can pay for basic medicine and some even for private hospitals</td>
<td>Have a lot from everything what is local available, buy sweets and drinks in bars, have medicine and go to private hospitals</td>
<td>Have everything that is local available, even go to town and buy more special and expensive things, also luxury products like chocolate, wine, liquids</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td></td>
<td>&lt;50,000 UGX per month</td>
<td>50,000 - 100,000 UGX per month</td>
<td>100,000 – 400,000 UGX per month</td>
<td>&gt; 400,000 UGX per month</td>
</tr>
<tr>
<td><strong>Food</strong></td>
<td></td>
<td>Only one warm meal in the evening and something cold in the morning, do not cook water, eat only what they produce, meat only on special days</td>
<td>Lunch and supper, cook their water, eat sometimes meat, some buy additional food to have more variety</td>
<td>3 proper meals a day, cook their water, eat meat 1-2 times a week, buy in local shops to have variety</td>
<td>3 nice meals a day, eat regular meat, drink water from bottles, have variety of different food</td>
</tr>
<tr>
<td><strong>Mobile money/Bank account</strong></td>
<td></td>
<td>Only mobile phones</td>
<td>Use mobile money</td>
<td>Use mobile money and have a bank account for savings</td>
<td>Use mobile money, have bank account and use it also for transactions</td>
</tr>
</tbody>
</table>