Entrepreneurship in Africa: Improving Lives through Clean Energy and Clean Cooking

Discovering the barriers and drivers for entrepreneurs in the SSA clean energy sector

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Clean Energy for Sub-Saharan Africa

How can clean energy entrepreneurs in the Sub-Saharan Africa context successfully contribute to achieving SDG 7?

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Executive Summary

In Sub-Saharan Africa (SSA) energy poverty is a widely spread challenge and access to energy is a key imperative for economic development. With the exponential population growth in the region the pressure on the energy that is available grows and the numbers on energy poverty rise. In an effort to promote change, Sustainable Development Goal (SDG) 7, set by the United Nations (UN), encourages to make access to affordable, reliable, sustainable, and modern energy possible for all. With the global agenda on sustainable energy access and the energy market gap in SSA, entrepreneurs are seeing opportunities. Both local and international entrepreneurs are finding their way in the SSA energy sector.

The status update from the UN on SDG 7 shows the progress regarding the development of energy access for all is not on track for many countries in SSA. With the time ticking on the SDGs timeline (goals should be achieved by 2030) more research should be done into investigating why entrepreneurs seem to be unable to reach substantial progress with regards to providing sustainable energy. This research aimed to discover the drivers and challenges local and international entrepreneurs are facing in their mission of brining sustainable energy to countries in SSA.

Limited research on entrepreneurship in Africa has been published. Different to many other studies, this research did not aim to investigate how entrepreneurship can be used as a way out of poverty. Entrepreneurs from different cultural backgrounds are trying their luck in SSA as they see market opportunities for their technologies or the clean energy products they are (re)selling. Furthermore, the most used methodology in cross-cultural entrepreneurship research is based on quantitative methods, such as regression analysis. The reliance on quantitative data limits the level of in-depth understanding of the motivations of entrepreneurs and their personal experiences.

Therefore, this study used a qualitative methodological approach with primary data collection through interviews. For this study nine participants active in the SSA clean energy sector in various roles and with different cultural backgrounds were interviewed. By better understanding the experiences entrepreneurs have, lessons can be drawn, and support can be offered in the ambition towards SDG 7.

The theoretical framework of this study consists of two parts. First, the Social Transformation model by Kroesen allowed to contextualize the cross-cultural experiences of the interviewees. It zooms into elements such as the role of social networks. Different cultures have different social networks and in SSA these are more patriarchal and along ethnic lines. The strong connection people in SSA could feel towards their social network influences how

they do business or how they behave as an employee. Second, the Business Model Canvas (BMC) by Osterwalder and Pigneur was used to find common patterns in the entrepreneurial operations of the organizations of the interviewees.

The research yielded the identification of several common drivers and barriers amongst the different entrepreneurs. Six main opportunities that drive the entrepreneurs in their work have been discovered: the possibility to make a positive impact on the lives of customers, the substantial market potential as many people suffer energy poverty in SSA, the for profit-mentality driving the entrepreneurs, the joy when motivated and qualified staff joins the team, working with skilled and local partners, and the ability to build a strong network locally. Four main barriers that make the work of the entrepreneurs harder were identified: the cultural differences within the company can cause frustrating challenges, the limited and culturally challenging financing opportunities for the clean energy sector, the challenges with unqualified local staff and their work ethic, and the power of vertical networks in society and the governmental institutions.

To conclude, based on the study several recommendations were made that can support the entrepreneurs in their mission to provide clean energy access in SSA. First, entrepreneurs should invest effort to understand the local culture to be able to act in this local context. Cultural awareness helps the entrepreneur steer his/her company in the process of ongoing social transformation happening in SSA countries. Second, as a non-local entrepreneur it is recommended to work with locals on topics that are not his/her expertise. Both the cultural distance and the lack of skill could be overcome by working with local and respected agents. Additionally, this could increase the trust from society in the novel products the entrepreneurs are offering. Third, it is recommended that entrepreneurs invest in onboarding programs for new employees. Having an education program to introduce the new employees to the company culture and content could help the employee feel more connected to the company and bridge the educational gap many have.

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List of Abbreviations

SSA	Sub-Saharan Africa
SDG	Sustainable Development Goal
USAID	United States Agency for International Development
ERP	Economic Recovery Program
DIFID	Department for International Development (United Kingdom)
UN	United Nations
HAP	Household Air Pollution
WHO	World Health Organization
UNDP	United Nations Development Program
EIA	United States Energy Information Association
SME	Small-Medium Enterprise
BMC	Business Model Canvas
RBF	Results Based Financing
CEO	Chief Executive Officer
OECD	Organization for Economic Co-operation and Development
ODF	Official Development Finance
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change

1. Introduction

Globally almost 800 million people live without access to electricity. This is negatively affecting their ability to develop economically as electricity powers our economies and so creates opportunities (Timmermans & Birol, 2021). In Sub-Saharan Africa (SSA), with a total population of 1.2 billion, one can find around 600 million people of the global total experiencing energy poverty (IEA, 2020a; World Bank Group, 2020). The globally lowest rates of energy access hinder economic growth and sustainable development in the region (World Bank Group, 2018). Furthermore, worldwide about 3 billion people do not have access to clean cooking fuels and technologies. Again, many of these people can be found in SSA. Around 900 million people in this region still cook with traditional fuels, such as wood (IEA, 2020a, 2020b; World Bank Group, 2020). Cooking on fires and inefficient stoves powered by traditional fuels produces substantial amounts of black carbon, which is harmful for people and the environment (Clean Cooking Alliance, 2021). Mainly women and children are affected through premature deaths and sickness. To summarize, in SSA only about half of the population has access to electricity and only one-third to clean cooking (OECD et al., 2018).

The challenges do not end here as the United States Energy Information Association (EIA) estimates that the world's energy consumption will surge by nearly 50% between 2018 and 2050 (EIA & Kahan, 2019). For Africa alone, the demand is estimated to grow at 5.2 GW of new energy demand per year through 2025, which would mean a 65% increase from the 2010 level (Sanoh et al., 2014). Additionally, the population in SSA is exponentially growing. The average population growth rate is around 2.5% per year (World Bank, 2020). The pace of progress with regards to electrifying the continent is outshined by the population growth in the region. This keeps the absolute numbers of people lacking access to clean energy high for the following years (OECD et al., 2018). Furthermore, in SSA, energy demand will continue to grow as certain levels of society will experience increasing wealth (Njirani, 2015).

With these challenges in mind, the world is not on track to deliver clean energy to all as targeted by Sustainable Development Goal 7 by 2030 (Timmermans & Birol, 2021; United Nations, 2021). The SDGs form the global roadmap towards a more sustainable and inclusive future set out by the United Nations (UN) in 2015. By committing to the SDGs many of the world's countries agreed to several ambitious goals set to mobilize countries' efforts to solve many of the world's most pressing problems. These problems include, but are not limited to, inequality, all forms of poverty, climate change and energy access (UNDP, 2021). SDG 7 aims to 'achieve access to affordable, reliable, sustainable and modern energy for all' (United Nations, 2021). The goal includes electrification and clean cooking under the concept of clean

energy. Clean cooking refers to all forms of cooking on non-traditional, healthy alternative energy sources. Clean energy, also referred to as renewable energy, entails 'energy from natural sources or processes that are constantly replenished' (Shinn & NRDC, 2018).

Asa the energy landscape in SSA is changing, it is creating opportunities for another actor in the energy market, namely the clean energy entrepreneur. The market for (clean) energy is growing faster than the supply of such energy. Additionally, SDG 7 has put energy poverty on the international agenda. And so, a market opportunity is presenting itself for new clean energy technologies and businesses.

There are several trends that explain this market opportunity. First, a shift is happening away from traditional energy generation systems monopolized by governments. Governments in SSA only minimally invest in the energy sector, let alone in clean energy. There are promising technologies and positive market trends, yet, today's policies do not align with the demand of the market (OECD et al., 2018). The African Development Bank Group notes that African governments only invest 0.5% of gross domestic product on energy, annually (Adom-Opare & Yeboah, 2019). This amounts to an average of US\$ 8 Billion, which, in conservative phrasing, "is insufficient to power homes and boost business" (Adom-Opare & Yeboah, 2019). Governmental policies in Africa seem to miss the potentially large social and economic benefits of clean energy, including clean cooking (OECD et al., 2018). It is estimated by the International Energy Association (IEA) that to achieve universal access to energy in SSA, US\$ 27 billion per year between 2018 and 2030 needs to be invested (OECD et al., 2018). This stark difference highlights the need for an increase in financial input, most probably from diverse sources to allow long-term sustainable investment. Especially, as currently the major contributor to financing electricity access in SSA is official development finance (ODF). Yet, based on an analysis of the spread of funding, the OECD concluded that SSA does not receive a proportionate share of international ODF knowing that the region has the greatest share of population without access to electricity (OECD et al., 2018). Private financing, through impact investment, for example, is growing. This source of financing is mainly interested in the decentralized energy systems. Mixes of different types of organizations, such as entrepreneurs and NGOs, are already entering the clean energy market and exploring decentralized systems (Deloitte, 2017).

Second, in recent years the amount of clean energy projects globally has been increasing. Nevertheless, it is estimated that not all clean energy projects are successful and deliver the desired results (Ikejemba & Schuur, 2020). To illustrate, while 61% of the global population had access to clean cooking in 2017 (United Nations, 2019), this number is only

increasing by 0.5% every year (United Nations, 2019). These numbers show an unmet market need but also signal that clean energy entrepreneurs in SSA face a variety of challenges in addressing the market gap. According to the OECD, decentralized systems for electricity and more renewable options for clean cooking, are part of the solution to address the gap between supply and demand. The OECD suggests that policies and financing needs to step-up in order to achieve universal energy access in SSA (OECD et al., 2018).

Third, the opportunities for decentralized systems can be explored more easily by entrepreneurs. These energy systems require lower funding and less support from existing energy infrastructures allowing a new and disruptive player to enter the market. It is not likely that all households in SSA will be serviced by national grids due to cost, spatial distances, and national central energy supply. It is more advisable to leapfrog the traditional fossil-fuel dependent centralized power system model such as we have in Europe (World Bank Group, 2018). The decentralized energy systems are especially interesting for the poor as they generally offer module systems that can be build up as one's financial position improves. Furthermore, the African Development Bank Group believes that the key to financing smaller, more local energy projects lies with private investment (Adom-Opare & Yeboah, 2019). From a financial perspective it is estimated that the decentralized off-grid systems represent a 24 billion US Dollar opportunity in Africa yearly (Okonkwo, 2021).

Fourth, another opportunity for clean energy entrepreneurs can be found in the worrisome lack of clean cooking strategies in most countries in SSA. The inadequate response burdens economies and limits human productivity because of negative health impacts associated with traditional cooking methods. In the few countries that do have clean cooking strategies, the implementation is weak and limited financial resources are made available (Hosier et al., 2017; OECD et al., 2018). The IEA estimates that around US\$ 1.8 billion is needed to finance the transition to clean cooking in SSA (IEA, 2018). This is a much lower financial need than for the electrification process. The challenges for the clean cooking transition, however, will lie with the scale-up process. Unlike the electricity sector, clean cooking technologies cannot rely on already existing grid networks (infrastructure) or dedicated institutions (OECD et al., 2018).

These four entrepreneurial opportunities are offset by some challenges. The limited access to funding for entrepreneurs in SSA is challenging. Most clean energy businesses are Small-Medium Enterprises (SMEs) and research has shown that it is less likely for a SME to obtain bank loans, for example, due to the expected increased risk (World Bank, 2019b). Especially if a SME is active in the clean energy sector as this market still has many unclear

risks due to the novelty of the transition. Another key challenge for clean energy entrepreneurs in SSA is the impact of cultural differences. Entrepreneurs from diverse cultural backgrounds are active in the energy sector in Africa. To illustrate, in 2019 eight of the top ten African startups were led by foreigners (Okonkwo, 2021). This indicates that formal enterprises are often not run by locals of the respective countries they operate in and that valuable knowledge regarding culture and civil society might be left on the table.

Knowing that the energy demand will continuously grow, and there is a collective desire to give everyone clean energy access, it is becoming more important to explore the clean energy sector. Transitioning to a new type of society, with decentralized energy systems and new cooking methods, can disrupt existing structures. Society needs to learn to trust these new technologies as their ways of life can change through it, for better and for worse. Governments needs to reassess their position in the energy sector, which will not go without a battle. Entrepreneurs, both local and international, need to deal with the already existing entrepreneurial challenges as well as with the local context. For a successful completion of SDG 7 one needs to better understand what causes clean energy enterprises to be successful or causes them to fail, including both electrification and clean cooking as part of the investigation.

1.1 Research Question

The problem observed is that SSA is experiencing widespread energy poverty. The challenge is exacerbated by the growing population and the already limited energy supply. With the current status the target of SDG 7 on clean energy for all will not be met. An opportunity for energy entrepreneurs arises. There is a market gap that governments are leaving open, yet the desire for economic development is widespread. With this context in mind, this thesis aimed to identify how clean energy entrepreneurs can be successful in the SSA context and so contribute to addressing energy poverty, as promoted by SDG 7. Therefore, the main research question of this study is:

How can clean energy entrepreneurs in the Sub-Saharan Africa context successfully contribute to achieving SDG 7?

The Business Model Canvas by Osterwalder and Pigneur (2010) is used as a frame to identify the main barriers and drivers an entrepreneur can face from a business operations perspective. The BMC consists of nine building blocks in which a business can be broken down. This model

is one of the most used tools to simplify a business and get to its core. One of the four sub-research questions focuses on these business operations.

However, the BMC alone would be too limited for this study as entrepreneurs in SSA must deal with an additional dimension. Most of the energy entrepreneurs in the region are not native to the culture they operate in. Their work should be researched using a cross-cultural entrepreneurship lens. Furthermore, there is limited literature about entrepreneurship in Africa and even fewer literature about the impact of culture on entrepreneurship in the African context (e.g. Naudé & Havenga, 2007). For these reasons, the theoretical framework of this study is also based on the Social Transformation model by Kroesen (2018). This model captures the impact of being an entrepreneur in a different culture trying to run a successful business. It zooms in on the business culture, the role of civil society, and the impact of governance on the business operations. These three focus areas are each translated into a sub-research question.

1.2 Personal Motivation

Additional to the societal, political, and economic reasons mentioned in the previous sections, the SSA region and clean energy sector have been chosen due to personal experiences. Through travelling and internships with companies working on the transition to clean energy, I have been exposed to the challenges these actors face in working towards the large task set by SDG 7. Having worked with people in the field and listening to their stories has shown me how limited the sector is compared to the global pressure and need to address clean energy in low-income economies. This personal drive and the alignment with my studies at TU Delft had led me wanting to further investigate this topic.

Moreover, this thesis is part of the Management of Technology (MOT) master program. This program aims to teach students how to use technology as a corporate resource. In practice this means a large focus on many technological and societal aspects of technology, innovation, product and resource design and development. Additionally, there is an emphasis on how these all integrate into the functioning of competitive and profitable businesses. In the topic of this thesis, similar to the MOT master program, there is a large focus on innovation in business, as my thesis investigated a relatively new business type and relatively new technologies employed in the African context.

1.3 Academic Relevance and Importance

Limited research has been done on the role of clean energy entrepreneurship in addressing energy poverty and sustainable business model development in low-income economies (Park, 2016). Only few studies show the socioeconomic impact of clean energy projects and focus mainly on innovation theory, social entrepreneurship, and micro-finance (Engelken et al., 2016). According to research by Koubaa, "one of the most important weaknesses in the entrepreneurship literature is the lack of studies on the connection of entrepreneurial perspective, opportunities and its challenges, with renewable energy business in the emerging market countries" (Koubaa, 2017 p.70). Yet, entrepreneurs can play a positive role in solving environmental degradation where efforts of governments, NGOs and existing firms are failing. By helping institutions in achieving their goals and by creating new more environmentally sustainable solutions, entrepreneurs can contribute to solving environmental problems (York & Venkataraman, 2010).

However, getting a start-up of the ground is a difficult endeavor and many ventures fail in this first phase (Gonzalez, 2017). In the developing world in the clean energy sector, it is no different. According to research by Park, one of the reasons why many clean energy ventures operating in the developing world never get off the ground is because "traditional sources of capital, like banks, shy away from sectors that seem unfamiliar or too risky" (Park, 2016). As aforementioned, limited research has been done into the role of entrepreneurs in the clean energy sector and what makes them successful or what causes them to fail. Especially, in-depth accounts of entrepreneurs are limited and so conclusions, like the challenges with financing, come with limited context (Naudé & Havenga, 2007). To illustrate, comments that investments into SMEs in the clean energy sector is 'too risky' can be found often. Yet, there might be more behind this challenge than mere risk averse behavior by banks. Cultural differences, the role of the government, or societal perspectives on clean energy could have an influence on the ability of clean energy entrepreneurs to be successful or not. After all, they are seen as disruptors in an existing market and in direct competition with governmental institutions. This can be both destructive and creative (Deloitte, 2017). To better understand these changes as part of the clean energy transition and to successfully achieve SDG 7, more research is needed.

1.4 Research Objective and Research Methods

The objective of this research is to contribute to our collective knowledge on clean energy entrepreneurship and the ability to achieve SDG 7, with a focus on the SSA region. As limited research on this topic has been done, there is a knowledge gap that could hinder our ability to

successfully achieve SDG 7. It has become clear that governments are not going to be able to address the challenges around the energy supply and demand alone. This study looks at how entrepreneurs can successfully contribute to addressing energy poverty is a more sustainable way.

To answer the research questions and reach the set objective, this study relied on a qualitative methodological approach and was exploratory in nature. The main source of data came from primary data collection through interviews. The goal was to give entrepreneurs an opportunity to express and describe their experiences and opinions. In total nine interviews were conducted with entrepreneurs active in the SSA clean energy sector.

To limit the scope of this study, the research focused on Small-Medium sized Enterprises (SMEs) currently part of the formal economy in SSA, with a special focus on actors in Zambia, Uganda, and Lesotho. Focusing on SMEs seemed most relevant as this type of organization is very common and active in SSA. Additionally, the energy entrepreneurs have to experience cross-cultural challenges and opportunities to be part of this study, meaning they should do business in a different country than their home culture.

1.5 Conceptual Framework

The conceptual framework in figure 1 visualizes the relevant variables of this study and how they might relate to each other. It shows what the expected outcome of the research is. In this case, the outcome is the clean energy transition in SSA driven by entrepreneurs. These entrepreneurs are influenced by and can influence the local culture they operate their business in, which is not always the same culture they originate from. The impact of cultural differences and how cultures are changing in Africa, form the context in which entrepreneurship in SSA needs to be understood.

To break down the framework, there are several variables that influence each other in different ways. First, cultural values are at the top of the framework as it is expected that cultural values lay the foundation for the cultural context of SSA countries. These values form societies and so the context in which entrepreneurs operate. Following, the cultural values drive a social transformation in SSA societies, which in the process causes two systems to exist simultaneously: the traditional and the modern system. The two systems also influence each other as society balances between a more traditional way of life and the newer path. Additionally, both regional and international entrepreneurs are involved in the SSA energy sector. They bring their own cultural values as well as are influenced by the existing cultural

values in country of operation. Thus, the balance between the traditional and modern system influences the entrepreneurial ecosystem, which is the landscape in which the entrepreneurs operate. It creates the drivers and barriers for entrepreneurs that this study is focused on researching. Finally, at the bottom of the framework is the ambition for a clean energy transition and tackling energy poverty in SSA. SDG 7 serves as a guide to define this final ambition. The entrepreneurial ecosystem influences the ability of the clean energy entrepreneurs to be successful and so affects the ability to achieve the goal set out by SDG 7.
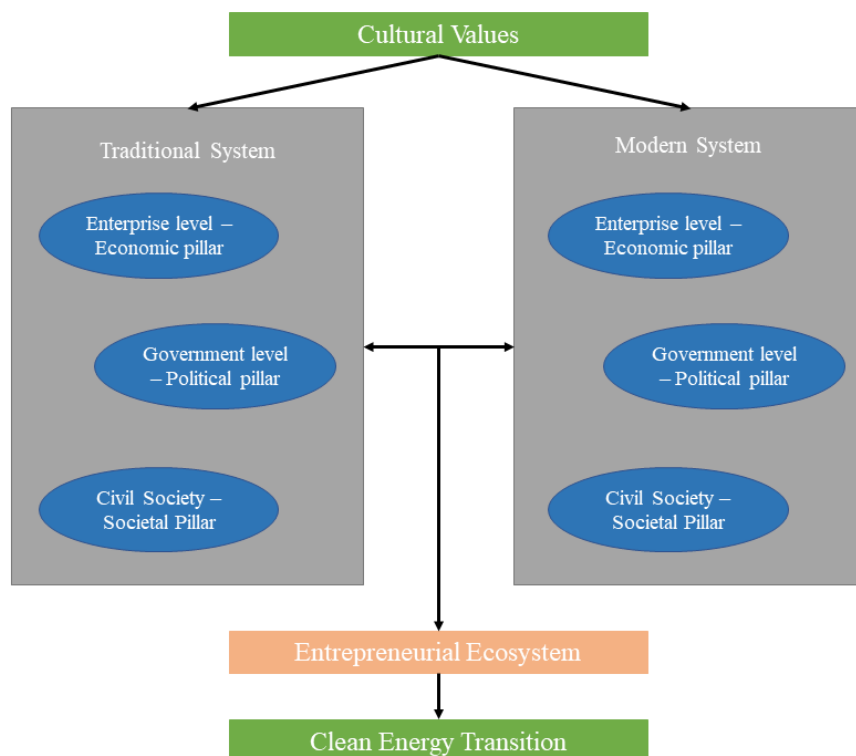
Figure 1 Conceptual Framework.

1.6 Thesis Outline

The first chapter introduced the context and objectives of this study. The second chapter contains a review of existing literature on the clean energy sector in SSA. It starts with going deeper into the energy challenge, followed by defining clean energy, next reviewing published entrepreneurship literature, consequently introducing the theoretical framework that followed from the literature review, and ends with summarizing the knowledge gap. The third chapter outlines the research methodology and discusses how the research has been conducted. The fourth chapter, which is the analysis section, presents the results from the interviews. The data has been organized following the key elements from the theoretical framework. The fifth

chapter presents the discussion, in which a reflection is made on the results. The new data is connected to previous work in the field to discover novelties and common patterns. The sixth and final chapter is the conclusion. This chapter summarizes how the Social Transformation model and the BMC were used to identify how entrepreneurs can successfully contribute to tackling energy poverty in SSA in a sustainable way. The main drivers and barriers are listed and several recommendations are made as lessons for entrepreneurs in the industry.

2. Literature Review

This chapter starts with going deeper into the current energy challenge including the state of the energy sector in SSA and the status of SDG 7. The second part focusses on defining the clean energy sector. Thereafter, a section explores literature on entrepreneurship in Africa and SSA specifically. Following from the literature, the next section introduces the theoretical framework for this thesis: the Social Transformation model by Kroesen (2018) and the Business Model Canvas by Osterwalder and Pigneur (2010). The literature chapter ends with a summary of the knowledge gap.

2.1 The Energy Challenge

The concept of energy is a difficult one to grasp as it is an abstract quantity that knows many forms, ranging from chemical, to electrical, to mechanical, to nuclear, to thermal. In essence, energy is defined as 'the ability to do work' (Dell & Rand, 2004). Energy has allowed us to improve our material well-being by using it as an instrument to do all kind of work (Dell & Rand, 2004).

It is argued that the contemporary production of energy poses a serious threat to the global environment. The emissions these energy forms produce are believed to have an influence on the Earth's climate (Dell & Rand, 2004; Dincer & Acar, 2015). We seem to have reached a limit with certain energy forms as they are showing to degrade our environment (Dell & Rand, 2004). Additionally, the exponential energy demand is exhausting our fossil fuel supply at an alarming rate (Dincer & Acar, 2015; Kamat, 2007). Energy demand has increased 16 times in the 20th century as the world population has quadrupled. The economic growth of the past decades can in part be thanked to the affordable energy prices. This could all change when scarcity starts to kick in. Entire societies are dependent on oil and electricity for it to function (Kamat, 2007). There is an increased need to decouple energy emissions and economic growth. To combine continuous economic growth with energy security and environmental

protection, countries, especially in the industrialized world, are reviewing their policies and existing technologies. A transition to more sustainable energy consumption is needed to ensure a prosperous future for all (Dell & Rand, 2004).

As an alternative to the contemporary polluting energy sources more sustainable energy supplies are suggested. These are non-polluting in nature and renewable while allowing us to maintain a certain standard of living. Nature has such benevolent, sustainable energy forms on offer: hydro, wind, tidal, thermal, and solar energy, to name a few. The challenge is to capture and utilize these renewable energy forms in an efficient and economical way (Dell & Rand, 2004; Dincer & Acar, 2015). Out of all renewable energy sources, solar energy stands out to most likely be able to meet the increased energy demand (Kamat, 2007). Especially in many developing regions that can be found in more solar prone areas. However, despite the sun being such a vast resource, the energy produced via solar remains around 0.01% of the total energy demand (Kamat, 2007).

In short, we need to find a way to meet the growing energy demands in a sustainable manner. This especially holds true for developing countries with their exponentially growing populations and increasing standards of living (Dincer & Acar, 2015).

2.1.1 The Energy sector in SSA

Securing reliable and available energy is crucial for continuous (economic) development. The availability of energy is a prerequisite for physical and socio-economic development in both rural and urban communities in SSA (Kebede et al., 2010; Mohammed et al., 2013). SSA contains developing countries that are poverty-stricken. Mohammed, Mustafa, and Bashir (2013), argue that these countries have a slower rate of development due to their low access to modern energy, which is caused by underprivileged energy policies, inadequate funding, ineffective energy infrastructures, and the low pace of technological diffusion (Mohammed et al., 2013).

Currently, the SSA energy sector faces several challenges on the supply side, such as inadequate generation capacity, poor transmission infrastructure, unskilled or low numbers of skilled workforce, and poor maintenance of existing power stations. The low reliability and insufficient quantity of energy hinders the expansion of the energy infrastructure. As a result, general investment in various sectors in SSA is hindered by the low levels of infrastructure and limited power supply in many countries in the region, according to Deloitte (2017). The challenges on the supply side, affect the willingness to use renewable energy sources. On the

demand side some of the challenges are poor metering and billing systems. As a result, unreliable supply of energy has become the norm (Deloitte, 2017). Therefore, many people still rely on non-commercial energy sources, such as charcoal, wood, and animal waste (Kebede et al., 2010) as it is more reliable in supply in the current market. Yet, charcoal is infamous for its negative impact on one's health. The black carbon produced can cause premature death, reduces life expectancy and reduces quality of life (Harmsen et al., 2020).

Besides the challenges of energy supply in the region, SSA has a tremendous solar energy and clean-cooking potential as many of its countries are near the equator and so exposed to powerful sunlight year round (Kebede et al., 2010). Additionally, SSA houses a sizeable portion of the world population. Around 1.14 billion people live in SSA spread across 48 countries. This counts for approximately 14% of the world population (World Bank Group, 2020). The region has optimal exposure to solar energy and a large market available. Yet, the transition to clean energy has been slow.

2.1.2 Status of Sustainable Development Goal 7

Sustainable Development Goal 7 is one of the 17 SDGs. Goal 7 declares the ambition of the UN to ensure access to modern energy for all by 2030. The Goal has three targets and two sub-targets. Target one focuses on universal access to affordable, reliable, and modern energy services. Target two emphasizes the need to increase the share of renewable energy globally. Target three urges that the global rate of improvement in energy efficiency doubles. This target is supported by two sub-targets. One focuses on the role of international cooperation to facilitate accesses to and promote investment in clean energy research and technology. The other sub-target focuses on the expansion of the infrastructure and upgrading the technology needed for supplying modern and sustainable energy services for all developing countries (United Nations, 2021). Figure 2 is a visual summary of the key elements of SDG 7.
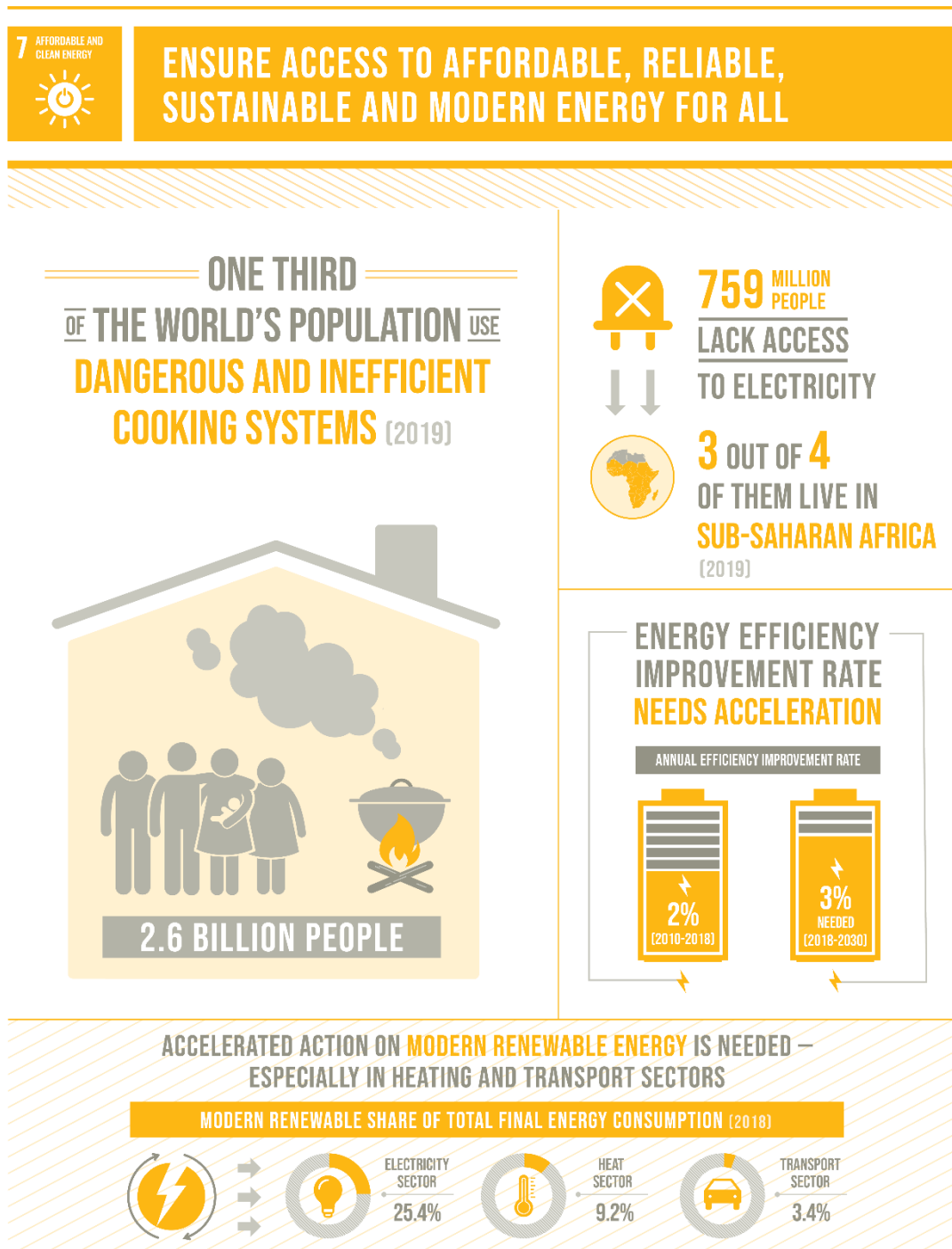
Figure 2 Infographic Sustainable Development Goal 7. Source: United Nations (2021).

According to the progress update of 2021, the world is nowhere near the ambition set by SDG 7. On the positive side, significant steps forward have been made in the last decade with regards to improving access to electricity, increasing the use of renewable energy in the electricity sectors, and improving energy efficiency globally. In 2010, the global electricity access rate was at 83% and improved to 90% in 2019. It is estimated that at this rate still 660 million people

will not have access to clean and affordable energy by 2030. The COVID-19 crisis has negatively impacted the progress on electrification (IEA, 2020a; United Nations, 2021). Nonetheless, in SSA the global electrification rate is comparably low. In 2018, 53% of the population in SSA lacked access to electricity compared to 17% globally (United Nations, 2021).

With regards to clean cooking, in 2019 around 66% of the global population had access to clean cooking fuels and technologies. Most of the progress was made outside the continent of Africa. In SSA, due to the rapid population growth and stagnant rate of access to clean cooking, the number of people with no access to clean cooking has increased over the last few years. In 2018, the international financial flows for developing countries to invest in clean energy reached US$ 14 billion, which was 35% lower than in 2017 (United Nations, 2021).

2.2 Clean Energy

Clean energy can offer a solution to the energy challenge SSA is facing while meeting the targets of SDG 7. Clean energy is a broad concept, however, and contains a wide array of options. To allow focus in this thesis, clean energy is defined as 'the ability to do work relying on renewable energy sources'. Clean energy systems take advantage of clean, inexpensive, vast, and available sources of energy input. For more continuous output several of the energy sources can be combined, such as solar and wind systems for day and night supply (Dincer & Acar, 2015). Clean energy includes both electrification and clean cooking.

This thesis is inspired by the criteria that Dincer and Acar (2015) defined. They found seven criteria that an energy system must meet in order to be deemed fully sustainable. First, the energy system must have minimal or no negative environmental or social impact. Second, it must not cause natural resource depletion. Third, it must be able to supply the current and future population with energy. Fourth, the energy needs to be sourced in an equitable and efficient manner. Fifth, air, land, and water need to be protected. Sixth, the energy system must only produce little or no net carbon or other Green House Gas emissions. Seventh, it must be safe for the people now and future generations (Dincer & Acar, 2015).

Finally, table 1 below summarizes the strengths, weaknesses, opportunities, and threats that clean energy systems have. Several of the points have already been mentioned in the thesis so far and some are expected to come forward during the interviews based on the elements of the theoretical framework.

Table 1 Strengths, Weaknesses, Opportunities, and Threats of clean energy systems. Source: Dincer & Acar (2015).

Strengths	Weaknesses	Opportunities	Threats
	Lack of cooperation with political authorities and enterprises		
Economic potential	Public perception	Energy independence and security	Global financial crisis
Use of local resources	Resistance to changes	Job creation	Scalability and timing
Vast resources	Commercial viability	Market enhancement	Commercialization
Flexible energy market	Lack of information and training	Overall productivity	Substitutability
Diversification options	High initial investment, installation, O&M costs	Supply efficiency	Complexity
Better design practices	Lack of affordability	Carbon footprint	Regulatory requirements
Smart technologies	Low energy density	Air/water/soil quality	Government regulations and policies
Innovative solutions	High payback time	Climate change	Low price of conventional energy sources and systems
Reliability	Infrastructural changes	Need for sustainability	
Government incentives	Lack of institutional and government consensus and policies	Vitality	
End-use variability			

2.2.1 Clean Cooking

It is more complex to define clean cooking as there is no one-size fits all. There are different culinary habits across cultures and families. In general a cooking method/tool can be considered clean when it produces limited damaging pollutants and works with a renewable energy source, such as biogas, solar energy, or biomass (World Health Organization, 2018). The World Health Organization (WHO) calls for discussions on what clean cooking should mean to make it more measurable for the future. To be able to suggest a suitable definition, several aspects of clean cooking need to be considered. The impact on health and the environment are two important factors. Yet, affordability, safety and accessibility should not be forgotten. There are several options for the energy source as well as the type of cooking device. For this research the following definition of clean cooking is used as defined by the WHO: "A cookstove is considered 'clean' if its emissions meet WHO Guidelines. Currently available options that are clean at point-of-use include electricity, gas, ethanol, solar, and the highest performing biomass stoves" (WHO et al., 2018, p. 3).

What is certain is that the use of polluting fuels as a source for cooking poses serious health, development, and environmental challenges. The commonly used inefficient and unvented stoves expose the cook, generally the women in the family, and surrounding family members, often the children, to high levels of Household Air Pollution (HAP). This can cause many health risks, such as lung cancer, chronic respiratory disease, or cardiovascular disease, and even premature deaths (Quinn et al., 2018; World Health Organization, 2018).

Researchers predict that if in Africa policies on energy access do not change radically, little change is expected in the number of people that rely on polluting materials such as fossil fuels and charcoal (Quinn et al., 2018). The World Bank estimates that by 2030, which is the target year for the SDGs, only 72% of the global population will have access to clean cooking (World Health Organization, 2018). This is short of the international target for a 100% as stated by SDG 7.

2.3 Entrepreneurship Literature

Entrepreneurship is not an easy or straightforward concept to define, neither to measure. There are different schools of thought which each have their own notion of entrepreneurship and view it from different perspectives (Bruyat & Julien, 2001; Cunningham & Lischeron, 1991). Therefore, there is no commonly accepted definition of entrepreneurship (Bruyat & Julien, 2001; Naudé & Havenga, 2007). Generally, the definition chosen depends on the focus of the research. For example, when believing entrepreneurship is about opportunity creation, the concept could be defined as "the process of identifying, valuing, and capturing opportunity" (Engelen et al., 2009, p.164). The classical school of thought associates the concept mainly with innovation and can define it as "the process by which individuals exploit opportunities for innovation" (Stam, 2015, p. 1761). As a final example, the definition of entrepreneurship in which it is about the intuitive ability of the entrepreneur. The concept in this school of thought is connected to the traits and instincts a person is born with that makes someone and entrepreneur (Cunningham & Lischeron, 1991). Regardless of the school of thought, often when writing about entrepreneurship in Africa, the focus is on the concept as self-employment, which refers to people who provide employment for themselves rather than seeking a paid job (Naudé & Havenga, 2007). In the African context, entrepreneurship is seen as a way of survival rather than a conscious life choice.

For this thesis, the aim was to work with a definition of entrepreneurship that is able to capture the complexity and diverse possibilities of entrepreneurship, while working in different cultural contexts. Hence, the definition from Bruyat & Julien (2001) is followed. Based on his research into defining entrepreneurship, he suggests entrepreneurship should be described as: 'the dialogic between individual and new value creation, within an ongoing process and within an environment that has specific characteristics' (Bruyat & Julien, 2001). In this definition the entrepreneur as an individual is considered, the project/business, the entrepreneurial environment, and the links between these three elements over time. It reflects that an

entrepreneur is capable of creating, learning, and influencing the environment. An entrepreneur is not a blind machine responding to stimuli from the environment (Bruyat & Julien, 2001). This definition is deemed most suitable for this study as it can encompass the uniqueness of the businesses in the SSA clean energy sector. The description highlights the importance of the entrepreneur as an individual, which is important from a cultural perspective, and puts emphasis on the role of the surrounding environment, which is very contextual in the case of the SSA clean energy sector.

The focus on the business/project itself is captured using the BMC by Osterwalder and Pigneur (2010). Capturing the business operations of an organization in a model helps to simplify the understanding of a business. The most comprehensive and prominent study on how to capture a business has been done by Osterwalder and Pigneur. They co-created the BMC with 470 practitioners from 45 countries (Srinivasan, 2011). The global scope of the study of which the BMC is the result, makes it suitable for use in this research. It indicates cross-cultural applicability.

2.3.1 African Entrepreneurship

Entrepreneurship research with a focus on Africa is relatively lacking compared to entrepreneurship research in other regions (Naudé & Havenga, 2007). In contrast, policy-makers in Africa seem convinced of the positive role of entrepreneurship for economic development. The study by Naudé & Havenga (2007), who created a bibliography of African entrepreneurship research, shows that research on African entrepreneurship steadily grew from the 1960s onwards. Only in the 1990s did this research field experience exponential growth in the number of articles published. One reason for this sudden growth could be the realization that entrepreneurship and SMEs could play a major part in economic growth and development of low-income countries. Hence, more research started to investigate this correlation and the programs implemented to develop African countries. Yet, the majority of research has been focused on South Africa or Africa as a whole (Naudé & Havenga, 2007). Looking forward, it is becoming increasingly important that we have a good understanding of different forms of entrepreneurship in Africa, the role of entrepreneurship in development, and what is needed to support entrepreneurship in the region. The focus of this study, SSA, is rapidly moving away from a resource-based economy into one of innovation and progress (Herrington & Conduras, 2019).

When looking at the literature related to entrepreneurship in SSA one quickly realizes that the challenges are often far greater in Africa compared to Western countries. There are several themes that can be distilled from the literature. For starters, Rivera-Santos et al. (2015) identify four African contextual dimensions that influence entrepreneurship in Africa. The four dimensions are acute poverty, informality, colonial history, and ethnic group identity. Within each of these dimensions a few trends can be isolated from the literature. First, many countries in SSA deal with high levels of poverty, with 21 countries ranked among the 25 poorest countries in the world (International Monetary Fund, 2021). Second, access to basic services is not self-evident and often entrepreneurs face large challenges in a variety of aspects of their daily tasks, such as reliable access to resources, reliable communication services, having access to transport services, and accessing finance services (Mugobo & Ukpere, 2012). In rural areas these challenges tend to be exacerbated even more. Furthermore, counties in SSA are generally characterized by poor infrastructure, market failures, and large informal economies. According to the World Bank, 15 of the countries in SSA are ranked among the 25 most difficult countries to do business in (World Bank, 2019a). Third, the governmental and bureaucratic hoops one has to jump through in many of the SSA countries can severely limit the viability and success of a venture. Additionally, government failures are actively present, with 12 countries out of the 25 most corrupt countries in the world being in SSA (Transparency International, 2020). Fourth, lingering colonial influences and strong ethnic group identities characterize African society and institutions (Acemoglu et al., 2001; Michalopoulos & Papaioannou, 2013). Furthermore, the challenges around funding are frequently mentioned in the literature. According to Park (2016), it is hard for clean energy entrepreneurs in SSA to acquire funding. Traditional sources of capital, such as banks, shy away from sectors that are still unsure and risky. This limits clean energy entrepreneurs in getting their business off the ground. Finally, Ikejemba et al. (2017) indicate a gap between existing project management theory and practice. In renewable energy projects specifically, the challenges are even greater, as the aspect of adoption of new technology comes into play as well. Adoption of new technology has to 'pass through' all layers of society. Meaning that the various political, local, financial, regulatory, etc. channels have to support the product and so increases the probability for failure.

There are also several opportunities for entrepreneurs in Africa. First, international development programs have in recent years shown an increased interest in brining modern energy services to SSA. The presently low levels of access to these sustainable energy products combined with an increasing awareness of climate change is the driver behind the increased interest, according to Davies (2018). The failure of governments to provide the energy

demanded has opened the market for the private sector to deliver energy services in SSA. Second, research in 35 SSA countries has shown that environmental pollution can decrease in the presence of environmental entrepreneurship. The authors concluded their research by recommending governments and policymakers that to mitigate environmental problems and achieve sustainable development, they should encourage environmental-oriented entrepreneurs and promote the use of environmental products (Sun et al., 2020). Yet, more research is needed as there is still limited knowledge on the role clean energy entrepreneurship can play in dealing with energy poverty and sustainable business model development in developing regions (Park, 2016).

These factors set the entrepreneurial environment in SSA apart from other developing countries. Overall, the business climate in most SSA countries is sub-optimal and there are a vast number of areas for potential improvement (Sriram & Mersha, 2006). At the same time, there are untapped market opportunities for motivated entrepreneurs.

2.3.2 Cross-Cultural Entrepreneurship

Established literature agrees that entrepreneurs and entrepreneurial organizations are major drivers of economic growth (e.g. Engelen et al., 2009; Stam & Stel, 2011; Wennekers & Thurik, 1999). This insight has been confirmed across different cultural settings and countries (e.g. Stam & Stel, 2011; Wong et al., 2005). Studies do show that national culture is an important boundary parameter as it has a substantial influence on the entrepreneur (Engelen et al., 2009). Three important observations can be made from the literature. One, when countries or cultures want to benefit from the full growth potential of entrepreneurship, the underlying mechanisms for entrepreneurs and entrepreneurial organizations needs to be understood (Engelen et al., 2009). Two, more and more entrepreneurs are launching ventures in several countries or cultures (Mtigwe, 2006). For them, it is important to know whether proven procedures tested in one culture achieve the same results in other foreign cultures. This point is especially relevant for the clean energy entrepreneurs as a significant number of energy projects in SSA are undertaken by non-African entrepreneurs. Three, cross-cultural entrepreneurship studies can contribute to advancing entrepreneurship research by identifying which elements of entrepreneurship are universally valid and which are culture dependent (Carayannis et al., 2003; Engelen et al., 2009; Hayton et al., 2002; Lee et al., 2011). Doing studies across cultures challenges and confirms the generalizability of entrepreneurship theories.

The acknowledged importance of culture in entrepreneurship has resulted in a dedicated cross-cultural entrepreneurship stream within the field of entrepreneurship. This stream combines entrepreneurship research with theories on national culture (Engelen et al., 2009). Cross-cultural entrepreneurship research is still in its infancy. Until the beginning of the 1990s there was limited research on cross-cultural entrepreneurship (Tung et al., 2014). Through the globalization of markets entrepreneurship has become inevitably more international, inspiring a need for greater emphasis on cross-cultural entrepreneurship research (Dana, 2013). Following, the Global Entrepreneurship Monitor (GEM), for example, was introduced, which is an international study that compares entrepreneurship across cultures or nations. As a result, the number of cross-cultural entrepreneurship studies increased dramatically (Tung et al., 2014).

Throughout the literature it becomes clear that there is not one clear-cut and unambiguous understanding on the definition of 'cultural entrepreneurship'. According to research by Albinsson, most authors that use cultural entrepreneurship in their study do not define it (Albinsson, 2017). However, there is academic and contextual value in understanding what the author had in mind when researching the concept. Therefore, for this study cultural entrepreneurship is a combination of the definitions for entrepreneurship and culture. Entrepreneurship has been described in the previous section. Culture should be understood as 'the patterned ways of thinking, feeling and reacting, acquired and transmitted mainly by symbols, constituting the distinctive achievements of human groups, including their embodiment in artifacts' (Engelen et al., 2009). Together this leads to the following description of cross-cultural entrepreneurship: 'the dialogic between individual and new value creation, within an ongoing process and within an environment that includes unfamiliar traditional ideas and their attached values' (Bruyat & Julien, 2001; Engelen et al., 2009).

Cross-cultural entrepreneurship research has been criticized for the lack of methodological maturity as the most popular methodology so far has been quantitative research relying on the analysis of databases (Engelen et al., 2009; Tung et al., 2014). Through the reliance on mean differences scholars have restricted themselves in their research. With mean differences it implies that cross-cultural differences directly affect how entrepreneurs work. However, it is more likely that there are different correlations in different cultures. Hence, culture should be conceptualized as a moderator (Tung et al., 2014). The lack of qualitative models limits the depth of the studies.

Engelen et al., (2009) have done research into several studies on cross-cultural entrepreneurship. These studies turned out to all be survey-based using quantitative methods.

First, Scheinberg and MacMillan (1988) researched the cross-cultural motives to start a business. They built their framework using factor analysis. Second, McGrath et al. (1992) studied what values differentiate entrepreneurs from non-entrepreneurs across cultures. They relied on step-wise discriminant analysis. Third, the study by McGrath and MacMillan (1992) focused on entrepreneur's perceptions across cultures. A similar methodology to the previous study was used. Fourth, Holt (1997) looked at character traits between entrepreneurs in various parts of the world as a basis for succeeding. For this an ANOVA model was used. Fifth, research by Mitchell et al. (2000) researched the relationship between cross-cultural awareness and the venture creation process. This study worked with discriminant and cluster analysis. Sixth, two studies by Mueller and Thomas (2000a; 2000b) using regression models. One looked into the variations in entrepreneurial traits across countries and the other connected culture with personality characteristics associated with entrepreneurial motivation. Seventh, two studies by Stewart et al. (2003; 2008) relying on regression models. One focused on the relation between the level of achievement motivation, risk-taking propensity and preference for innovation across cultures and the other on the relationship between environmental perception and scanning behavior of the entrepreneurs. Eight, two studies by Shane (1994a; 1994b). The study on national culture and preferences for innovation relied on factor and correlation analysis. The study on national culture and choice of foreign market entry worked with a regression model. The following studies all worked with regression models. Ninth, the research by Shane and Venkatraman (1996) looked into the relationship between national cultures and rational championing versus renegade championing. Tenth, Makino and Neupert (2000) investigated the connection between national culture and choice between joint ventures and wholly owned subsidiaries. Eleventh, study by Steensma et al. (2000) researched national culture in connection with the entrepreneurs' attitude towards cooperation. Twelfth, Marino et al. (2002) studied the relationship between entrepreneurial orientation and strategic alliance portfolio extensiveness across different cultures. To conclude, there is still little research with regards to the impact of culture on organizational performance and project success. This presents an opportunity for further research (Engelen et al., 2009).

For this study the goal was to understand the entrepreneur better and see what the drivers and challenges are in the SSA clean energy sector. In-depth research into the how of entrepreneurship in the region is required. Therefore, the Social Transformation model by Kroesen (2018) is chosen for this study. It is one of the few qualitative, in-depth models in cross-cultural entrepreneurship. The referenced transformation and ability to transform is what characterizes low-income countries as they are constantly changing in search of (economic)

development. The importance of cultural values and its impact on the entrepreneurial environment is often overlooked in entrepreneurship research. Other researchers agree that different regional cultures, economic contexts, or political circumstances, to name a few ecosystem factors, affect the personal entrepreneur's experiences (Acs et al., 2017). These factors are captured in the local cultural context with the Social Transformation model.

2.4 Theoretical framework

To contribute to the body of cross-cultural entrepreneurship research this study combines the BMC and the Social Transformation model. It allows to research the what and the how of clean energy entrepreneurs in SSA. The BMC allows to deep dive into the internal workings of organizations, which is outside the scope of the Social Transformation model. This model outlines the entrepreneurial environment in African countries taking into account the role of cultural values for successful entrepreneurship. Both models complement each other in addressing the research gap.

2.4.1 Entrepreneurship and Social Transformation Model

In his book Cross-Cultural Entrepreneurship and Social Transformation, Kroesen (2018) introduces a model to map the challenges that entrepreneurs in the global south have to deal with. The model makes it possible to suggest strategies to deal with these challenges. The model is based on four different types of issues/challenges. First, the internal management style and business culture. Second, the external environment of civil society. Third, the state apparatus. Fourth, the process of social transformation. These four types of issues are related to the three dimensions that entrepreneurs most often have to deal with, namely governance, institutions, and company values. These internal and external dimensions have different changes of speed. Regulations, for example, may change quickly, while value systems of societies are slow to change as they are more deeply embedded in cultural values. As aforementioned, so far the importance of cultural values has been often overlooked in entrepreneurship research. Yet, these cultural values and the existing institutions are crucial for understanding cross-cultural entrepreneurship according to Kroesen (2018). Table 2 summarizes the foundational pieces of the model.

Table 2 Overview Foundational Elements Social Transformation Model Kroesen.

The Dimensions of the Entrepreneurial Environment		Types of Issues Entrepreneurs Deal with	Levels of the Model	Affecting the Entrepreneur on what Level	Speed of Change
State (Governance)	Cultural values and Institutions	State apparatus	Framework of governance and regulations	External	Can change quickly
Society (Institutions)		External environment of civil society	External relationships	External	Can change quickly
Individual Enterprises (Company Values)		Internal management style and business culture	Internal functioning of the company	Internal	Changes slowly
		The process of social transformation	The process of social transformation	Internal and External	Changes slowly

The model by Kroesen encourages to look at the dynamics between the different levels and how they interact with each other, cultural values and with the process of transformation. The four levels at the core of the model are internal functioning of the company, the external relationships, the framework of governance and regulations, and the participation of entrepreneurs in the process of social transformation (Kroesen, 2018). An interpretation of the model is visualized in figure 3. The figure shows how in a low income economy context the process of social transformation takes place. The choices an entrepreneur makes is situation and context dependent. The behavior can be classified more as System I or System II behavior. Modern system behavior is preferred for the SSA society to move forward and become more inclusive, but in some instances the entrepreneur will have more success showing traditional system behavior. The relationship between the behavior and the systems is moderated by the cultural values, which are location specific, as they influence why the entrepreneur takes a certain decision. When the entrepreneur decides to participate in the process of social transformation, he/she will contribute to the shift of society from a traditional system to a more modern one.
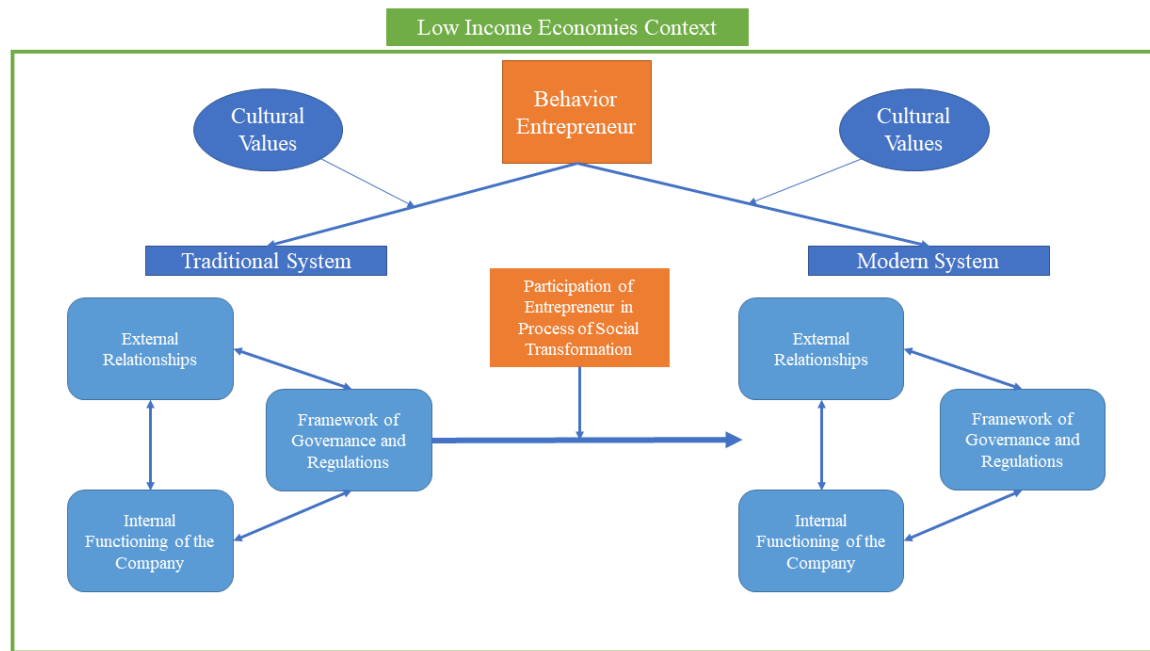
Figure 3 Visualization Social Transformation Model by Kroesen.

2.4.1.1 Internal Management Style

The internal functioning of the company, which focuses on the internal management style, is crucial for how an organization functions. Some of the most important issues that have been identified by Kroesen are hierarchy versus egalitarianism, group versus individual, time management and labor, and equal treatment and universalist attitude.

1. Hierarchy versus egalitarianism. Organizations in low-income economies are often characterized by hierarchical and patriarchal top-down structures of management. This limits the employees' self-development and so creates a dependent workforce in which the focus is mainly on the tasks of today and not those of the future.

2. Group versus individual. In the Global South it is common that the group goes before the individual, meaning that the individual has to adapt to the course/wishes of the group. For an organization this means that employees will often not think outside of the group, which is the company, and therefore will not think so much outside of the box. The problem-solving skills of employees is limited as creative thinking requires outside of the box behavior. Furthermore, an organization should not have too many different groups with a collective identity as this can stand in the way of teamwork. Think of a clash between different tribes having to work together in one organization.

3. <u>Time management and labor</u>. Challenges can be identified with regards to inefficient time management and labor. Lack of planning and foresight, underestimating deadlines, or doing too many things at once are examples of inefficient time management. Low education and lack of work experience negatively affects efficient labor. Employees in low-income economies might need more training to get the job right. They often need to learn to work without the constant presence of a boss or how to operate industrial production.

4. <u>Equal treatment and universalist attitude</u>. To deal with the patriarchal and clan-based society in Africa, equal treatment and equal access in the organization are crucial. The patriarchal attitude will not disappear most likely as values are hard to change. Yet, this value can be used as a positive role model instead of one of tyranny. Similar to the role model of a good father showing the desired behavior for the company.

To conclude, the management style of entrepreneurs in SSA needs to adapt to the aforementioned challenges in order to overcome them. Such a management style does not exist naturally per se. The cultural background of the entrepreneur can influence its behavior and perspectives. An entrepreneur that believes in the future of its company needs to value the internal cultural capital to ensure growth. Therefore, awareness of the described challenges is important and the ability to respond adequately to them (Kroesen, 2018).

2.4.1.2 External Relationships, Partners and Customers

External relationships are built on an exchange of trust. Anonymous trust, which is the trust you have towards someone you do not personally know, is not so common in Africa. According to Kroesen (2018), 'trust and commitment are usually limited to the family and to vertical networks'. Vertical networks are networks of friends, which include clan members or people from the same region or school. Common in these networks is that people in powerful positions distribute favors amongst others in the network in return for their support. Trust between people who do not know each other personally is built by an exchange of money (or time, or equivalent) for an advantage. This should not be interpreted as straightforward corruption, but rather as an exchange pattern. Cooperation between different vertical networks goes through a person who can function as a gate between the networks. This person is part of both the networks and generally requires a form of compensation for the efforts (Kroesen, 2018). For the entrepreneur operating in SSA this means that there needs to be a focus on creating cooperation inside and outside of the organization. Open networks of trust and reliability need

to be developed to step away from the transactional trust building (i.e., 'buying' trust). Entrepreneurs are encouraged to invest time into making external partners their reliable 'friends'.

2.4.1.3 Governance and Regulatory Framework

The vertical networks are also of importance for the entrepreneur's relationship with the government. Government bureaucracy consists of vertical networks too. It is common for organizations to maintain a good relationship with their network in the government offices. Only with the right contacts can one influence policies, regulations, or licenses (Kroesen, 2018).

To overcome the challenges associated with favoritism, governments need to become more transparent and equal in their treatment, rely on rule of law, introduce clear and consistent regulations, and enforce the law. Open cooperation and changing coalitions are important for civil society to function in a less complicated and cheaper manner. Organizations need to be able to rely on the government and anonymously trust it. How well connected you are through your vertical networks should not be the driving force for getting things done in SSA (Kroesen, 2018).

2.4.1.4 Social Transformation

A change with regards to the relationships is society is happening. Vertical networks are still important, yet newer and more personalized relationships are gaining momentum in low-income economies. At the same time, states are striving to be stronger and more equitable promoting a civil society of open cooperation. According to Kroesen, this change can be described as a transition from a System I economy to a System II society. System I is the traditional system of vertical networks and System II the modern system of anonymous trust (Kroesen, 2018).

Entrepreneurs active in SSA need to balance System I and II to participate in the social transformation process. Their behavior influences if this transformation process will be a positive or negative experience. To steer their activities between the two systems and to positively participate in the transformation process, entrepreneurs need to deal with the following three issues.

1. The corruption discourse. There is a distinction in the framing of corruption between System I and II. The entrepreneur needs to judge when to use what perspective and not

be blinded by political correctness and his/her own values. According to Kroesen, in some cases, it might be more beneficial to follow the traditional habits of rent seeking, personalized favors, and comply with the allowance culture. While in other instances, problems need to be dealt with in a more modern way by relying on open cooperation, anonymous trust, and creating equal access. In short, non-African entrepreneurs need to reframe the notion of corruption in order to effectively operate in SSA. Solidarity networks in which people offer each other favors, are not experienced as corruption in traditional African societies, but rather part of the personal safety net culture. Yet, with that said, the in-groups of the existing networks need to be broadened and made more inclusive for the values of a modern economy (System II) to function.

2. <u>Niche management and civil society</u>. Due to the balancing act between System I and II, entrepreneurs in SSA need to understand the challenges and opportunities with regards to niche management. According to Kemp et al, niche management is, "the creation, development and controlled phase-out of protected spaces for the development and use of promising technologies by means of experimentation, with the aim of (1) learning about the desirability of the new technology and (2) enhancing the further development and the rate of application of the new technology" (Kemp et al., 1998, p. 186). Therefore, according to Kroesen, enterprises in Africa cannot avoid creating an environment that is conducive to equal treatment, open networking, and flatter hierarchical management structures. The creation of such social environment promotes the functioning of the organization. Kroesen coins this socially responsible entrepreneurship as it nudges society towards a modern system. This crucial activity especially holds true for SMEs as large companies might have the resources to participate in the rent seeking behavior of System I. Such a social environment is created by building bridges of trust and cooperation with stakeholders (e.g. schools, NGOs, village leaders, farmer associations) in their environment. With socially responsible entrepreneurship, the enterprise can create bridges between the old System I, driven by lifelong solidarity, and the more modern System II, driven by equal access and civil society.

   In short, entrepreneurs should not feel ashamed if they must rely on the traditional vertical networks to get things done from time to time. Yet, they should not forget to invest in open cooperation and trust building for long term gain as the system is slowly transitioning. The SSA entrepreneur should start by giving the right example internally and treat its employees with elements of anonymous trust to grow their trust

in return. The same should happen with customers and business partners and so build towards a spirit of teamwork.

3. <u>The changing role of the state</u>. In many post-colonial countries, the state is rather bureaucratic. Generally, one ethnic group organized itself in a political party and uses bureaucracy to keep other competing ethnic groups in check. This approach aligns with the vertical networks culture. It has hampered the development of common state functions, such as protection of property, law enforcement, rule of law, or developing effective transparent economic policies. Currently, the role of the state is changing in many African countries. It is transitioning from a particularistic state towards a universalistic (i.e. rule of law, equal access, etc) one. Civil society needs to become more open for this transition to happen and entrepreneurs in SSA can play a role. Preferential treatment needs to be suppressed. As aforementioned, entrepreneurs need to set the right tone by showing behavior of anonymous trust and try to break with the traditional vertical network system.

At all levels a transformation is required as the different levels mutually reinforce each other. Entrepreneurs can contribute by showing more System II behavior, but others need to follow for the environment to change. At the same time values from System I, will not change overnight and the entrepreneurs in SSA need to balance participating in traditional behavior while showing modern ways of doing business to encourage positive change. Collaborative and open teamwork between different stakeholders, combined with dedication and creativity, can navigate the transformation successfully (Kroesen, 2018).

2.4.2 Business Model Canvas

In their book Business Model Generation, Osterwalder and Pigneur introduce the Business Model Canvas. The BMC is a tool that uses "a shared language for describing, visualizing, assessing, and changing business models". According to Osterwalder and Pigneur, a business model can be defined as 'describing the rationale of how an organization creates, delivers and captures value' (Osterwalder & Pigneur, 2010, p.14). It consists of nine building blocks placed in relationship to each other (Osterwalder & Pigneur, 2010). The nine building blocks and their description can be found in table 3.

Table 3 The Nine Building Blocks of the Business Model Canvas. Source: Osterwalder and Pigneur (2010).

Building Blocks	Description
Value Proposition	The value the organization creates for its customers – generally focuses on what problem the business intends to solve.
Customer Segments	The different stakeholders an organization aims to reach or serve.
Channels	How the customer segments can be reached to deliver on the value proposition.
Customer Relationships	Which type of relationship is established with each customer segment.
Key Activities	The core activities of the organization.
Key Resources	The key assets an organization needs to make its business work.
Key Partnerships	The network of key stakeholders, such as suppliers, that make the business model work.
Revenue Streams	The cash flows an organization generates from its customer segments.
Cost Structure	All the costs that are made to operate the business.

These nine elements interact with each other and form the foundation of any business, according to Osterwalder and Pigneur (2010). It is a model and therefore a simplification of the true complexities of business. However, the BMC helps entrepreneurs and others map their activities in an organized way. For this study, the BMC is used to identify the most important internal functioning's of a company.

As the model by Kroesen does not go deeper into the business operations of a company, the BMC is added to the theoretical framework. It will allow for discussion in how far and what elements of the internal workings of an organization influence its behavior and ability to function in a certain culture. These insights are important as the goal is to better understand how SSA clean energy entrepreneurs can successfully operate in achieving SDG 7.

2.5 Knowledge Gap and Overview Theoretical Framework

To summarize, the literature shows that there is limited research into clean energy in SSA. The research that has been done does not focus on the driving forces and thought processes of entrepreneurs active in the SSA energy sector. It is therefore difficult to understand how the relevant stakeholders view the ambition of SDG 7, what drives them and what barriers they

experience, and how cultural values influence their entrepreneurial behavior. Based on the literature the below theoretical framework in figure 4 has been made.
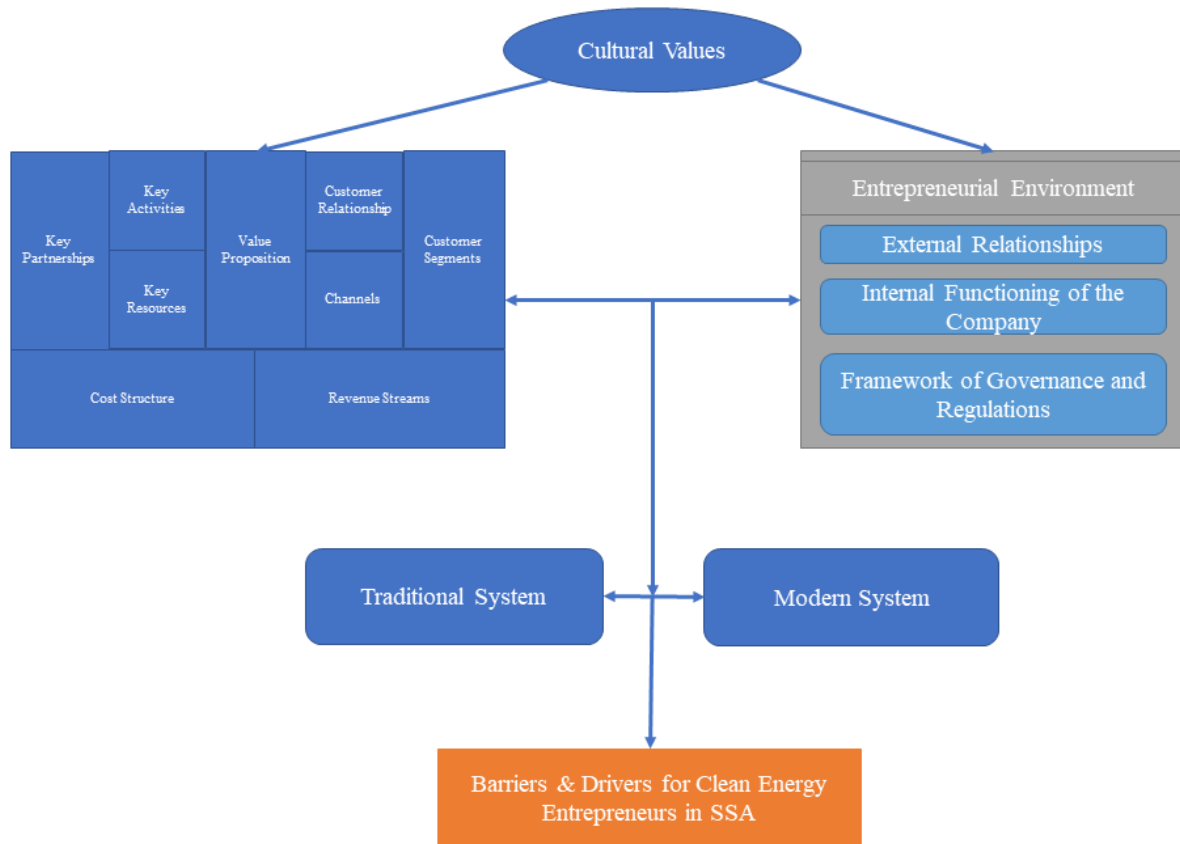
Figure 4 Theoretical Framework.

3. Research Methodology

First, the methodological approach is described, which contains all research questions. Second, the methods on how the data was collected are presented. Third, the methods of analysis focuses on how the collected data was processed and analyzed. The results of this part can be found in the following Analysis chapter.

3.1 Methodological Approach

The aim of this study was to investigate an under-researched topic and provide insights into how SDG 7 could be achieved in SSA. A qualitative methodological approach was selected as this would allow in-depth data collection on personal experiences and opinions of entrepreneurs in the SSA clean energy sector. Using interviews as primary data collection method, made it possible to collect real-world knowledge and identify patterns. The theoretical

framework allowed to put these patterns into context and frame it for academic purposes. The following main research question was investigated using the described methodological approach:

How can clean energy entrepreneurs in the Sub-Saharan Africa context successfully contribute to achieving SDG 7?

This main research question is supported by four sub-research questions. These four topics have been identified as the main themes from the theoretical framework. The first theme on business operations focuses on the what of an enterprise. Using the nine elements of the BMC, this sub-research question aims to better understand what entrepreneurs in the SSA energy sector do and what their mission is. The second theme on business culture is a representation of the internal functioning of the company as part of the Social Transformation model by Kroesen. The third theme on civil society is connected to the external relationships level of the same model. The fourth theme on governance aims to investigate the framework of governance in which the entrepreneurs in SSA have to operate.

1. **Business operations:**

What do the business operations of entrepreneurs in the SSA energy sector look like?

2. **Business culture:**

What are the challenges and opportunities with regards to the business culture in enterprises in the SSA energy sector?

3. **Civil society:**

How does civil society affect the actors in the SSA energy sector?

4. **Governance:**

How is the governance in the SSA energy sector affecting its actors in their activities?

3.2 Methods of Data Collection

The data was collected using a combination of the following methods: personal observations, in-depth interviews, and secondary research (part comes from the literature review). This section provides more details on the personal observations and the in-depth interviews.

3.2.1 Observations

The foundation and starting point of this research were personal observations. I have worked in the SSA energy sector myself and have visited several of the countries and companies that took part in this study. My personal experiences served as the source of inspiration for the topic of this thesis. I have first-hand seen the challenges that actors are facing in trying to transition the energy sector to a more sustainable one. These personal experiences made it possible to interpret the data collected through the interviews in their real-world context. Fieldnotes were made to organize the personal observations and to be able to reflect on them.

My personal experiences based on the few countries I have been able to enjoy when in the SSA region, have shown that the clean energy sector in SSA is rather limited. Which also partly explains why this thesis is based on a limited number of participants. It further signals the need to investigate this topic.

3.2.2 Interviews

In-depth interviews provided the majority of the data. They allowed for first-hand insights into the experiences of actors in the SSA energy sector and their perspective on SDG 7. In total nine people were interviewed for this study. The first participants had been selected from my personal network. I asked each interviewee to reference at least one other entrepreneur that could be interviewed. All interviewees had to meet the following criteria presented in table 4 to become part of this study.

Table 4 Overview Criteria for Interviewees.

Criteria	Explanation
Active in the SSA region.	Active in one of the countries classified as being part of the SSA region by the World Bank (World Bank, 2021).
Be an entrepreneur themselves or have a significant influential role in an SME.	Entrepreneur is defined as someone who starts/has started their own business (Cambridge Dictionary, 2021). Significant role is someone like a business developer for the Africa region or a member of the managing board.

Work in the clean energy sector.	Can work on electrification only or electrification combined with clean cooking. For the electricity sector, there are several companies solely focusing on (small) solar home systems, while other companies either focus on larger scale domestic solar systems or a combinations of solar home systems and domestic solar systems.
Work in a SME sized organization.	Defined as organizations with a maximum of 250 employees (European Commission, 2016). The balance sheet total and the turnover are also capped, yet the exact amount varies per country. The size of the organization does not however say anything about their impact.
Need to be part of the formal economy of SSA.	The interviewees need to own or work at a registered business.

Table 5 shows an overview of the interviewees that participated in this study. It includes their name and role, personal info, and the countries or region their company is active in. There is also a column indicating if their company is consumer (B2C) or business (B2B) oriented. The interviewees come from diverse backgrounds and age groups. There is a balance between entrepreneurs born in SSA and entrepreneurs born abroad but having or working at a company active in the SSA region. Several are active in Zambia, Uganda, and Lesotho. This could be explained by the fact that these countries are part of the region in SSA that I have also visited and worked in.

Table 5 Overview Interviewees.

Role	Sex, Age group	Country of Birth	Country/Region of Activity	B2B and/or B2C
Interviewee #1 - Rural Spark/Spark Energy	Male, 30-40 years	India	Sub-Saharan Africa	B2B
Interviewee #2 - Business Development Africa,	Male, 25-35 years	Rwanda	Sub-Saharan Africa	B2B

FuturaSun and OffGridSun				
Interviewee #3 - SupaMoto	Male, 40-50 years	Sweden	Zambia	B2C
Interviewee #4 - SupaMoto	Female, 55-65 years	United States	Zambia	B2C
Interviewee #5 - NalaPayGo, former Project manager at Vitalite	Female, 35-45 years	Lesotho	Zambia, Lesotho	B2B/B2C
Interviewee #6 - ThomroBiofuels and professor in Mining Engineering at University of Zambia	Male, 55-65 years	Zambia	Zambia	B2C
Interviewee #7 - Standard MicroGrid	Male, 35-45 years	United States	Africa	B2B/B2C
Interviewee #8 - PowerTrust East Africa	Male, 35-45 years	Uganda	Uganda	B2B
Interviewee #9 - AfricaCleanEnergy	Male, 30-40 years	Lesotho	Sub-Saharan Africa, Cambodia	B2C

The interview questions are based on the theoretical framework. The four main themes from the framework are also the main themes under which the interview questions are grouped. The four main themes are: business operations, business culture, civil society, and governance. Below figure 5 shows the schematic overview on which the interview questions are based. Under each of the four themes, elements from the models in the theoretical framework were selected. These elements were identified as key to getting insight into the themes. The interview questions in each theme link to the theoretical elements under it. The interview questions are designed in such a way that they will contribute to developing the answers to the sub-questions, which in turn will contribute to discussing the main research question. The resulting interview questions can be found in Appendix A.
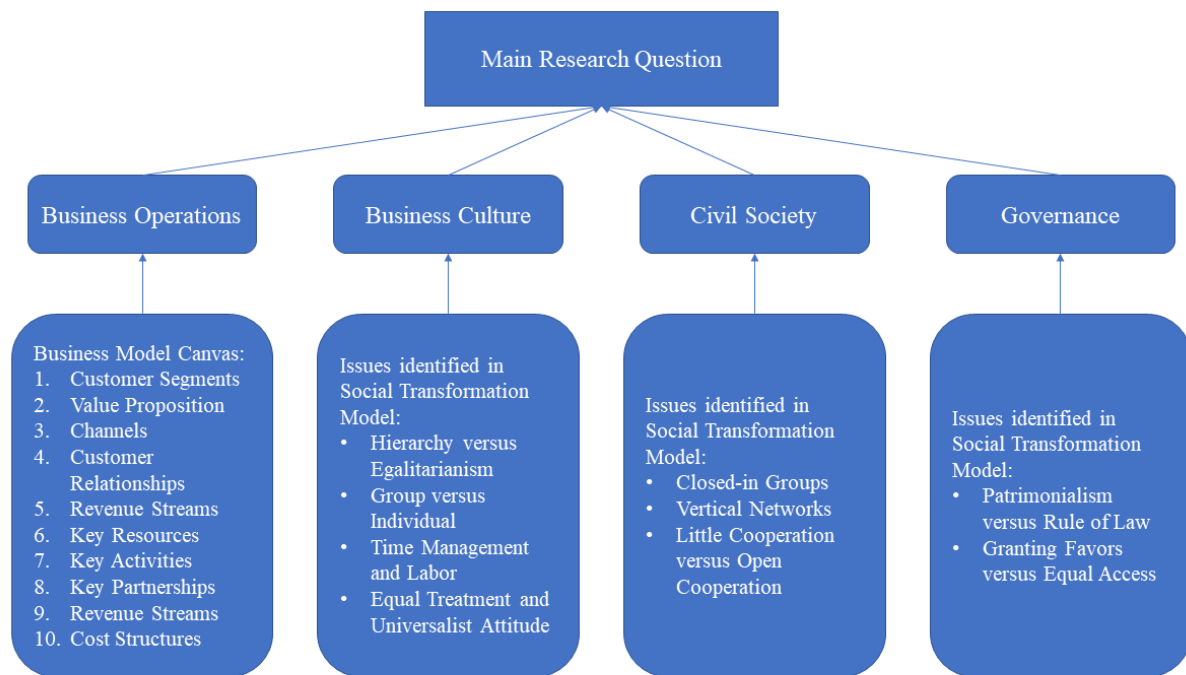
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                        ┌──────────────────────────┐
                        │   Main Research Question   │
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Business Operations	Business Culture	Civil Society	Governance
Business Model Canvas: 1. Customer Segments 2. Value Proposition 3. Channels 4. Customer Relationships 5. Revenue Streams 6. Key Resources 7. Key Activities 8. Key Partnerships 9. Revenue Streams 10. Cost Structures	Issues identified in Social Transformation Model: • Hierarchy versus Egalitarianism • Group versus Individual • Time Management and Labor • Equal Treatment and Universalist Attitude	Issues identified in Social Transformation Model: • Closed-in Groups • Vertical Networks • Little Cooperation versus Open Cooperation	Issues identified in Social Transformation Model: • Patrimonialism versus Rule of Law • Granting Favors versus Equal Access

Figure 5 Schematic Overview Research Framework.

The interviews were one-on-one and semi-structured. Relying on the semi-structured method allowed room for the interviewee to add or comment on topics outside of the initial scope during the interview. This ensured that the interviewee had room to as much as possible share his/her authentic experiences and perspectives. Additionally, semi-structured interviews can reduce the level of researchers bias as interviewees are able to break through potential pre-set frames in the questions. The interviews lasted on average one hour. Due to COVID-19 and safety restrictions the interviews were held using digital communication platforms, such as Zoom and Skype. I took notes during the interviews and, with permission, also audio-recorded the interviews to allow the possibility to revisit points discussed later during the study. After each interview I wrote a summary of the call with the key points. All participants signed a consent form and were made aware of the purpose of this study.

3.3 Methods of Analysis

The main method of analysis was thematic analysis. All data collected from the interviews was first coded and thematically organized. In an excel sheet I grouped together the thoughts and quotes from all the interviews that seemed to be linked. The set up and themes from the interview structure guided me in this process. Thereafter, I connected the grouped data to

themes from the theoretical framework. In the end I was able to connect data to all nine elements from the BMC and to the main parts of the model by Kroesen. The final set of recurring themes forms the frame of the analysis section. The personal observations and the secondary data helped me to put points into context and fill in the missing gaps, when needed. By coding and examining the data with thematic analysis it was possible to identify broad themes and patters.

4. Analysis

This chapter presents the data collected, structured according to the four main themes that were derived from the theories: Business Operations, Business Culture, Civil Society and Governance.

4.1 Business Operations

The business operations look into how a business operates, meaning how it turns its assets into value. The nine building blocks from the BMC are used to guide this section. Data from the interviews has been coded according to the nine blocks and this section summarizes the outcome. The elements are discussed in order of how Osterwalder and Pigneur recommend the discussion of a BMC.

4.1.1 Customer Segments

All the interviewees indicated that they are aiming to create value for individuals and families. Small households is the overarching customer segment. The collective goal of the interviewees is to address mass market with their products as many people in SSA suffer from energy poverty and still cook with unhealthy and unsustainable fuels.

Seven of the entrepreneurs have additional customer segments as they also aim to create value for organizations and institutions. Standard Microgrid, OffGridSun and SupaMoto, for example, can serve schools, hospitals, small to medium size businesses and communities with their scalable or larger solutions (Interviewee #2, personal communication, 2021) (Interviewee #4, personal communication, 2021).

Six entrepreneurs have small households and organizations as their direct customer segments, while for two this is indirect as they sell business-to-business. They therefore do not have direct interaction with the small households or organizations. For this group of

entrepreneurs their direct customer segment is local clean energy business. These businesses are generally local distributers as they sell the branded products from the supplier in the local market. Spark Energy is an example of a company with such a B2B model.

Interviewee #5 shared an interesting observation in her interview regarding customer segments. In her experience often the person deciding on whether or not a solar home system or clean cooking installation is bought, is the female of the household. Quite a number of NalaPayGo customers are elderly women who make the financial decisions without having to consult anybody else. These women base their decision on whether the clean energy products have perceived benefits for their grandchildren. They reflect on the improved ability of their grandchildren to be able to do homework or how light at night might make them feel safer (Interviewee #5, personal communication, 2021). As none of the other interviewees mentioned such an observation it is hard to say if the customer segments of the companies should maybe become more specific to target the right members of the household or the institution. Women in many SSA cultures still hold important positions in the household or business when it comes to care (Interviewee #5, personal communication, 2021). Hence, the experience of Interviewee #5 should be reflected upon and asks for further investigation.

4.1.2 Value Proposition

Seven entrepreneurs interviewed sell Solar Home Systems, aiming to provide electricity from solar to small households. Four entrepreneurs offer cooking solutions for small households. Both product groups create value for the identified customer segments as they meet the need to address energy poverty. Additionally, the products provide solutions to the negative environmental impact of current energy and cooking sources, which has value for both the local and the international community.

The entrepreneurs are differentiating themselves through pricing strategies, striving for quality, offering supportive customer service, or being available in many regions.

4.1.3 Channels

The interviewed entrepreneurs have different channels (owned channels or partner channels) of how they reach their customer segments. Of the total, five enterprises have physical locations in one or several countries in SSA. Here the customer segments can come experience the products and buy them.

SupaMoto works with road shows to reach customers. In these shows a large truck with music, sales agents and products drives around and visits villages to promote and sell the product. In addition, SupaMoto has local stores that have the pellets for the stoves in stock. Some of these stores are owned by SupaMoto and others are reseller points where they work with existing businesses, such as local food shops. Some reseller sell pellets from their own house, effectively turning them into entrepreneurs. This way customers can always find a location in their neighborhood lowering the bar to use the products (Interviewee #4, personal communication, 2021).

Three enterprises work with partners in the SSA region and so have indirect channels. Spark Energy, for example, works differently from SupaMoto, to name one, as they have a B2B model. The company has its head-office in the Netherlands, production of the solar systems in China and India, and local distribution in several SSA countries. The local partners buy the products from Spark Energy and are solely responsible to market the product locally. Spark does have a solar technician in each country that they operate in to have eyes and ears on the ground and to offer technical support to the distributor on the products (Interviewee #1, personal communication, 2021).

4.1.4 Customer Relationships

Customer relationships focuses on how an enterprise gets, keeps, and grows its customer base. First, to get customers generally the entrepreneurs rely on personal connections. Agents go into the field and encourage potential consumers to explore the products. According to Interviewee #5, raising consumer awareness is part of attracting new customers. She sees that many consumers are still unaware of the negative side effect of unclean cooking and the positive impact a switch to clean energy can have on an individual and societal level. Interviewee #5 directly questioned who is responsible for educating consumers. Clean energy entrepreneurs share in this responsibility as it is in their interest to get more customers. Yet, she suggests that governments should step up to their role as public policy creators to accelerate change (Interviewee #5, personal communication, 2021). The relatively small and young clean energy industry in SSA is not equipped with their limited resources to run a business and educate the masses. Until that changes, much energy will have to go into getting customers interested in the clean energy products.

The marketing budget amongst the interviewees also seems rather limited. Additionally, in-house expertise on how to address and communicate with the identified

customer segments correctly seems to be missing. Interviewee #5 reflected and shared that in the end word-of-mouth still seems like one of the most powerful marketing techniques. Yet, for this to start working, you first need to invest in agents in the field who have direct customer contact and build personal relationships (Interviewee #5, personal communication, 2021).

Second, to keep customers the entrepreneurs have several strategies. Call centers to offer customer service is common among the entrepreneurs as five of the total interviewed has such a call center. Consumers can call to these call centers with questions about the products. At the same time these call centers contact people who have defaulted their payment and see how they can be kept as a customer. NalaPayGo is a female driven enterprise and has mainly women in the call center. As mentioned before, Interviewee #5 shared that many consumers buying clean energy products are women. She thinks that having a mainly female call center connects better with the customer segment. Encouraging women to buy a product or offering support to another women seems to lead to higher success rates. To be certain of this, Interviewee #5 suggest that further research be done on this topic (Interviewee #5, personal communication, 2021). From a theoretical perspective the conclusion of Interviewee #5 could hold ground as in SSA societies women generally make the decisions about the household and discuss household tricks with other women.

Furthermore, agents in the field can offer repair services or support when a product malfunctions. Regional offices house such agents to cover a larger geographical area. SupaMoto, for example, works with such a model and has six offices throughout Zambia. Spark Energy works with the placement of local technical support at their partners' offices as mentioned in the section on channels.

These strategies do not always function well as Interviewee #5 discovered with her business. In her interview she said that after some time the incentive for the agents to do follow-ups disappears. Especially if the product is paid off by the consumer and the agent does not have a financial incentive anymore to visit the customer. As a result, the whole safety-net of service, which is supposed to maintain customer-relation and keep products well-functioning, dies out. Customers can feel duped and revert to their old and potentially harmful technologies. Additionally, the customer's perspective on clean energy might have been harmed in such a way that they are reluctant to deal with other companies providing similar solutions. It is an uphill battle at times to get customers, but with the wrong customer service it is easy to lose those hard-won customers. In short, clean energy products need follow-ups and so companies need to be able to provide the needed support networks if they want to make it in this industry (Interviewee #5, personal communication, 2021).

The interviewees have in common that they strive for long-term relationships with the consumers. Clean cooking customers are continuously dependent on the clean fuel for their stoves, such as the wood pellets that SupaMoto produces (Interviewee #3, personal communication, 2021). For clean electricity there is a dependency as people have to purchase codes to active their products after a certain timeframe (Interviewee #1, personal communication, 2021; Interviewee #4, personal communication, 2021; Interviewee #8, personal communication, 2021).

Third, the entrepreneurs need to grow their customer base in order to reach the masses with their clean energy solutions. A strategy that SupaMoto has explored is the concept of co-creation through local cooking workshops. Similar to the Tupperware concept where housewives sell Tupperware containers to other housewives through Tupperware parties at home. The relationship of co-creating with your customers helps to get feedback to improve the product as well as onboard new customers. Therefore, this strategy is part of both get and grow.

For Interviewee #5 growth should be sustainable, rather slower, and stable. Rapid and uncontrollable growth is not possible in this new industry. For the long-term success of the company she believes growth should happen step-by-step together with trusted customers. Interviewee #5 would ideally like to see the market shift to a point that customers dictate the product-range and have a say in what their needs are. Currently a standard portfolio is generally being 'imposed' on them and designed from a designers perspective (Interviewee #5, personal communication, 2021). Through engagement with the consumers, mouth-to-mouth will become more powerful and so grow the market.

Another challenge for growth is the lack of awareness. Interviewee #3 of SupaMoto stated, "The pellets sold in the store are dependent on all these other steps, so we have had pellet shortages and other disruptions due to various factors. You know, from broken machinery, lack of spare parts, etcetera. […] so I think it's the overall challenge that we are dependent on so many steps and there are so many potential bottlenecks in terms of the actual selling at the demand. With our pricing plans now selling the products is not the issue. That's actually the least of our worries" (Interviewee #3, personal communication, 2021). In a sense it is every entrepreneur's dream to have an abundance of demand. Demand however does not equal high adoption rates, which is something Interviewee #3 recognizes as well. He stated that, " I think we're seeing among our users a different range of adoption. We're seeing some people 100% only cooking on pellets, and we're seeing others still 'stacking' as it's called. Cooking some dishes on charcoal and some on pellets. This is the reason why we produced our

own stove because we saw the need for improving the range of the of the cooking device" (Interviewee #3, personal communication, 2021). By offering more complete cooking solutions adoption might become less of a hurdle. By creating a system that eliminates the bottleneck of technology one less barrier to adoption has to be overcome, according to Interviewee #3 (Interviewee #3, personal communication, 2021). When asked about other barriers to adoption Interviewee #3 is pretty clear: financing (Interviewee #3, personal communication, 2021).

4.1.5 Revenue Streams

The interviewees have shared different sources of where the money for their organization comes from. Common themes are financial input from the customer segments through Pay-as-you-go schemes, support from national or international organizations through foreign aid or grants, and investments from the private sector and loans. All companies interviewed are for-profit companies, meaning they try and intend to follow a business plan that aims to turn a profit.

First, revenue streams from sales of clean energy products through Pay-as-you-go schemes (also known as PayGo). The customer segments pay for the clean energy products while already using them. For many in SSA it is too costly to completely pay-off a solar home system or a clean cooking stove at point of purchase. Generally people only pay a down payment and can take the product home for use. Therefore, four of the interviewed companies, all B2C businesses, work with PayGo schemes. This allows a customer to pay in several instalments spread over a number of months or years. Paying remotely is possible in SSA, where the number of people with a bank account is low, due to the rise of mobile money. With mobile money people can deposit cash at defined local kiosks and the money will be wired via mobile phone to an receiving account chosen. This system works fast and even in remote areas. Six of the interviewees shared that the possibility to work with mobile money in SSA has contributed substantially to the success of getting more products to customers, even in remote areas. The combination of PayGo and mobile money has created the option for a new type of loan-servicing. Consumers can now get clean energy products with a loan broken down in installments (PayGo) and pay off their dept from anywhere using the mobile money network. To highlight this unique value Interviewee #1 of Spark indicated that they had initially intended to sell their systems in India, but the lack of payment-infrastructure was one of the main contributing factors to focus on Africa instead (Interviewee #1, personal communication, 2021). PayGo schemes cover a gap in the credit loan market. Many people in SSA are

'unbankable' according to general commercial bank requirements as they have very little of value that can cover for the loan. Yet, Interviewee #5 believes that access to credit can alleviate poverty as it helps to break the poverty cycle. One can buy cement to build a house with a loan, for example. As traditional banks are reluctant to offer many people who suffer energy poverty a loan, clean energy entrepreneurs step in and with PayGo become an alternative bank. Interviewee #3 and SupaMoto would like to take it even further and generate credit scores for customers currently taking loans from the company for their clean energy products. This credit score could help people become more bankable and potentially help to obtain larger credits at other financial organizations. "I see this as an add on effect of our work with PayGo. It starts with stoves and ends with alleviating poverty" (Interviewee #3, personal communication, 2021). Interviewee #5 has good experience with PayGo as about 60% of their customers pay their loans regularly, 30% pays occasionally, and only 7% defaults their loan. She does admit that these are good numbers for the sector and definitely not always the norm (Interviewee #5, personal communication, 2021).

The interviewees working with PayGo schemes shared the challenges of utilizing such systems as well. One might have to wait longer for customers to service the loans. Some customers default their loan altogether, which means the customer default rate must be accounted for in the sales price of their product, along with other factors that might impact the eventual profit, such as exchange rates. With PayGo schemes the clean energy companies take the role of a bank as they are the ones an outstanding balance is owed to. This includes holding the risks when someone defaults on their loan. This model can make rapid expansion very challenging, according to Interviewee #5, as there is already limited profit margin on the products and with large outstanding loans, there is limited cash to invest in growth (Interviewee #5, personal communication, 2021). The balance between growth ambitions and the value of the units already in the market is dependent on the ability to attract more cash, either through well paying customers or entering external funding.

Second, financial support from organizations and grants. Besides income from operation revenue grants are a very important source of income. However, obtaining grants and funding is not easy. Seven of the nine interviewees indicated the challenges they face in acquiring funding to be real barriers for growth. Seven of the interviewees indicate a lot of time is spent writing proposals for grants (or so-called impact financing), for which the hit-rate is often very low. Companies like Spark have dedicated staff solely focusing on writing proposals for local partners, which if funding is approved is then to be used to buy their product. OffGridSun tries to assist their local partners in a similar manner. Interviewee #5 from

NalaPayGo, who has a history of working for and helping to build VitaLite, a major player in the SSA solar sector, states that writing proposals seems to be an essential skill and she, who also operates a consultancy firm, indicates that having people who know how to navigate these proposals and to guide the process might make the difference in receiving or not receiving a grant. "Writing a proposal to USAID, or DIFID or the EU is almost a science. All of these are completely different, and they take up a lot of time" (Interviewee #5, personal communication, 2021). In the ten years of experience of Interviewee #5 in the clean energy sector in SSA, she has observed that most of the funding from large organizations, such as USAID tends to end up with in-between layers and barely reaches the consumer level, which is where the impact is supposed to be made. These large organizations are not transparent and have high overhead due to their heavy administrative organizational structure. Interviewee #5 therefore argues that these institutions are not equipped to address the needs around the clean energy transition. Non-action should be turned into action by putting more on the ground entrepreneurs behind the steering wheel (Interviewee #5, personal communication, 2021).

According to Interviewee #3 from SupaMoto impact funding is another way of financial support. It is result oriented and can lead to positive impacts for society. The project proposals must contain clear deliverables on how many people will be impacted by the program. Interviewee #3 describes impact funding as: clean energy companies are paid to achieve positive impact rather than financial returns (Interviewee #3, personal communication, 2021). During additional reflection by Interviewee #3, he shares that: "[…] revenue from operations, it's very drawn out because we have to give our customers credit, consumer credit. Revenue from operations is of course key, but also revenue from impact is another key one. And it has traditionally been actually bigger than revenue from operations" (Interviewee #3, personal communication, 2021).

Interviewee #8 initially stated that there was a lot of money available for funding in the solar sector and that 'anyone with a good proposal can receive funding' (Interviewee #8, personal communication, 2021). However, later interviewee #8 indicated the tremendous amount of challenges faced in acquiring this funding, indicating that it was almost impossible to write proposals to the standard needed to actually become a recipient of the funding. In addition, interviewee #8 indicated that they had received funding approval for a large grant at some point, but the amount of reporting and follow-ups needed to receive the money ultimately lead to them dropping out of the application and going on to seek funding elsewhere (Interviewee #8, personal communication, 2021). Interviewee #5 also indicates how time-consuming these activities are and how challenging the activities to retain cash-flow from

funding activities often are. EEP Africa, who provided a 500.000 Euro grant to NalaPayGo, has done so under the condition that NalaPayGo would look for other investors as well and raise money to match their investment. However, in the changing political and economic environment following the start of the COVID pandemic, EEP Africa has shown limited flexibility in their demands to raise this investment, even though these circumstances are beyond the control of entrepreneurs. "It seems that EEP has difficulty in adapting their strategies to accommodate for the varying circumstances of the individual projects" (Interviewee #5, personal communication, 2021).

Rural Spark sells their products to local partners via the Dutch Good Growth Fund (DGGF), meaning DGGF pays Rural Spark most of the loan back immediately and the local partners must pay their loans to the Dutch Government. Rural Spark determines the terms with the local partners but does not have to wait for three or four years for the complete loan to be serviced (Interviewee #1, personal communication, 2021). As such, Rural Spark is able to have finances available for development much sooner than other companies might have and is therefore able to invest in further development faster. Their local partners often rely on grants for revenue, which are then used to buy the product from OffGridSun directly (Interviewee #2, personal communication, 2021). Interviewee #3 from SupaMoto said that they have raised around 6 million US Dollars so far. Roughly speaking that can be divided into to three sources. One third comes from grants and impact financing projects. The other two thirds come from equity sales to a family owned business in Sweden and debt financing, which is the next source of financing discussed (Interviewee #3, personal communication, 2021).

Third, investment from the private sector and loans. These types of revenue streams have been mentioned the least. Equity and debt financing are included in this source of financing. To clarify, equity is selling a stake of the company for money and debt financing is working with loans. Interviewee #5 shared her experience with investors from the financial sector, which in her opinion have difficulties dealing with newer, less established companies in the developing clean energy sector. According to Interviewee #5, part of the challenge is that these starting enterprises, in a constantly changing market, have a larger focus on getting more units of their product on the market rather than on necessary secondary activities such as reporting, data collection, and fundraising (Interviewee #5, personal communication, 2021). Interviewee #3 added in his interview that their debt funders took about a year of due diligence with stacks of paperwork that needed to be provided and several site visits. In addition, frequent future follow-ups were requested as well (Interviewee #3, personal communication, 2021). In the experience of Interviewee #1 local loans in SSA are available with interest rates of 30% to

36%, if not more. Loans obtained in the Netherlands, where the headquarters are of Spark Energy, have interest rates of 7% to 8%. Therefore, opting for a loan in SSA is not very realistic and development funding is needed to finance high risk companies in the clean energy sector (Interviewee #1, personal communication, 2021).

When asking the interviewees if they were satisfied with the way their revenue was built up, a number of gripes were indicated. Interviewee #5 had liked some of the funders to be more considerate towards the current COVID-19 climate (Interviewee #5, personal communication, 2021). Interviewee #6 of ThomroBioFuels stated he has reverted to only using his own money and funding from family and friends, after some unsatisfactory experiences with funding from Musika, the Swedish development fund (Interviewee #6, personal communication, 2021). In the experience of Interviewee #1, many of their local partners are so busy raising money that they can lose focus of why they are in business. They have the right market knowledge so should use it to get the products to the people and offer good customer service. The for-profit mindset gets lost when focusing only on external funding. Ideally the majority of revenue stream should come from sales to consumers and not from external funding (Interviewee #1, personal communication, 2021).

Interviewee #3 of Supamoto, had some interesting views on the future of the energy sector. He would like to see people be paid more directly for the impact they make, which does not necessarily mean more revenue for his own business, but that would mean people have fewer difficulties in making the payments needed for the pellet-stoves and fuels his company sells. As such, he has been developing a new form of funding on which he could not share more details at the time of interview. To conclude, financing the clean energy transition is a problem. If that can be solved, scalability is no longer the problem, according to Interviewee #1, as the demand is there (Interviewee #1, personal communication, 2021).

For all interviewed entrepreneurs financial input from external funding is important. Even though all interviewees work at for-profit organizations, they require funding from international institutions to fund their business, especially in the early stages of the clean energy market. One reason for that is the presence of PayGo schemes in clean energy sector. This increases the need for external funding in this pioneering phase as much credit needs to be provided to customers to lower the bar to try clean energy products.

4.1.6 Key Resources

Throughout the interviews human resources and intellectual property resources have been identified as the most important strategic assets. Financial resources are also rather important as the previous section has indicated. Both the interviews with the B2B and B2C oriented companies expressed the need for funding for their business to function properly. Yet, for the analysis on key resources it is left out as most that was discussed about this topic has been included in section 4.1.5.

First, the importance of capable and well-trained human capital. All interviewees touched upon the need to have good personnel when asked about the key resources. SupaMoto has around 100 employees locally plus a network of independent agents and resellers (Interviewee #4, personal communication, 2021). Yet, a common conclusion was that it is hard to find enough capable employees, especially ones with potential to stay for a longer time with the company. About her experience with finding capable staff, interviewee #5 from NalaPayGo, one of the first female led solar companies in Lesotho, stated that: "[…] One of the key factors in creating early success in NalaPayGo was this manager, who not only moved from Lusaka, Zambia to Lesotho, but also the fact that he had previous business experience in the sector and understood the mission behind NalaPayGo, which is women-centered" (Interviewee #5, personal communication, 2021). Interviewee #3 adds to this point as well, stating that it is not only difficult to find qualified managers, but that skilled laborers are also difficult to find (Interviewee #3, personal communication, 2021). A lot of time is spent on training people to do tasks and jobs that in the Western world would be straightforward. To address this challenge, Rural Spark and OffGridSun, who are both B2B companies, have chosen to let their local partner make decisions about the required staff and ensure that these employees have the right skill set for the job (Interviewee #1, personal communication, 2021; Interviewee #2, personal communication, 2021). Rural Spark does have an employee located in the office of the partner locally. This solar technician, as they call it, operates as the eyes and ears of the mother company in the Netherlands. They find this person through various channels, such as recruiting through LinkedIn, local recruitment agencies, word of mouth or regular job opening placements (Interviewee #1, personal communication, 2021). The B2C companies, like AfricaCleanEnergy, have more intensive personnel development processes in their business, making sure all staff is trained before starting their job and continues to be trained while on the job (Interviewee #9, personal communication, 2021). As the clean energy

entrepreneurs mainly work with agents in the field for production, sales, distribution, and after-sales care, human resources is very central in their business model.

Good staff is also necessary for the grant and proposal writing as introduced in the previous section on revenue streams. Interviewee #1 and #3 agreed that it requires special skills to write these grants. Both companies have a dedicated employee or work with external experts to increase their chances of getting financial support (Interviewee #1, personal communication, 2021; Interviewee #3, personal communication, 2021). Writing proposals seems to be an essential skill and interviewee #5 indicated that having people who know how to navigate these proposals and to guide the process might make the difference in receiving or not receiving a grant. Interviewee #6 of ThomroBioFuels, mentioned similar challenges working with funding from Musika, indicating that the amount of follow-ups and due-diligence stood in the way of doing 'normal' business and developing their products (Interviewee #6, personal communication, 2021). Interviewee #1 of Rural Spark indicated that they assist many of their partners with the writing of proposals, in order to allow their partners the freedom to develop their networks and focus on getting the product 'out there' (Interviewee #1, personal communication, 2021). Even though Interviewee #1 shared that they have a dedicated person writing proposals for grants the hit-rate is still quite low at around 10%, meaning that every business dedicating valuable time and resources to writing proposals for grants is very likely to not receive this grant and have the time invested be wasted (Interviewee #1, personal communication, 2021).

Second, the intellectual property resources are of importance, specifically the partnership network. It has become quite evident from the interviews that in all parts of doing business huge emphasis lies on who you know. As such, your network is of importance. In order to acquire funding, receive licenses and to navigate both the economic and political climate. All interviewees indicated the importance of knowing the right organizations and people. Interviewee #5 shared the changes she has observed between the business climate in Lesotho and that of Zambia. Zambia, where for several years clean energy initiatives have already been taking place, is quite different from Lesotho, where NalaPayGo is one of the first initiatives in the clean energy sector. As such, doing business is easier in Zambia, as some of the rather basic undertakings in doing business require far less struggle (Interviewee #5, personal communication, 2021). In addition, some of the B2B focused interviewees indicated they will not do business with a company that does not have a good network in place. Interviewee #2, developing the solar energy market in emerging countries on behalf of OffGridSun, a subsidiary of FuturaSun, said that: "Most of the time the local partner will have

all the connections already, i.e. it makes more sense for European companies to not interfere so much with operations of existing companies" (Interviewee #2, personal communication, 2021). As such, it is not only important for B2B focused companies to do business with companies already established in the market, but also to limit interfering with their operations. SupaMoto and AfricaCleanEnergy have their own production facility in SSA for some of their products. Rural Spark does have a factory in China but no production activities in SSA locally. The other six companies import their products and distribute them in SSA. Therefore, physical assets are not a key resource. One can run a clean energy company in SSA by fully relying on a network of suppliers, distributers, and independent sellers.

4.1.7 Key activities

The key activities, which are the most strategic things a company must do to make the business model work, are dependent on the type of business model. Six of the interviewed companies are B2C and two are B2B focused. An additional differentiating factor is the geographical location of the companies, which also influences the key activities. Two are located in Europe, four are located in SSA, and two companies have locations both in Europe and SSA. The main key activities identified are research & development and sales.

First, research & development. Eight of nine interviewees indicated that their companies have, to varying degrees some involvement in the R&D process of some or all of the products that are being sold. Rural Spark designs and manufactures their own products. OffGridSun is part of FuturaSun, which has their own factory in China where in-house designed products are produced. The products OffGridSun produces follow from their own market-research (Interviewee #2, personal communication, 2021). SupaMoto is a reseller of solar home systems, where they have no involvement in the R&D of the system they sell. Their main business however is clean-burning stoves. Their customer base has been the testing ground for systems designed by multiple companies over the years, where SupaMoto's and their customers' feedback has greatly influenced the design of products. The clean burning stoves of both Philips and MimiMoto have received input during their development from SupaMoto, making them involved in the R&D process. Currently, SupaMoto is doing the R&D for their own pellet-stove, aiming to develop a product that improves vastly on the existing market offering (Interviewee #3, personal communication, 2021). The company NalaPayGo has not indicated involvement in the R&D process of the products it sells. The founder however has had a long career at VitaLite, a company that sells products of its own design following

their own extensive research and development (Interviewee #5, personal communication, 2021). Next, ThomroBiofuels is developing various systems aimed at producing biofuels. These systems follow from existing technologies, but are also the result of own research and development (Interviewee #8, personal communication, 2021). Standard MicoGrid has a involvement in the R&D process as well. In their case that means mostly a focus on tailoring non-MicroGrid specific technologies to fit the MicroGrid business model, and implementing and applying those technologies in conjunction with more established technologies to their own cause of achieving a viable MicroGrid model (Interviewee #7, personal communication, 2021). Lastly, interviewee #9 is part of a company that develops, produces and sells their entire product line (Interviewee #9, personal communication, 2021). As shown here it is evident that almost all interviewees have some degree of involvement in the R&D of the products they sell. This involvement might be relatively superficial, such as through relaying the feedback received by customers and through lessons learned throughout customer service calls and various other forms of customer interaction. However, some of the interviewees are much more deeply involved in developing the technologies and products they sell.

According to Interviewee #1, the clean energy sector does not grow as fast as it could in SSA because companies are focusing too much on vertical integration. In the end a company cannot be good at every part of business, especially with the limited resources in the sector. "They try to do everything themselves from R&D to after sales care. They should be focusing on product development instead as this is where their strengths lie" (Interviewee #1, personal communication, 2021). At Spark Energy manufacturing, distribution and financing is done elsewhere. The company only focuses on product development and local personnel training. Regional distribution partners are responsible for the direct sales to the end consumer (Interviewee #1, personal communication, 2021). Interviewee #3 agrees with this point. He admits that working on all levels is not so ideal in the already complex sector. SupaMoto is a B2C company as opposed to Spark Energy and SupaMoto has their own pellet factory for the fuel for the stoves. Yet, according to Interviewee #3, it is not possible to focus on just a few key activities as there are not enough organizations in the local value chain to fill in the open spots. Therefore, the few companies in the market have to engage in vertical integration (Interviewee #3, personal communication, 2021).

The two interviewees (From Spark and OffGridSun) whose companies have a head office in Europe are mostly B2B focused. This means they have close interaction with their on-ground partners and focus mostly on production, creating partnerships, sales (to businesses) and R&D/product development. Africa Clean Energy (ACE) is an outlier here, as Interviewee

#9, discusses the companies aim to be as vertically integrated as possible (Interviewee #9, personal communication, 2021). As such they are responsible for their own manufacturing and production and have stores and shops in Africa selling directly to the customers, making them both B2C and B2B businesses (Interviewee #9, personal communication, 2021)

Second, the four companies located only in Africa have a B2C focus and one of their key activities is customer interaction and selling their product to the customer directly. In essence, they rely on other companies' product offering, which in turn is sold by their company.

An outlier here is Standard Microgrid, the company discussed by Interviewee #7. Standard Microgrid started relatively small but has since attracted larger investments and therefore has found itself in a position to invest heavily in product development in order to more effectively develop the Microgrid concept, which, according to Interviewee #7 is quite challenging, as the African energy market is not comparable to that of the Western world. Perhaps Interviewee #7 would use existing product solutions to build their microgrids with, if they existed, but he indicated that they simply don't exist and therefore they develop them themselves (Interviewee #7, personal communication, 2021).

Another outlier is SupaMoto, where Interviewee #3 indicates that the business started as a B2C, with a sole focus on selling stoves. However, SupaMoto's focus has shifted somewhat over the past few years and large investments in the development of their own highly efficient clean cooking pellet stove have been made. This stove is aimed at making a dent in the current market offering through increasing efficiency over the performance of the stoves offered by competitors (Interviewee #3, personal communication, 2021).

4.1.8 Key Partners

Not all tasks can be key to the business, so some tasks are distributed to partners. The main tasks that are being outsourced to key partners are production of products, distribution, and in some cases sales related activities. An additional key partner is the local government. Interviewee #1 summed it up nicely, saying "succeeding in an emerging market is impossible is you do not know the right people" (Interviewee #1, personal communication, 2021).

First, production partners. Out of nine interviewees seven indicate varying levels of importance to partnerships, but in order to understand why some of the interviewees indicate differing reliance on the various partners one should separate the various levels of involvement the companies have. Production of solar systems and cookstoves, for example, is not something all interviewees do themselves, and as such, interviewees without their own production

facilities must rely on partnerships with production facilities. Interviewee #3, for example, has indicated the extra costs involved in having to buy specialty parts for their cookstoves from the developer, while circumventing the developer and buying these parts from the Chinese factory directly turned out to be much cheaper. OffGridSun, the company where interviewee #2 works on the other hand is a daughter-company of Italian company FuturaSun, which has their own manufacturing facilities in China. As such, they are in a position where they can avoid many of the extra costs each extra link in the supply chain adds (Interviewee #2, personal communication, 2021).

Second, distribution of the products is outsourced. All companies must have some means of distribution. Distribution starts with getting the products imported into the country where they are meant to be sold. As such, good partnerships with freight carriers, courier services and customs-clearing personnel are needed. Some of the companies interviewed have their own connections, while others use the connections of their local partners to get products imported. Importing the solar home systems and the cooking stoves relies on having the proper import licenses. As the process of acquiring these licenses can be challenging, it is valuable to have partners who are experienced in this field focus on this part of the business.

Third, sales activities, which follows once the products have been produced and imported into the respective countries is the next step. Most of the interviewees with physical offices in SSA, as well as their partners rely on agent networks. Unsurprisingly, this follows from the main target group being single-family households. These single-family households are often best reached with agents. These agents live and work in the communities and market and sell the products to the potential customers. Good agent networks are not only crucial for sales, but also for follow-ups, warranties, service, etc. As such, many of the interviewees indicate how vital the agent networks are to their operations (Interviewee #1, personal communication, 2021; Interviewee #3, personal communication, 2021; Interviewee #4, personal communication, 2021; Interviewee #9, personal communication, 2021). Companies in the clean-cooking space, such as SupaMoto and AfricaCleanEnergy have pellet-burning biomass stoves and as such their stoves need to be supplied with fuel. This fuel must be accessible to the customer to make the system work. As such partners supporting the infrastructure, i.e. logistics, transport, storage, etcetera are essential (Interviewee #3, personal communication, 2021; Interviewee #4, personal communication, 2021).

Fourth, the government. Interviewee #5 notes that the government has a role of creating awareness of all the benefits clean cooking and clean energy might bring. According to Interviewee #5 the governments can do better. "If consumers were helped to understand benefit

and it would be explained better to consumers, the shift would be a lot easier" (Interviewee #5, personal communication, 2021). Cost, according to her is not the limiting factor here, and services like 'pay-as-you-go' might be beneficial but are not the defining factor in getting consumers to switch to a certain product. Vetting products, helping to understand whether something is good value for money, and helping to set standards and provide solutions in case something goes wrong, could be of huge benefit to the consumer. This consumer should, to some extent be provided with solutions in case the product does not live up to its expectation and, in addition, be able to recover funds if duped by a company that does not have the consumers best interests at heart. Interviewee #5 states that businesses shouldn't necessarily have to be the ones taking on both the educational role as well as the sales role. According to Interviewee #5 the responsibility is too large to be placed solely on entrepreneurs. Governments are in a position to set standards and guide these emerging product-groups to a certain extent. Products can be tested and given ratings to help the consumer understand better what they're getting into and help in creating confidence for consumers (Interviewee #5, personal communication, 2021). Furthermore, Interviewee #5 notes that in Lesotho governmental influence is practically non-existent in the small-scale solar and clean cooking sector. This, according to her, is because the sector is currently so small that there is not much value for government to be found here (Interviewee #5, personal communication, 2021). Creating more traction and seeing an increase in players in the market however is likely to increase the level of governmental influence. As an example, she provides insights in working both in the Zambian energy market as well as the Lesotho energy market. While in Lesotho, where the market is still relatively new, the out roll of large-scale energy projects is inhibited due to the lack of awareness by many, this is less the case in the Zambian market, which has existed for a longer time. Here some efforts have been made already to create awareness about matters like clean cooking and conservation of energy and water. The Zambian consumer may have had more education than the average consumer in Lesotho, for which the NalaPayGo initiative is one of the first 'real' boots-on-the-ground projects. "A first stab at bringing this to life" as opposed to more general climate-change related intangible policy (Interviewee #5, personal communication, 2021).

Throughout the discussion on key partners a common theme can be discovered. Even though some have production partners outside of SSA, most prefer to rely on the knowledge of partners locally. Interviewee #2 noted that it makes sense to work with local partners as they have the local connections already. It is more difficult for, for example, European companies to enter the market as they have less knowledge on it. Interviewee #2 believes they should not

so much interfere with the operations of existing local businesses but rather rely on them as partners (Interviewee #2, personal communication, 2021). Spark Energy does also follow this approach. The company selects their partners in the region based on their presence in the country of focus. So a partner needs to be physically present in the SSA country of focus. Additionally a background check is done to determine the value the local partner can bring (Interviewee #1, personal communication, 2021).

Finally, Interviewee #5 shared an interesting perspective on how she thinks that because the businesses in the clean energy sector are still rather small, they are more heavily reliant on their network. More players in the sector could create a more open market and make the sector more noticeable as a larger allocation of resources is drawn into the sector. Market partnerships would become more optimal (Interviewee #5, personal communication, 2021). More players will not automatically result in an open market, but rather make the clean energy partnership network more diverse, which could make the sector more open. Different partners bring different cultures and skills. Players will become more connected and create new value chains. Eventually, these growing value chains are more present and so get more noticeable locally and internationally.

4.1.9 Cost Structure

To operate the business models of the clean energy entrepreneurs certain costs are incurred. The entrepreneurs are mainly value driven as they strive to make a positive impact on the lives of their customer segments. Yet, all have indicated that they are for-profit organizations and ideally want to see their businesses become financially independent. The topic of cost seemed to be a sensitive one during the interviews and most entrepreneurs were not transparent about it. According to Interviewee #7, the economics of developing new businesses in the clean energy sector are extremely difficult. "[…] To get most out of your capital expenditures you need to have a very competitive business model" (Interviewee #7, personal communication, 2021). The costs are high and the customer segments have limited budgets for clean energy products. The main costs that did get mentioned were staffing, inventory, and costs around production.

The cost of having personnel and holding inventory was suggested in the interviews with Rural Spark and Africa Clean Energy. They are both developing their own service platforms and are aiming to support themselves and many of their partners as much as possible. This costs a significant amount of money to develop (Interviewee #1, personal communication,

2021; Interviewee #9, personal communication, 2021). Interviewee #1 of Rural Spark also indicates that a business cannot be good at everything, and therefore money is spent to outsource certain jobs. Interviewee #1 states that: "You can't be good at every part of the business. Manufacturing we do somewhere else, distribution, finance, elsewhere. Only product development and staff training we do…" (Interviewee #1, personal communication, 2021).

Furthermore, production takes a significant role in the cost structure. Interviewee #3 from SupaMoto indicated that the production of the pellets was one of their main costs. The production of the pellets is accompanied by maintenance costs to the machinery, breakdowns (which occur often) and other unexpected costs. In addition, labor costs of the laborers, raw material cost and transportation costs of the raw materials to the factory as well as the finished product transport to the depots and warehouses are responsible for other large expenditures.

4.1.10 Overview Results Business Operations

Table 6 summarizes the results on business operations following the nine BMC elements.

Table 6 Overview Results BMC

Business Model Canvas Element	Results Interviews
Customer Segments	Main customer segment is small households. The female head of the household is generally the main customer as she decides how the cooking is done.
Value Proposition	Focuses on delivering clean energy to energy poverty stricken regions, such as in SSA (market opportunity).
Channels	Different channels are used depending on the type of enterprise (B2B or B2C). Close, direct connection to customers is needed to sell most products and make impact on lives.
Customer Relationships	Focus on getting, keeping, and growing customer base to ensure future of the company. Each requires its own type of activities, ranging from customer service offices to field agents. Both can offer customer support on the products and so work on building a relationship of trust for new and unknown products.

Revenue Streams	In the current entrepreneurial environment it is a challenge to generate sufficient revenue from clean energy products sales. Entrepreneurs are dependent on additional external funding. The market is new, customers have limited financial resources, and there is a heavy reliance on PayGo systems. The clean energy enterprises have to operate similarly to a bank. In a new and uncertain market it is challenging to acquire the right funding.
Key Resources	Capable and well-trained human capital is needed and protection of intellectual property around partnerships. Unqualified staff can turn out to be a barrier and hinder performance in an already new and sometimes complex market. Besides protecting one's clean energy innovation, relying and exploiting your unique partnership network can drive your business further.
Key Activities	Focus should be on research and development, customer interaction, and sales. These three reflect the innovation, brand building, and revenue generating parts of clean energy business. Clean energy products need to be innovated based on customer feedback, customers need to be encouraged to try the often unfamiliar products, and through offerings, such as PayGo, encouraged to purchase the products.
Key Partners	Partners are key for clean energy entrepreneurs in SSA. In the local cultures who you know is really important for trust building and acceptance. Enterprises need product production partners, local distribution partners, local sales partners, and connections to local governmental organizations
Cost Structure	Entrepreneurs are mainly focused on making positive social and environmental impact locally. The costs-

	revenue balance is challenging in the still underdevelopment clean energy market. Common costs are staff, inventory, and production.

Following, figure 6 is a filled out BMC based on the common responses from the interviewed entrepreneurs. It should be interpreted as an example BMC for a (successful) clean energy enterprise in SSA.

Key Partners	Key Activities	Value Proposition	Channels	Customer Segments
Production partners	R&D Customer interaction Sales	Provide electricity from clean energy sources.	Shops Resellers Local Distributors	Small households Organizations and Institutions
Distribution partners	**Key Resources**	Provide clean cooking solutions.	**Customer Relationship**	
Sales partners Government	Human Resources Intellectual Property Capital		Personal Connections: Agents Call Centers	

Cost Structure	Revenue Streams
Staffing	Sales of clean energy products through PayGo schemes
Inventory	Financial support from organizations and grants
Production	Investment from the private sector and loans

Figure 6 Filled out BMC Based on Common Responses Interviewees

4.2 Business Culture: Internal Functioning of the Organization

This section describes the results from the interviews focused on the business culture of the different organizations. The four issues identified in the Social Transformation model by Kroesen form the structure of this section. Two topics, that are not originally part of the model, are added, namely the hiring process and staff education. This is added to the part on time management and labor as hiring and staff education turned out to be important topics based on the interviews. Entrepreneurs struggle with these topics and they are relevant parts of labor. Hiring and education are not part of the Social Transformation model because the connection to cultural values is less apparent. Yet, hiring does turn out to be culturally sensitive and the need for education is higher in traditional systems.

4.2.1 Hierarchy versus Egalitarianism

The data from the interviews shows how imbedded hierarchal structures are and that there is a need for such structures in SSA. With regards to external relationships, four out of nine interviewees indicated the need for establishing close relationships with a company before conducting any 'larger' business or doing any major project. Interviewee #2 indicates that it is important to supply products and stay in close contact whenever something might go wrong. Interviewee #2 also indicates that the desire for a project might play a big role in how close of a management it requires and how much they – as partners – have to involve themselves in the operational aspect of a project (Interviewee #2, personal communication, 2021). If a project is pushed for by their company, the local partner might not be as excited or involved as they would be in case the partner is the one asking and pushing for the project. Interviewee #2 indicates the challenge of finding a balance between being too involved and not pushing for results enough. "You wouldn't like it if a foreign company came into your country and told you how you should do your work" (Interviewee #2, personal communication, 2021). Interviewee #3 indicates the need for large amounts of hierarchy and lots of standard operating procedures (SOP's) (Interviewee #3, personal communication, 2021), If extreme amounts of structure are lacking, a lot of the work is not done or done improperly. Interviewee #7 indicates both the need for structure and hierarchy in order to get work done. "Things have to be defined to the most minuscule process, otherwise it will be handled inappropriately. " (Interviewee #7, personal communication, 2021). Other interviewees provide similar notions. Interviewee #5 states that good management is crucial and that there is much need for a hierarchical structure in order to have business and projects function properly (Interviewee #5, personal communication, 2021). In NalaPayGo, executive decisions are made by Interviewee #5, while other decisions are left to the operations manager, who is in charge in her absence. The accounting unit is run by one person, but this person has been given an advisory role in making decisions as well (Interviewee #5, personal communication, 2021).

Interviewee #7 describes a separation within the company between managers and staff. "Staff perform the work and are told explicitly and very prescriptively how to do something. Managers oversee the staff and they can self-manage" (Interviewee #7, personal communication, 2021).

There are some outliers to the rigid structure, however. Interviewee #8 of PowerTrust East Africa describes that many of their projects don't involve a lot of hierarchy. Projects still have a team leader on site, setting deadlines and discussing daily goals, but people can speak

their mind when they say room for improvement. On the other hand, Tony also states that: "Employees know what they were hired to do, so that is what they will do." (Interviewee #6, personal communication, 2021). However, Interviewee #6 also states that the goal is to get many issues that arise during projects resolved on site and only escalate them further up the chain when there are no solutions found (Interviewee #6, personal communication, 2021). This means that some room for input from all members of project-teams might be necessary in case of problems. Interviewee #7 states that every employee can change procedures if anyone of any level feels that changes for the better can be made. The people are being actively incentivized to scrutinize processes and offer up improvements, which, according to Brian is also done regularly by the employees (Interviewee #7, personal communication, 2021). In AfricaCleanEnergy, run by Interviewee #9, people are incentivized to report when they see potential for improvement as well (Interviewee #9, personal communication, 2021). Naturally, being in a position to report when improvements can be made does not constitute lack of hierarchy, but the freedom to speak one's mind does indicate a certain sense of egalitarianism amongst the staff of the various companies. Depending on the size of the company and the number of managers and 'regular' personnel, the amount of hierarchy changes as well, which is not unlike many companies in the Western world.

4.2.2 Group versus Individual

Theory states that it is common that the group goes before the individual in the global south. This also clearly came across during the interviews. Two elements were mentioned more frequently. First, employees do not often think outside of the group and their problem-solving skills are limited. Second, the challenge of having too many different groups inside the company, which stands the collective identity and teamwork in the way.

        People hired locally in SSA tend to find it difficult to take initiative. According to Interviewee #5, when you train, for example, 25 people there is a good chance you will end up with a maximum of ten active agents, of which five will be fully active and stay long term with the company (Interviewee #5, personal communication, 2021). This reflects how dependent the workforce is and how difficult local people find it to take initiative. An agent needs to scout for new customers in the field and take care of his/her already existing customers. They need to be able to solve problems on the spot and offer creative solutions to problems their customers face.

The confrontation between groups becomes clear through the different languages spoken in the enterprises. Additionally, different languages are spoken in different layers of the business, which are upper management, lower management, factory workers, fieldwork and agents. In general people working in the field as well as agents are local and therefore speak the same languages and are from similar areas. Agents tend to speak the language of the area they operate in as well as the most common languages in the country they operate in. Managers tend to always speak English, especially if the company is Western-run company. The different languages can cause misunderstandings and so problems in working together. Each language has particular nuances that are specific and unfamiliar to others outside of the culture attached to the language.

Agents are often a combination of both men and women, where factory-workers or solar-installation teams are mostly male. Within the office staff there is more diversity. Especially in Western-run companies both at junior-level management and at senior-level management there is a range of employees varying in nationality, gender, age and level of education. Most companies still have predominantly employees originating from the country where the company is based, but especially in companies with locations across Africa, there is more variety between the nationality of the employees as well. Interviewee #4 of Supamoto indicates that they have actively scouted for managing staff not from Zambia, which according to her eliminates some of the cultural pressures local staff faces (Interviewee #4, personal communication, 2021). It seems that senior-level management of many of the companies is predominantly male, where NalaPayGo is a notable outlier, since about eighty percent of their employees are female (Interviewee #5, personal communication, 2021).

4.2.3 Time management and Labor

It is common that entrepreneurs in Africa face challenges with inefficient time management and labor. From the interviews three main themes on this topic were discovered: the strategy to work with structured planning, spend time on education and training of the workforce, and be aware of the challenges with regards to hiring new employees.

First, when asked about time management and labor it seems that all companies interviewed have some form of planning in place for their undertakings. Most interviewees indicate that a strict planning must be made for many of the projects that are undertaken. (Interviewee #3, personal communication, 2021; Interviewee #4, personal communication, 2021; Interviewee #6, personal communication, 2021; Interviewee #7, personal

communication, 2021). Daily goals must be made and followed-up on and work has to be checked frequently. Managing personnel must go to project-sites in order to make sure work is done properly. Generally, there is a manager or project-manager who has to make sure that these plans are executed properly. Some level of reporting in order to finetune projects seems to always be involved, especially in projects that have longer durations or involve more money. Interviewee #4, who runs the operational side of SupaMoto indicates that tuning and streamlining processes and procedures is a constant battle, since for many of projects there is no clear manual on how to execute them. As such, planning and revising said planning with good communication between the various levels of staff is essential (Interviewee #4, personal communication, 2021).

Second, while most of the interviewees indicate a wide range of education levels amongst staff, it seems that all companies unanimously agree that spending time and money on some form of continuous development is a good idea. Interviewee #8 indicates that his team of solar installers follow lots of workshops and training and that certification is necessary in order to be able to do the work properly (Interviewee #8, personal communication, 2021). Some of the interviewees are developing their own training facilities or education programs. Rural Spark has recently sent several solar technicians from four different countries for training in Uganda (Interviewee #1, personal communication, 2021). Rural Spark, as indicated previously believes that hiring someone to sit full-time at their distributor's office is essential in making sure that their distributors and partners always have someone skilled available in order to deal with the issue that arise on a daily basis. This person must be well educated, but Rural Spark has developed a training more specific to their needs. One of the core tasks their technicians have is that they function as a set of local eyes and ears, which can be extremely useful in capturing lessons learned as well as developing future products (Interviewee #1, personal communication, 2021). Africa Clean Energy has a similar strategy. Being a B2C company operating in a number of countries and their respective markets have created the need to develop their own trainings in-house. In addition, they are in a process of setting up a more widely accredited certification system allowing their trainings to be recognized by other parties as well (Interviewee #9, personal communication, 2021). Interviewee #7 states the value of capturing lessons learned, which can later translate into training. Managers do a weekly check-in, put together reports of learnings and document how anything can go into either updating techniques or technologies or anything in general in order to establish new standard practices, as procedures for dealing with many of the problems and challenges he and his team encounters often do not yet exist (Interviewee #7, personal communication, 2021)

Interviewee #5 of NalaPayGo also brings attention to the challenges of education and training. Often employees have a desire to grow and in order to complement this desire to grow training is offered. Offering this training however can be challenging as funds are often not available. A solution that Interviewee #5 specifically mentions is that a lot can be found online for free and course material and training material for basic skills, such as excel, and bookkeeping can be found online (Interviewee #5, personal communication, 2021). While these skills are not necessarily related to the energy market, allowing personnel the opportunity to develop is very important according to Interviewee #5, regardless of the means through which this is done (Interviewee #5, personal communication, 2021).

Third, to fill new roles within the various businesses, the interviewees have several hiring practices. Positions requiring no education are generally filled fast, since in many African countries unemployment rates are high. SupaMoto indicates that every employee must have a high-school degree at the minimum (Interviewee #4, personal communication, 2021). Others have not indicated a necessary minimum level of education. Finding educated and experienced staff however is more challenging. When possible, some of the interviewees prefer to promote from within the existing staff. By doing so employees with a proven track-record and experience within the company can be utilized more effectively. simultaneously, some of the interviewees believe there is added value from promoting within, since promoting someone instead of hiring from outside the business seems to generate some level of intrinsic motivation to do well within the employee, which in turn increases their reliability (Interviewee #4, personal communication, 2021).

Interviewee #7 notes the challenges of hiring capable staff: "There is a real challenge in finding mid-level management. Lower-level staffing is fairly easy, but upper-level management is both difficult and expensive. High skilled people are very difficult to find and there are not many people trained to manage millions of dollars of assets residing in Lusaka (Zambia)" (Interviewee #7, personal communication, 2021). Interviewee #7 notes that there is a large skill gap as well for mid-level management and softer skills are very difficult to train, since they take a long time to develop (Interviewee #7, personal communication, 2021). Interviewee #7 also notes that making manuals for some hard skills is not a challenge and finding people for these roles is not difficult (Interviewee #7, personal communication, 2021). Finding people capable of more lateral thinking, critical thinking and strategic thinking however can be a bit challenging at times. Therefore, projects are very structured and very hierarchical. Interviewee #7 (personal communication, 2021): "People are so used to structure, so sometimes it's structure purely for the sake of structure. For example, going into a parking

lot and having to sign a paper which nobody will ever look at again is something so ingrained in daily routine and nobody ever questions it" (Interviewee #7, personal communication, 2021).

Another challenged faced in the hiring process is the challenge of COVID-19. Many experienced -especially Western- people have left Africa during COVID, which made the supply of qualified labor even more narrow. Interviewee #7 states that: "Throughout COVID supply chains froze and talent left the country, which makes the labor market more expensive (Interviewee #7, personal communication, 2021).

Interviewee #5 from NalaPayGo, the first women-led solar energy initiative in Lesotho has a some less conventional views on hiring and as such, practices at NalaPayGo are not necessarily in line with other companies in the same industry. Interviewee #5 indicates that rather than solely focus on job experience and formal training, she assigns huge value to growth potential and willingness to grow. Especially in Lesotho, where there is no real energy sector for women to gain experience in, finding staff with formal training and large amounts of experience is difficult. In addition, people shouldn't stay with the company solely because they feel an obligation to do so. If opportunities for more and continuous growth exist elsewhere, employees of NalaPayGo are encouraged to pursue these (Interviewee #5, personal communication, 2021).

4.2.4 Equal Treatment and Universalist Attitude

African society is mainly patriarchal and clan-based. To reduce the chance that this influences business, showing values of equal treatment and equal access in an organization are important. For the clean energy sector, Interviewee #5 feels still much needs to change. Leadership in the energy sector is currently mainly Caucasian and male dominated, while the true beneficiaries of the sector are often dark skinned and female. In her company, NalaPayGo, there is a good role model taking lead in making a change. The manager understood the mission of the company to be more female oriented both towards its customers as well as internally. She tried as much as possible to build the business on the values of equal treatment and equal access between the genders (Interviewee #5, personal communication, 2021). Yet, this example is a rather standalone case of female empowerment. Interviewee #5 said that the public rhetoric is that society wants to see more female African people in the clean energy sector. However, the amount of initiatives to give females equal access to the sector are limited (Interviewee #5, personal communication, 2021). About her own position as African female in the SSA energy sector, she says "despite being at a huge advantage because of my large network and skills, I

am still struggling" (Interviewee #5, personal communication, 2021). What is interesting is that Interviewee #5 shared that it is hard for her company to retain male employees. Mainly the male employees break company policies and so have to leave (Interviewee #5, personal communication, 2021). Possibly because the patriarchal values are engrained so deeply, the male employees lack that leadership type in NalaPayGo. There is no patriarchal figure who looks down on them and determines the order inside the business. A tyranny style of leadership is not present in the company of MS. Therefore, the males maybe try bend the rules and see how far they can go seeing a female leader displaying values of equal treatment as less of a threat.

Unfortunately, none of the other entrepreneurs was so outspoken about the topic of equal treatment and how they implement this in their business.

4.3 Civil Society: Closed-in groups, vertical networks, and cooperation

This section focuses on the three main issues classified under civil society by the Social Transformation model, namely closed-in groups, vertical networks, and little cooperation versus open cooperation. In SSA anonymous trust is not so common. Rather, there is a high reliance on vertical networks and the closed-in groups that this creates. In the interviews the topic of vertical networks came forward several times. All the interviewees at one point or another made reference to the importance of a good network to do business in SSA. Especially relatively young companies, just starting in the market have challenges navigating the vertical networks and reaching the right people. There are three levels on which these challenges take place: the level of external relationships, partners, and customers.

First, the level of external relationships. According to Interviewee #1 of Rural Spark, succeeding in an emerging market is downright impossible if you do not know the right people (Interviewee #1, personal communication, 2021). Interviewee #5 indicated that she already had a very large network, built during her time at VitaLite, of which she could piggyback, yet starting a new venture was still very challenging (Interviewee #5, personal communication, 2021). It is her impression that someone without any previous existing network will have a much harder time getting started, especially in the African environment (Interviewee #5, personal communication, 2021). It is important for business to build relationships with, for example, the local government. As Interviewee #3 puts it: "the main difficulty of doing business in Africa is that things in general are not smooth." (Interviewee #3, personal

communication, 2021). This is affirmed by Interviewee #5, who noted that: "Despite being at a huge advantage because of my network and because of my skills I'm still struggling".

Second, the level of partners. It is clear that relationships are of importance to do business in SSA. Interviewee #1 compared it to a friendship: "if we cannot be friends, then we cannot be partners either" (Interviewee #1, personal communication, 2021). Interviewee #2 of FuturaSun shared that they prefer working with local partners from companies run by local people. The trend of non-local/western people starting a company and receiving finance to do so is not necessarily bad, but one has to be aware that it might crowd-out local, capable parties as well (Interviewee #2, personal communication, 2021). Interviewee #2 also stated that:" We, as European companies are heavily involved in Africa. Therefore, as a company you have to make sure you are adding value and delivering things the local environment might need, as opposed to doing things that just work well for you" (Interviewee #2, personal communication, 2021). To effectively work with the existing vertical networks and closed-in groups, you need awareness of the local ethos. Working with local partners is a way to do this as they have already 'cracked' the challenge of building the right networks and how to navigate the vertical networks (Interviewee #1, personal communication, 2021).

Third, the level of customers. Based on the interviews there are players in the clean energy sector that are tarnishing the name of the responsible players by offering poor services and so breaking the trust of consumers. Customers might have such bad experience with other industries or companies in the clean energy sector, that they expect very little support. Interviewee #1 suggested that the often broken promises around nationalized power grids in SSA is one of the causes that people do not have large trust in clean energy companies to begin with. People suffering from energy poverty have been promised a connection to the power grid numerous times. As they trust the government they rather continue to keep the hope that it will happen one day. With such mindset it makes little sense for people to invest money into buying small solar-home-systems. But the effect of broken promises and the continuous trust, create a hard market for the clean energy entrepreneurs to break into. As a result, customers do not expect good customer service for their clean energy products when they do decide to take a chance with it. Consequently, people do not notify the company when something is wrong with their products. Therefore, Standard Microgrid is investing in technology that is better at identifying and alerting automatically in case of issues (Interviewee #7, personal communication, 2021). Such technology would override the barrier of trust between people.

Another challenge on the level of the customer is that the customer base often does not feel responsible for products that they do not own yet (i.e. they are still paying for it via PayGo).

Interviewee #7 stated that, especially in his industry, where larger solar and battery systems are installed as shared assets in communities, this is even more of an issue. Theft, unwillingness to maintain systems and general neglect of shared assets hinder the clean energy sector in thriving (Interviewee #7, personal communication, 2021).

4.4 Governance

The topic of governance knows two main issues according to the Social Transformation model: patrimonialism versus rule of law and grant favors versus equal access. Government bureaucracy consists of vertical networks too. In SSA patrimonialism and granting favors are still rather common. Rule of law and equal access need to be promoted more in order to socially transform to a modern system.

4.4.1 Patrimonialism versus Rule of Law

Interviewee #6 brings attention to a few more challenges regarding working with government. When he had the initial idea to start his biofuel company in 2005 several investors and partners were interested in starting a venture with him. At the time however, there was no policy or legislation for any kind of biofuel or ethanol start-up, leading to uncertainties. These uncertainties caused the investors and partners to leave (Interviewee #6, personal communication, 2021). Again, in 2015 a new partnership was formed, and a large investment was approved, but changes in the political landscape caused the investors to back out once again. Interviewee #6 also points out that politicians in Africa seem to see little benefit in enabling the renewable energy sector to thrive. "As the Americans say, don't mend it if it's not broken. Politicians don't survive on economic performance; they thrive on poverty. As long as people make money off folks by maintaining the existing situation, there won't be much improvement" (Interviewee #6, personal communication, 2021). Interviewee #6 would prefer it if the government would at the very least provide better access to investment funds. In addition, Interviewee #6 would like to see the government implement legislation that promotes the vertical market. By promoting the vertical market, the demand for biofuels could increase drastically. This market could be promoted by banning the use of non-clean fuels, such as firewood and charcoal. In turn this would grow the market for clean-burning fuels and every household would become a customer (Interviewee #6, personal communication, 2021). Nevertheless, as Interviewee #3 indicated, whichever fuel you pick it will need infrastructure to support it (Interviewee #3, personal communication, 2021).

Furthermore, Interviewee #3 stated that the clean cooking sector has stayed under governmental radar somewhat over the past few years, meaning they don't have to involve themselves in politics as much or depend on politics as much as people in other sectors might. Economic downturn however has the potential to really impact business a lot. A country like Zambia, with severe levels of inflation, tends to create a business climate where a lot of regulatory uncertainty is present. Interviewee #3 indicates that from time-to-time they are charged with fees for various things that were never charged before. The governments decide a certain item is to be taxed suddenly and business owners just have to comply if they want to do business, import products, sell products, etc. (Interviewee #3, personal communication, 2021).

4.4.2 Granting Favors versus Equal Access

Next, in terms of doing business with the government, many of the interviewees indicate relying heavily on their networks and on 'knowing the right people'. Interviewee #4, Interviewee #5, Interviewee #7, Interviewee #3, and Interviewee #8 all rely on permits allowing them to import and export items to their respective countries (Interviewee #3, personal communication, 2021; Interviewee #4, personal communication, 2021; Interviewee #5, personal communication, 2021; Interviewee #7, personal communication, 2021; Interviewee #8, personal communication, 2021). As such, having a hassle-free process of acquiring and maintaining permits to do so is of huge value to them. In addition, the process of having items clear customs tends not be hassle-free as well. Knowing the right people can once again increase the potential efficiency of doing business immensely. Companies like Rural Spark and FuturaSun have indicated that they prefer working with established partners (Interviewee #1, personal communication, 2021; Interviewee #2, personal communication, 2021). By working with established partners, they avoid having to involve themselves in the process of building the vertical networks needed in order to do business.

Interviewee #5 implies that an increase in players in the sector will allow for a more equal connection to government as well. Now, being so small scaled that their company is hardly on the radar, the dependency on network is very large. However, more players in the market might create a more open and equal government, since a larger allocation of resources to this network is necessary. In addition, Interviewee #3 notes that many of Africa's governments don't have making impact high on their agendas. As such, legislature accommodating clean energy companies intended to help further the energy transition simply

doesn't exist. Clean cooking technologies are bound to involve a lot of manufacturing, distribution and storage. The Zambian government has shown little interest or intention to assist the companies in the clean cooking sector in Zambia in enabling the transition.

Interviewee #7 agrees with the notion that it is probably easier for the time being to not be too high on the governments radar. While he states that he has mostly good experiences working with Zambian government he also notes that there is a chance of processes becoming slower and inefficient when government becomes involved (Interviewee #7, personal communication, 2021). Another challenge pointed out by Interviewee #7 is the challenge of acquiring qualified staff, which is brought up by many of the interviewees. The right staff is often difficult to find inside the country and when permits are needed to bring people into the country, it's often difficult as well. Knowing the right people to help with immigration and visa's is therefore essential to many of the interviewees (Interviewee #4, personal communication, 2021).

4.5 Overview Results Business Culture, Civil Society, and Governance

Below table summarizes the main results on business culture, civil society, and governance.

Table 7 Overview Results Business Culture, Civil Society, and Governance

	Elements Social Transformation Model	**Overview Results**
Business Culture	Hierarchy versus Egalitarianism	Hierarchical structures are still very present in the SSA business environment. Employees seem to need them to get work done according to business standards. Some entrepreneurs are trying to change the current system by engaging employees to give input in solving challenges and suggest improvements.
	Group versus Individual	Group goes before the individual as employees do not often think outside of the group, have limited problem-solving skills, and challenges arise

		when there are too many different groups inside the company.
	Time Management and Labor	Time management and labor is generally inefficient. To overcome this the entrepreneurs work with structured planning, invest in education and training of the workforce, and have locally fitting hiring procedures.
	Equal Treatment and Universalist Attitude	SSA societies are mainly patriarchal and clan-based. As a response some of the entrepreneurs focus on equal treatment. Furthermore, clean energy sector is currently mainly male dominated, while the main customers are female.
Civil Society	Closed-in Groups, Vertical Networks, and Cooperation	Knowing the right people and having a good relationship with your partners is important for conducting business due to the power of vertical networks.
Governance	Patrimonialism versus Rule of Law	The political landscape in SSA can be unstable and lacks clear policy. This causes challenges for the entrepreneurs when it comes to attracting investments, grow their market, or building partnerships.
	Granting Favors versus Equal Access	The need to know the right people is a common challenges the entrepreneurs face, especially when working with governmental agencies. The clean energy sector in SSA is still rather small and therefore gets little attention and support from the government.

5. Discussion

In order to achieve SDG 7 major changes to the SSA energy market need to happen. The study aimed to investigate the current state of the barriers and drivers within this energy market. The results indicate that the interviewees face challenges in dealing with governmental involvement or lack of involvement, finding investments and develop sustainable business models, and finding capable staff in order to make their business practices sufficiently scalable to achieve the desired results. The discussion chapter delves into the meaning of the presented results and reflects on their relevance.

5.1 Reflection on Business Operations

One of the striking results is that all interviewees indicated that they needed external funding to survive. Often the funding they do receive is not enough. It became clear that writing proposals to receive funding is difficult and time consuming. That time is then not spent on running the organization. The average success rate of about only 10% and the financial pressure to apply to external funding sources to survive, make it a challenging barrier for entrepreneurs in the SSA energy sector. The costs are also rather high in the early phase of clean energy entrepreneurship and business is still uncertain. For a business to be successful it needs to have a sustainable cost-revenue balance (Osterwalder & Pigneur, 2010). This is clearly a challenge of the interviewed actors. It is perhaps not a surprising result as they are operating in a market that is traditionally serviced by the government. Additionally, operating in low-incomes economies and often dealing with the bottom-of-the-pyramid citizens makes that only limited financial contribution from the energy product consumer can be expected. Furthermore, business operations in SSA are rather expensive. It is a new market and everything costs more time because of cultural and institutional challenges. The not transparent way of working of governmental institutions and the power of vertical networks cause entrepreneurial activities to take more effort and halt business progress. As time is money and corruptive systems cost money, doing business in SSA can be rather expensive. These reasons explain why external funding is needed in this stage of clean energy entrepreneurship in SSA.

Besides limited funds, consumers lack awareness of the added value of clean energy products. The customers of the SSA clean energy sector seem to have little understanding of why they should invest in clean energy products. The question is whether the right customer segments are targeted using the right channels. Customer relationships specially targeted for a specific customer segment could potentially influence the understanding of the clean energy

products (Osterwalder & Pigneur, 2010). Perhaps the actors in this study should take a step back and reflect on who they are targeting for what reasons, and through which means.

One of the key resources is the staff of the SSA clean energy organizations. The employees are in most of the companies the bridge to the consumers and hired locally. Yet, finding qualified staff that is willing to learn and grow is difficult. The lack of skill and education is a problem for more innovative tasks within the companies (also part of labor challenges described by Kroesen). Furthermore, the leaders interviewed for this study shared that they have to focus on all aspects of running a business. They often do not have the time, right skills or capacity to do all jobs. Full cross-cultural understanding and dedication to work on bridging the cultural gaps, or missing the right connections with the consumers and governmental institutions are a few of these skills. As such, some activities such as marketing are often forcefully omitted, which negatively affects their business elsewhere. Think, for example, of the relevance of good customer relationships using effective channels, which is generally part of marketing.

When it comes to partnerships, the government was mentioned frequently. Also, very much in line with the model by Kroesen, dealing with the government in SSA countries can be troublesome. The entrepreneurs indicated that they try to avoid government interaction where possible. Luckily the industry is not high on the radar yet. This is at the same time unlucky as it signals the limited awareness and lack of urgency felt by the government. This institution is a relevant partner as its support is needed to acquire certain key resources and execute certain key activities.

5.2 Reflection on Business Culture

First, the importance of hierarchy. The results indicate that entrepreneurs are missing a professional attitude from the employees. There is a lack of initiative and limited feel of responsibility. If employees are not told top-down what to do, most do very little. This observation is in line with Kroesen's (2018) theory regarding 'System 1 thinking'. The interviewees shared that they try to engage their staff more and to have them share their thoughts but that this only works on higher managerial levels. On the levels of factory-workers or lower level agents there is still a large reliance on hierarchy and delegation and the focus on one's individual input is not so relevant.

Second, balancing the group and the individual. The interviewees indicate that over the past decades the African market has undergone some major changes with regards to the

building of capacity and the levels of education. There are more well-educated Africans in many of the companies. These people are less attached to their groups and more focused on their individual development. Vertical networks however stay relevant but are not only based on ethnic relations. Places of origin of many employees are much more varied due to the more global nature of the world. Especially in Western-run countries it is evident that hiring practices place much more emphasis on qualifications than on background and culture. While lower-level staff still tends to come from similar background and therefore tends to belong to the same groups, amongst the office staff there is more diversity. The Western-run companies have more diversity on both junior-level management and senior-level management. There is a range of employees varying in nationality, gender, age and level of education. As the focus on the individual instead of the group is aimed at creating an environment more suitable for 'out-of-the-box' thinking, this shift away from companies being mostly populated by employees of the same group. In non-Western countries the focus still lies more on the group as opposed to the individual. This is in line with what Kroesen describes (Kroesen, 2018).

Third, time management and labor. Some interviewees indicate focusing on the ambition of employees when deciding to hire someone. Instead of focusing solely on their level of education during a job interview, the focus is also aimed at their potential and their drive or motivation. As such staff with lots of room for development can be hired and trained further. In addition, sourcing staff from other countries is a practice more common now. Following the mass adoption of tools like LinkedIn the recruitment process seems to have changed and the level of outreach needed to fill positions that might previously have been impossible to fill is much more accessible to small entrepreneur in Africa. The skills and practices needed to become better at planning and time management are ever evolving in many of the interviewees' companies. A good understanding of the necessity of creating proper training to learn these skills is also something that seems to have formed over the past few years. All the interviewees indicate that they see a lot of value in training their personnel and try to find solutions within their means to accommodate this training. Some companies have devised intricate training methods, while others rely on lots of communication and training courses available for free online.

Fourth, unawareness of equal treatment and universalist attitude. While Kroesen's model indicates the need for equal treatment and equal access within the organizations to deal with the patriarchal and clan-based society, this topic did not come forward during the interviews. Equal treatment and equal access without restrictions seems to be an unspoken truth. Whether this follows from the fact that many of the interviewees were Westerners and male is possible.

Fifth, the power of vertical networks. It is quite evident from the interviews that vertical networks are so ingrained in the culture, that nobody even questions them anymore. Knowing the right people in order to achieve something is part of doing business in Africa and building the networks to do so might take years. Many of the interviewees indicate that this is part of doing business in Africa and that there is no way around this. In fact, most interviewees seem to have accepted it is being something that is unlikely to ever change. In Africa the focus lies tremendously on who you know, whether it is in finding partnerships, investors or dealing with government and governance. Knowing the right people is once again key to succeeding in business. Therefore, many of the things that might be considered corruption in the Western world are just part of the nature of doing business in the countries the interviewees operate in. There is a large grey are when it involves corruption. Interviewees indicate the importance of network, but nobody generally feels comfortable admitting to any type of corruption.

Sixth, the limited role of the state. The clean energy sector in many of the African countries has not yet developed to such a degree that government sees much value to be found there. Extremely large players do not really exist. At least, not at a level like the conglomerates managing the copper mines in Zambia or the coffee farmers of Uganda. As Stam (2015) already indicated, governments should take the role of feeders and support the creation of an entrepreneurial economy by, for example, adjusting laws and regulations. This is not evident in the economies in which the interviewees operate. One of the interviewees indicated that not being on the governments radar so much can be both a good thing and a bad thing. Good thing, since the assumption that one has to bribe themselves out of every situation doesn't exist. Bad thing, since one might need government involvement in order to make business thrive and this involvement might simply be lacking. In order to make mass adoption of clean energy products by consumers a success several of the interviewees indicate the importance of the state in creating awareness. Awareness of monetary benefits as well as health benefits might create a movement in society steering away from conventional polluting forms of energy. Creating said awareness is not high on the government's radars and the companies operating in the SSA energy sector simply seem to lack the money and scale to take on this job themselves.

Finally, the process of social transformation. The results indicate that the SSA entrepreneurial environment is balancing between System I and II. On the one hand, vertical networks and corruption are still powerful. On the other hand, foreign entrepreneurs are playing their role in the clean energy transition and slowing winning the trust of their stakeholders. Employees are seeing a different example and consumers are being exposed to behavior not seen before. However, what really lacks in the transformation is the role of the state. The

government can play a key role in making the industry more modern and promote clean energy behavior.

6. Conclusion

The lowest energy access rates in the world can be found in SSA, while there is a hunger for economic growth. More reliable and clean energy supply is needed to address this increasing demand. The energy needs to be supplied fitting to the targets of SDG 7, which aims towards clean energy for all. From this starting point, this study intended to focus on the actors in the SSA clean energy sector. The limited research on successful clean energy entrepreneurship in general and in the SSA region specifically warrants for the need of additional research. By analyzing experiences from actors in the SSA clean energy sector this thesis has revealed the barriers and drivers that these actors face in trying to transition to a clean energy sector. The Social Transformation model by Kroesen and the BMC served as the theoretical backbone. It guided the interviews and the analysis. The used theories helped contextualize the results from this study.

Six main drivers have been identified and four main barriers. The section will start with the drivers. First, there is a large market demand. The high levels of energy poverty in SSA and the limited current supply has opened a market gap for clean energy. Second, and following from the first, the possibility to make a positive impact on the people in the customers segments. The ambition to provide clean energy and alleviate some economic, social and environmental problems, gives the entrepreneurs ample motivation to continuously deal with the many challenges. Third, the entrepreneurs are driven by a for-profit mentality to successfully convert the market demand in sustainable business. Even though, in reality the businesses often still rely on external funding, it does not mean that they have for-profit focus. Yet, one has to consider the newness of the industry in the context of Africa, with PayGo models amongst others. Fourth, having motivated and qualified staff makes your life as an entrepreneurs easier so they are driven to find these. This is especially crucial on the management levels but good staff is scarce. Therefore, being able to recognize potential in someone and assisting them with training and continuous development is essential. Potentially reaping the rewards for your business is why entrepreneurs put in the effort. Fifth, entrepreneurs are driven to develop or otherwise acquire the skill and capacity to build a strong network and the knowledge how to use it. Working with local people has been identified as one of the keys to local vertical networks. Due to the different cultures in the sectors and the international influences, the actors

need to balance the power of vertical networks with modern, open relationships. Sixth, which follows from the previous driver, work with local partners where possible to get access to local knowledge. Beyond the access to local network, working with local employees, partners or other organizations supports having a strong touch with the local market and its distinct cultural values.

The identified barriers are the following. First, challenges caused by cultural differences. This challenge is not only for the Western actors but also the entrepreneurs from other SSA countries have to deal with the cultural differences in the country of operation. Every country, and even separate regions within these countries has its own cultural rules and values, which are not always easy to navigate. Second, the high costs and the limited availability and access to financing. The higher costs of doing business in SSA due to cultural and institutional challenges form a barrier. Especially as acquiring funding to do business is difficult and the process to acquire it is arduous and time-consuming. Many of the actors in the SSA clean energy sector lack the time, skills or capacity to write compelling proposal for grants they wish to receive. The necessity of having to 'play bank' by providing features like paying in instalments and other forms of pay-as-you-go, means many of the entrepreneurs lack the liquidity to grow and expand at a rate they please. This is the result of much of the money being tied up in loans awaiting servicing by customers. Additionally, geographical distances are large, transport is expensive, import and export cost money, the additional time required to deal with the power of the vertical networks needs capital. So overall the costs of doing business in SSA are high. Third, the power of vertical networks and little governmental support challenges the entrance and expansion in the local market. The interaction with the government is limited and difficult due to the power of vertical networks, the overall lack of governmental structure and the role of corruption. Yet, the government is needed as a partner as the same vertical networks can be used to leverage trust with the local population for clean energy products. Fourth, problems with finding and retaining the needed qualified staff. While great strides have been made in terms of education and qualifications of the African people over the past decades, it is often difficult for the businesses to find local qualified staff. Retainment levels are low and building trust is a challenge. Having the capacity to treat staff in such a manner that it creates dedication and passion for the business is therefore of major importance, as good staff is key in making the business work.

In short, entrepreneurs in the African clean energy sector have taken on a variety of roles within their businesses and sector. These roles focus on development, acquiring funding, marketing, sales, logistics. The need for these roles follows from the lack of adequate solutions

and provisions in their respective countries to outsource these tasks. The additional time it takes to run a business in SSA due to cultural and institutional challenges is reflected by the lack of scalability the businesses often face. While some of the businesses have been around for ten years, none of them are thriving and they are not growing rapidly due to many factors inhibiting their growth. Being in a position where they could limit their focus much more could potentially allow for much more growth. Yet, the general business climate in the SSA energy sector is not set up for this.

6.1 Recommendations for Further Research

To better understand the implications of these results, future studies could investigate how the consumer market could be positively influenced towards clean energy products. Research could be done into the role of the government in the transition towards a clean energy sector in SSA. Furthermore, academia and the stakeholders in the SSA energy sector might benefit from a business model review for clean energy products and services.

Overall, continuous research is needed to monitor the changes in the entrepreneurial environment. The social transformation is an ongoing process and so influences the barriers and drivers for entrepreneurs in SSA over time. Other countries in Africa could take lessons from this research, measured at this point in time, if they see similarities with the region of focus.

6.2 Recommendations for Entrepreneurs

The next three recommendations for entrepreneurs follow from the work of this study. First, increase the focus on clean cooking. Arguably, the impact that can be made from clean cooking as opposed to that of electrification is much greater. As indicated in the literature review, the energy used by cooking in the average African household is much larger compared to the energy used for lighting and other forms of energy. In addition, one could argue that the commodity-factor of lighting is much higher than that of cooking fuel, i.e. one has to cook every day, but being without light in the evenings and nights for months at a time is much easier to cope with. The current growth of the clean cooking sector is marginal at best, while there are still almost three billion people who lack the proper fuel needed to cook cleanly. Great strides can be made by actively trying to switch these people. Once again, this does not mean that the solar sector should be neglected, however it does mean that proper measures to generate more awareness of this sector should be considered. There is clearly ample market opportunity.

Second, focus on your own strengths and work with local people where this could bring value. Entrepreneurs are recommended to focus on their core capabilities when entrepreneuring in a foreign culture. It is better to rely on local people for tasks that you are not fluent in. They bring knowledge of the local way of working. For example, spreading a new and unfamiliar product in a market is highly culturally sensitive. When the entrepreneur also comes from a different region, it causes additional trust challenges and low acceptance rate of the new product. Engaging with local agents and influential members of the community could bridge this gap. They are more likely to have the knowledge on how to best communicate about the innovation and trigger a higher adoption rate. However, the entrepreneur should stay involved to try to insert the openness of his/her culture in the engagement with the locals. This can slowly change the local culture to becoming more modern.

Third, invest in onboarding programs for new employees and partners to build trust and talk about the impact of cultural differences. By investing in an education program, entrepreneurs can slowly introduce their cultural values and how they would like to see the company operate. Additionally, the differences between the business culture and the culture outside of the company can be emphasized. Open dialogue through monthly come back sessions in the first year of employment can help an employee more easily ground in the company. For the entrepreneur this could save correction costs that are required to address problems caused by cultural misunderstanding. Furthermore, through constructive onboarding an employee might feel more connected to the business and the entrepreneur more to its employees. In the end the goal is to find a middle ground between the cultures and effectively work together to bring clean energy to all in SSA.

6.3 Limitations

Several limitations need to be acknowledged to understand the contribution of this thesis. First, the influence of subjectivity needs to be considered when interpreting the results. I have been personally involved in the SSA energy sector and feel invested in the future success of some of the businesses there. My experiences in Zambia, for example, have allowed me to put into context what the entrepreneurs were talking about in the interviews. It gave me a better sense of the deeper meaning of their experiences as I have experienced many of them too. Following, I have interpreted the answers from the interviews using my personal lens. Potential biases could therefore be present in this study.

Second, the results of this study have limited generalizability due to its size and scope. A group of diverse cultural clean energy stakeholders was selected for this study, yet, they are from/are active in a selected amount of countries in SSA and have limited diversity in gender. The sample size is too small and therefore not representative of the population. This makes drawing conclusive and generalizable learnings from this study difficult. I have tried to include clean energy entrepreneurs from different genders, regions, and specialties to aim for some level of generalizability, albeit minimal. Even though the sample is not representative of the population, it does reflect the diversity and similarities of entrepreneurs active in the clean energy field. Future research should test the results of this study with a larger sample size.

Third, throughout the process it became clear that some topics are not so commonly discussed and so do not get on the table without extensive questioning from the researcher. As starting researcher I was not prepared for this. As a result some topics are discussed more in-depth than others. Additionally, some interviewees reserved limited time for the interview and so the discussion did not reach the desired levels of depth. For future research focusing on less topics might be advisable to allow more time on each theme. In the end this study encompassed a wide range of topics and so interview time had to be spread amongst all the topics. Narrower focus is recommended. As this was an exploratory study, future research needs to focus on going more in-depth on the themes that this thesis touched upon.

Nonetheless, the results of this study are valid and a contribution to the body of knowledge on entrepreneurship in SSA. Qualitative research is seldom completely objective as the personal role of a researcher cannot be eliminated. Furthermore, the limited sample size reflects the few entrepreneurs active in the SSA clean energy sector. It signals the need to investigate further as the large size of the SSA market is covered by a small group of private sector stakeholders. To conclude, the results of this study should be held in regard to the results of previous works and be used to further investigate the clean energy sector in SSA.

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Appendix A: Interview Questions

Interview Questions

Interviewee:

Date of Interview:

Opening Questions

- Personal Introduction:

    - Can you give me an introduction of who you are, where you're from, your background and your current function in this business?

- Business Introduction:

    - What country/countries is/are the organization active in?

    - What is the size of the business? How many employees does it have? Would you be willing to give some insights regarding annual turnover?

Part 1: Business Operations (Following the 9 categories of Osterwalder's Business Model Canvas)

1. Value proposition

    - What does your organization do in short?

    - What is de value proposition of your business? What mission does your organization have?

        - What value do you deliver to your customer group(s)?

        - What space in the market did you step into?

2. Key activities

    - What are the key activities of your organization? (production, sales, R&D, customer service, etc.)

    - What is your role in these key activities?

    - Is your organization active in the private and/or public sector?

    - Are the key activities mainly B2B or B2C oriented?

3. Key resources

    - What key resources does your organization require to function?

    - How do you acquire these key resources?

4. Key partners

- Who are your key partners?

- What are the roles of these various partners? How essential are they to your organization?

- How would you describe your relationship with these various partners?

5. Customer segments

- Who are your customers? Could you describe your customer groups?

6. Customer relationships

- What type of relationship does your organization have with each customer group?

- How important is each customer group for your activities?

7. Channels

- How do you reach your customers? Both in communication and in delivery of the product/service.

- What distribution channels does your organization employ? Both internal and external.

8. Cost structure

- What are the most important costs your organization has?

- Which key resources and which key activities are most costly?

9. Revenue streams

- What are the most important revenue streams your organization has?

- Could you elaborate on the payment structures for your customers?

- Are you satisfied with the current payment structures?

- Does your organization receive external funding?

- If yes, where do you receive this funding from? Is it an essential source of revenue?

- Are you satisfied with your revenue build up? Please elaborate.

Part 2: Business Culture (Following the issues as identified by Kroesen)

1. Hierarchy versus egalitarianism

-Could you give me some insight into the structure of your business? Do you have lots of hierarchy with various management levels, or is it the division more horizontal?

-Can you expect employees to finish task when left to themselves, or do you need to supervise them and assist them when doing jobs? Does this depend on the level within the company they have?

2. Group versus individual

-Which language do the employees of the company use to communicate with each other?

-Are all employees of this company from this country as well?

-Do you have some insights about the level of male/female in the management of this company?

3. Time management and labor

-What measures are in place to make sure deadlines are met? What does planning of jobs/projects generally look like in your business?

-In your factory (if applicable), what types of people are present? Could you give some information about their backgrounds, educations? Are there certain groups that stand out (same age, gender, background, etc)

-Do you have anything in place to assist in continuous development of your employees to benefit your business (schooling, training, courses, certificates, etc)?

-Would you be willing to tell me something about the things that go well and don't go well when you take a break for a couple of weeks? How does your presence impact daily operations?

-Are employees told what they need to do or is discussion possible?

-Could you share some insights about the hiring process in your company? If you need to fill a position, what does the process look like?

4. Equal treatment and universalist attitude

-What's it like to be part of a business where most of the employees are from a different culture? (only applicable when interviewing western entrepreneur in SSA)

-Could you give some insights into the challenges and successes of your intercultural work?

Part 3: Civil Society and Governance

-Civil society

 -Do you have relations with organizations that help you with your business? (excluding partners, distributors, suppliers)

 - How important do you feel your network is in doing business in this country?

 -How are the networks you do business with built?

 -Does the energy sector in this country have an organization you can go to that will help you with information, contacts, access to funds, etc? If not, do you think the energy sector would benefit from it?

-Governance

 -What kind of contacts does your company have with government and governmental organizations?

 -Does your company require permits? Could you share some of the process of acquiring these permits? Was it difficult or challenging to acquire the permits?

 -What rules and guidelines are imposed on your company? Does someone come to check of you are following these rules and guidelines?

 -Do you deal with import and export of products? What does the process of import and export look like?

 -Do you feel it's beneficial to have contacts in government when trying to obtain information, permits and documents?

 -Is it important to know well connected people in order to do business?

General finalization, reflection on SDG 7

1. How do you see the future of the energy sector in this country? Specifically, from the viewpoint of where you are trying to make an impact.

2. Do you think the goals set by SDG 7 are realistic for your country? Do you feel like this country will achieve these goals? (if needed, I can explain SDG 7 to the interviewee)