Developing An Innovative Value Proposition To Replace Paraffin In South African low-income communities

Based on the case of Sesolo Mello B.V. working in the Kayamandi township, Western Cape, SA

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Table of contents

I. Abstract

Household air pollution presents a major social and environmental problem. The WHO (2014) states, that 3 billion people cook and heat their homes using open fires and simple stoves, using impure fuels like paraffin. This results in approximately 4 million people dying prematurely from illness related to cooking with solid fuels. Women and children are mostly affected. Paraffin mainly prevalent in the South African township context is one of the worst pollutants, causing not only disease through household air pollution but, in combination with unsafe stoves, causes large shack fires every year. Moreover, residential solid fuel burning accounts for 25% of global black carbon emissions (Tait et al., 2013).

Governments and NGO´s like the Global Alliance For Clean Cookstoves have been trying to introduce alternative stoves and fuels for decades – with little success. Reasons for this are among others: Foreign Design without local "buy-in", underestimated hurdles of behavioral change, unaffordable solutions and limitations through lock-in designs.

This entrepreneurial research is targeted at supporting the social enterprise Sesolo Mello B.V. in surrounding these pitfalls by developing a sustainable value proposition to replace paraffin, valid for township communities in the Western Cape, South Africa. The value proposition canvas, as basis for Sesolo Mello´s business model was utilized to deduct relevant research questions, and conduct a proper customer validation process in the Kayamandi township - underlined by principles of the Integrated Renewable Energy Potential Assessment (IREPA) approach.

The results of applying the value proposition design process, show that the best way to replace paraffin and other solid cooking fuels in Western Cape Townships would be to establish the provision of cheap electricity through centralized or decentralized electricity production. Since this development is costly and only slowly facilitated by the government, next to the incurred costs for customers, to buy an electrical cooker - a transition solution is advised.

The derived value proposition results in the introduction of a fluid biofuel alternative, based on waste vegetable oils, that could replace paraffin one by one in the existing cook stoves. It is well perceived, avoids the common pitfalls – based on the current knowledge base- and checks most customer requirements in the value proposition canvas. This solution would be able to create substantial impact not only in the Western Cape but in the whole South African context, where 650 million liters of paraffin could be replaced yearly, with a reduction of toxic household air pollution by 90%.

This value proposition design does not claim to be complete or be technically and economically feasible – this will still be evaluated by Sesolo Mello. However, it can be seen as a representation of customer pains and the wish to transition away from paraffin. Moreover, it aims to present a different view on sustainable entrepreneurship in BOP markets.

II. Acknowledgements

This thesis does not only represent the six months I spent in South Africa, researching and working in township communities of Alexandra, Kayamandi, Khayelitsha. It represents the start of an entrepreneurial journey and a personal development with a lot of struggle paired with a lot of joy. It all started during the Climate-KIC summer school 2015, where Roy Hendriks, Nico de Vriendt, Max Bedouét and I were asked to find a global problem, that we would like to address during the summer school, and the astonishing environmental damage, emissions and health issues related to cooking popped up. This lead to a winning business plan draft, thanks to the support of our coaches Aga and Pete and well-connected influencers in our network opening doors to relevant information. After the journey, thanks to the support of Climate-KIC (Mobility, Greenhouse and Accelerator) and Wageningen UR, we acquired necessary financial support and I was the first to go to South Africa, being able to combine my thesis research on site with the validation of first ideas around replacement of paraffin.

Of course, there have been many challenges along the way, but I am grateful for having done this journey with amazing people, like Roy, Nico, Max, Aeneas, Jan and James! On the South African side, there has been such a great support by Junior Ackeem Ngwenya, Huub van Zwieten (Clean Cooking Revolution), Bernice Robbertse, Bonny Horbach (Consulate Cape Town - Kingdom of the Netherlands) and among many others, especially George Arrey (Health Promoters SA), who does amazing work on education, prevention and general support around health-related challenges in South African township communities. You deserve more support and funding, that is for sure! Moreover, I want to thank all the community members, mostly women, that were open for many interviews, workshops and brainstorming sessions. I learned that listening can get you a long way, especially in finding mutual understanding and joint solutions with complete buy-in. Thank you for your trust.

I want to thank Valentina Materia, Thomas Lans, Bart Doorneweert, Marjo Lexmond, Nies Springer and Gareth Wakeling making this possible on the Wageningen UR and Climate-KIC side. Last but not least I want to thank friends like Roy Hendriks, Jan Ritter and Theo Xenakis for supporting me in times where this journey was frustrating, I felt deprived of energy, or suffered from mononucleosis disease during summer 2017 – you kept me going and had my back. Same goes to my family who have been a safe haven along the way.

Completing and submitting the thesis now, after officially being done with the research in September 2016 and Roy´s validation, that technical and business case wise there is no feasibility has been hard to accept. Since January 2017, I am already involved in my next venture, together with Jan whom I met in South Africa. We are pretty confident that we are part of a sustainable agricultural transformation.

Osnabrück, 21.10.2017

III. Glossary

Biofuel	Fuel made from organic resources
Bottom of the Pyramid (BOP)	The 3 billion people worldwide living off less than $2 dollars per day
Business Model	Economic earning model of a company
Business Model Canvas (BMC)	Tool to present a company's business model – in 9 blocks.
CO_2	Carbon dioxide. Prominent greenhouse gas contributing to global warming
Customer Development	Learning process going along with Value Proposition Design – identifying and developing customer segments
Entrepreneurship	The act of setting up an enterprise, creating or harvesting untapped opportunities
Formal housing	Government-initiated social housing located in South African townships which include basic amenities such as water and electricity
Global Alliance For Clean Cookstoves (GAGC)	Global umbrella organization for clean cooking initiatives.
Health Promoters SA	NGO based in Kayamandi and Khayelitsha supporting this research
Informal housing	Makeshift shacks often lacking basic amenities in South African townships
Illuminating Paraffin	Paraffin certified by the South African government
IREPA	Integrated Renewable Energy Potential Assessment – Toolset for effective work in rural/ low-income communities
Iterative	Repetitive process of theorizing – testing – reflecting to gain knowledge or improve a product
Kayamandi	Township in Stellenbosch housing 26.000 people. Location of research
Khayelitsha	Township in Cape Town housing approximately 1,5 million people
Paraffin	Refers to Illuminating Paraffin used in South Africa for cooking and heating
Paraffin Safety Association of SA (PASASA)	"Non-profit organization dedicated to ensuring the safe use of paraffin in the domestic environment." Founded and funded by BP, CALTEX, ENGEN, SASOL, SHELL and TOTAL
PM	Particulate matter – polluting and toxic particles released when combusting fossil fuels
Sesolo Mello B.V.	Case company of this research
Shack	Informal housing built from scrap material
Spazashop	Small general store selling most basic commodities in South African townships
Stellenbosch	Municipality in the Western Cape, South Africa
Survivors	Term coined to describe the people living off a bare minimum in South African township communities
Township	Socio-economically deprived urban areas in South Africa, containing a mix of formal social housing and informal settlements or shantytowns/slums
Triple Bottom Line (P)	Taking into account People, Planet and Profit in a business model
Triple Top Line	Creating additional value on every social, environmental and economic level around the business model and leaving the complete ecosystem better than the status quo
Tuckshop	See spazashop
Value Proposition (VP)	Core value/ product/ service, a business aims to deliver to its customer - Element of BMC
Value Proposition Canvas (VPC)	A specific canvas tool, that "feeds" into the BMC – it entails all relevant information concerning "product-customer" fit – jobs, pains, gains vs pain relievers, gain creators and envisioned products/ services
Value Proposition Design	The process of developing Value Propositions based on acquired information – often presented in form of a VPC
Xhosa	South African ethnic group and language
ZAR	South African rand – currency with an exchange rate of 16 ZAR to €1 euro at the time of research

1. Introduction

This thesis researches the opportunities to replace paraffin in South African communities, by conducting a customer validation and value proposition design based on Sesolo Mello B.V.´s ideas. Sesolo Mello is a social enterprise that aims to substitute paraffin with safer, and cleaner cooking methods at the Bottom of the Pyramid (BOP). The approach is to jointly develop and validate solutions directly with the users in the Kayamandi and Khayelitscha township. Sesolo Mello B.V. is based in the Kayamandi township, which is the main case for this research.

The first chapter will introduce all relevant aspects that form the footing of this thesis. First the situation of indoor air pollution, different fuel types and further problems related to unhealthy cooking practices are introduced. Followed by existing value propositions to tackle these challenges and their common pitfalls. In the end, first ideas and set requirements by Sesolo Mello are summarized, to derive the approach for value proposition design.

1.1. Impact of cooking practices

Roughly four billion people live in the so-called "Bottom of the Pyramid" (BOP), where harmful cooking practices are mostly predominant (Global Alliance For Clean Cookstoves, 2015). The BOP has been developed as a concept to be able to understand the different dynamics and requirements of the markets of the poorest of the poor. Prahalad developed the wording which is used in management literature to describe the untapped opportunities and innovation potential in those markets (Prahalad, 2012). South Africa consists of a society which is partly poverty stricken and has an unfortunate history of inequality and poverty. Despite of the fact that the country has many predominant features of a groomed economy, poverty is widespread among the black citizens residing in rural areas of the country (Mensah & Benedict, 2009). As in South Africa government is taking steps for the betterment of society, there are still few initiatives taken with regard to the link between energy and health in township communities, leading to little choice apart from using paraffin for cooking, heating and lighting. Despite the increasing electrification in South Africa, the use of paraffin oil remains predominant in low-income households where electricity is available as well as in those where it is not available due to high costs (Global Alliance For Clean Cookstoves, 2015).

Choice of cooking fuels is often connected to cultural cooking traditions like the slow-cooking on charcoal and wood (Sesan, 2012). But in many regions, it is also dependent on fuel availability, which is varying in rural and urban areas. In South African townships, there is a tendency to use paraffin, since biofuels like wood can´t be collected, are partly culturally not respected and are hardly available, while the existing logistics infrastructure for paraffin distribution is in place for

a long time. Thus, paraffin is the most common fuel in South African urbanized areas (Global Alliance For Clean Cookstoves, 2015; HESASA, 2013). Moreover, it is an economic decision, since fuel costs for cooking and heating take away a large part of people's income - up to 25% of household income in the South African context (UCT Unilever Institute, 2015). There is hardly any local economic value creation due to paraffin distribution. Since in the South African context Paraffin is the most prevalent fuel, charcoal or other harmful fuels are not further explored (Tait et al., 2013).

Known by Europeans mostly as kerosene or jet fuel, paraffin fuel is a liquid fossil petroleum derivate. In Europe, it is often utilized as paraffin wax in form of candles. Often it is present in industrial use cases as well as in BOP households for cooking heating and lighting. Some outdoor enthusiasts might also know paraffin heaters and cookers in countries of the Global North.

Figure 1: Shackfire Houtbay (Image by TheSouthAfrican)

Particulate matter (PM), high flammability and carcinogenic compounds among other chemical compounds lead to its inherent danger (Tait et al., 2013).

Even though infrequent contact with fumes, does not necessarily impose long-term damage, exposure to paraffin can lead to skin damage, lung cancer and if accidentally swallowed it can cause damage to lungs and severe poisoning (Chilcott, 2006). Generally, there is to note, that the properties of these cooking fuels are implicating health risks (Schwebel et al., 2009). An additional factor is related to the way people utilize these fuels. Both factors are to understand the scope of harmful cooking practices, the World Health Organization (WHO) summarized in 2010, that three billion people are cooking with harmful fuels using open fires and unsafe stoves and approximately 250 million liters of paraffin are used per day (Index Mundi, 2016). Harmful cooking practices result in 4 million humans dying prematurely every year (WHO, 2014). Moreover 80,000 children die in South Africa alone due to poisoning by ingestion of paraffin - which is colorless and often stored in old beverage bottles (Tait et al. 2013, HESASA, 2012). More than 50% of premature deaths among children under 5, due to pneumonia are related to inhalation of particulate matter in households (WHO, 2014). Township fires, where thousands of lives and homes are destroyed every year are another big challenge in the Western Cape context (Murray, 2009). These are often related to paraffin wick stoves (see figure 2), falling over while unobserved. These stoves are often low-quality products imported from China and without the relevant safety equipment. Due to the nature of paraffin a paraffin fire usually cannot be stopped, 60 seconds after ignition (Smiedt,

Figure 2: Paraffin wick stove (image by Sesolo Mello)

2016; see figure 1). Next to the aforementioned socio-economic, health and environmental impact of paraffin use, the scale of CO_2 emissions emitted by this fossil fuel combustion is around 3 kg CO_2 per liter of paraffin consumed (Bedouet, 2015), which thus amounts to approximately 750 million kilograms of CO_2 per day globally.

One of the associations addressing these issues is PASASA (Paraffin safety association of Southern Africa), founded and funded by the petroleum industry since 1996. The first steps taken, are encouraging as they have focused on tackling the issue by safe packaging, safe appliances and safety education (Global Alliance For Clean Cookstoves, 2015). These measures are mostly targeted at safer handling of paraffin - not replacement. In figure 3, the paraffin value chain is portrayed. There is little value generated on township level, just for a few middle men (Arrey, 2016).

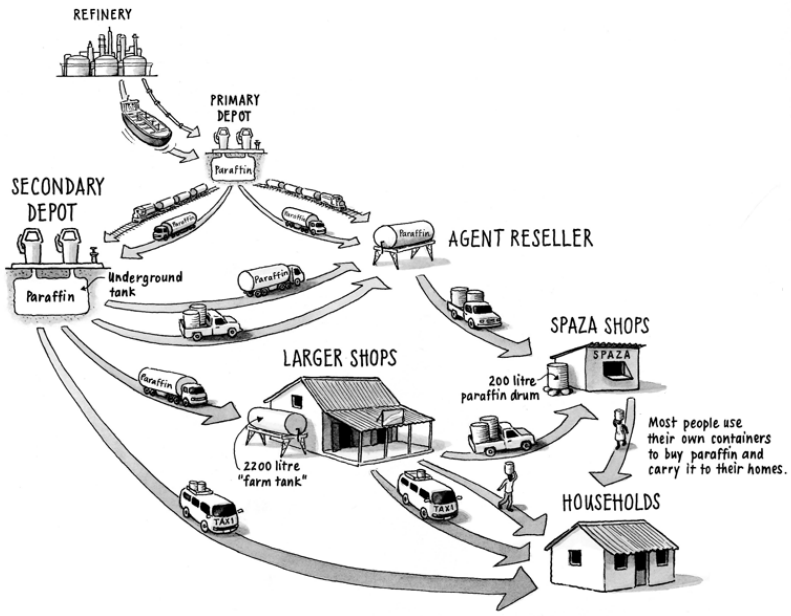


Figure 3: Paraffin value chain (http://supplychainn.blogspot.de/2012/09/oil-refinery-distribution.html)

There are also misconceptions among the decision-making bodies that the use of paraffin is decreasing with the increase in electrification. Although the trend of using other fuels along with paraffin for end use has been observed in some households, the usage of paraffin for specific end uses particularly for space heating, water heating and cooking have been pre-dominant (Truran, 2004). This is due to the reason that the alternatives to paraffin provided are either not affordable or not considered affordable by the users belonging to low income groups.

1.2. Value Propositions of existing solutions and common pitfalls

The Global Alliance For Clean Cookstoves, founded in 2010 has the mission to mitigate the cooking situation globally. It is funded by large foundations and is an umbrella organization for clean cooking initiatives worldwide, providing knowledge exchange and network. After the challenge has been taken up by international organizations in the past decades, the main focus has been on developing cheap, clean cook stoves that ensure complete, clean combustion of solid fuels and so called solar cookers (Global Alliance For Clean Cookstoves, 2015; Osinga, 2015). There is an

international standard ranking for stoves, ranking emissions, safety and efficiency (IWA, 2012). Solar cookers, which are around for over thirty years have proven to be hard to implement and scale - a challenge that all of the younger initiatives are facing as well (Sesan, 2012). Reasons might be related to foreign design work and less buy-in of local users. Moreover, there is often high initial cost of change and related difficulty to convince customers of the higher long-term utility. Mimi Moto, Philipps as well as many other entrepreneurs like Huub van Zwieten (Clean Cooking Revolution) are working towards mitigating the aforementioned challenges in the South African context. This often goes in the direction of implementing new appliance designs for cooking, heating and lighting connected to a variety of different fuels - among others wood pellets, lpg and solar thermal. Mimi Moto, Philipps, and the Clean Cooking Revolution all focus on the wood pellet clean cook stoves, that provide a relatively clean combustion with low emissions, but require new distribution channels and a dependency on wood pellets - thus risking locking in users on using wood pellets that might not always be cheap or available (Clean Cooking Revolution, 2016).
Next to the clean cook stove initiatives, that are always reliant on availability of specific fuel needs, electrification poses a big long-term opportunity in replacing paraffin stoves. Electrification can be done through grid connection and/or decentralized off-grid solar systems that have been proven successful in many African countries during the past decade. Mobisol, M-Kopa, Solar 17 and others are established players (Bloomberg, 2016). Thus, Sesolo Mello regards existing clean cooking initiatives as well as their own ideas as intermediate solutions on the way to electrical cooking. Unfortunately, many existing players try to jump on global subsidy schemes by the Global Alliance For Clean Cookstoves and governments, producing large quantities of "clean cook stoves", producing them in China and distributed at dumping prices in Africa (e.g. Mimi Moto - Osinga, 2015). This resembles the pattern of dumping cheap products in Africa - e.g. meat industry by-products, thus destroying local farmers. In any case these solutions are barely coordinated with local customers and users of these cook stove products and repeat common mistakes of "give away" development work approaches, imposing solutions on local systems and seldom generating acceptance. This is leading Sesolo Mello (2015) to describe the challenges of the current clean cooking initiatives as common pitfalls, that should be avoided in the value proposition design during this research:

The three most relevant **common pitfalls** are (Sesolo Mello, 2015):

I. Assumption that inducing **behavioral change** is easy:

Heritage and culture related to hygiene, energy sources and food preparation is very much integrated in current cooking behavior - not only in BOP markets. The perception of engineers and companies that are often alien to BOP communities, that cheap, innovative and efficient solutions should be easy to implement has been proven wrong in many examples - most prominently, the

solar cooker example. Even though in principle it is a great, healthier and cheaper solution, it did not take into account traditional slow-cooking practices (Sesan, 2012). New technology always requires behavioral change and the “buy-in” of users is not easily reached without integrating the communities in an early product development stage. Often, people in BOP markets even strive for "luxury" technology, owned by "rich" people, like fridges, television and electrical cookers, and don´t accept intermediate compromises. According to Health Promoters South Africa (2016), there is little awareness of direct health implications related to paraffin cooking - apart from shack burns. Inducing voluntary behavioral change, while marketing for health benefits has thus to be considered. It might be worth testing, whether, marketing a product as high-tech solution is perceived well locally.

II. Often new products are **too expensive** for BOP markets:

This has been shown in many cases where the barrier to adopt new technology has been too high. However, paraffin stoves are exchanged every 1-2 years (Arrey, 2016), even though the wicks could be exchanged. The product is cheaply available and does not require any change of behavior. One has to fill in paraffin and is able to experience the common cooking experience.
The technology driven development of clean cook stoves, that aim to be ranked cleanest is a costly process and when implemented, prices are often too high. This leads to the conflict of day to day survival rather than a decision for long-term utility – where the clean cook stove actually earns back its high initial cost through cheaper fuels. Approaches, where stoves are donated through subsidies or monetary donations have not gained traction yet either (Global Alliance For Clean Cookstoves, 2010; Sesan et al., 2013). This might be related to the following pitfall.

III. Some approaches are based on a **“lock in” nature**:

When looking at subsidies for stoves or donated stoves, to avoid the second pitfall, one must ask how a sustainable business model might look like. Some initiatives have thus developed an approach to create revenues via constant fuel supply. Just to mention a few, the Clean Cooking Revolution aims to provide wood pellet based clean cook stoves cheaply and provide suitable wood pellets in different packaging sizes to generate revenues. These wood pellets are rarely available in Khayelitsha and Kayamandi, so there is an opportunity to establish an own distribution infrastructure, using local entrepreneurs as multiplicators. On the other side this creates dependency on fuel reliability and availability which might be abused. Moreover, it does not appear to be a long-term model, since other players can easily enter this "low-tech" fuel market as well. Other initiatives take it one way further and provide stoves that solely work with their bio-based fuel gel, and/or bioethanol fuels (Emmett, 2014). They create a "lock-in" through special stove-packaging connections.
These initiative´s products are hard to find in Khayelitsha and Kayamandi, and have difficulties in

getting traction in BOP markets generally. Biello (2014) and Sesan (2012) state, that this is connected to unwillingness to enter into these dependencies and not be able to switch fuels easily. Moreover, there is experience or fear of failing fuel supply. Donated stoves are thus often left unused after a few weeks (Clean Cooking Revolution, Interview, 2016).

Summarized, these pitfalls often are results of **foreign designs,** that do not understand BOP dynamics and do not take into account local culture, consumer behavior and structures in the design process.

Based on the aforementioned existing experiences and pitfalls of clean cooking initiatives, this research aims to explore Sesolo Mello´s value proposition ideas, integrating local needs and local knowledge. That´s why Sesolo Mello B.V. is based in the Kayamandi[1] township, working together with local stakeholders following IREPA[2] principles (Sesolo Mello, 2015).

1.3. The Sesolo Mello B.V. case in the Western Cape

Figure 4: Sesolo Mello´s logo

Sesolo Mello B.V. is a European start-up founded in 2016 and composed of a Dutch, Belgian, British and German team supported by many mentors and advisors in South Africa and globally. The start-up originated in the EIT Climate-KIC summer school 2015 and has the mission statement to replace harmful paraffin in countries of the Global South with sustainable alternatives. This research aims to validate ideas in the South African Western Cape context and integrate local community members and other relevant stakeholders in an early product development stage. The main focus will be on ideas around liquid biofuel products as paraffin replacement. Opposed to other clean cooking initiatives, Sesolo Mello does not want to replace the paraffin wick stoves, but solely the fuel. The advised value proposition design will be based on local customer validation and already existing business model ideas, that will be extended with locally collected information. The advice will be compiled in a value proposition canvas and an extended business model canvas.

[1] Kayamandi is home for around 25.000 people whereof according to Health Promoters SA (2016), one third is using paraffin on a daily basis. There is mostly Xhosa living in the community and there is a relatively low unemployment rate.
[2] IREPA (Winkler et al. 2017): Integrated Renewable Energy Potential Assessment - Includes high principles of participatory stakeholder processes in marginalized communities.

1.3.1. Concept idea: Liquid biofuel as paraffin replacement

Compared to the aforementioned initiatives challenged by the common pitfalls, Sesolo Mello aims to avoid those by working with the local population and by aiming at a more direct approach. Replacing paraffin directly with an alternative liquid fuel - functional in existing stove technology. Sesolo Mello and this research focus on avoiding the common pitfalls and four additional factors that can lead to public opposition and loss of local support - "The development is involuntarily imposed on the public´s locality, the technology is unfamiliar, the public has no decision-making power, the development is for corporate profit rather than for local benefit." (Amigun et al., 2011b, p. 2503). Moreover, Sesolo Mello aims to create positive environmental impact, not creating a fuel vs. food conflict, common in biofuel projects (Winkler et al. 2017). This is forming the necessary criteria to validate whether Sesolo Mello´s value proposition is feasible from a socio-ecological-economic perspective:

Criteria I. Embrace local community and validate willingness to change

Criteria II. Avoid high price of products/ opportunity costs

Criteria III. Avoid lock-in nature

Criteria IV. Offer participatory opportunities

Criteria V. Utilize familiar technology

Criteria VI. Make sure there is local value creation

Criteria VII. Make sure there is no negative environmental impact derived from bio-fuel production, supply and consumption

Criteria VIII. Make sure the health risks of consuming the bio-fuel alternative are at least 75% reduced when comparing to paraffin[3]

Since the solution should be beneficial compared to the current situation, other fossil fuels will not be considered due to environmental and health implications. Thus, a biofuel will be more beneficial, more specifically a biofuel made from waste cooking oils since a production of energy crops would be in direct competition to food production in South Africa.

Biofuels have a long history. In the 19th century, when the first diesel engine was introduced by Rudolf Diesel, it could use peanut oil to run. Use of vegetable oils in engines have lost importance compared to fossil fuels over a longer period of time till the world faced problems of fuel shortages and environmental impact. Biofuels are fuels which are generated from biomass and/or biodegradable waste in different processes.

[3] In regard to shack fires, ingestion and indoor air pollution

Sesolo Mello B.V. (2015) aims to implement an enzymatic production process, to convert waste oils from the food-processing industry into a higher value biofuel. This process is more environmentally friendly and reduces the production costs of biodiesel when compared to methanol based production. It is important to note, that the biofuel cannot be produced from staple crops, since otherwise there will be a conflict to food production (Winkler et al., 2017). Thus, Sesolo Mello focuses on waste streams only. As last production step, 10% paraffin will be added as an ignition enhancer.

In the process, another by-product is produced - Glycerol, which can be utilized for additional value creation through localized soap production.

The product will be healthier, due to up to 90% reduced toxic compounds and resulting reduced indoor air pollution. Moreover, it is safer due to the reduced flammability of the fuel (e.g. when a stove is falling over). In Addition to this, ingestion of biofuels is less likely due to its smell and color - in case of ingestion it is less harmful. Last but not least it can save up to 5.22kg CO_2 per liter paraffin replaced (Figure 6; Bedouet, 2015). This is due to using a renewable waste resource for a higher value product. This would create a substantial environmental impact, looking at 250 million liters of paraffin consumed per day. In South Africa, forty percent of the population is using paraffin for heating, lighting and cooking. Of course, there is an energy mix that includes wood, charcoal, electricity and sometimes gas. In the township context, paraffin is the most prevalent fuel (HESASA, 2013). Even though the government regulates the prices of paraffin oil, it has been observed that paraffin is sold at a higher price and especially during the times when the demand for paraffin is high its prices usually shift upward and even sometimes double compared to the average price of paraffin oil – especially during winter months. The use of biofuels would also reduce the dependency upon paraffin. Finally, the biofuel will be cheaper based on current paraffin prices of 10-15 ZAR/liter[4]. The goal is to establish a localized decentralized production system (e.g. in shipping container format), that can tap into existing distribution channels to ensure fuel availability and where local community members can be educated and employed to create value. An additional feature of this approach is a possible franchise model to scale this

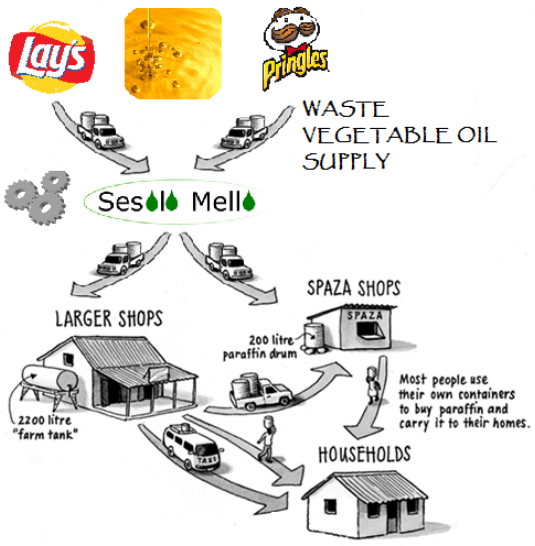


Figure 5: Biofuel value chain (Sesolo Mello, 2015)

[4] Arrey (2016)

approach across South Africa. In figure 5 the potential biofuel value chain is portrayed, that shows how many industrial stakeholders can be reduced compared to figure 3. Compared to the traditional paraffin value chain, Sesolo Mello adds most value from moving the production to the townships. Moreover, other value chains around soap production and bio-fuel distribution can be developed together with local entrepreneurs. Generally, this approach leads to more opportunities for local value creation when compared to paraffin fuel (Corner & Ho, 2010).

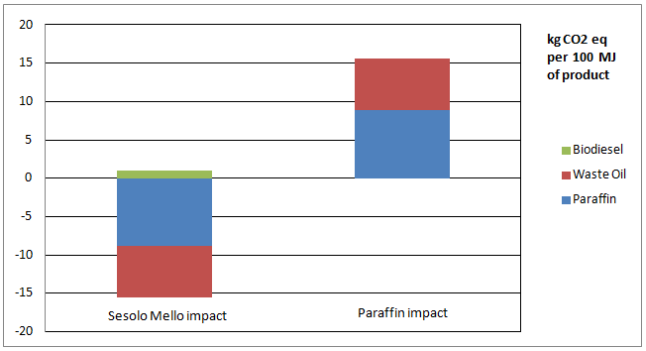


Figure 6: LCA of Paraffin and Sesolo Mello (Sesolo Mello, 2015)

1.3.2. Sesolo Mello in the context of Social Entrepreneurship

A proposed Definition of Social Entrepreneurship

Santos (2012) describes that social entrepreneurship, involves "addressing problems with positive externalities with a dominant goal of value creation" rather than value capture for the entrepreneur. And that many social entrepreneurs target disadvantaged populations, since the "most neglected problems with positive externalities affect disadvantaged populations". These disadvantaged populations and related markets are often referred to as the Bottom of the Pyramid.

Sesolo Mello's Mission is defined in its mission statement (2015): to eradicate the need of billions of people in the Bottom of the Pyramid to rely on toxic, dangerous and polluting fossil fuels for daily household use.

Sesolo Mello B.V. has set forth to create a positive impact with every action taken. Opposed to many existing business models, that means to include all relevant externalities. Environmental, Social and Economic factors that are weaved into a successful, sustainable business model. That´s why Sesolo Mello aims not only to work after triple bottom line criteria, but triple top line criteria – creating additional value on every social, environmental and economic level around the business model and leaving the complete ecosystem[5] better than the status quo (McDonough & Braungart, 2002).

This explains the intrinsic motivation to serve BOP markets and tackle large international challenges – starting on a local level. That´s why Sesolo Mello understands itself as a social enterprise.

Even though the sustainability assessment is not in the core of this thesis, a short summary of the main benefits on a practical level is deemed necessary to compare with the 8 proposed feasibility criteria (see 1.3.1).
The proposed business concept as described in chapter 1.3. offers the potential to create positive impact on all sustainability layers.

Environmental Factors: there will be a reduction in GHG emissions and other polluting emissions, while through the use of waste resources based on renewable resources, there is a GHG positive effect per liter paraffin replaced (Bedouet, 2015). Through Sesolo Mello´s proposed enzymatic production process there are no toxic chemicals involved and no pollution generated on local level. Through localized production, there is a minimum in logistic emissions, and vegetable oil powered cars can create a positive impact on this side as well. This development can

[5] Here defined as social, environmental and economic surrounding on local and international level.

even be attractive from an economic perspective, since resource costs might come down and carbon trading schemes offer potential alternative income streams.

Socio-Economic Factors: There will be many opportunities for local value creation. These can be grouped in direct impact and indirect impact. The direct product related impact is linked to the reduction of fires, household emissions, poisoning due to ingestion and fuel costs. The indirect product related impact is associated with local job creation, local education facilitation, empowering existing local entrepreneurs and supporting new entrepreneurs in e.g. building a local soap business from a production by-product.
In the best case, all these factors lead to a positive socio-economic development in the addressed BOP markets.

1.4. Relevance

Even though there are many reasons for the relevance of this thesis. The most striking one is the globally "hidden" but significant issue of paraffin related environmental and socio-economic damage done by each liter of paraffin consumed. Matinga (2010) weighs that the related issues in South Africa are unique in their intensity – globally. This also shows the relevance for the project location and research sample in the Western Cape context, where there is a hotspot of large township structures and informal settlements, that are highly dependent on paraffin. The choice of Kayamandi as one of the smallest and safest townships in the Western Cape, has been made by Sesolo Mello since they found a local partner in the Health Promoters SA on the one side - this provides a "safe" framework to work from and to potentially set-up a first pilot production. And on the other side, the representative balance of informal and formal settlements when comparing to Khayelitsha.

Apart from the relevant project locality, the demand to find a solution to the under chapter 1 described challenges related to paraffin and clean cooking, is and will be a major contribution for a sustainable development of these BOP communities. This also serves the current progress regarding the Sustainable Development Goals (SDGs).
This research aims to do a first socio-economic feasibility study on a holistic approach to implement liquid biofuels as a paraffin replacement in O markets, avoiding the aforementioned "state-of-the-art" common pitfalls. Even though targeted to be an intermediate solution, the potential Triple Top Line impact is surprising and could present a breakthrough innovation worth exploring.

2. Theoretical Framework

2.1. Composite project structure

Regarding the thesis from a broader perspective, it is part of a composite project between Sesolo Mello B.V., Roy Hendriks and myself. As portrayed in figure 7, the focus of my research and data collection is on sharpening the view on the value proposition, and assessing the socio-economic feasibility of the project idea through customer development. All in the light of weather Sesolo Mello will be able to avoid the common pitfalls of other clean cooking initiatives. Roy Hendriks then evaluates the technical feasibility and economic feasibility from a production point of view. Sesolo Mello B.V. expects to receive a good basis for decision making through these four research factors. Sesolo Mello agreed on providing all information and network necessary to conduct the research in the best possible way.

<table>
<tr><td colspan="4">Objective: establish if Sesolo Mello's approach can avoid the common pitfalls of clean cooking initiatives</td></tr>
<tr><td>Factor 1: Value Proposition (Bussmann)</td><td>Factor 2: Customer Validation (Bussmann)</td><td>Factor 3: Technical Feasibility (Hendriks)</td><td>Factor 4: Economic Feasibility (Hendriks)</td></tr>
<tr><td colspan="2">Thesis Bussmann</td><td colspan="2">Thesis Hendriks</td></tr>
</table>

Figure 7: Thesis structure and connection between research of Bussmann and Hendriks

2.2. Research objective

The thesis objective is to determine whether Sesolo Mello´s social entrepreneurial solution for paraffin replacement, is able to avoid the common pitfalls of the current clean cooking initiatives. The three main pitfalls described in chapter 1, are that solutions are often too expensive, are based on a lock-in nature linked with foreign design and require too much behavioral adaptation. In order to prove that these pitfalls can be circumvented, the first part of the assessment will focus on value proposition design, based on analyzing Sesolo Mello´s value proposition concept and running customer validation to validate assumptions and find a product – user fit, indicating the suitability for the Western Cape BOP markets. This will be followed by the technical and economic assessment of Roy Hendriks.

2.3. Main research question

In order to complete the composite project successfully and answer the defined research objective, a research question that covers all aspects of social feasibility related to the value proposition design is required. The scope of the research question still has to be clear enough to avoid vagueness (Suddaby et al., 2015). Moreover, due to the inductive nature of this research and the entrepreneurial approach of Sesolo Mello, the research scope must be sufficiently robust to allow unexpected adaptations and still deliver valid results.

Based on the thesis objective and the factor that will be researched, as well as the aforementioned basis - the main research question is formulated accordingly:

"What is the social[6] feasibility of introducing a biofuel[7] alternative to paraffin in townships of the Western Cape?"

This research question permits to answer the thesis objective based on conducting a value proposition design process. Whether the common pitfalls can be avoided in Sesolo Mellos approach, will thus be determined on the basis of social feasibility. If the results of this research are positive, this will indicate a commitment of potential customers to the approach and thus Sesolo Mello can go ahead on assessing technical and economic feasibility in the light of a successful avoidance of common pitfalls. If the results are negative, it is established whether Sesolo Mello enters the same pitfalls or whether it is due to other factors, that might be set as additional common pitfalls for new initiatives in the future. The thesis objective can be fulfilled in any case. This thesis research is conducted under the assumption that Sesolo Mello´s approach is technically and economically feasible, while not addressing the scalability of the model. This is necessary to test the assumptions and goals of Sesolo Mello´s business model during the customer validation. It requires though, that the technical and economic feasibility of the business model will be assessed by Roy Hendriks and/or Sesolo Mello B.V. since it is beyond the scope of this research.

This research question is based on a more specific sub-question. This sub-question will lead the author to answer relevant questions for customer validation. Culminating in the defined value proposition advice for Sesolo Mello B.V. Finally, this will answer the main research question.

[6] Based on criteria defined in chapter 1.3.1..

[7] Defined in accordance to Sesolo Mello´s liquid waste vegetable biofuel (see chapter 1).

2.3.1. Sub-question: Customer validation

"Does Sesolo Mello´s biofuel solve the customers jobs, pains and gains?[8]"

This question covers all relevant factors for customer validation and value proposition design. If answered positively, the main research question is not necessarily positive, but it shows that Sesolo Mello´s approach can work from a customer perspective. This is presented in a Value Proposition Canvas (VPC) and renewed Business Model Canvas (BMC). If answered negatively or partly negatively, it is established that Sesolo Mello´s approach or parts of it are perceived negatively by the customers and there is most likely no market for Sesolo Mello B.V. in Western Cape townships.

In order to answer this question, there is multiple smaller sub-questions, that lead to relevant questions in the interview design:

- Which customers use paraffin in the Western Cape? How do the personas look like?
- How do township inhabitants source/buy and use paraffin during the year?
- What are the jobs, township inhabitants have for fuels and for cooking, heating, lighting in general?
- How does paraffin use affect township inhabitants? And what factors are most important to them?
- What alternative technologies or products for cooking heating and lighting are township inhabitants using? Are they satisfied with it?
- How are township inhabitants reacting to alternative approaches, more specifically when confronted with Sesolo Mello´s direct biofuel alternative to paraffin?
- Would tuck- /spazashop owners adapt/source and sell a new alternative product?
- How would such a product need to be marketed (including packaging)?
- Do alternative solutions succeed already in the Western Cape context? If not, what does them stop from succeeding currently?

[8] Based on Value Proposition Design (Osterwalder, A. et al., 2013)

3. Methodology

The research questions will be addressed through qualitative research, namely semi-structured interviews and focus group research. These are structured in order to be presented in a value proposition canvas and business model canvas format. The format for interviews and focus group research are based on mixed methods from the IREPA approach, the MOM test and standard customer development methodology. As described in chapter 2, the inductive nature of the research and the entrepreneurial approach require the methodology to support the necessary flexibility. Thus, the methodology will be divided in three parts. Definition of terms, including descriptions and principles of Value Proposition Design and Business Model Canvas. The second part describes the qualitative research design, namely the choice of semi-structured interviews and focus group research, including condensed principles of the MOM test and IREPA[9]. The third part describes the work performed, in order to present an overview that enables the reader to better follow the approach conducted to generate the research results in the BOP context.

3.1. Definition of Terms

3.1.1. Value Proposition Design

A value proposition (VP) is a business or marketing statement that a company uses to summarize why a consumer should buy a product or use a service. This statement convinces a potential consumer that one particular product or service will add more value or better solve a problem than other similar offerings. Companies use this statement to target customers who will benefit most from using the company's products. The VP includes information from steps like identifying the relevant customer group/ persona and the testing of different assumptions in the customer validation. One tool to develop and display a VP is the Value Proposition Canvas by Alex Osterwalder et al. (2013). Basically, it is a tool to match "jobs"/tasks that a customer needs to have solved with a "product" and/or "service" that solves all "gains" and "pains" a customer currently experiences related to those jobs. It is about really understanding a potential customer segment/ "persona". Moreover, it aims to really understand how a customer is currently solving the challenge/jobs, and what competition products are currently out there. This job-solution fit is then called Value Proposition (see figure 8).

On a practical level and in the framework of this thesis there is some basic information and basic order that should be entered into the fields of the VPC – following a short explanation (Osterwalder, 2016), divided into the "right customer side":[10]

[9] This includes the underlying research paradigms for BOP markets.

[10] All these information per box, then should be ranked according to the relevance to the specific customer group. The overview does not expect to be complete, since there are always more questions, or better questions to ask – it provides a good start though.

- **"Customer Job(s)":** Description of what a specific customer segment wants to get done – when and where. This includes, tasks they might want to tackle or problems they want to solve. What are the specific functional tasks or specific functional problems they have. What are the specific social jobs, like e.g. gain of status, they want to get done? What are the emotional jobs, like e.g. security, they want to get done? What basic needs[11] do they want to get done?
  Moreover, there is multiple small jobs a customer performs to get the main job(s) done – these should be researched as good as possible.

- **"Gains":** Description of benefits a customer expects, wants or would be surprised by. Including social gains, cost savings, good emotions and social gains. More specifically one has to assess which savings would make the customer happy, what results a customer expects and what would be a cherry-add-on, how current solutions satisfy the customer in terms e.g. of quality, what solution would make the customers life easier and what positive social outcome does he/she desire. What are customers looking for and dream about, or measure success and failure? This is crucial to understand what would increase the likelihood to adopt your solution.

- **"Pains":** Description of undesired costs, situations, risks and negative emotions a "customer experiences or could experience before, during, and after getting the job done". This includes questions around what is too costly, makes the customer feel bad or how current solutions under-deliver for the customer. Moreover, there needs to be information around the main challenges and difficulties, customer experiences, as well as what negative social outcomes or risks he/she fears – what is keeping the customer awake at night? What are the common mistakes he/she makes and what are the common barriers preventing the customer from adopting solutions (which is strongly related to the under chapter 1 described common pitfalls).

[11] (McLeod, 2007): Maslow´s hierarchy of needs

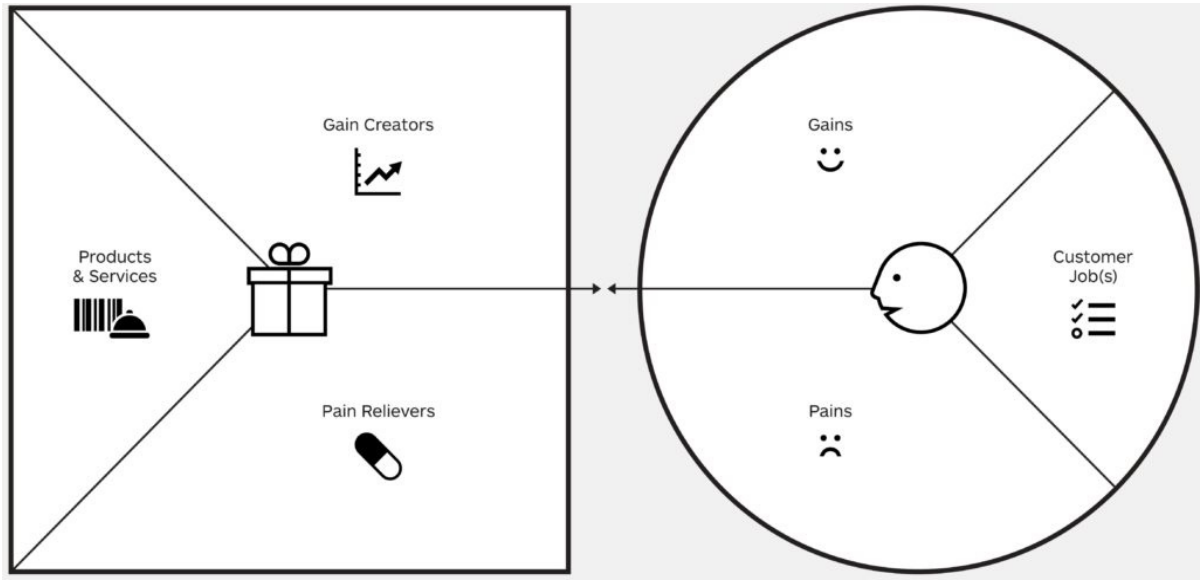


Figure 8: Value Proposition Canvas (Osterwalder et al., 2016)

…and the "left product/ service provider side" (Osterwalder, 2016; see figure 8):

- **"Products & Services":** Description of services and products, which the holistic value proposition is formed around. Basically, it defines what value you offer that help the customer to get the prior described functional, social and emotional job done – or satisfy the basic needs. Questions around which secondary products and services help the customer to be the "buyer" (e.g. compare, decide, buy), "co-creator" (individualize, co-design) or "transferrer" (e.g. product disposal, transfer). These products and services may be tangible, like for example Sesolo Mello´s liquid biofuel, digital/virtual like e-books, intangible as for example insurances and copyrights or financial as for example financing services.

- **"Pain Relievers":** Description of how products and services solve customer pains and eliminate negative emotions, undesired costs and situations, as well as risks the customer experiences, or could experience related to getting the job done. Do the solutions produce savings, make the customer feel better, fix under-satisfying solutions, solves difficulties and challenges he experiences or diminish social consequences and risks the customer fears. Does the solution help the customer sleep better at night and supports him eradicate mistakes he commonly makes and finally, does it reduce and eradicate the barriers that prevents the customer from adopting the solution(s)?

- **“Gain Creators”:** Description of how the products/services are able to create gains for the customer segment. How are expected benefits, desires including functional utility, social gains, positive emotions and cost savings generated by the solutions. Related questions should find out, whether the solution generates savings that satisfy the customer, produce outcomes that fulfills expectations or over-delivers on expectations. Moreover, it might copy successful current solutions, make the customers job/life easier and create positive social consequences for his desires. Does the solution match the things customers are dreaming about, or looking for while matching customers success and failure criteria? And finally, do they make the adoption easier for the persona?

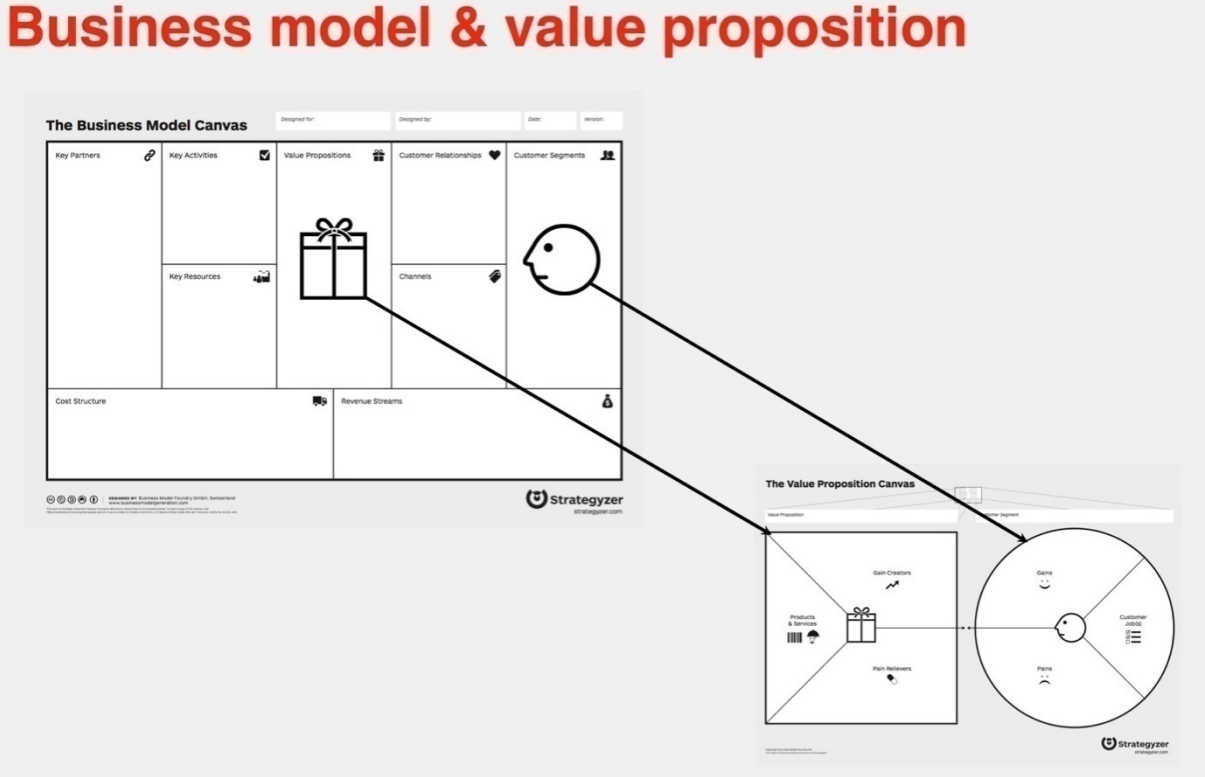


Figure 9: Connection between BMC and VPC (Osterwalder, 2016)

The Value Proposition Canvas can be understood as core of and a plugin to the Business Model Canvas (BMC), as portrayed in figure 9 where the customer is at the center of a successful business case. That´s why in the next chapter, the Business Model Canvas is explained in more detail to understand the holistic framework.

3.1.2. Business Model Canvas

Directly connected to, and partly based on the VPC, the BMC is described in this chapter. In order to develop the term business model, the definition of Kaplan (2012, p.18): "*A business model describes the rationale of how an organization creates, delivers, and captures value*" is adapted. This definition is taken one step further by Osterwalder & Pigneur (2013) who propose nine specific building blocks for business model creation. These blocks are the following: Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships and Cost Structure.

These blocks are also visually represented in the form of a canvas, called "Business Model Canvas" (BMC), as seen in figure 9 & 10. The way and the sequence that the "Business Model Canvas" is worked with, is to be decided by each user. Therefore, there is no specific method regarding the way the Canvas is developed (Doorneweert, B. & Lans, T., 2015).

Even though the canvas seems as a complete tool, each block has its own separate function and purpose. Their definition is given by Osterwalder&Pigneur (2013):

- Customer Segments: "the different groups of people or organizations an enterprise aims to reach and serve".
- Value Propositions: "the bundle of products and services that create value for a specific Customer Segment".
- Channels: "how a company communicates with and reaches its Customer Segments to deliver a Value Proposition".
- Customer Relationships: "the types of relationships a company establishes with specific Customer Segments".
- Revenue Streams: "the cash a company generates from each Customer Segment (costs must be subtracted from revenues to create earnings)".
- Key Resources: "the most important assets required to make a business model work".
- Key Activities: "the most important things a company must do to make its business model work".
- Key Partnerships/ Strategic partnerships: "the network of suppliers and partners that make the business model work".
- Cost Structure: "all costs incurred to operate a business model".

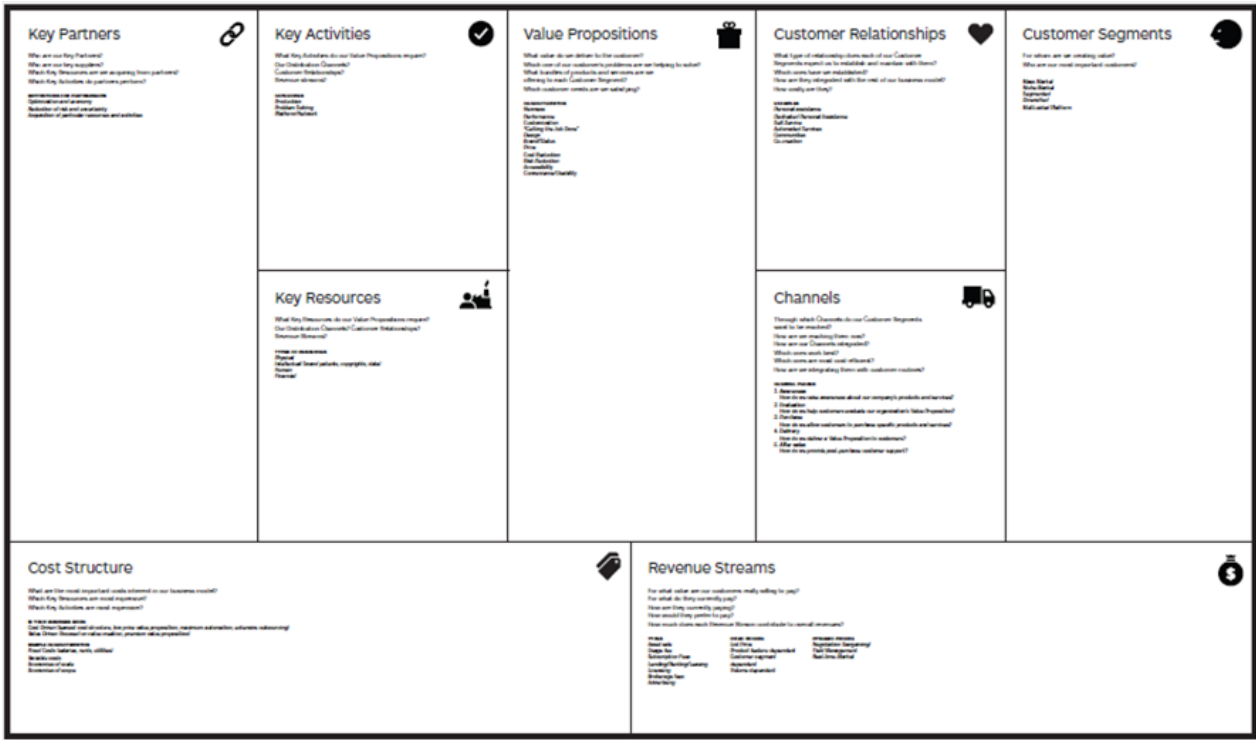


Figure 10: Business Model Canvas (Strategyzer, 2015)

The gathering of information, described in the previous chapter, necessary for developing a solid VPC and BMC and thus understanding a potential business case in every relevant detail, is often challenging, since for example founders are often biased and adapt their questions to the answers they want to hear – on the other hand customers often don´t like to give honest answers in case the wrong questions are asked (Fitzpatrick, R. (2013). To prevent this, during the research process the following chapter deals with principles of entrepreneurial qualitative research and describes the approach taken in this thesis.

From a sustainability perspective, the business model canvas, does not necessary include external factors as environmental, or social implications, neither does it present vision and mission. That´s why Alexandre Joyce developed the “triple layered business model canvas”, which presents a social and an environmental layer of the business case (Joyce, 2016). And Libes (2016) created the “business presentation pyramid”, adding purpose, opportunity, financial plan, immediate needs and competition to obtain a more holistic view of the business. Since the BMC is still the most established and widely spread tool, and the information necessary to answer all boxes of triple layered business model canvas or business presentation pyramid are out of the scope of this research, the BMC will serve the purpose of presenting the results obtained of the value proposition canvas.

3.2. Inductive Qualitative Research Design

3.2.1. Research paradigms in the light of entrepreneurial Value Proposition Design

Research paradigms consist of basic beliefs that deal with the reality and represent the world view that explains the nature of the world. There are recently two dominating research paradigms: positivism and interpretivism (Bryman & Bell, 2015; Klassen et. al, 2012). The positivism approach is external, independent and objective from the social reality. The role of the researcher is neutral and he should not be allowed to introduce his/her bias into the research (McNeill & Chapman, 2005). According to Klassen (2012), deductive logical inquiry is used to gather data. To generalize the findings to a whole population, data will be collected on large sample size in quantitative methods. Due to this reason, the quantitative approach is more reliable when repeated and quantifiable (McNeill & Chapman, 2005). Overall, the main focus of positivism is on facts, numbers, validity and generalizability using quantitative surveys and statistical techniques (Easterby-Smith et al., 2008). In contrast, an inductive, interpretive, qualitative research stance accepts that social reality is driven by human interests and it seeks to understand human experiences inductively and as a whole (Erikksson & Kovalainen, 2008). The basic assumption of interpretive research is that there is no single reality; instead multiple realities exist (Lincoln & Denzin, 2003). It assumes that human behavior cannot be understood objectively, but that people are rather subject to many influences such as feelings, perceptions, attitudes and behaviors (Crossan & Sorenti, 2002). Consequently, interpretive research helps to gain insight into individual lives in terms of their life-long experiences. In the words of Leedy and Ormrod (2005: 133): "this type of research focuses on the phenomenon which occurs in the natural setting and will also involve phenomena in all their complexities". In sum, positivism is based on realism ontology which assumes that observations are theory neutral and that generalizations of the observed can be made. Whereas, interpretivism is based on life-world ontology which assumes that the social world cannot be understood without subjective meanings of social reality (Lincoln & Denzin, 2003). These two philosophical schools are attached to two different types of research approaches: positivist to quantitative and interpretive to qualitative (Bryman, 2012).

According to Denzin and Lincoln (2011: 30): "the researcher approaches the world with a web of ideas and a framework (theory and ontology) that specify a set of questions (epistemology) that he or she examines in specific ways (methodology and analysis)". However, the choice of a particular stance regarding nature and knowledge of the world is based upon the research questions that are to be explored, the method of investigation and the nature and interpretation of the data gathered.

The ontological position argues that reality is not an objective phenomenon and that there are multiple realities (Denzin & Lincoln, 2011). Especially, when a researcher aims to study individuals' behavior and the social world in which they live, the assumption of critical realism (subjectivity) is that knowledge of the social world and individual behaviors are inevitably interpretive in nature rather than forthrightly representative (Frazer and Lacey, 1993). This is why this study is based on the ontological stance of realism, to best represent the inductive social entrepreneurial approach in the BOP market context. Thus, the intent to claim any objective observation or to present an objective prediction is out of the scope of my study. But since this research aims to provide an entrepreneurial advice on specific customer groups, to Sesolo Mello B.V. based on local circumstances, interpretive observations are relevant and important to answer the research questions and the VPC design questions posed in chapter 3.1.1.

My epistemological stance lies in social constructionism, which states that all knowledge produced is local, provisional and situation specific (Bryman and Bell, 2015). Grounded into the critical realism perspective, the findings of this research study may differ depending on the contextual factors under which data is collected and analyzed (Madill et al., 2000). In particular, when a researcher is engaged in social constructionism, it becomes inevitable to exclude personal and cultural views about the research and its impact on data collection and analysis. This can be a chance as well, since in the context of the townships of the Western Cape, the researcher can connect views from his European context and possible solution approaches with the local knowledge obtained. However, as explained in chapter 1, this presents another reason, why having the Health Promoters South Africa as local partner, and being supported by native (female) translators is so crucial to get a less biased view on the actual situation.

In accordance to the research questions posed and the inductive entrepreneurial approach, the adoption of a qualitative approach is best suited to obtain a contextual understanding of the issues under investigation. Due to experience of prior entrepreneurial projects, and an academic consultancy training at Wageningen University, the combination of semi-structured interviews and a focus group workshop design is chosen. The section below discusses the procedures and criteria adopted in interview and workshop design – followed by the criteria for recruitment of the sample.

3.2.2. The Mom Test & IREPA: Asking the right questions in the BOP context

As already described in the previous chapters, entrepreneurial research poses a big threat in the form of confirmation bias. Often an entrepreneur or researcher is asking questions in the wrong way, leading to false answers – a major factor is customers giving dishonest answers, since they do not want to disappoint the interviewer (Fitzpatrick, 2013). However, there is criteria for information acquisition and question design, that has proven quite successful in practical

entrepreneurial research: The Mom Test. Condensed in a book by Fitzpatrick, it establishes some relevant principles for this research:

The qualitative research focuses on multiple focal points consisting of what people say (their knowledge and understanding), what people do (their meaningful behavior), what people mean, need or desire (emotional drivers) and the culture within which people live (norms and codes). In order to establish a sufficient data-basis and be able to interpret the information, the right questions are key (Winkler et al., 2017).

According to Fitzpatrick (2013), questions should be asked about current or past behaviors/ actions in a qualitative way – this leads to more elaborate descriptions and the likelihood of an honest answer is high. Moreover, the researcher is able to obtain additional information, that might not have been intended to be obtained in the first place. Always avoid "would you and I formulations" as well as future assumptions. Some **example questions** (and their example effects; Fitzpatrick, 2013) are:

- How do you solve challenge now? (identify potential competitors or missing services/products)
- Why do you bother? (understand the customer´s values)
- What are the implications? (understand potential fears or risks)
- Talk me through the last time that happened. (identify current behavior and potential common mistakes in product usage)
- Talk me through your workflow. (identify potential for process improvement)
- What else have you tried? (identify potential competitors or missing services/products)
- Where does the money come from? (what is the customer able to pay)
- Who else should I talk to? (expansion of customer groups)
- Is there anything else I should have asked? (knowledge expansion)
- Why do you want that? How are you currently coping with the problem? (identify pains and gains)

Next to the quality of questions, it is important to assess the **level of commitment**, which is another indicator for honesty and real interest. This can be done through following example factors:

- time – clear next meeting, trial agreement
- reputation risk – intro peers to entrepreneur
- public testimonial
- cash – letter of intent

- pre-order
- deposit

In order to improve the conversations from time to time, this process should be understood as an iterative learning process. It includes prepping, researching questions well enough, doing a due-diligence and writing down assumptions about a person and validate them later; asking yourself what commitment you want to achieve, how one should show up in the meeting and how to write it down – or should one record it? - the focus is on emotions, problems, goals, workarounds, obstacles, ideas, requests, budgets, follow-up tasks and referenced persons. In the end the notes should be reviewed, the assumptions updated and the researcher has to ask oneself – how to improve and learn better next time (Fitzpatrick, 2013)?

More generally speaking the following **7 points of advice** are crucial to understand your customer segment (Doorneweert, B. & Lans, T., 2015):

1. focus on customers' issues, not your product
2. don't fish for compliments, ask hard questions
3. if they say it's a problem but they haven't attempted to solve it, it's not a problem
4. after each and every meeting potential customers should commit to the next steps
5. segmentation of who you want to reach where and how
6. you should be terrified of at least one question you are asking!
7. the only thing people love talking about more than themselves is their problems

In theory, you should then choose the segment that scores well for profitability, easy to reach and rewarding for you to build a business around. [12]

In case, you obtain too many new answers after a few meetings, it is time to redefine your customer group and narrow it down. If you don´t, this is a sign of a good understanding of the customer segments jobs, pains and gains and normally this is a good point to (re-)define your value proposition.

Summing it up, the best results are generated in a conversation, rather than an interview. That´s why even though in qualitative research terms, it has been labeled semi-structured interviews in this research – in practice the interviews have rather been conversations, leading to new conversations. The same character applies to the focus group workshop.

[12] Since this is a social entrepreneurial research project, these criteria add to the pre-defined social and environmental factors.

3.2.3. Sampling strategy for inductive research

This leads into the sampling strategy for relevant customer segments and interviewees and how to find out about them. In this research, the semi-structured interviews will lead through an explorative progress towards the suitable focus-group sample. In entrepreneurial research, the researcher/ entrepreneur is often trusting key informants, to lead to other relevant informants. The aim is to get as deep of an insight into the local context as possible before conducting a focus group workshop, through literature research, followed-by semi-structured interviews (conversations) with relevant stakeholders. Relevant stakeholders have been identified through a purposive sampling (Bryman, 2012) approach, in order to select for example local spaza-/ tuckshop owners to investigate the current trade structures and proposition of customers´ behavior regarding purchase amounts, labelling and packaging. It is a strategy to select those cases deliberately who can provide important information (Bryman, 2012). According to Patton (2002: 230) "the logic and power of purposeful sampling lies in selecting information-rich cases, from whom one can learn a great deal about issues central important to the purpose of the inquiry". Purposive sampling was used in a planned manner to select the information-rich sample cases/participants who could provide relevant information about the research questions raised in this study (Bryman, 2012). This is reflected in the present sample of shopkeepers (interviews: 5); social workers, ngo´s, entrepreneurs, government related informants (interviews: 13); and especially local female township inhabitants (focus group: 22). The interview sample size is based on the prior described "Mom Test"-criteria. In the inductive process, the information started repeating itself, until a sufficiently clear picture of the local context has been established to answer the research objective and prepare for the focus group workshop. Approaching the research from an interpretive perspective (Denzin & Lincoln, 2011), I was aware of the fact that the qualitative approach uses small samples with the aim to produce thick and rich descriptions (Miles and Huberman, 1994), instead of large samples that aim to generalize the findings (Bryman, 2012), which was not the intent of the study.

3.2.4. Semi-structured interviews in the BOP context

Based on IREPA (Winkler et al., 2017) and the described criteria and pre-requisites, the following factors are important for semi-structured interview design in the BOP context:

- dialog should be free to flow and keep space for individual knowledge and input
- information always should be cross-checked during the interview and between different interview partners
- the researcher needs to decide by his own what type of information source and method of data collection should be chosen at a specific location

Concerning the locality of conducting these conversations, there is a good option for the specific township context, there is the possibility of so-called transect-walks with key-informants and observations, which has been done with e.g. George Arrey in the Kayamandi township. These walks can give good information without the need for household members to spend a lot of time to give information during interviews. The questions during the walk are asked to a key informant who knows the local situation well enough to tell differences between different households and localities (Winkler et al., 2017). In this case this knowledge should be related to health, cooking, heating, lighting and township logistics. It is important to note, that the person chosen should be respected by the community in order not to disturb social hierarchies when these social interactions take place with a non-respected person (Bondreau et al. 2008). Due to safety reasons of carrying high-tech equipment in the township, only few interviews have been recorded with an audio recorder (Arrey, 2016). Thus, the interviews are not fully subscribed - the information is rather processed on the basis of the bullet-point summaries.

Next to the prior mentioned questions, the semi structured interviews and focus group workshop aim to establish information about:

- which customer segments use paraffin in the Western Cape;
- where and how customers source/buy and use paraffin during the year;
- how paraffin affects township inhabitants, and what is most important to them;
- what alternative technologies or products for cooking heating and lighting, township inhabitants are using and weather they are satisfied with it;
- what currently inhibits adoption of alternatives to paraffin;
- how tuck- and spazashop owners source and sell paraffin and alternative fuels;
- how paraffin is currently packaged - including product marketing and labelling;
- how potential customers and distributors react to and how they commit to Sesolo Mello´s alternative biofuel approach;

Based on the above described criteria and prerequisites, the interview guides for the semi-structured interviews can be found in Appendix A.

3.2.5. Focus group research in the light of BOP markets

IREPA (Winkler et al., 2017), defines group discussions and brainstorming as a method, that can be used by researchers together with homogenous and heterogeneous groups in BOP markets, to discuss local problems and constraints in order to implement bottom-up solutions.

According to IREPA, focus group discussions around a focal question - "How Cooking activities are currently performed in Kayamandi?" – can lead to a dynamic creative process, with many interactions. Often this saves time, combining valuable input and even generates deeper insights and knowledge than semi-structured interviews – which are in nature not that different apart from the sample size. A main potential pitfall is the quality of workshop moderation, which requires a thorough preparation. Due to limited local staff available, limited time to jointly prepare a workshop, and my prior experience in moderation, this research aims to conduct the focus group research from the perspective of a participative observer. Since as participative observer there is little to no time to take relevant notes. Thus, the workshop will be recorded with an audio recorder.

Besides creating innovative ideas, this workshop format also results in specific steps that should be executed in order to realize a Sesolo Mello´s pilot project in Kayamandi. Ideally, after this workshop the stakeholders show commitment and sign up on a list[13] as pilot customers to further participate in the feedback loop during Sesolo Mello´s product development.

The general concept of this workshop is to take all the stakeholders on a journey through the current cooking, heating and lighting situation in the Western Cape, along potential alternatives approaches leading to a brainstorming on a bottom-up design product. During the first half of the workshop the participants brainstorm out loud on their current cooking behaviors. During this process, where most likely many jobs, pains and gains around cooking emerge, the researcher will feed some information around healthy cooking into the brainstorming. This is due to the fact, that the Health Promoters South Africa do estimate, that many community members are not aware of the health implications of paraffin (Arrey, 2016), even though they are experiencing other pains or describe the health implications in other words. The detail of information, and wording depends on the pains being described during the first half – and the perceived readiness to brainstorm on alternative approaches in the second half. During the second half, the stakeholders will not be constrained by too many factors, such as time, money, resources etcetera, and will brainstorm on potential alternative approaches. This will enhance the creativity of the ideas that will be produced. The second half of this workshop requires the stakeholders to convert their jobs, pains and gains into reality and potential pain relievers, gain creators and products/services to let them decide upon the steps that need to be taken in order to achieve an alternative to paraffin – in case this is wanted by the participating community members. Following, the scientific value

[13] See Figure 17 (Sesolo Mello, 2016)

of focus group research and the general approach is shortly portrayed.[14]

According to Street (1997) workshops are one of the most useful tools that can be used for enhancement of stakeholder involvement. Their value and proven application on a sustainable local –and urban- scale has been highlighted by several studies (Andersen & Jaeger, 1999; Street 1997), while Weaver et al (2000) describe the use of stakeholder workshops for applications of sustainable technology development. However, it is essential to be mentioned that only one single workshop is not enough to engage an in-depth collaborative process; a workshop needs to be included in a bigger context of a participatory process and be combined with more stimuli, like interviews, as stated by Mayer (1997) - depending on the complexity of the research question. This is why the Kayamandi workshop needs to be carefully planned and combined by Sesolo Mello B.V. with other follow-up activities to establish a successful pilot project.

Due to (dr. ir.) Annemarie van Paassen – communication and workshop expert in the subdivision Knowledge Technology and Innovation of Wageningen University - on how to effectively engage potential participants, I decided that the approach of the workshop should be based on the concept of **Appreciative Inquiry (AI)**. According to Holman and Devane (1999), AI is "the cooperative search for the best in people, [...] and the whole world around them". The same authors present a four-dimensional (4-D) model of the AI cycle (see Figure 11) which is not a "formula" but more of a conceptual approach in the context of organization-change efforts.

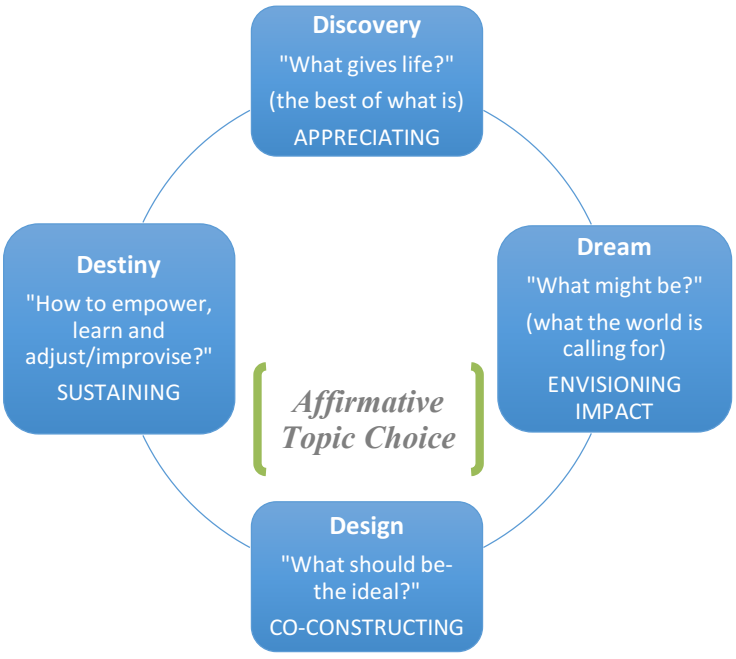


Figure 11: The Appreciative Inquiry 4-D Cycle (Holman & Devane, 1999)

[14] Based on E-ACT (Bussmann et al., 2014): "Towards a new business model for reintegration in combination with local food production in Zwolle, NL"

This workshop design approach is transferred into the BOP setting, based on the Mom Test and IREPA principles, e.g. around asking the right questions, described in the prior chapters.
The theory is applied in the so-called AI Organization Summit where most members of an organization (here community) are taking part in a strategic and collaborative process that aims in reaching consensus over a challenge. The Summit has been proven to be effective and it usually requires 4 days to complete -one day is devoted for each component of cycle- for a number from 50 to 2000 participants (Holman & Devane, 1999). However, a four-day workshop would not be a realistic option in Kayamandi and in the scope of this research, therefore the four components are presented in a very concise manner and be covered relatively quickly within a three-hour workshop. The general aspects of an AI Summit (Holman & Devane, 1999), are thus integrated. Based on the above described criteria and prerequisites, the workshop design can be found in Appendix A.

3.3. Description of work performed in South Africa

After thorough preparation and gaining access to relevant networks, while still at Wageningen University in the Netherlands, this chapter presents a basic summary of the activities performed and the results achieved during the 6-month time period in South Africa.
After arrival in Johannesburg, the first steps were related to re-activating and expanding the network in South Africa. This entailed visiting local townships and organizations which are working in townships, like Awethu, VulaVula and Thebe Ventures. There I conducted the first interviews and got first "real life" impressions apart from the information available in literature and input received upfront via Skype calls with local entrepreneurs and the Health Promoters South Africa. From there I travelled to Cape Town, since the decision has been made to conduct the project and main research h in the Western Cape. This was due to a good support network in Cape Town, many large townships and links to Stellenbosch University – where the Kayamandi township is located. After the big South African summer holiday in December, where barely any people are in offices and many township inhabitants move back to the "homelands", the task was to activate and expand the network in Cape Town and Stellenbosch as quickly as possible, meeting the Sustainability Institute in Stellenbosch, Dutch embassy in Cape Town, ECN, Lions Club and local/ international entrepreneurs, like Lumkani – local fire sensors for shacks, Green Diesel – Upcycling waste cooking oils to biodiesel, or Ackeem Ngwenya – Social Entrepreneur. Moreover, there has been contact with social entrepreneurship hubs like OPEN and the Philippi Village around Cape Town.

Figure 12: Awethu logo (Awethu, 2016)

Figure 13: Philippi Village logo (Philippi Village, 2016)

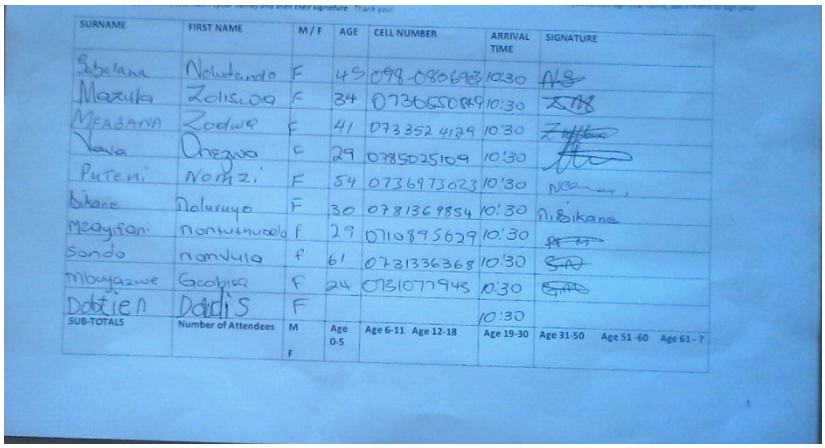
Here I could conduct further semi-structured interviews and found additional possible entry points to the townships. Especially, finding and gaining trust of a local partner organization in a township has been important. The network expansion appeared to be a natural process, where one contact lead to the next one and the information obtained from the conversations, narrowed down and repeated itself more and more. Luckily, I got to know the Clean Cooking Revolution and the Health Promoters South Africa who are active in the Stellenbosch township "Kayamandi" and "Khayelitsha". Kayamandi has approximately 30.000 inhabitants with a large formal part and informal part[15]. It is a relatively young township and due to its size, it presents a relatively safe work environment than e.g. Khayelitsha or Mitchells Plain. The Health Promoter CEO George Arrey is an experienced "social worker" and is well linked across townships around Cape Town. His guidance and mentorship has been a great help to get interviews done safely, understand the local environment better and prepare and co-organize the local focus group workshop. At this point George committed to do a focus group research with approximately 30 women in the community center on cooking practices and paraffin use, consumer behavior and willingness to test a new product. Moreover, he agreed on finding a group of 100 committed women who will extensively test Sesolo Mello´s product in the pilot phase. This potential long-term partnership with an established organization appeared to be a great opportunity for the start-up to get access to local townships. Furthermore, I started seeing George as senior advisor on paraffin distribution networks, since he ran a spazashop himself and has a vast network of other friends and entrepreneurs living in other Western Cape townships. This gave me relevant insider knowledge on the existing structures and consumer needs (Patton, 2002).

Figure 14: Clean Cooking Revolution logo (CCR, 2016)

Figure 15: Dutch Consulate General Cape Town logo (NL Consulate General, 2016)

Figure 16: Health Promoter SA headquarters and Legacy center (Sesolo Mello, 2016)

[15] Informal settlemens: Currently not accepted by local government – thus no infrastructure development



SURNAME	FIRST NAME	M / F	AGE	CELL NUMBER	ARRIVAL TIME	SIGNATURE
Sibelana	Nolutando	F	45	098-0806983	10:30	
Mazula	Zelisiwa	F	34	0736650849	10:30	
MEABANA	Zodwa	F	41	073352 4129	10:30	
Nava	Onezwa	F	29	0785025109	10:30	
Puteni	Nomzi	F	54	0736973023	10:30	
Sikane	Noluvuyo	F	30	0781369854	10:30	
Mzayiya	Nonwabiso	F	29	0710895629	10:30	
Sondo	Nomvula	F	61	0731336368	10:30	
Mbayazwe	Geobisa	F	24	0731077945	10:30	
Dabtien	Dadis	F			10:30	
SUB-TOTALS	Number of Attendees	M	Age 0-5	Age 6-11 Age 12-18	Age 19-30	Age 31-50 Age 51-60 Age 61-7
		F				

Figure 17: Excerpt of pilot customer list (Bussmann, 2016)

Thus, the main focus of research was on Kayamandi township - in agreement with Sesolo Mello, who managed to touch base in Stellenbosch/ Kayamandi. This allowed to narrow down and find a good scope to solve the research objective. At the Health Promoters hub, I could spend a lot of time and work in the local context. This is where I conducted the focus group research on paraffin usage and health awareness with 22 local women (since women are mostly responsible for household decisions and cooking). Moreover, I interviewed five tuckshop- and spazashop-owners in Kayamandi, who purchase and sell paraffin on a regular basis and who could give valuable insights on the market structures. While visiting the township regularly and obtaining more and more detailed information, I started to work out a more detailed value proposition around Sesolo Mello´s approach of using waste cooking oils as fuel alternative for cooking, heating and lighting. During the time in South Africa I managed to obtain my thesis research data and validate assumptions for a solid value proposition design. Following, the results of the performed activities are presented.

4. Results

This chapter has the objective of answering the sub-question of this thesis: *"**Does Sesolo Mello´s biofuel solve the customers jobs, pains and gains**?"* and the main research question: *"**What is the social feasibility of introducing a biofuel alternative to paraffin in townships of the Western Cape**?". It is thus divided into three parts: The qualitative research results[16] condensed in the Value Proposition Canvas. Followed by the integration of the VPC in the Business Model Canvas and explanation of the customer segment implications for the business model.*

Figure 18: Workshop start in the Health Promoter Headquarter (Sesolo Mello, 2016)

4.1. Value Proposition Canvas for Sesolo Mello approach

In order to keep a good overview, the relevant research results (jobs [j], pains [p], gains [g]; gain creators [gc], pain relievers [pr] and product/service propositions [ps]) utilized in the VPC are marked with the letters and numbers, that correlate with the numbers in figure 19. The numbers are not to be understood as ranking.

Through the semi-structured interviews and focus group research it could be validated, that paraffin users in the Kayamandi township are using paraffin on a regular basis. Moreover, the demand is depending on seasonal effects. They need higher quantities during winter, mainly due to heating related to bad insulation of shacks. Even though, prices should in theory be government regulated, the demand peaks have immediate effects on prices of available paraffin in the townships. In summer, the shop owners describe that they sell paraffin around 9-10 ZAR per liter, in winter prices may soar to around 15-16 ZAR[17] per liter. The so called "survivor" (Arrey, 2016) community women describe, that this results in cooking, heating and lighting being even less affordable. Thus, increasing the barriers of changing to alternative solutions even more. However, the price changes are better or

Figure 19: Promotional banner of Healther Promoters SA (Sesolo Mello, 2016)

[16] The more detailed summaries can be found in Appendix B.
[17] 16 ZAR equals approx. 1Euro (currency rate: January 2015)

worse depending on the location where paraffin is purchased. According to the Health Promoters, the worst conditions apply at suppliers that drive around the townships and supply small amounts for relatively high price – "the fuel is even often of a bad, impure quality standard" (Bussmann, 2016). The fuel purchased in local tuck-/spazashops is underlying little less price fluctuations, but at least the fuel quality is quite constant, since "customers will definitely come back, return bad quality products and demand refund" (Tuckshop owner #1, 2016). The lowest and more stable prices apply when driving to the next bigger stores outside or at the outer boundaries of the formal settlements – best is to buy paraffin in larger quantities. This is done by some women, who collectively go to these stores, or collectively place orders that are often realized together with local men/ taxi businesses. The products are then often purchased in larger quantities and divided between the customers. From a single community member perspective, products, especially paraffin are often purchased on a weekly or even daily basis in smaller quantities, since the pay-checks are often paid weekly, and the survivors struggle every day to fund their food and energy supply. Paraffin quantities consumed in a standard household of three to four community members is around 0,75-1 liter per day in summer and 1,5-2 liter in winter (see figure 1). In the formal settlements of Kayamandi around 1500 households utilize electricity for cooking, and lighting and use non-or little paraffin in summer. In winter, they still use around 0,75-1 liter per day. The approximately 4500 households, that use no electricity or only for lighting, consume around 0,75-1liter of paraffin a day. And 1,5-2 liters in winter respectively. This shows that cooking and heating are the main factors for paraffin consumption, especially since electricity is too expensive – cooking in summer – and cooking and heating in winter. George Array explained, that the demand in winter can be as much as three times higher than in summer. This is supported by other studies as well (Lam et al., 2012). Many women describe, that they are cooking only every three days in order to save on fuel – sometimes even together – this is mostly a cost question, but cooking together does represent cooking tradition from the homelands as well.

Table 1: State of electricity usage in Kayamandi (Health promoters, 2016; Clean Cooking Revolution, 2016)

Electricity usage in Kayamandi (formal part)	**Sum of households**	**Summer Paraffin [Liters] /hh/day**	**Winter Paraffin [Liters] /hh/day**
¼ is on full electricity	1500	none or little	~0,75-1l (heating)
½ electricity only for light	3000	~0,75- 1l	~1,5-2l
¼ has uses no electricity	1500	~0,75- 1l	~1,5-2l

The households without direct income often have around 300 ZAR per month from government allowance. This allows them to spend around 10 ZAR per day on energy and food. A new paraffin

stove, on average replaced every second year, costs around 120-200 ZAR. Buying new alternative stoves that easily cost double the price are thus often not affordable – even though the fuel might be cheaper in the long-run. Even in formal settlements, electricity is not always available, or the voltage is just not sufficient. In the informal parts, electricity is often obtained from formal part by connecting wires without permission. Sometimes there are agreements between neighbors, that distribute the electricity in an informal matter (Horbach, 2016). The difference between the poorest community members - "survivors" – and average community members in Kayamandi is, that the latter live in e.g. brick houses, take care of health and show interest in the Health Promoters. Cooking is treated as healthy as possible but cheap. The survivors on the other side, live in informal settlements, in the cheapest shacks with no insulation and little protection in the event of heavy rain events. For them everything depends on price – not about health or environment. Traditionally, women are mostly responsible for household and cooking decisions, so they need to instigate the buy of a product (Arrey, 2016).

On a practical level, when explaining the process of cooking, women describe that paraffin emits black smoke ("black pots") and children as well as adults have to cough. Many of the women are not aware of long-term health implications, and have been very interested in the information provided during the workshop – the education factor is something that is wished to be strengthened together with the Health Promoters.

The biggest problem, the women describe are shack fires due to stoves tipping over and related burn injuries. Moreover, it has been described quite detailed on how to store paraffin safely, so children do not drink it – however, transparent soft drink bottles are still often used as packaging material. The availability (winter shortages) and the high cost fluctuations of paraffin (number one complaint about paraffin – more important than health issues) were further issues described. During the workshop, many women were keen on finding an affordable, healthy alternative to paraffin and engaged with all their knowledge and imagination. This lead to 20 women signing up, and committing to be further involved in the education and pilot customer phase with Sesolo Mello – how many keep the commitment to test the fuel will depend on Sesolo Mello´s qualities in avoiding the common pitfalls. This shows the relevance of health, social and environmental challenges related to current cooking practices in the Kayamandi context. Based on all qualitative data collected, the following value proposition canvas[18] is completed. Based on the interviews and focus group attendees, the customer segment is narrowed down to following persona: Kayamandi Xhosa community woman between approximately 20 and 60 years, mother of at least one child, living as single or in a partnership. The differentiation between formal and informal settlements is currently not required, since responses on behavior did not differ significantly among the

[18] Due to reasons of presentability, it is split into two parts on the vertical axis.

connected customers – however, this has to be considered when applying results on other townships in the Western Cape.

Following the main selected aspects for the value proposition canvas are listed and elaborated on (see figure 19&20).

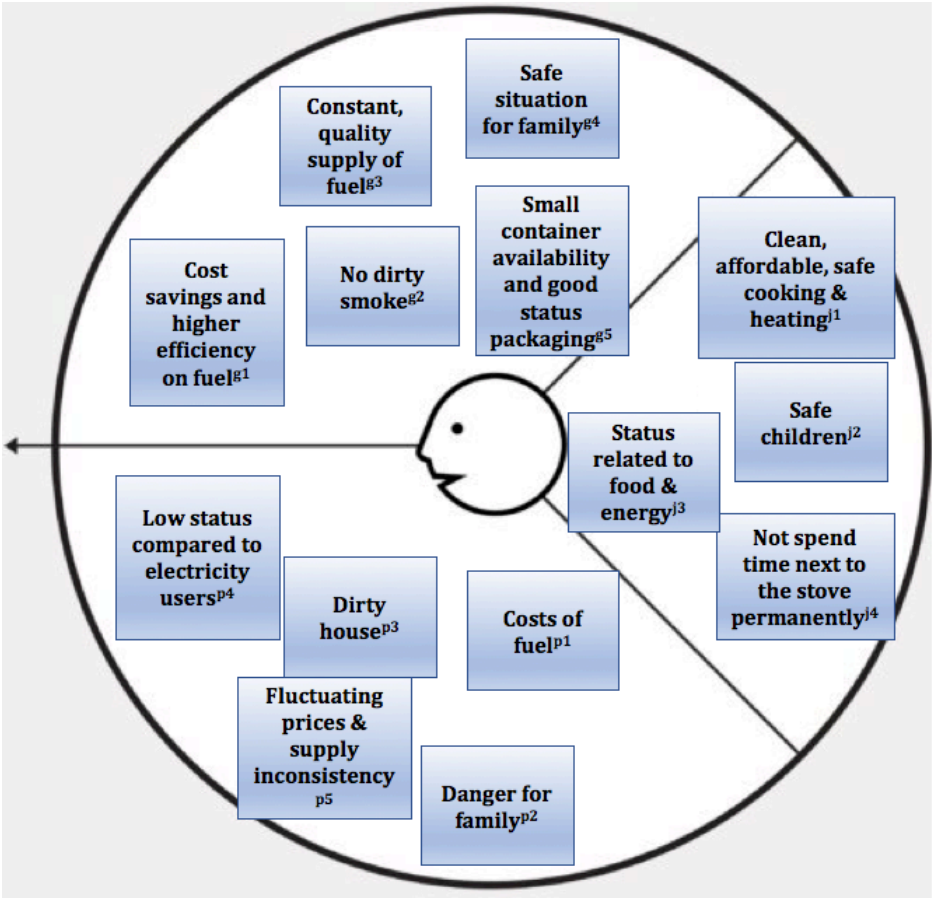


Figure 20: VPC – Jobs, Pains, Gains (modified by author, Osterwalder et al., 2014)

Jobs (j)

- 1: Desired by end-user - in the long-run modern stoves, powered by cheap electricity or gas. The main relevance is on cooking and heating, since they require most energy.
- 2: The user wants a safe product, that does not endanger their families, especially children anymore.
- 3: The user does not care about the environment or health that much, but increase in social status within the community is an important factor.
- 4: The user wants to be more flexible when it comes to household activities, especially cooking.

Pains (p)

- 1: Costs of energy match one of the largest expenditures and is barely affordable in winter time.

- 2: The user fears fires, poisoning, coughing, loss of property, not affordable energy and food.
- 3: A dirty house, black walls and pots are perceived as negative.
- 4: The user feels under-served through bad quality fuels, that are associated with poverty. Many community members look-up to electricity based technic and gas-powered devices.
- 5: Unpredictable, unfair treatment in the supply of fuel, a means to fulfill basic needs is a big service gap

Gains (g)

- 1: Everything revolves around a fair pricing strategy and fuel efficiency, that enables more degrees of freedom.
- 2: Having a clean home, is associated with a good feeling.
- 3: Security around fuel supply and quality, relieves day-to-day fears.
- 4: Security for the family, creates more freedom and reduces day-to-day fears associated with cooking, heating and lighting.
- 5: Suitable container sizes, safe containers, and well branded containers improve the customer experience on multiple layers. They create more flexibility, security and when marketed right (fuel bottles as well-known as e.g. coke in the township context) increase the status in the community.

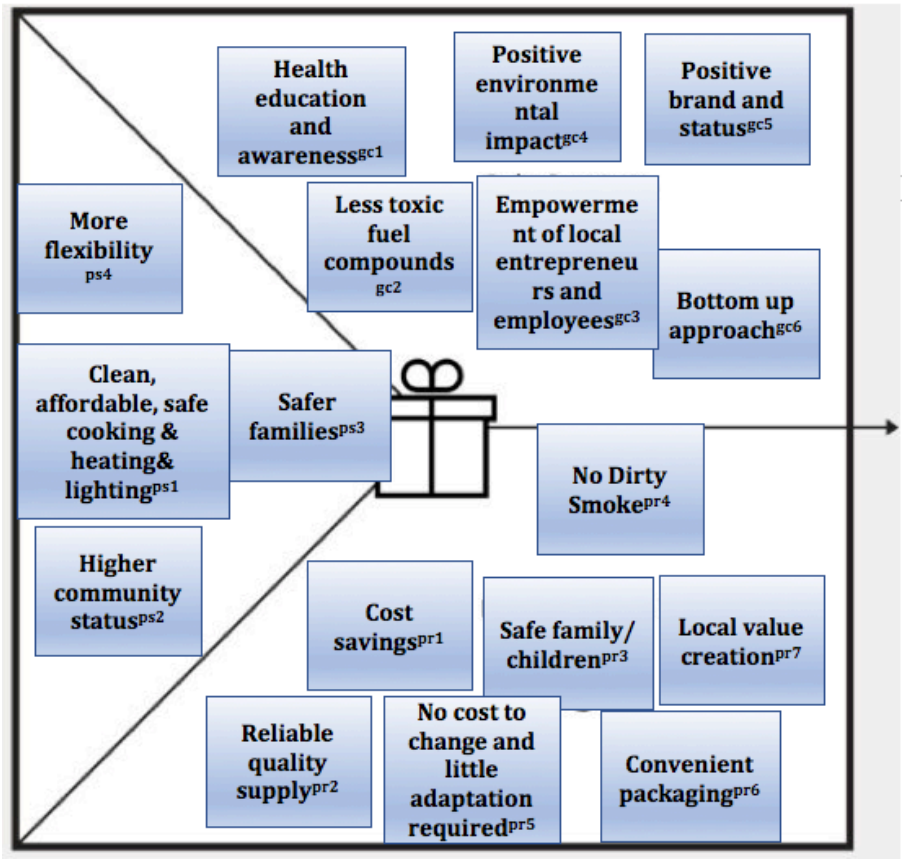


Figure 21: VPC – Products&Services, Pain Relievers, Gain Creators (modified by author, Osterwalder et al., 2014)

As seen in figure 19, the main pains, gains and customer jobs are explained. The pain relievers, gain creators around the products/ services try to match these customer expectations as good as possible, for Sesolo Mello to create a triple top layer value proposition.

Pain relievers (^{pr})

- 1: The fuel has to be cheaper, and more price stable.
- 2: The supply has to be constant in quality and reliable even during demand peaks.
- 3: Air pollution, risk of fire and risk of poisoning has to be reduced to a minimum – even though it won´t be as perfect as a gas- or electricity-powered solution.
- 4: The fuel can´t emit black smoke, that creates a dirty home, black walls or pots.
- 5: It is crucial to provide an easy to adopt, cheap solution, using existing channels and utilities to avoid reluctance to adopt and common pitfalls.
- 6: Packaging can solve, safety, flexibility and status issues.
- 7: As an indirect factor, local value creation will create more jobs and opportunities within the township.

Gain creators (^{gs})

- 1: Education provides an additional value to the community, that is perceived as positive and status increasing.
- 2: Good air quality will increase user's happiness and health (e.g. less coughing) in the longer run.
- 3: Job creation and opportunity creation plays a crucial role for socio-economic empowerment. The end-user will likely assign a positive value to this.
- 4: Even though not perceived relevant currently – it may portray a way to increase status when marketed as innovative "western" and quality product.
- 5: Increasing status through branding, is a big gain creator addressing the current under-serving and experienced dependence on a bad product.
- 6: Experience shows, that involving the users in the product design, will create more ownership and acceptance of a product.

Products/ Services (^{ps})

- 1: This is the set goal, targeting all jobs, pains and gains of the persona. Sesolo Mello aims to address clean, affordable and safe lighting as well, even though this does not appear to be a major pain.
- 2: Through the explained pain relievers, and gain creators Sesolo Mello aims to improve the perception and status of the customer segment within the township community.

- 3: Safety and health is at the core of Sesolo Mello´s activities. This will be delivered through the described mechanisms as well.
- 4: More flexibility in practical terms and economic terms is a great challenge to solve for the customer.

To summarize the results from the value proposition design process, the best possible product – user fit as intermediate solution, is to create a biofuel made from waste vegetable oil as a one to one replacement to paraffin. Especially important is, that the fuel has to work in the same cooking stove and lamps as paraffin, in order to allow cooking, heating and lighting with the same energy source. Moreover, existing supply chains can be utilized to establish reliable supply – a regulation on end-consumer prices has to be installed. Even though healthier, and more efficient per liter consumed, the fuel price per liter should still be cheaper than paraffin at all times of the year, and be less fluctuating over the seasons – this is a crucial point for validating the economic feasibility of the approach. Defined by Sesolo Mello, the fuel has to emit less harmful compounds, reducing health implications. From a customer point of view, it is more important to not experience "black smoke and pots", as well as coughing anymore. Moreover, a branded child-safe "container" packaging is desirable to reduce poisoning incidents and to prevent fuel mix-up along the supply chain while creating brand awareness. A specifically designed multi-use container is perceived to even create a positive social status for customers in the community. The value proposition design process appears to support the social feasibility of Sesolo Mello´s approach and positively answers the sub-research question.

4.1.1. Business Model Canvas for Sesolo Mello approach

The following business model canvas, designed by Sesolo Mello (2015) and modified based on the value proposition canvas input, that influences not only the "Customer Segments" and "Value Propositions", "Customer Relationships" boxes, but all other boxes as well. The aim to establish and maintain "Customer Relationships" through co-creation of the product with end-users. Additionally, a personal relationship with the retailers has to be developed and incentives to guarantee a stable price and good marketing can be achieved through a reward system. This BMC represents the current status and approach of Sesolo Mello. The validation, elaboration and analysis of the other "6 boxes" is out of the scope of this research and will be mostly conducted by Mr. Hendriks.

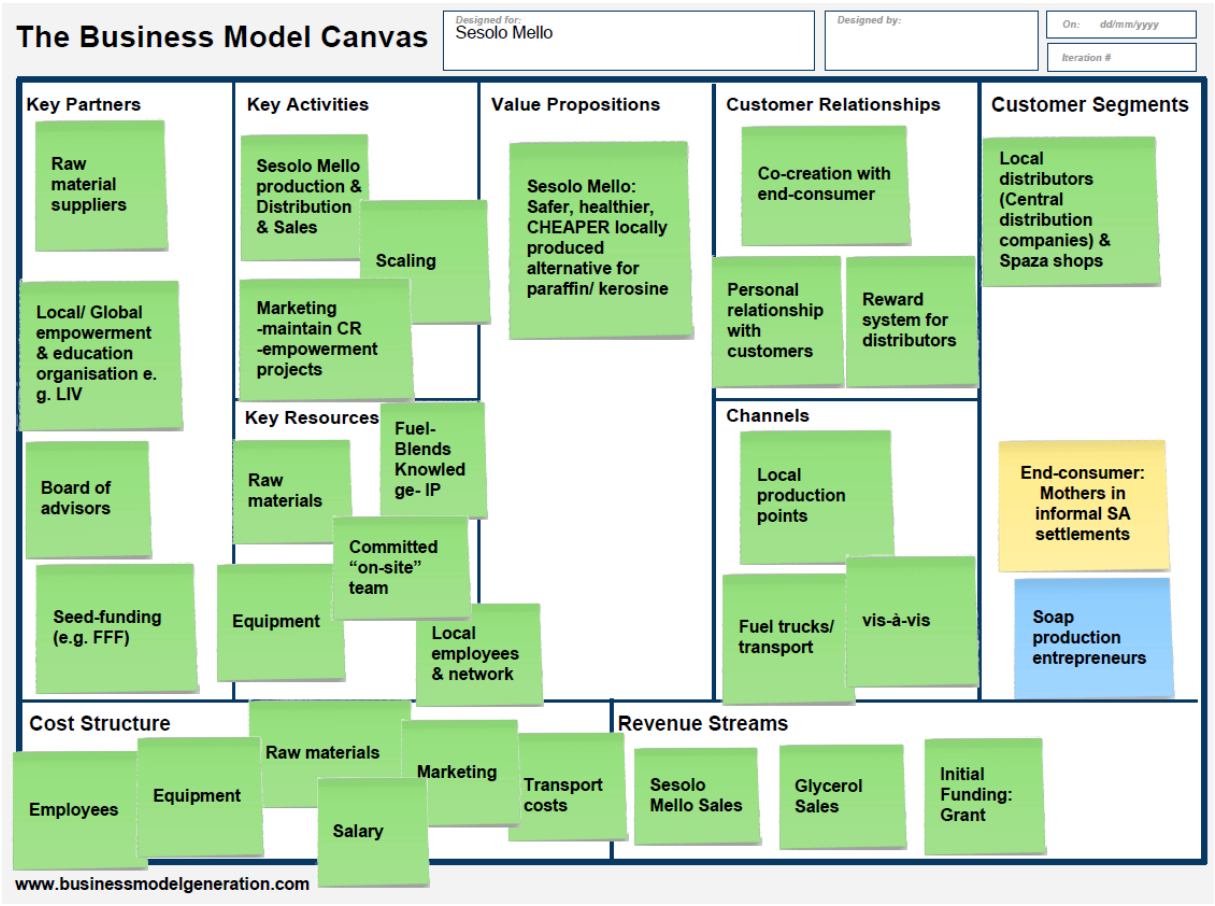


Figure 22: BMC of Sesolo Mello´s approach (modified by author, Sesolo Mello, 2015)

Sesolo Mello defines their "key resources" as intellectual property, the equipment and materials to produce the fuel, and a committed on-site team, including employees and a local support network.

"Key Activities", are currently identified as production, distribution, scaling and marketing – including empowerment projects (e.g. education). Sesolo Mello needs "Key Partners": its suppliers, supportive NGO's, a board of advisors, and providers of seed funding for the start-up phase. "Revenue Streams" will be generated by selling fuel and the by-product glycerol. In the start-up phase, grants can be considered a "Revenue Stream" as well. The "Cost Structure" comprises of labor costs, material, cost of equipment and resources, marketing and transport costs.

Even though, in the beginning Sesolo Mello will probably sell directly to the pilot end-consumers, these are not the main customers. Sesolo Mello set the goal to utilize as much of the existing distribution channels as possible, to decrease entrance barriers. Thus, the paying direct customer is the local distributor. However, since the jobs, pains and gains are related to the prior market segment and described persona - the end-user – the scope of the research is limited to this persona. Moreover, only when the solution appeals to the user, the distributor will show interest in purchasing the product.

4.2. Conclusion Value Proposition Design process and "social feasibility"

The chapter had the objective to answer the sub-question: *"Does Sesolo Mello´s biofuel solve the customers jobs, pains and gains?"* and the main research question: *"What is the social feasibility of introducing a biofuel alternative to paraffin in townships of the Western Cape?".*

In order to do this, the chapter has been divided in three parts. First the most important qualitative research results have been condensed into the value proposition canvas, grouping customers jobs, pains and gains – and matching pain relievers, gain creators into suitable services/ products. Followed by the integration and update of Sesolo Mello´s business model canvas, that now leaves the other 7 boxes around technical feasibility and economic feasibility open to be assessed. Concluding it can be said that Sesolo Mello´s value proposition has been successfully developed around addressing all relevant pains, gains and customer jobs in this customer segment. Thus, it can be concluded that the business model is feasible from a socio-economic perspective.

5. Discussion

This chapter will discuss the consequences of the presented results for the research objective and Sesolo Mello´s approach; as well as the relevance for theory and practice of other clean cooking initiatives.

5.1. Implications for thesis objective and Sesolo Mello´s approach

The results of assessing the social feasibility of Sesolo Mello's approach were clear: The customer jobs, pains and gains can be matched with adopted pain relievers, gain creators and according products/ services. The established Value Proposition Canvas and Business Model Canvas is based on the following product and related services:

"A biofuel made from waste vegetable oil as a one to one liquid fuel replacement to paraffin."

The presented results have implications on the objectives of this research as well as on Sesolo Mello´s approach. The objective was *" …to determine whether Sesolo Mello´s social entrepreneurial solution for paraffin replacement, is able to avoid the common pitfalls of the current clean cooking initiatives."*.

The results and answers to the main- and sub- research question implies that Sesolo Mello might be able to avoid the common pitfalls, if technical and economic feasibility is validated successfully. Following the implications of the social feasibility on the main three pitfalls is discussed:

- **Solutions are often too expensive**

As shown in the results, customers mainly want three things when it comes to fuel sources. A low energy price in general, supply security and price stability (Tait et al., 2013). With Sesolo Mello´s sustainability approach to business, these topics will be a core perspective in the business model and be guaranteed. This means, the price needs to be the same as the lowest paraffin prices, or if feasible – cheaper. This can only be guaranteed if local feedstock and distribution partners are reliable and committed. If this is not the case, Sesolo Mello would be forced to introduce own distribution channels. However, introducing competitive elements in township structures has proven difficult, according to Neves & du Toit (2012) who describe events of violence against Somali traders that tried to take a market share in tuck- and spazashops.

Based on a first interview with Green Diesel in the Cape Town area, potential risks for fluctuating waste vegetable oil prices arose:

"It has become more expensive for us to get waste cooking oil. Because of the weak rand (ZAR) much is exported to Germany and other countries. Then they make biodiesel from it over there." (Watermann, 2016).

This should be further evaluated. Sesolo Mello still needs to Still, if Sesolo Mello´s approach does work technically, there will very likely be a way to partner with local waste vegetable producers, to ensure economic feasibility and price stability.
Thus, it can be concluded, that if these questions of technical and economic feasibility are answered, from a customer perspective the solution is competitive to paraffin and more easily accepted, then alternative cook stoves.

- **Solutions are often based on a lock-in nature linked with foreign design**

Opposed to other clean cooking initiatives, where often stove and fuel is exchanged. Customers can always switch back to paraffin, without having lost the initial investment for an expensive stove. Thus, in case Sesolo Mello does not manage to deliver the defined value propositions or customers have other reasons for switching back, they can utilize the same stove. Again, under the assumption, that the technical feasibility is rated positively.

- **Solutions require too much behavioral adaptation**

Customers do not need to change their stoves; thus, they do not need to adapt to a new stove. The only thing they have to adopt to, is a more efficient and less hot fuel combustion (Bedouet, 2015). The focus group workshop showed, that slow cooking is a common practice, which is supported by the fuel properties (Bussmann, 2016). Moreover, the adoption willingness is supported by a competitive fuel pricing as well as access to the fuel via the same distribution channels customers are used to (Sesolo Mello, 2015). This means that customers do not have to change their habits to obtain the product – nor invest in the change. However, customers might even be interested in changing their behavior related to adopting to new, safer packaging materials. This is an opportunity for a co-creating process between Sesolo Mello and the local community.
Based on research of Tait et al. (2013) and the obtained results from Kayamandi, the little adaptation required, might be one of the most convincing arguments of Sesolo Mello´s approach. Thus, supporting another avoided pitfall of other clean cooking initiatives.
Concluding, based on the Kayamandi situation, Sesolo Mello will most likely be able to convince their customers and avoid the common pitfalls of clean cooking initiatives. As long as they keep up to their promises and deliver the described value proposition.

Comparing the results of the study to the 8 pre-defined criteria, one can say that:

"Criteria I. Embrace local community and validate willingness to change" - can be rated positive, based on the acceptance of Sesolo Mello founders, supporter and approach in Kayamandi.

"Criteria II. Avoid high price of products/ opportunity costs" - has to be proven from a technical and economic perspective. Avoidance of high opportunity costs to purchase a stove - can be rated positive.

"Criteria III. Avoid lock-in nature" - can be rated positive.

"Criteria IV. Offer participatory opportunities" – can be rated positive, through Sesolo Mellos bottom-up approach and opportunities in co-creation on for example packaging design.

"Criteria V. Utilize familiar technology" –can be rated positive due to little required change in behavior.

"Criteria VI. Make sure there is local value creation" – can be rated positive based on Sesolo Mello´s decentralized, local production approach and opportunities in local Spin-Off´s.

"Criteria VII. Make sure there is no negative environmental impact derived from bio-fuel production, supply and consumption" – can be rated positive based on Bedouet (2015), but has to be validated further after the technical feasibility has been proven.

"Criteria VIII. Make sure the health risks of consuming the bio-fuel alternative are at least 75% reduced when comparing to paraffin[19] - can be rated positive based on Bedouet (2015), at least related to household emissions. The positively influenced fire (higher ignition temperatures) and poisoning risk (new packaging) has to be assessed by an external organization.

Concluding, eight out of eight pre-defined criteria can be matched by Sesolo Mello´s approach, as long as technical and economic feasibility is guaranteed. Based on the current knowledge base, six out of eight criteria can be rated fully positive and two out of eight require additional measurement and validation.

Based on the research objective, it can be established that the social feasibility for Sesolo Mello´s approach is give, and the common pitfalls can be avoided. At least in the context of the Kayamandi township in the Western Cape, South Africa.

[19] In regard to shack fires, ingestion and indoor air pollution

5.2. Relevance of results

Chapter 5.2, addresses the relevance of the results for the qualitative research and Value Proposition Design in the BOP market context. Moreover, for theory and praxis of other clean cooking initiatives.

This research and Sesolo Mello, show that there is keen interest of BOP communities to collaborate and co-create to develop solutions for the paraffin problematic. This might be a sign, that there is potential for other, not cooking related, challenges as well. The communities should be taken seriously and a product-user fit should be created together, rather than aggressively marketing solutions, that somebody "foreign" thinks are necessary and might not offer the requested user experience (Example of MimiMoto opposed to Clean Cooking Revolution; Arrey 2016).

This shows the importance of emotional and qualitative inquiry as well, rather than quantitative measurements (of course this is not mutually exclusive) (Winkler, 2017).

Moreover, there appears to be a lack of understanding and/or interest of the importance and potential impact of adapted packaging solutions. Not only from the perspective of packaging safety (Tait et al., 2013), but from a customer experience point of view. This does apply for alternative fuels, but will be transferrable to other consumables as well. Customers at the Bottom of the Pyramid, at least in the Western Cape context, often purchase their consumables on a day to day basis – in smaller quanitities (Health Promoters SA, 2016). This offers opportunities for co-creation and new business models and should be further explored by Sesolo Mello and/or other stakeholders. Moreover, Sesolo Mello´s approach offers a new perspective on the importance to, sometimes, develop blunt and simple solutions – rather than overcomplicated ones.

From a qualitative research perspective, the results of the study cannot be generalized, but the mixed methods applied, can create a new point of view for other initiatives aiming to work in BOP markets. For actors targeting BOP markets, the customer focus should be as important as it is in entrepreneurial ventures in e.g. Europe – User experience appears to be key to acceptance and success. Even though, many large corporates like Unilever are doing in depths studies on the hidden potential of BOP markets; serving customers jobs, pains and gains should be even more at the core (UCT Unilever Institute, 2015). However, social, environmental and economic sustainability should be considered in any new venture, be it in the BOP context or not – that is what value add stands for, and what poses immense challenges to social entrepreneurs competing with more conservative paradigms (McDonough & Braungart, 2002).

6. Conclusions

This section aims to conclude results of the discussion, by adding limitations and finally deliver recommendations for research in general and Sesolo Mello´s next steps specifically.

6.1. Limitations

The scope of this research is focused on the South African context, more specifically on the Kayamandi township in the Western Cape. Thus, there is a geographical limitation, when aiming to transfer the developed model to other settings (e.g. other cultural background). Moreover, there is a limitation in regard to the research methodology. Since the researcher and the team of Sesolo Mello are white Europeans in a predominantly black South African setting, parts of the results might be biased. It has been tried to avoid this through cooperation with locally accepted people to translate and connect. However, it is unlikely, that my presence did not have an effect on answers given. Thus, this research can be seen as a basis to decide on a good research methodology approach and try to avoid, not only the common pitfalls, but the limitation pitfalls in this research approach.

Due to the limitations in physical mobility within the township, it has been difficult to conduct many interviews. Even though, the specific amount of customer contacts, required to validate assumptions is discussed controversially (Doorneweert & Lans, 2015.; Fitzpatrick, 2013). The sample of 22 workshop participants, 13 other relevant stakeholders and 5 tuck-/spazashop owners might be too small – especially when aiming to conclude for other Western Cape townships, there needs to be additional interviews and focus group workshops. However, the density of repeating answers has shown, that the narrow view on the market segment has been correct. Moreover, many of the collected results have been matched with existing literature, e.g. done by Tait et al. (2013), who conducted extensive research on paraffin in the South African context. Still, the data obtained from the study design - qualitative inductive research – will be hard to replicate; apart from speaking with the same people. And even then, due to the personal influence on the interview/ conversation situation another researcher will most likely not be able to obtain the same results. This poses an important question for entrepreneurial research and the inherent conflict of inductive, intuitive data processing - and a systematic and reproducible way.

The inherent nature of this entrepreneurial research together with Sesolo Mello and Roy Hendriks; and the realistic scope of this master thesis; limited the data collection and conclusion to customer validation and VP design around one identified customer segment. It would have been beneficial to test the biofuel assumptions on a broader level; with more and other potential customers (e.g. like industry, using paraffin for industrial heating processes). Moreover, it has proved difficult, to assess social feasibility, without doing own validation on technical feasibility, and only being able to do limited validation from an economic perspective. Nevertheless, this

might have been a positive opportunity, to co-create with users – without being biased by a larger knowledge base on what is possible and what is not.

6.1. Recommendations

A key take-away, of this close collaboration work between a social entrepreneurial venture like Sesolo Mello B.V. and the research project, shows the potential and maybe the responsibility of research and business to collaborate together with local communities to solve local challenges. This supports the conclusions drawn in this thesis, even more. Goal should be to respect and understand the BOP communities as eye-level-partner, in developing new solutions and business models to solve socio-economic and environmental challenges. The same goes for other clean cooking initiatives, that still often fall into the common pitfalls. And who knows, when listening closely, there might be solutions, products and mind-sets worth transferrin to the "developed world". Moreover, from a Western European perspective, I can't perceive how the living conditions in the formal and informal townships can still be that bad; while across the road there is vine yards, luxury hotels and art exhibitions on a Western European level. There is a strong necessity to challenge the South African government to work on solutions, especially related to sanitation, electricity and poverty relief/ economic empowerment. My impression was, that through gentrification, the informal settlements are rather growing then shrinking. This should be something to consider as well, from the viewpoint of a clean cooking initiative – and this does require to integrate an approach of local empowerment, as Sesolo Mello does (Klemz et al. 2006).

Figure 23: Jacob and Nonzame at the end of the workshop (Bussmann, 2016)

It could be established that Sesolo Mello´s value proposition will not require too much behavioral change, will not be too expensive and does not establish a lock-in. However, the scope of this research has not been on technical and economic feasibility and scalability, it is required to test the assumptions and business model in this light. This entails re-validating the avoidance of the common pitfalls and pre-defined criteria.

Further research is required, especially in a broader Western Cape context – in case the expansion of the concept to these areas is planned. Concrete research questions could be:

- In how far can the state be mobilized in order to tackle the clean cooking issues?
- If paraffin can´t be replaced, what can be done to mitigate risks in the short-term?
- Realization of health implications and sense of urgency – versus costs of change?

- Include Haddon´s Matrix on injury prevention, when comparing alternative fuel sources & cooking appliances in qualitative research, in order to compare potential interventions with existing risks and potential pitfalls (Deljavan et. Al., 2012).
- How to avoid confirmation bias as foreign initiative in a local context?

A second direction of research, not only related to paraffin appears to be intriguing as well. Questions arising during the research process are:

- What is the impact of culture and traditions on product design, how can it be utilized from a local entrepreneurial perspective.
- How would the facilitation of local think-tanks and entrepreneurship centers to drive bottom-up innovation be perceived in developing countries? Is there a required order – poverty relief before innovation?
- Qualitative vs quantitative research in customer development and market research?

In Sesolo Mello´s case, not only the technical, economic and environmental feasibility should be further pursued, but other personas in a broader Western Cape context. The potential for “cash-cow” market opportunities, like in industrial sectors, should be explored, to be more financially independent on feedstock partners in creating real value on a township level.

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Appendix

A. Collected Data

1.1. Interview & Focus Group Design

This appendix includes all interview[20] and focus group formats that were applied to obtain data. The tuck-/spazashop interviews and the focus group research have been conducted together with George Arrey and Amenda Mfenyana (Health Promoters South Africa) in order translate questions into Xhlosa and reduce language barriers. Interview content has been written down in bullet points and partly been recorded[21].

1.1.1.A semi-structured interview format for philantrophical/social workers, (social) entrepreneurs and diplomats

Interview time: approximately 20-30 minutes

- What do you like about South Africa and what don't you like?
- How long are you/ have you been living here?
- How do your experiences with BOP markets/ South African townships/ townships in the Western Cape look like?
- What are the challenges related to townships - you experienced/ got to know off in the past?
- What do you know about clean cooking/paraffin?
- What other initiatives do you know that are working on poverty alleviation, sanitation, energy and clean cooking? How did you experience their work?
- What challenges of working in townships did you experience in the past and what should one do/not do?
- How do you perceive the township handling by the SA government?
- Who would be a person good to talk to about this topic?

[20] Interview questions have been designed in accordance with to The Mom Test (Fitzpatrick, 2013)
[21] Recording, as well as taking pictures has not always been possible, since it is not always safe to take valuable equipment into the township.

1.1.2.A semi-structured interview format for spaza-/ tuckshop owners

Interview time: approximately 15-20 minutes

- What are the products sold most in your shop?
- How does your relationship with the customers look like?
- How does your contact with other shop owners and retailers look like?
- What are challenges you experienced and experience in Kayamandi/ Khayelitsha?
- How does your experience with paraffin look like?
- How do you get your paraffin?
- How often do you get new paraffin?
- In the last year, what was the lowest, highest and average price you paid per liter of paraffin? And sold it for?
- What is your busiest month and calmest for paraffin sales?
- How many liters of paraffin do you sell in your shop per week?
- What is the average amount of paraffin that your customers buy per purchase?
- What is the male/female ratio of your customers buying paraffin?
- Did you ever have someone steal paraffin from you? If so, how many times has this happened?
- Are you obligated to purchase paraffin from specific traders, or are you free to choose?
- Who would be a good person to talk to about paraffin sales?

1.1.3.A focus group format for community members in Kayamandi

Workshop time: max. 4 hours
Participants: approx. 20 stakeholders

Facilitators: 3 (George and Amanda of Health Promoters SA & Jacob for Sesolo Mello)

General workshop structure:

First half:

- Introduction and "get-to-know", which makes the structure and expectations very clear
- Open brainstorming on current cooking behaviors
- Discussion around challenges (with jobs, pains and gains in mind)
- Researcher feeds some missing information around healthy cooking into the brainstorming (information density, depending on previous discussion)

15-minute break with informal chat and some beverages and snacks provided.

Second half (during the second half the group will be split in two for more effective idea development – George and Amanda will respectively supervise the groups and take relevant notes additional to Jacobs notes and the recording):

- Brainstorming on potential alternative approaches (converting jobs, pains and gains into reality and potential pain relievers, gain creators and products/services to let them decide upon the steps that need to be taken in order to achieve an alternative to paraffin)
- Summarizing the results and presenting Sesolo Mello´s approach
- Do a feedback round on the complete discussion and open opportunity to participate in co-creating the product and testing it (including a subscription list, with all data required to get in touch – this is facilitated by Health Promoters SA as well)

Materials required:

Purpose	**Materials**
General	- 4 tables for stakeholders - 23 chairs
Introductory presentation on success cases	- Powerpoint presentation/ flipchart presentation
Assignments stakeholders groups	- Flipchart outlining the general structure of the workshop - Markers - Pencils - Sketch paper - Award for the group with the best idea

1.2. Summaries of interviews & focus group

This appendix presents the summaries of data obtained during interviews and focus group research.

1.2.1. Summaries of semi-structured interviews philantrophical/social workers, (social) entrepreneurs, diplomats

Interview Summary Owen Muzambi - Awethu (Johannesburg, 3rd December 15)

Awethu is a South African organization based in Johannesburg which incubates local entrepreneurs among others township based ventures. Owen Muzambi lives in the Alexandra township himself and has a leading role in the Awethu Schools Entrepreneurs project. Owen Muzambi suggested to talk to VulaVula during my stay in Johannesburg.

Muzambi describes the recent positive developments towards more entrepreneurs and especially younger entrepreneurial minds born in townships. He connects this development to a mind-set shift of young township inhabitants and the growing mentoring and financial support through organizations like Awethu. Moreover, he mentions that the better access to information via the internet plays an important role in this development. Concerning paraffin use and awareness of health implications he describes that his family used a paraffin cook stove for cooking and heating for a long time until his youth, until they switched to electricity based cooking due to availability and better family income through his own growing contribution. He describes that his mother has always been responsible for purchasing paraffin and cooking food. His mother still sometimes uses paraffin for heating during winter months. Moreover, he describes that the family did not talk about health implications, but that due to the indoor cooking and a lot of black smoke he had to cough sometimes and the pots and walls were black.

Interview Tony Malgas – VulaVula (Johannesburg, 5th December 15)

VulaVula is a company based in Johannesburg suburb "Braamfontain". They provide in depth market research for their customers and are specialized on performing focus group research and in-depth-interviews in township settings, since most of their employees do live themselves in those areas.

Tony Malgas

- Stresses importance of local employees for focus group research due to language barriers, "black and white prejudices" resulting in trust issues
- describes paraffin as an issue affecting many inhabitants
- describes that there is not really an affordable alternative
- describes that he personally is using electricity cooking

Interview Huub van Zwieten – Clean cooking revolution (Cape Town, 10th January 16)

The clean cooking revolution is a start-up founded end of 2015 by the dutch entrepreneur Huub van Zwieten. They focus on replacing paraffin stoves by wood pellet stoves starting in the Western Cape. After the interview, he connected me to Philippi Village, Western Cape.

- Believes that a change away from paraffin is necessary and that people are ready for it.
- Employs local women as independent entrepreneurs (so called "Clean cooking angels") in order to spread the word and sell the wood pellet stoves.
- Describes social entrepreneurship as value creation through empowering people and describes it as a better development tool than classical giveaway approaches.
- Runs a crowd-funding campaign in Europe to subsidize new stoves.
- Aims to generate profits on selling wood pellets as fuel for the stoves.
- Works with many local stakeholders, like restaurants and wine farmers in the region to sponsor stoves for their employees.
- The Alliance for Clean Cook stoves is apparently going to give away many clean cook stoves during 2016/17 but he does not know details of what stoves, where and when.

Interview George Arrey – CEO Health Promoters (Stellenbosch, 21st January 2016)

Health Promotion South Africa Trust is a non-profit organization providing information and training in health and hygiene to prevent illness in the townships of Southern Africa. The health promoters are hosting workshops in different Western Cape townships, especially the Kayamandi township, where their headquarters are located.
George in the function as CEO of Health Promoters committed to host my focus group research with approximately 30 women in the community center on the 14th February on paraffin, consumer behavior and willingness to test alternatives. I am seeing George as an expert on local paraffin channels, since he ran a spazashop himself and has a vast network of other friends and entrepreneurs living in townships. He believes that a one by one replacement is a better approach than changing stoves. In the very beginning George offered safety concerns and insisted, that I should only walk in the township are together with him. Moreover, I was advised to not carry any valuable materials.

- Townships have never been meant to be a place for proper settlement, during the apartheid it was meant for men who would come for five year contracts from the eastern cape to work in the western cape. Woman haven't been allowed to live there, but stayed in the eastern cape to do farming etcetera. Municipalities partly still see it in the old way, thus not adapting the settlements for family's needs.

- At the same time the townships are growing, these growing parts are the informal settlements which are not designated by the municipalities /government. Thus there will be no infrastructure until there is a new law in place.
- In general, older parts in townships are more developed. In Khayelitscha you can see the roll-over effect (gentrification) of growing cape town.
- Newly built, designated township areas are well developed from the beginning including infrastructure solar geysers etcetera.
- At the same time in the developed parts, people started using electricity or some time gas for cooking and lighting, while they are still using paraffin in the winter for heating (in the normal paraffin stoves), because electricity is too expensive.
- Moreover, electricity is not available in unlimited amounts, many people just simply don't have the voltage or whatever to run a fridge, washing machine etcetera PLUS it is too expensive
- Electricity prices went up by 15% lately!
- So these people using electricity for cooking still need paraffin for heating in the winter...
- Coming to the amounts people use in Kayamandi (formal part)
    - 24000 people
    - 6-7k households

Electricity status	Sum households	Summer Paraffin [Liters] /hh/day	Winter Paraffin [Liters] /hh/day
¼ is on full electricity	1500	None or little	~0,75-1l (heating)
½ electricity for light	3000	~0,75- 1l	~1,5-2l
No electricity	1500	~0,75- 1l	~1,5-2l

    - Summer no heating but cooking – winter high heating cost
    - Poorest people = informal settlements+ cheapest shacks: everything depending on price
    - Avg. people = e.g. brick houses: care of health, cooking+ healthy+ cheap
    - Women decide on cooking tool and is the one cooking because of culture
        - They need to instigate the buy
    - Money available for electricity/ energy: 3-4 people = 1 household = 300 Rands/month = 10 R/day – Summer lower – Winter higher
    - Paraffin stove 120-200 Rands

  - 1l Paraffin currently around 10 Rands (heard of 1,5 l for 13,50R as well)
    - 1,5 l = 13,50 R for 3 proper meals - 2 days of cooking in Summer
    - In the winter they cut on cooking to heat and not increase the cost – they cook one time for 3 days… - in winter 13,50R for one day (cooking+heating)
  - 1l Paraffin in winter might easily cost 12-14 Rands
    - Sometimes they run out of paraffin supply in winter
  - Paraffin is subsidized by the government but sold more expensive than allowed
- Salary structures
  - People get paid monthly and party weekly
  - Some citizens receive government grants 300 R/month/person
- Paraffin distribution
  - Spazashops (Tuck-shops) make own decision where to buy
    - A central wholesaler /distribution point (majority in Kaymandi)
    - Suppliers who drive through the townships and sell it from the truck (sell it more expensive)
  - End-consumers buy it at Spazashops for convenience
    - They are more expensive, so the main groceries are often done at bigger stores/ shops in the city
  - Kayamandi
    - 500 tuckshops
    - 14 years ago, Somalians chased away the SA´s entrepreneurs/ owners, partly through underbidding their prices in response there have been some SA shop owners retaliating
  - Khayelitscha
    - Similar structures but much bigger
- Other initiatives
  - Often lack understanding of local circumstances and requirements
  - Are often not willing to listen. He mentions the example of mimi moto, a dutch clean cooking initiative aiming to sell wood pellet stoves in the Western cape, but trying to convince customers of the product as it is, rather than involving them in the design process. Opposed to the Clean Cooking Revolution, that works closely together with the community to develop a localized approach
- Feedstock
  - George describes that waste cooking-oil can be directly sourced from small take away shops and households inside the townships

- he believes it would be easy to test alternative products in the Kayamandi community and create a more "circular economy" inside the township

Interview Philipp Freiherr von Bodenhausen – HSH Global Software, Rotary Club Cape Town (25th January 2016, Cape Town)

Von Bodenhausen has been interviewed mainly due to his activities at the Rotary Club and their involvement in township projects.

- Describes shocking poverty in townships
- Describes shocking paraffin shack fires in winter months where 100-1000s of people are suddenly homeless and lose all their belongings
- Describes that the Rotary Club is donating clothes and required consumables every year
- Mentions the Health Promoters SA, as well as Deepak Chopra

Interview David Gluckman – Director Lumkani (21st January 2016, Cape Town)

Lumkani is a social entrepreneurial business which has developed an early-warning system to reduce the damage and destruction caused by the spread of shack/slum fires in urban informal settlements.

- Stresses importance of local support and local employees if you want to be successful as entrepreneur in townships – trust issues
- Describes how Lumkani implemented a lot of local knowledge and feedback in their product development – very important for taking ownership and acceptance of new products
- Describes shocking paraffin fires in winter months and black smoke on shack walls
- Describes that he sees a lot malnurtured children and that some of them have respiratory issues

Interview Junior Ackeem Ngwenya – Social Entrepreneur "Roadless" (26th January 2016, Cape Town)

Ackeem Ngwenya is a South African Entrepreneur and designer who is working on upcycling resources and simplifying life for low-income citizens in South Africa with his designs.

- Describes that local knowledge and feedback in product development is very important for taking ownership and acceptance of new products
- Describes that he is aware of the Paraffin issues but that most people just care about financial implications of cooking
- Women are responsible for taking care of the household and their children

- Describes that there are many resource flows in the townships which could be recycled/upcycled locally, like plastics, waste oils, water
- Mentions bad design and low quality production of the Panda-Paraffin stoves – often made in China even though there is a local company producing paraffin stoves
- Apparently, many illegal fake panda stoves which do not match the government legislation
- Townships are the untapped 1 trillion $ market

Interview Leslie Smiedt – US/ International Entrepreneur and Product Designer/Patenting expert (2nd February 2016, Cape Town)

Leslie Smiedt is a serial entrepreneur and product designer specialized in designing and patenting products. Sometimes he builds young teams to take on one of his concepts. I interviewed him because of his "All-Out"-project which aims at providing theft-secured fire extinguishers in townships for immediate response to fires.

- *Paraffin fires are a big issue*
- Apparently, many illegal fake panda stoves which do not match the government legislation are sold
- Product design should be done in close contact with local customers because customers are picky and return products that are not working (even though products are not working due to user mistake/ error)
- Townships are the untapped 1 trillion $ market

Interview Bonnie Horbach&Thessa Bos - Consul General Cape Town& Deputy Consul General, Kingdom of the Netherlands (Cape Town, 15th February 2016)

After the interview, Thessa connected me to Robert Thijssen of the African Center of Frugal Innovation.

- Know the Health promoters and think they are trustworthy
- Describe the paraffin issues as high on the consulates agenda, thus supporting initiatives like the clean cooking revolution
- Describe that they think a solution aiming at just replacing a fuel one by one could be more easily implemented, more beneficial to customers and better accepted than replacing stoves – compared to other initiatives they have seen in the past

Interview Bettina Waterman – COO Green Diesel Cape Town (Cape Town, 10th March 2016)

Green Diesel is one of South Africa´s first producers of biodiesel from waste cooking oils and bioethanol. They are predominantly active in the Western Cape and collect waste oils from restaurant chains like KFC.

- Waste cooking oils can be sourced around 3-4 Rands per liter
- Describes that Green Diesel sells Biodiesel at 9-10 R a liter and Bioethanol at 25 R a liter.
- There are people from townships coming to buy their biodiesel for generators.
- Biodiesel has a hire flame point (>200-degree C instead of 40), which is safer than paraffin
- Waste cooking oils are source from restaurants and restaurant chains, thinking about sourcing it from townships
- There are waste cooking oil collection companies who sell the waste oil at approximately 6 Rands
- Due to globalization, many collectors sell the waste cooking oils to Europe, e.g. Germany to meet Europes Bio-diesel percentage – this drives up costs of local supply

Interview Robert Thijssen of the African Centre of Frugal Innovation (Cape Town, 15th April 2016)

The CFIA is a multidisciplinary research center that studies all facets of Frugal Innovation, a relatively new concept of innovation focused on the development of high-quality, affordable products for emerging markets. Herein we cooperate with African, multi-national and Dutch partners from the fields of business, research and government.

- Trying to implement the Ishack with Stellenbosch university, a solar shack to provide electricity in the household – problem of stealing in townships
- Paraffin issues are a big topic on the government agenda, but not really pursued
- Describes that they think a solution aiming at just replacing a fuel one by one could be more easily implemented, more beneficial to customers and better accepted than replacing stoves

Interview Amenda Mfenyana – Health Promoters SA (Stellenbosch, 20th February 2016)

Health Promotion South Africa Trust is a non-profit organization providing information and training in health and hygiene to prevent illness in the townships of Southern Africa. The health promoters are hosting workshops in different Western Cape townships, especially the Kayamandi township where their headquarters are located.

- Same as George Interview
- Electricity status symbol – fridge as luxury – electric cooking as luxury
- Heating still with paraffin in many cases
- Bad diseases due to paraffin

Interview Amor Strauss - General Manager Philippi Village (Cape Town area, 22th February 2016)

Philippi Village is an entrepreneurial development within the low-income Philippi suburb of Cape Town, providing a space where entrepreneurs and businesses can grow; where residents can develop skills, and increase their employability.

- Since electricity is more and more developing, the informal (not to be developed) parts of the townships might be more interesting for alternative cooking energy carriers.
- Inside townships there are designated housing areas which are actively developed into brick houses, with sanitation and electricity.
- Khayelitscha
    - 50% of inhabitants use electricity – since it is quite an old and developed township
    - But there are areas as well which don't have access to electricity and might not have in the next years because of development plans
    - There might be 5-6 people living in a shack
- Local Entrepreneurship is developing in a positive direction. More and more young township inhabitants ask for workspace at Philippi Village.
- Often topics around recycling/upcycling materials from the township are treated by local entrepreneurs.

1.2.2.Summaries of semi-structured interviews spaza-/ tuckshop owners

Interview Spazashop Owner #1 (Stellenbosch, 17th February 2016)

Owns spazashop in Kayamandi township.

- So these people using electricity for cooking still need paraffin for heating in the winter...
    - Money available for electricity/ energy: 3-4 people = 1 household = 300 Rands/month = 10 R/day – Summer lower – Winter higher
    - Paraffin stove 100-200 Rands
    - 1l Paraffin currently around 10 Rands (heard of 1,5 l for 13,50R as well)
        - 1,5 l = 13,50 R for 3 proper meals - 2 days of cooking in Summer
        - In the winter they cut on cooking to heat and not increase the cost – they cook one time for 3 days... - in winter 13,50R for one day (cooking+heating)
    - 1l Paraffin in winter might easily cost 12-14 Rands
        - Sometimes they run out of paraffin supply in winter
- *Customers buy paraffin per day rather than in higher quantities*
- *In summer he sells paraffin for 11 R/l*
- *He buys paraffin for 8.5R/l*

Interview Spazashop Owner #2 (Stellenbosch, 5th March 2016)

Owns spazashop in Kayamandi township.

- 1l Paraffin in winter might easily cost 14-16 Rands
    - Sometimes they run out of paraffin supply in winter
- He buys paraffin from a distributor
- *Customers are mainly women*
- *In summer he sells paraffin for 10 R/l*
- *He buys paraffin for 7.5R/l*
- *80% women buy at his store*
- *Women buy around a liter in summer and 2iter in winter – per day*
- *The market is quite competitive and he does not like all of his colleagues*

Interview Tuckshop Owner #1 (Stellenbosch, 17th February 2016)

Owns tuckshop in Kayamandi township.

- 1l Paraffin in winter might easily cost 12-14 Rands
- He buys paraffin in a bigger store
- Sometimes he runs out of paraffin supply in winter
- *Customers buy paraffin per day rather than in higher quantities*

- *Thinks paraffin is bad and there should be an alternative*
- *In summer he sells paraffin for 11 R/l*
- *He buys paraffin for 9R/l*
- *Women buy around 2 liter for 3 days in summer and nearly double in winter*
- "customers will definitely come back, return bad quality products and demand refund"
- mainly women purchase paraffin

Interview Tuckshop Owner #2 (Stellenbosch, 5th March2016)

Owns tuckshop in Kayamandi township.

- 1l Paraffin in winter might easily cost 14-16 Rands
    - Sometimes they run out of paraffin supply in winter
- *Customers are mainly women*
- *He buys paraffin in a bigger store outside the township*
- *Does not like paraffin in private – prefers electricity*
- *In summer, he sells paraffin for 10 R/l*
- *He buys paraffin for 8R/l*

Interview Tuckshop Owner #3 (Stellenbosch, 5th March 2016)

Owns tuckshop in Kayamandi township.

- 1l Paraffin in winter might easily cost 14 Rands
- *Customers buy paraffin per day rather than in higher quantities*
- *Customers are mainly women*
- *Women buy around a liter per day*
- *Thinks paraffin is unhealthy, because of the coughing*
- *In summer, he sells paraffin for 10.5 R/l*
- *He buys paraffin for 8R/l*
- *He does not want to disappoint his customers with missing supply*

1.2.3. Summary of focus group research in Kayamandi

Focus group session (Stellenbosch14th February 2016)

(main extracts from recording and notes)

Participants: 22 Women, all mothers, Xhosa

Facilitators: Amanda Mfenya, George Arrey, Jacob P. Bussmann

First Half:

- Warm welcome and openness for the exchange
- Cooking behavior: 12 Paraffin – 5 Electricity – 5 lpg (2plate stove9 for cooking - all of them heat with paraffin in Winter
- Women agree on preferring slow-cooking due to culture
- They describe the cooking process as inconvenient, since due to the expensive fuel, they often have to cook together, cook for a few days in advance or partly cannot cook in case there is no fuel or they don´t have money. Some of them complain about the high electricity costs and the high initial costs for lpg and electricity stoves.
- They describe the problem of safety related to fuel ingestion by their children and shack burns and the bad paraffin smell. Moreover, they complain about black pots and walls.
- Some say, that they buy around 10-15 liters per month (in summer) = 150-190 Rands – many calculate in ZAR rather than in liters or some of them do not really calculate their fuel consumption.
- Some buy it at spaza-/ tuckshops but are not happy with the quality. So, some of them go outside the township to buy it in whole sale stores. It is packaged in 1, 5 and 10 liter bottles and canisters. They split it up accordingly.
- Paraffin perception.
    - Smoke in the food
    - Black smoke in the house
    - Have to be present to cook, because stove could fall over and can´t be saved
    - Children get sick– are coughing
    - Children might drink it – most of them store in cold beverage bottles
    - Paraffin creates lung pain
    - Fear of exploding stoves
- Most of them agree, that there is no other option – electricity is too expensive or they are not able to connect to the grid (informal settlements). Those who have lpg or electricity, still see paraffin as a good option and necessary for the winter heating.
- The women describe paraffin quality as a big issue – there is 2 types of paraffin.
    - Guys driving around (worst) and tuck-/ spazashops (better): bad smell

    - Whole sale /shopping center (best): less smell (perception is: "good paraffin")
        - They don't know where the difference between the two is. The price is the same.
        - On average prices are explained at around 10 R/liter in summer
        - And 15 R/liter in winter
- Women don't have a budget, buy things when they have money
- Cooking is too expensive!
- Traditional food cooking takes long-time -> too much fuel
- Heating is expensive in winter – thus, sometimes no heating
- Sometimes no supply available – one reason is electricity and lpg heaters switching to paraffin for heating in winter
    -

Second Half:

- Collaborative ideas to improve the situation:
    - Have cheaper fuel and steady supply – or a cheaper energy source in general
    - Electricity would be great for cooking, but there is no imagination for heating yet
    - Lock the paraffin bottle tight, so children cannot open it
    - Clearly label bottles or containers that contain paraffin
    - Do not re-use everyday household bottles, such as milk or juice bottles, to store paraffin – perhaps create a new bottle
    - Make a good, safe, reusable bottle for 1 to 5 liters of paraffin (diverse opinions)
    - Store it away from the reach of children
    - Have a longer lasting fuel – more efficient fuel, "less smelly" fuel
    - Retrofit the existing stoves to make them cleaner
    - Distribute alternative stoves for free or make them cheaper – but still opposition for wood pellets – too complicated and different cooking style
    - Use a funnel when dealing with paraffin, away from open fires or stoves
    - Preferably cook and deal with paraffin in an area where there is a free flow of air – ventilation in shacks?

  - Use sand, to put out fires

- Sesolo Mello is well perceived and related questions are answered by Jacob. 20 out of 22 women signed up to participate in co-creating the product and testing it in the future
- They expressed gratefulness for the opportunity to describe their daily challenges
- Statements:
  - Bikane Nulovuyo (Kayamandi): “I always try to store paraffin away from my child. I always store it on a shelf, but I use an old cold drink bottle “
  - Dobtien Dadis (Kayamandi): “I don´t like the black smoke in my house while cooking. The Walls and pots are black”.
- Follow-up ideas of Health Promoters SA:
  - Do an experiment with monitoring available budget, since results appear to be quite vague.
  - Do regular health workshops on cooking or even create cooking workshops with live cooking on alternative stoves – with alternative fuels, in order to prove the effects and educate people on right treatment of fuels etcetera