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Master Thesis

**Marketing solar lights to the base of the pyramid:
The case of Zambia**

The challenge of rural distribution and affordability

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Abstract

Around 600 million people in Africa still lack access to electricity and often rely on comparatively expensive and unsustainable energy sources to cover their lighting and charging needs. While good technological solutions exist namely in the field of solar energy, there are many challenges in effectively serving these target markets, which are usually little developed and hard to reach. OOLUX is one of a growing number of solar lighting and charging devices designed to meet the needs of un-electrified people living at the base of the pyramid (BOP). This thesis analyses the challenges of marketing OOLUX in rural Zambia, where the distribution of the product has recently been launched in the framework of a field test. On that basis, it evaluates possible strategies for the OOLUX venture in Zambia to overcome the identified challenges successfully.

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List of Abbreviations

4As	Framework of Distribution Challenges by Anderson and Billou (2007): Availability, Affordability, Acceptability and Awareness.
AC-DC	Alternating Current – Direct Current
BMI	Bethlehem Mission Immensee
BOP	Base of the Pyramid
CIA	Central Intelligence Agency
DRC	Democratic Republic of Congo
e.g.	For example
ESCO	Energy Service Company
FMCG	Fast-Moving Consumer Goods
GDP	Gross Domestic Product
HDI	Human Development Index
IEA	International Energy Agency
IFC	International Finance Corporation
IHDI	Inequality Adjusted Human Development Index
IT	Information Technology
kWh/m ²	Kilowatt-hours per square meter
LED	Light-Emitting Diode
MEWD	Ministry of Energy and Water Development
MFI	Microfinance Institution
MJ/m ²	Megajoules per square meter.
MPPT	Maximum Power Point Tracking
MSME	Micro, Small and Medium-Sized Enterprises
MW	Megawatt
NGO	Non-Governmental Organisation
PPP	Purchasing Power Parity
PV	Photovoltaic
REA	Rural Electrification Authority
REMP	Rural Electrification Master Plan
RGC	Rural Growth Centre
ROSCA	Rotating Savings and Credit Association
RGC	Rural Growth Centre
SHS	Solar Home System
SIDA	Swedish International Development Cooperation Agency

SME	Small and Medium-Sized Enterprises
SPL	Solar Portable Lights
UC	University of California
UNDP	United Nations Development Programme
USB	Universal Serial Bus
USD	United States Dollar
VAT	Value Added Tax
VE	Village Entrepreneur
V	Volt
W	Watt
WRI	World Resources Institute
ZAMSIF	Zambia Social Investment Fund
ZDA	Zambia Development Agency
ZESCO	Zambia Electricity Supply Corporation
ZMW	Zambian Kwacha

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1 Introduction: Outline and Scope

1.1 Problem Definition

Around 600 million people in Africa do not have access to electricity (IEA, 2012). They rely on traditional energy sources for lighting and walk long distances to charge their phones. While good alternatives to the grid exist, most of the un-electrified households and businesses have little financial resources and, in addition, live in rural areas that are hardly reached by market institutions. People therefore resort to unsustainable and over the longer-term expensive energy sources like candles, battery-powered lights, kerosene or biofuels. Equally costly and often time-consuming is the charging of the millions of mobile phones African households possess. At the same time, access to proper lighting can have a significant positive effect on income-generating activities as well as on education of children (Lighting Africa, 2010: 14ff).

New technologies and innovative business models are needed to provide large-scale access to affordable, modern energy services in these rural ‘base of the pyramid’ (BOP) markets, where the extension of the grid is expensive and unlikely to happen soon (The Economist, 2010). Promising solutions exist particularly in the field of solar energy, which is illustrated by the rapidly growing number of quality solar off-grid lighting and charging devices – so-called solar portable lights (SPL) – that reach African households. However, marketing these new products remains extremely challenging as many of the target markets are underdeveloped and as target customers have little financial resources (Lighting Africa, 2012). Zambia is an illustrating case: Given that the national grid reaches only a tiny part of the sparsely populated rural areas, there seems to be a large potential in marketing affordable and reliable energy solutions. Yet, typical for a BOP market, infrastructure networks are lacking in most parts of the country, incomes are low and volatile, and people living in rural areas have limited access to information and thus little awareness of modern energy technology. To successfully serve the rural Zambian market, innovative strategies and models adapted to local needs and circumstances must be developed.

1.2 Research Focus and Objective

This thesis addresses the challenges of serving the rural Zambian market with a solar off-grid solution. More specifically, it assesses the case of the solar lighting and charging device “OOLUX”, which aims at providing un-electrified, low-income customers with an economic, high quality solution to cover their lighting and charging needs. Designed to meet the demands of BOP markets, OOLUX promises reliability and modularity, and incorporates a flexible payment solution in order to ensure affordability for target customers. The OOLUX

product and business model were developed in a collaborative project between several Swiss organisations (see Chapter 3). The venture is currently managed by Antenna Technologies (Antenna), a Swiss non-profit foundation researching and disseminating technologies designed to fulfil the needs of people at the bottom of the income pyramid (Antenna, 2013c). Since March 2013, a first series of the OOLUX kit is being tested and marketed in various low-income countries in collaboration with local partners.

This thesis intends to contribute to establishing viable and sustainable channels to market OOLUX in rural Zambia, where one of the field tests is taking place. It focuses on the insights from the first weeks of the field test, which the author of the thesis accompanied as a field test assistant for Antenna. In line with the related dissertations of Simon Moser and Thomas Tenchio assessing the cases of OOLUX in Tanzania and India respectively, the study thereby aims at delivering practical insights in the challenges of marketing a solar off-grid solution in a BOP market. More specifically, it addresses the following research questions:

1. What are the challenges of marketing a solar lighting and charging device in the rural, low-income market in Zambia?
2. How could OOLUX be marketed to overcome these challenges successfully?

The goal is, first, to give a comprehensive overview of the Zambian SPL market as well as the challenges SPL distributors face in serving low-income households in rural Zambia. On the basis of this assessment, the paper intends to elaborate recommendations for the marketing of OOLUX in Zambia based on insights from the field. The recommendations address the distribution, the pricing as well as the promotion of the product. They are developed with regard to the business environment of Antenna's field test partner, an individual distributor (rather than an organisation or company) leading a farming project in a small village in the central North of the country. Extensively treating both challenges and possible strategies of marketing a novel, unknown solar lighting device in rural Zambia, the study may also provide useful insights for other ventures entering that market.

1.3 Framework of the Thesis

The thesis is divided into a first theoretical, and a second, more practical part. The first part begins with a brief overview of the theoretical background on marketing at the BOP in chapter 2, introducing the reader to the BOP terminology and the debate around market-based approaches to alleviate poverty. Chapter 3 then presents the OOLUX project and product, as well as the business model on the level of the global distributor, which is currently Antenna. In chapter 4, an overview of the Zambian energy market, electrification trends and the status of solar power provide the bigger picture of the market OOLUX enters, indicating long-term trends, opportunities and countrywide needs. The second part of the paper

focuses on the specific case of marketing OOLUX in rural Zambia. An analysis of the SPL market in chapter 5 helps situating OOLUX among competitors and substitutes, while chapter 6 identifies the needs and preferences of target customers. After an introduction to the context of the field test in chapter 7, chapter 8 discusses the various challenges of marketing OOLUX in Zambia under the specific context of the current distribution partner. The challenges are clustered according to the “4A Framework” elaborated by James Anderson and Niels Billou (2007)¹ and discussed based on research during the field test. The chapter further examines possible marketing strategies to address the identified obstacles. On that basis, a final section elaborates practical recommendation for the OOLUX venture in Zambia on how to market OOLUX in order to overcome the identified challenges successfully.

1.4 Research Method

The theoretical part of the thesis is based on secondary research that includes relevant academic and business literature, field surveys as well as official sources from the Zambian government. In the practical part, the secondary data is combined with extensive primary data gathered during the first weeks of the field test in Zambia. During the time in the field, the author collected data both for the purpose of this thesis as well as in order to investigate the OOLUX field test goals, namely the validation of the concept, the technical validation of the product, and the identification of opportunities (Antenna, 2013a). Accordingly, research was carried out by means of both tools developed by the OOLUX field test team and questionnaires elaborated specifically for the purpose of this paper.

The common field test tools consist of questionnaires for semi-structured interviews with (potential) retailers and customers. They were developed according to the research method called “deep dialogue”, described by Mollebaek and Flensburg (2011). Deep dialogue is one activity helping businesses that newly enter a BOP market to support first customer contact, learn more about people’s perception of products, packaging, marketing channels, or their willingness to pay for a product, as well as to get a comprehensive insight into the dynamics within a community (Mollebaek and Flensburg, 2011: 64ff). While some of the conversations were set up in advance, others were held spontaneously and informally, for instance during product demonstrations. It proved unrealistic to conduct interviews closely following the questionnaires (most questions can only be answered satisfactorily at a more advanced stage of the project), but they nevertheless served as useful guidelines for discussions with potential customers, first clients and retailers.

¹ The 4A Framework describes a set of four factors – availability, affordability, acceptability and awareness – that businesses need to deliver effectively in order to overcome the challenges of serving BOP markets (Anderson and Billou, 2007). The framework is further elaborated in Chapter 8. For more information see also Moser et al., 2013.

Besides these common OOLUX field test tools, the author developed a questionnaire-template specifically for the purpose of this thesis (see Annex 2) with a focus on distribution challenges in rural BOP markets. This template is based on a catalogue of challenges elaborated in a working paper on “The Challenges of Serving Rural BOP Markets” (Moser et al., 2013; see Annex 3), co-authored by the field test assistants in India, Tanzania and Zambia. Using this questionnaire as a basic guideline, semi-structured interviews with two SPL distributors (Zamsolar and SunnyMoney) were conducted. Other conversations with diverse individuals were held more informally and rather framed by their focus on the various challenges of distributing solar lights in Zambia. Finally, personal observations also formed an important part of the field research and are integrated in the discussions as the author’s own opinion. Both informal conversations as well as personal observations are referred to in this thesis as the author’s own research, as the diversity of conversation partners and the spontaneity of many discussions would not have allowed distinguishing them specifically.

Part I: The Theoretical and Economic Background

2 Theoretical Framework

2.1 BOP Markets and Ventures

As stated in the introduction, OOLUX targets “base of the pyramid” (BOP) markets. The term ‘base of the pyramid’, or ‘bottom of the pyramid’ defines the four billion people constituting the lowest tier of the world economic pyramid and was developed by C.K. Prahalad and his colleagues Stuart L. Hart and Allen Hammond in 2002 (Prahalad and Hart, 2002; Prahalad and Hammond, 2002). Since then, there has been an extensive scholarly debate around the basic theory that there is a large untapped opportunity for businesses to make profits at the base of the pyramid and thereby help alleviate poverty, creating a win-win situation (Prahalad and Hart, 2002). Taking a market-based approach to poverty reduction, BOP market analysts and practitioners focus on the BOP as consumers and producers and seek for market-oriented solutions that increase market efficiency, competitiveness and inclusiveness, allowing the BOP to benefit from them (WRI/IFC, 2007: 6). Without entering a detailed discussion on existing theories on business and poverty alleviation, the next paragraph will give a brief overview of the key characteristics of BOP markets.

According to Prahalad, the BOP market comprises the four billion people living on less than USD 2 a day (Prahalad, 2012: 6). These four billion people – a majority of the world’s

population – are highly diverse with regards to their cultures, ethnicities, capabilities and needs and live in both rural and urban areas. As an in-depth study of the BOP market carried out by the World Resources Institute (WRI) and the International Finance Corporation (IFC) shows, the four billion at the bottom of the pyramid have annual per capita incomes below USD 3,000 in local purchasing power (2002 PPP).² Together, they constitute a huge consumer market with an aggregated purchasing power of USD 5 trillion (WRI/IFC, 2007: 3). This market is very heterogeneous: Depending on the income level within the BOP, characteristics differ substantially across countries, regions and industry sectors. Moreover, it includes not only poor households but also local enterprises that are poorly integrated in the formal economy. Typically, BOP consumers depend to a large part on the informal economy (WRI/IFC, 2007: 18; London and Hart, 2011: 8-9).³ The BOP market can further be differentiated by sectors, the relative sizes of which represent the spending patterns of BOP households. Unsurprisingly, food is by far the largest sector market – the poorer the household, the larger part of the budget is spent on food. Next to health, transportation and housing, energy is another important sector within the BOP market. Interestingly, spending on energy is high among all income segments of the BOP – highlighting the need to make less expensive, efficient energy sources available (WRI/IFC, 2007: 9).

Evidently, the first BOP theories have been subject to critical discussion and further development. In short, the debate has shifted from a focus on business opportunities, positive and negative impacts on the poor as well as environmental impacts linked to serving BOP markets, towards the co-creation of markets *with* the BOP and the support for BOP ventures themselves (London and Hart, 2011: 2ff). Accordingly, London and Hart define ventures doing business with the BOP as “revenue-generating enterprises that specifically target the BOP demographic described as buyers, sellers, and entrepreneurs.” (London and Hart, 2011: 9). There are two kinds of such businesses: those “serving BOP consumers” sell nonlocal offerings to the BOP, whereas businesses “serving BOP producers” purchase products from local BOP producers. BOP ventures typically try to combine the informal and the formal economies in the best possible way, leveraging the resources and the technological knowhow from the formal sector and the local knowledge, the social networks as well as the local rootedness of the informal sector. The ventures are very diverse themselves, comprising multinationals, large domestic companies, local small and medium-sized enterprises as well as businesses established by NGOs and social enterprises. The goal is usually to reach both economic self-sustainability as well as a certain business scale.

² Or USD 3,830 when adjusted to 2013 USD (MeasuringWorth, 2013), which is about USD 8 per person per day (WEF, 2009: 8).

³ It should be mentioned that the definition of the BOP according to PPP demarcation lines is not a rigid one – if a person earns USD 3,001 or 2,999 does not actually impact their state of poverty – but should rather be regarded as a convenient way to illustrate what the BOP is (London and Hart, 2011: 7).

They frequently engage in partnerships across sectors and with diverse types of ventures, as pre-existing infrastructures are limited or inexistent (London and Hart, 2011: 10).

2.2 The Challenges of Marketing to the BOP

As London and Hart note, creating markets and demonstrating economic viability is challenging for BOP ventures – in most cases, external financial support is needed (London and Hart, 2011: 11). Indeed, there are numerous challenges of serving BOP markets, which are often “unorganised and fragmented” and therefore ignored by established companies (Prahalad, 2012: 6). These challenges typically include a lack of infrastructure such as transportation or financial services, low and volatile incomes of consumers, a lack of available skills, low education levels and limited awareness of many offerings – just to name a few (see e.g. Hystra, 2013; IFC, 2012a; Jenkins et al., 2009; Shukla et al., 2011; Vachani and Smith, 2010; WEF, 2009). While some obstacles are common to many BOP markets, others may be specific to certain regions or countries. Naturally, challenges are also differently pronounced in distinct markets and do not affect BOP businesses in the same way everywhere. With the growing number of ventures entering BOP markets, there is more and more academic and business literature on the specific challenges of serving BOP markets. An overview of these challenges as identified in the literature is subject of the working paper on “The Challenges of Serving Rural BOP Markets” (Moser et al., 2013), prepared for the field test. This chapter does therefore not further elaborate the corresponding theory and literature, leaving more space for a detailed analysis of the specific obstacles in the rural Zambian market in the practical part of the thesis.

The challenging environment in BOP contexts inevitably alters the way businesses market their products and services. Accordingly, when speaking of ‘marketing’, this thesis refers to social marketing rather than to commercial marketing.⁴ Andreasen (1994) defines social marketing as “the adaptation of commercial marketing technologies to programs designed to influence the voluntary behavior of target audiences to improve their personal welfare and that of the society of which they are a part” (Andreasen, 1994: 10). In contrast to commercial marketing, social marketing sells behaviour changes and not simply products and services. Indeed, OOLUX aims at eliminating the use of expensive, unsustainable lighting sources by providing a better alternative. Furthermore, while the objective of commercial marketing is primarily financial gain, the main goal of social marketing is to attain individual and societal gain. It follows that the main competition does not come from other institutions offering

⁴ Conventionally, marketing is defined as “the action or business of promoting and selling products or services, including market research and advertising” (Oxford Dictionaries, 2013) or, more extensively, as “[t]he management process through which goods and services move from concept to the customer. It includes the coordination of four elements called the 4 P’s of marketing: 1) identification, selection and development a product, 2) determination of its price, 3) selection of a distribution channel to reach the customer’s place, and 4) development and implementation of a promotional strategy.” (WebFinance, Inc., 2013).

similar goods, but from “the current or preferred behavior of the target market and the perceived benefits associated with that behavior” (Kotler et al., 2002: 10). As the following discussions will show, a key challenge for OOLUX is to make people aware of the benefits of an unknown product of which there is no established market yet. At the present stage, the main competition is therefore the current preferences of target customers for traditional lighting sources. As Neuwirth argues, a company entering a rural emerging market must create marketing channels that not only deliver products cost-efficiently, but that also “*unlock* the latent desire that customers have to purchase and receive those products” (Neuwirth, 2012: 5). Social marketing therefore involves comprehensive research on the ground, including the creation of positive exchanges between the marketer and the target group (Andreasen, 2002: 7). Only with an in-depth understanding of the existing market can successful business models be developed. But collecting and analysing data on a specific market can be difficult in BOP contexts such as rural Zambia. Access to market information and knowledge is often poor, particularly because of the typically large informal economies of BOP markets. Secondary research must thus be completed with “on-the-ground participatory market research”, in order to understand existing problems and needs and ‘unlock’ the latent desire of customers (Møllebæk Larsen and Flensburg, 2011: 16; Aron et al., 2009: 38).

3 OOLUX – a Product and a Business Solution

3.1 Project Background

OOLUX has been developed in the framework of an initiative originally called SmartLight Project, launched by Antenna Technologies,⁵ Caritas Switzerland,⁶ and the Bern University of Applied Sciences⁷ in 2012. The aim of the project has been to create an affordable, high-quality solar power lighting and charging device, designed to meet the unfulfilled energy needs, and to maximise the socio-economic benefits of consumers at the bottom of the income pyramid in developing countries. It is thereby part of an increasing number of social ventures entering the fast-growing market of solar lighting products targeting people without access to electricity and relying on low incomes.

Being in charge of the product development, the Bern University of Applied Sciences ensures high technological quality. Antenna and Caritas contribute their expertise in development cooperation and their established network in development countries. They are responsible for the project management as well as the development of the production chain and the business model (OOLUX, 2013; Antenna, 2013c). The authors of the dissertations

⁵ For more information, please visit the website of the organisation: <http://www.antenna.ch/>.

⁶ For more information, please visit the website of the organisation: <http://www.caritas.ch/en/home/>.

⁷ For more information, please visit the website of the institution: <http://www.bfh.ch/en>.

on India, Tanzania and Zambia as well as two other students supported the project on a volunteer base from March 2012 until mid-2013.⁸

At present, project implementation is managed by Antenna, which accordingly employs OOLUX's permanent staff and provides their office space. In the longer term, the goal is to establish a global distribution company in the form of a social enterprise, enabling a profitable distribution of OOLUX through local partners (Antenna, 2013b).

3.2 The OOLUX Kit

OOLUX is a solar power device for lighting and charging purposes. It is sold as a complete kit comprising a 5-Watt (W) solar panel, a PowerBox, two LED-lamps, a task light stand and a multi-phone charge adapter. The battery – the key component of the PowerBox – has a very high capacity. Thanks to its improved MPPT (Maximum Power Point Tracking) technology optimising the charging at all times, it can be fully charged within 10 hours of direct exposure to sunlight (using the 5-Watt panel). In addition, a fully charged battery provides 32 hours of lighting with one lamp, respectively 16 hours with two lamps, or fully charges 10 mobile phones. Working with up-to-date technologies like lithium ion batteries and high power LED lights, the system's performance is optimized while energy losses are reduced to a minimum. The light quality of the LED lights is very good – their luminance⁹ is ten times higher than that of a kerosene lantern. With their elaborated design, the lamps can be hung up in many different ways and angles. Furthermore, the product stands out for its modularity: The battery can be charged with diverse solar panels, car batteries or main adapters. At the same time, with its two USB plugs the battery can itself power any USB device. Similarly, the lights can be plugged into any USB power plug. Durability is maximized both by means of the internal thermal stabilisation ensuring longevity and with the use of capacitive touch buttons instead of mechanical switches (Hassler, 2013: 18).

⁸ Several other partners have supported the implementation of the project, including Hassler energia alternative AG in Zillis with its longstanding experience in Solar Home Systems; Flink GmbH from Chur as a specialist in the design and mechanical engineering of consumer goods; CCS from Lyss, providing support to develop the electronics from a prototype stage to mass production; Pulp Alibi from Geneva which created the brand; and last but not least, Symphasis Foundation in Zürich which has provided the necessary funds to realise the first production series and the field-test (Hassler, 2013: 19; Antenna, 2013b).

⁹ Luminance is a term used in physics to describe "the intensity of light emitted from a surface per unit area in a given direction." (Oxford Dictionaries, 2013).

Figure 1: The OOLUX Kit



Source: Flink GmbH, 2013.

3.2.1 Making OOLUX Affordable

With an estimated retail-price to the end customer of around USD 130-150, the kit is fairly expensive for people living at the BOP – the project’s target beneficiaries. To make the product affordable for target customers, a micro-finance software called OOLUX-Manager has been integrated in the PowerBox, allowing progressive payment over a pre-determined period. This should allow customers to cover the instalment payments with the savings from reduced expenses on kerosene or candle.

The micro-finance system works as follows: An electronic system activates the PowerBox after the payment of each instalment and for the duration corresponding to the amount of the instalment. When the pre-paid period expires, the PowerBox is automatically deactivated and cannot be used to power devices anymore until the client pays the next instalment, inciting clients to actually make the payments. Once the full price of the kit has been paid, the system is activated permanently. The activation of the PowerBoxes is managed through a software application, so each time a customer pays an instalment, the PowerBox will be connected to the computer. The software then activates the PowerBox for the pre-paid period. To facilitate the payment system, a software version for smartphones is currently being developed (OOLUX, 2013; Antenna, 2013b).

3.2.2 Field-Testing OOLUX

With the finalization of the prototype in the beginning of 2013, a pre-series of 1,000 OOLUX kits was produced in order to test the product extensively in various market environments, and to build up a supply chain for the logistics, the manufacturing, and assembling of the product. The actual field tests, started in April, aim at thoroughly assessing the product’s field performance, validating the OOLUX concept (payment and activation system, appropriateness and affordability for target users, business model of the partners) as well as

the technical viability of the devices (usability of the kits and of the management software, robustness and quality of its components, identification of technical issues). The field research thus focuses on assessing consumer demand and reactions from locally involved stakeholders (including partners, retailers and users), on potential technological refinements as well as on business model developments.

To carry out the OOLUX field-testing, eleven formal partnerships in ten different countries have been established.¹⁰ The diverse partners each received 90 OOLUX kits for USD 40, which is half of the provisional ex-factory price.¹¹ In return they agreed to provide extensive feedback on the product and the business model (Antenna 2013b; 2013c). The kits were dispatched from Switzerland in mid-April by air (DHL) and reached their destination 2-4 weeks later, depending on the custom clearance process in each country (which proved to be quite lengthy and complex in countries like Tanzania and Uganda). Each field test was accompanied by a project assistant (students of the University of St. Gallen and civil servants employed by Antenna) who supported the respective partner with technical training, helped developing their business strategies, carried out market research and ensured continuous exchange with Antenna. Each project assistant provided a report with the research results and the feedback gathered.

In contrast to India or Tanzania, the field test in Zambia is implemented in partnership with an individual entrepreneur rather than an established organisation and does therefore not take place within an existing institutional framework. Antenna's partner, Mr Bucher, is a Swiss agriculturalist working in Zambia in the framework of a development cooperation project. He is based in Mishikishi, a small village located on the main road connecting the two biggest cities of the country. The field test is carried out in the relatively close surroundings of Mishikishi (see chapter 7 for more information).

3.3 OOLUX Business Model

While both the OOLUX product and the business concept are currently being tested and further developed, certain elements are pre-determined by the decisions that have been taken before the field test. These fixed cornerstones influence all further developments and should be kept in mind when reading the following chapters on the marketing of OOLUX. This section will outline these parameters and touch upon their implications for actors involved in the local distribution of OOLUX.

¹⁰ Including SELCO Solar and TARA Technologies for Rural Advancement/Development Alternatives Group in India; RAVI Rural African Venture Investments in Eastern Africa; Agrinet in Uganda, Sunjua and Prosonergy/African Solar Rise in Tanzania; Entrepreneurs of a Masai community in Kenya; Entrepreneurs in the region of Ndola in Zambia; CSS Cameroun Solar Solution/Greenpeace Switzerland in Cameroon; IDE International Development Enterprise in Honduras; and social entrepreneurs and partners of Caritas Switzerland in Bangladesh (for more information, visit the website of the project: www.oolux.ch).

¹¹ There are a few exceptions of partners who received a smaller number of kits under a different contract.

First of all, for the time being the basic characteristics of the prototype, including the design and the integrated technologies, will not change significantly. This means that the product's main value propositions, namely its modularity, its high quality and robustness as well as its versatility, are broadly given. Both the use of USB ports and the limitation of the power output of the battery at 5 volts (V) influence the range of compatible accessories. Furthermore, the long lifespan of the kit's components (up to 15 years) and of the battery (only needs to be replaced after 5 years) leaves some time to plan recycling procedures. The kit's ability to charge several mobile phones at the same time further distinguishes OOLUX from competitor products and increases its value especially for small shops that can gain an additional source of income. Finally, its elaborated technological features increase the complexity of handling and repairing the product, making the delivery of appropriate after-sales services more demanding (OOLUX, 2013).

Given its features and respective value propositions, the kit is relatively high-priced. Without financial support or flexible payment terms, many businesses in BOP markets cannot afford to buy a stock of OOLUX kits. The integrated micro-finance system furthermore implies delayed revenue streams, a critical issue for most local entrepreneurs. It also puts high demands on the sales agents inasmuch as they have to be able to deal with a software appliance and put a lot of time and effort into the attention of customers. In fact, it requires a permanent contact between sales agents and customers for the duration of the instalment periods. The fact that Antenna guarantees a warranty of two years further means that after-sales service must be available for at least that time period. Moreover, as only a small series of 2,000 pieces will be produced by the end of 2013 (and no other production is planned yet), the possibilities of the local distributor to scale up the OOLUX business in the near future are limited considerably (OOLUX, 2013; Antenna, 2013b).

Besides the product features, the nature and involvement of the OOLUX project leaders also shape the OOLUX business model. Evidently, the background in development cooperation of most project initiators has influenced the designation of the social goal of the project. OOLUX is a typical BOP venture, creating a positive social impact through a market-based approach: It aims at reducing spending on energy and eliminating unsustainable energy solutions. OOLUX also intends to generate business opportunities by engaging local sales agents and by offering customers an additional income-generating activity with the kit's mobile phone charging ability. The project primarily targets un-electrified people with low incomes in developing countries, which constitute the main focus of product and business developments (OOLUX, 2013; Antenna, 2013b).

In addition to these fixed elements of the business model determined by the nature and the goal of the project itself, other parameters are given by the characteristics of the local partner. As there are not many institutional structures influencing the business model of the

field test partner in Zambia, the marketing of OOLUX has been set up according to the specific market environment of the region. The advantage is that most strategies implemented by the partner are easily adjustable as the venture evolves; the challenge is that all elements of the business need to be set up from the start.

4 The Economic Context: Electrification Needs and Solar Energy Trends

4.1 Zambia: A Country Profile

4.1.1 General Overview

Zambia is a landlocked country in southern Africa. With a surface of 752,618 km², Zambia is 18 times larger than Switzerland (41,277 km²) and almost twice as large as Germany (357,022 km²) (CIA World Factbook, 2013). Its total population, however, reaches with 14.2 million (July 2013 est., CIA World Factbook, 2013) only double that of Switzerland, resulting in a very low average population density of 18 persons per km² (World Bank, 2013b).¹² In addition, the population is concentrated in the area of Lusaka (the capital) in the South and the Copperbelt Province in the Northwest (the centre of the mining industry where the two second biggest cities Kitwe and Ndola are located). This leaves many parts of the country even more sparsely populated, with less than 10 people per km² of land area (CSO Zambia, 2013). The low population density in rural areas, where 61% of the total population live (CSO Zambia, 2010), is reflected in a lack of infrastructure networks across much of the country. Road conditions are often very poor and most rural communities are neither connected to the public transport network nor have access to the electricity grid.

The climate of Zambia is tropical but modified by altitude: most of the land is highland plateau of 1,000-1,350 metres above sea level. There is a cold and a hot dry season lasting from May to August and from September to November, respectively. The rainy season lasts from November to April. With around 3,000 hours of sunshine per year, Zambia's annual solar radiation is one of the highest in the world. It is quite uniform across the regions, varying from 6,600-7,700 MJ/m² per year. In electricity conversion, this results in an average daily solar generation of 4.35 kWh/m²/day, meaning that Zambia has a high potential for solar energy exploitation all over the country (Republic of Zambia, 2009: 9-7; UNEP, 2005).

The area of present-day Zambia was colonised in the late 1800s by the British, who ruled it as Northern Rhodesia until 1964. After the peaceful transition to independence, the new Republic of Zambia found itself at the beginning of a 27-years rule of Kenneth Kaunda, a key

¹² In comparison, the population density in Switzerland is 198/ km² (World Bank, 2013a).

figure in the struggle for independence. Kaunda enforced a one-party socialist system (Pettman, 1974: 240), introduced economic central planning and nationalised key industries (BBC, 2013). Agricultural production fell and Zambia became increasingly dependent on copper exports as well as foreign loans and aid. The country progressively impoverished as unemployment rose and as living standards and the quality of education and social services decreased. Public pressure and an increasingly broad opposition forced Kaunda in 1990 to open the way for multi-party elections (Rakner, 2003: 54ff; Encyclopædia Britannica, 2013). Under the new government, fundamental structural reforms and economic liberalisation and privatisation measures were implemented, but the achievement in terms of economic growth and diversification remained limited (Rakner, 2003: .65ff). It was not until the early 2000s that the economy began to recover as the privatisation of the mining sector attracted foreign investment and increased economic output (World Bank, 2013b; AfDB, 2003).

4.1.2 Economic Trends

Today, despite the fact that the Zambian economy is still dominated by the mining sector, it has experienced a decade of strong growth, with an average annual GDP growth of almost 6%. Foreign investments increased (going to mining, manufacturing wholesale and retail trade), macroeconomic stability was consolidated and inflation declined. In 2005, debt relief under the Highly Indebted Poor Country Initiative improved the country's external position and contributed to a comfortable foreign-exchange reserves level (World Bank, 2013b). Notwithstanding good economic performance, poverty remains a substantial problem: 60% of the Zambian population live below the poverty line and the absolute number of poor increases due to population growth (World Bank, 2013c); extreme poverty is considered to affect 42% of the population. There is a big difference between cities and countryside, where poverty rates are much higher (UNDP, 2013a). In addition, the distribution of income is highly unequal with a Gini coefficient of 57.5 in 2010 (World Bank, 2013c). On the 2012 Human Development Index, Zambia only holds position 163 out of 186 in total, ranking at 0.488 slightly below the Sub-Saharan average (UNDP, 2013b: 15). When adjusted for inequality (Inequality Adjusted Human Development Index, IHDI), Zambia's rank drops to 0.283, or 36.7% lower than on the HDI (UNDP, 2013c).

In 2005¹³, almost three quarters of the population worked in agriculture, the majority of which is classified as small-scale farmers. The service sector follows as the second largest employment provider; manufacturing, mining and construction each accounted for only 1-2% of the labour force. The private sector consists to a large part of small and medium-sized enterprises (SME) but it is the few large enterprises that generate the bulk of economic

¹³ Unfortunately, no newer data could be found but it is assumed that the numbers have not changed significantly.

growth. The vast majority (88%) of the 4.1 million Zambians employed work in the informal sector, of which agriculture again accounts for the largest share (Clarke et al., 2010: 13ff). According to the World Bank, what is needed for sustained growth and poverty reduction is “increasing the competitiveness of the Zambian economy by reducing the cost of doing business and ensuring that the rural economy, upon which much of the population depends for its livelihood, contributes meaningfully to overall growth” (World Bank, 2013b). In fact, the potential for a successful economic development in Zambia appears to be quite high. Despite long authoritarian rule and severe economic trouble, Zambia has – contrary to most of its neighbouring countries – remained peaceful and overall trouble-free since independence. The fact that five elections were held successfully since the introduction of multiparty democracy enhances the credibility of the democratic governance and boosts the country’s economic potential lying in its rich natural resource base (World Bank, 2013b). Zambia not only possesses rich mineral resources (including copper, cobalt, zinc, lead, coal, emeralds, gold, silver and uranium) but also disposes of important water reserves, particularly important for agricultural use and hydropower generation.¹⁴ Last but not least the country has abundant and fertile land (CIA World Factbook, 2013; FAO, 2005). Making reliable and affordable electricity available in rural areas would certainly help the population to better utilise the available land and water resources (e.g. for agricultural production through crop irrigation) and fully exploit its high potential for tourism (Haanyika, 2008: 1048).

4.2 Energy Supply in Zambia

The following section will first look at the Zambian energy market, analysing key players, government policies as well as electrification trends, including the status of solar energy. This overview will provide the bigger picture of the market OOLUX has entered, indicating long-term trends, opportunities and countrywide needs. The focus of the next section (4.3) will be on solar off-grid solutions and the respective market trends in Africa in general. This analysis intends to provide the basis for an understanding of where the Zambian solar off-grid markets stand in comparison to the continent-wide trends.

4.2.1 Key Player(s) in the Zambian Electricity Sector

The Zambian electricity power system is run as a part of an integrated power system connecting the Democratic Republic of Congo (DRC), South Africa, and Zimbabwe. Prior to the liberalisation of the electricity market in 1995, the power generation was monopolised in the hands of a state owned company called Zambia Electricity Supply Corporation. Today,

¹⁴ Several major rivers flow wholly or partly through Zambia, including the Zambezi, the Kafue and the Luangwa River, and there are a number of large lakes such as Lake Kariba, Lake Tanganyika, Lake Mweru and Lake Bangweulu (CIA World Factbook, 2013; FAO, 2005).

the sector is still dominated by few players. The parastatal company ZESCO Limited¹⁵, the successor of the Zambia Electricity Supply Corporation, still handles virtually all power generation, transmission and supply (IMF, 2008: 56). It owns several smaller and three large hydropower plants (Kariba North, Kafue Gorge and Victoria Falls) as well as a number of small diesel generation plants in remote areas (ZESCO, 2009: 2; Government of Zambia, 2009: 3-2ff). The few other major private players all sell or purchase power to or from ZESCO. Besides, there are some independent small-scale power producers and solar energy providers (ZESCO, 2009: 1).¹⁶ Within the government, the Ministry of Energy and Water Development (MEWD)¹⁷ is responsible for energy administration and policy formulation (Government of Zambia, 2009: 3-2). It oversees a number of governmental agencies: the Energy Regulation Board¹⁸ is responsible for the regulation of the Zambian energy sector; the Rural Electrification Authority (REA)¹⁹ is mandated to plan and implement the systemic electrification of rural areas according to the Rural Electrification Master Plan (REMP) (Government of Zambia, 2009: 3-2ff).

4.2.2 Management and Allocation of Primary Energy Sources

The electrification rate in Zambia is very low. Only 22% of the population are connected to the grid, leaving 11 million people without access to electricity (ZESCO, 2009). These figures are even more troubling in rural areas, where electrification reaches only 3.1% of the population (World Bank, 2013a; Government of Zambia, 2009: 4-2). Moreover, grid electricity is very unreliable. Power cuts are frequent and sometimes long, especially during the rainy season (Lighting Africa 2008b: 34). The low degree of electrification is especially striking when considering the rapid spread of mobile phones and more recently of all kinds of cheap, low-quality electronic devices across the whole country. This further aggravates the problem, as there is now not only a high latent demand for lighting but also for charging solutions.

Quite contrastingly, Zambia is very rich in primary energy sources, including hydropower, coal, forest biomass and renewable energy sources. Petroleum is the only energy source entirely imported, in all other energy resources, the country is principally self-sufficient. It has considerable unexploited reserves, including large coal reserves and a very high underdeveloped hydropower potential.²⁰ The comparatively small installed hydropower

¹⁵ For more information, visit the website of the company: <http://www.zesco.co.zm/>.

¹⁶ Major private players include the Copperbelt Energy Corporation (CEC), transmitting and distributing electricity purchased from ZESCO to the mining industry based in the Copperbelt region (ZESCO, 2009: 1), and Lunsemfwa Hydro Power Company, an independent power producer with a capacity of about 48 MW which is sold to ZESCO Ltd under a power purchase agreement (PPA) (Government of Zambia, 2009: 3-2).

¹⁷ For more information, visit the website of the ministry: <http://www.mewd.gov.zm/>.

¹⁸ For more information, visit the website of the agency: <http://www.erb.org.zm/viewpage.php?page=news>.

¹⁹ The Rural Electrification Authority (REA) is a statutory body established within the Ministry of Energy and Water Development (MEWD) through the Rural Electrification Act No. 20 of 2003 (Government of Zambia, 2009: 3.2). For more information, visit the website of the agency: <http://www.rea.org.zm/>.

²⁰ Coal reserves are estimated larger than 80 million tonnes; the unexploited hydropower potential amounts to 6,000 MW, while the installed capacity only reaches 1,985 MW (Zambia Development Agency, 2013: 3ff).

capacity accounts for more than 95% of the total installed electricity capacity (the remaining 4.1% come from thermal energy) (Reegle, 2012). Yet, much of the produced power is allocated to the mining sector, leaving only a small amount for domestic consumption (Foster and Dominguez, 2010: 17). The bulk of household energy consumption is supplied from biomass energy: many Zambians, including people who do have access to the grid, use wood and charcoal for cooking (Reegle 2012; Haanyika, 2008: 1047ff).

Despite the country's abundant energy resources, increasing demand since the 2000s – mainly due to the growth of the mining industry – has put a strain on power plants, resulting in frequent power cuts (Government of Zambia, 2009: 3-22). While only 0.5% of the population is newly electrified per year (Foster and Dominguez, 2010: 17), there is a rapid growth in demand. Total demand already exceeds internal power production, a gap which is expected to widen substantially over the coming years (Zambia Development Agency, 2013: 4). In addition, the country faces the challenge of satisfying the demand for modern sources of energy of almost 80% of its population (Reegle, 2012). A major obstacle in the development of the unexploited domestic reserves is the low power tariffs undermining the sustainability of the power sector.²¹ These are at least partly due to the longstanding overabundance of supply as well as to the political sensitivity of raising tariffs (IMF, 2008: 55). As tariffs are too low to meet production costs, the power sector remains without savings for major future investments (Foster and Dominguez, 2010: 17). These observations lead to the assumption that not much effort and investment will be put into meeting the latent energy needs of the rural population either – and imply a wide market potential for solar portable lights like OOLUX.

4.2.3 A Master Plan for Rural Electrification

Today's alarmingly low electrification rate in rural areas is not surprising given that the government's electrification efforts since independence in 1964 have concentrated on district administrative centres. The setting up of the few existing rural electricity lines dates back to colonial times when European farmers settled across the country. Since then, household electrification has not made much progress. The obvious reason for this are the high capital costs of building distribution lines due to the wide scatter of the rural population and the remoteness of many villages (Government of Zambia, 2009: 3-1). But one may also add the fact that neglecting rural populations has less negative implications for the government than neglecting cities and industrial centres.

Only with the establishment of the REA in 2004 did governmental efforts get more serious, and were policies and regulations concerning rural electrification strengthened. Five years

²¹ For comparison, residential users in Zambia pay 3-5 times less for electricity than their counterparts in Tanzania, Kenya or Uganda (Foster and Dominguez, 2010: 17-18).

later, the first “Rural Electrification Master Plan for Zambia”, covering the period from 2008-2030, was finalized. The plan sets ambitious targets: Aiming at increasing the rural electrification rate from the present 3.1% to 50.6%²² by 2030, it has identified over 1,200 Rural Growth Centres (RGCs) across the country which shall be electrified until 2030 (Government of Zambia, 2009: i). Once electrified, these RGCs are intended to serve as catalysers for social and economic development in neighbouring villages. The plan identifies three primary methods of extending electrification: the extension of the national grid (94.5% of the planned total), the construction of mini-hydro power stations (0.9%), and the installation of solar home systems (4.6%) (Government of Zambia, 2009: i; Dastgeer et al., 2011: 23ff). While Zambia’s energy policy largely supports rural electrification and electricity sector laws also provide an adequate framework for that endeavour, the plan is not considered realistic. Not only are the REA’s financial and human resources limited, but it is also extremely difficult to ensure electricity supply of a very dispersed population in a large country (Dastgeer et al., 2011: 4).²³ It seems therefore fair to claim that a large part of the population cannot count on receiving electricity in any form through official projects in the foreseeable future.

4.2.4 What About Solar?

As the objectives of the REMP illustrate, grid extension is considered the most favourable way of electrifying rural communities. This is first because it is seen as the most preferable solution in the view of customers, concerning both quantity and quality (24-hour availability; voltage and frequency stability). Second, it is perceived the cheapest solution to expand electrification rates even in many rural areas, as it is fairly easy to implement and as the costs per connection are ostensibly lower than those of off-grid technology options. Yet, the REMP acknowledges that, given the low population density as well as the limited power demand in remote areas, grid extension would simply not be efficient in economic terms (Government of Zambia, 2009: 9-1ff; Dastgeer et al., 2011: 22). In that context, the Zambian Government has recognised the potential of solar energy as a viable alternative to grid extension. Accordingly, the REA has launched a large project to install photovoltaic solar home systems (SHS) in public and social institutions (such as health centres, schools or chief’s palaces) in regions where grid extension is unsuitable. In 2008, the Government furthermore suspended the Duty and Value Added (VAT) Tax on solar PV panels, batteries and accessories, making solar products more affordable (REA, 2010a; 2010b). The Zambian

²² To calculate the access to electricity, the REMP associates each RGC with a number of villages and the corresponding number of households. When a RGC is electrified, the REMP thus considers all households nearby are automatically connected. In reality, however, connection rates of households are very low due to lacking internal wiring and lacking capacity to pay connection fees (Dastgeer et al., 2011: 13).

²³ The total cost is projected to reach USD 1.1 billion during the project period of 2008-2030 (or USD 50 million per year) (Government of Zambia, 2009: i).

Government thereby follows the African trend of incorporating off-grid solutions into rural electrification programmes (e.g. Ethiopia, Liberia, Mali, Senegal and Tanzania) and providing fiscal incentives (e.g. Kenya, Tanzania, Ethiopia). However, Zambia has not progressed as far as Tanzania and Kenya, which introduced quality control frameworks for solar products, or the Tanzanian programme providing business development services for solar lighting companies (Lighting Africa, 2012a: 85ff).

Despite lagging behind, the Government's adoption and supporting of solar technology is undoubtedly an advantage for solar lighting businesses. The suspension of the VAT on solar equipment considerably reduces the end price of the products, making the country more attractive as a potential market (Lighting Africa, 2012a: 41ff). Also, governmental institutions like the Ministry of Education or the REA become potential partners, for instance to establish sustainable distribution channels, to carry out education and training programmes, or to conduct awareness-raising campaigns.

4.2.5 Changing Energy Needs

Next to the increasing acceptance of solar technology, another important trend to consider at that point is the change in what energy is used for: Traditionally, ordinary Zambian households needed energy for cooking and lighting, while the industry relied on large, steady power supplies. Simply put, diesel generators and the electricity grid were the solutions to meet the needs of the industry and wealthier households, while poorer households could cover their needs with wood, charcoal and candles or kerosene. Today, however, there are not only new, alternative energy sources available but also completely new energy needs emerging: The spread of mobile phones and other small electronic devices among low-income consumers in Africa has been incredibly fast and extensive. In 2012, 76 out of 100 Zambians were subscribed to a mobile phone service (World Bank, 2013c), and radios are sold on every village market. What is interesting in the context of OOLUX is that not only are these electronic devices increasingly affordable but they also use comparatively little power – and can hence be charged with the OOLUX PowerBox. Of course, the electricity grid remains the best solution for many purposes. But other increasingly widespread needs can easily be met with small, individual installations.

In the case of solar energy, the market of small solar lighting and charging devices should therefore be distinguished from that of larger solar installations: the target segments – or the energy needs to be covered – are clearly different. The following outline of the trends of the African solar energy market will illustrate this distinction and show the potential of small solar devices.

4.3 Solar Off-Grid Solutions: Africa-Wide Trends

Of the nearly 1.3 billion people in the world without access to electricity, almost half – or 590 million – live in Africa. While their number is expected to decrease substantially in developing Asia and Latin America, in Africa it will further grow until 2030 (IEA, 2012: 529ff). Given the resulting large underserved demand for affordable, modern lighting and charging alternatives, there is a high growth potential in any industry that succeeds in delivering such solutions to un-electrified households and businesses.

Given sub-Saharan Africa's substantial solar radiation throughout the year, off-grid systems relying on solar photovoltaic (PV) technology are seen as a promising alternative to the still commonly used expensive and unsustainable energy sources. The advantages of PV technology are evident: power can be produced independently and basically for free whenever there is sun, and its use produces no soot, fumes or emissions and creates no risk of fire. In addition, solar energy is a clean and renewable resource. PV technology has thus been widely promoted as an economically efficient way to provide lighting and charging services to rural Africa (Kornbluth et al., 2012: 6738). Accordingly, the market for quality solar lighting and charging devices in Africa has grown exponentially over the last years (Lighting Africa, 2012a: 8). To further analyse the current market trends, off-grid PV technologies will be divided into two categories satisfying different energy needs: Solar Home Systems (SHS) and Solar Portable Lights (SPL). While OOLUX belongs to the latter, a look at SHS is still relevant to better delimit the potential market segments for OOLUX.

4.3.1 Solar Home Systems

Providing electricity for individual households or home-based entrepreneurs, solar home systems usually consist of one or more solar panels, a charge controller, a battery, and an AC-DC inverter and range from 20-100 W (Hystra, 2009: 11; Kornbluth et al., 2012: 6738). SHS are often seen as an efficient solution to electrify sparsely populated areas where households are widely dispersed and where overall electricity demand is low. They have thus repeatedly been promoted for rural electrification, as the example of the Zambian rural electrification plan shows (Anisuzzaman et al., 2006: 1; Wamukonya, 2007: 6; Lahimer et al., 2013:317). Indeed, SHS have been installed in developing countries since the 1980s and attracted widespread funding and subsidies from NGOs, development agencies and local governments. Yet, in many countries – including Zambia – no real commercial market has developed (Schultz and Doluweera, 2011: 333ff; Nieuwenhout, 2000: 5). As a matter of fact, the acquisition of an SHS not only requires a high initial investment but also the technical know-how for professional installation and maintenance. Unless some form of financing and/or subsidies is offered (Kornbluth et al., 2012: 6738), SHS remain an unaffordable option for most households. Their functionality is even further limited when there is a lack of skilled

technicians who could ensure proper installation and maintenance (Lahimer et al., 2013: 320-321). In the case of rural Zambia, both financial and technical constraints are high. In addition, looking at the primary energy needs of rural Zambians with low-incomes, it seems that SHS may simply not be the most suitable and economical solution: lighting and phone/radio charging do not need a 20-100 W installation. The limited spread of SHS in the country is therefore not surprising (own research).

4.3.2 Solar Portable Lights

Indeed, in contrast to the mixed record of SHS, the African market of smaller off-grid lighting and charging systems is growing extremely fast (Kornbluth et al., 2012: 6738). Lighting Africa²⁴ refers to these products as “solar portable lights” (SPL), a definition adopted in this paper.²⁵ This category involves various types of products including simple torches and lanterns, desk lamps as well as multi-functional and/or semi-portable devices also referred to as micro solar-home systems (Lighting Africa, 2010: 18). The batteries of typical SPL are rechargeable, the light source LED-based and the solar panel size limited to 10 W or below, distinguishing them from SHS. Offering a certain quality standard, SPL must be differentiated from the growing market of cheap, poor quality products – usually non-solar LED torches/flashlights with dry cell-batteries. The offer of SPL has both increased and diversified significantly in recent years, with product performances differing substantially. While battery life averages six hours (ranging from 2 to 13 hours), light brightness ranges from anything between 10 to 250 lumens. At present, the most widespread products in markets like Kenya, Tanzania or Zambia are those manufactured by d.light, Barefoot Power and Greenlight Planet. These manufacturers have struck the right balance between affordability, quality and meeting consumers’ needs, while at the same time having set up a sustainable distribution (Lighting Africa, 2010: 19; Antenna, 2013a). Designed with the aim of producing a robust, long-living and high-quality product, OOLUX also belongs to this category of products.

4.3.3 The SPL Market: Trends and Developments

In Africa, the market entrance of a number of successful quality SPL manufacturers has led to increased competition, wider market coverage and more variety in supply (Lighting Africa, 2012b: 1). More and more products offer high quality and performance levels and are tailored to specific customer needs. Consumer-oriented features include different brightness levels and mounting options, various charging capabilities, mobile phone charging and flexible payment solutions. For instance, some companies incorporate GSM chips or offer mobile

²⁴ “Lighting Africa is a joint IFC and World Bank program that works towards improving access to better lighting in areas not yet connected to the electricity grid.” (Lighting Africa (2013). For more information, visit the website of the programme: <http://www.lightingafrica.org/>.

²⁵ There is no universally used categorisation of solar lighting solutions. The International Finance Corporation (2012a), for instance, uses the term “solar kits” – defined as “portable solar home systems” (IFC, 2012a: 42) – to describe SPL and distinguishes these from solar lanterns and solar home systems (IFC, 2012a: 29).

payments, thereby allowing instalment payments (Lighting Africa, 2012a: 21ff). Others offer pay-as-you-go services, allowing consumers to gradually put together and enlarge their lighting and charging system by buying components separately (Avato and Madeira, 2010: 7ff). With its incorporated flexible payment system and its modularity, the OOLUX kit is evidently in line with the trend.

The fact that annual SPL sales in Africa increased 90-95% per year since 2009 illustrates the exceptional success of these products. Until 2012, 3.5-4 million SPL from more than eighty different manufacturers have been sold in twenty African countries. Lighting Africa projects a strong, continuous market growth of about 85% between 2012 and 2015, with total sales reaching 28 million SPL over that period (Lighting Africa, 2012a: 16ff). Despite this outstanding market performance, the need for lighting and charging remains imperative. The number of un-electrified people in Africa continues to increase as grid extension cannot keep pace with population growth. At the same time, important obstacles to higher market penetration of SPL across Africa remain. These include first and foremost access to finance for stakeholders involved in the local distribution, end consumer affordability and low awareness among potential users (Lighting Africa, 2012a: 17ff). In accordance with the African trend, many Zambian households will remain without access to electricity by 2030, resulting in a wide market potential for SPL. Regrettably, like in Africa in general, there are still many barriers for SPL distributors entering the Zambian market. These are reinforced by the fact that the country's solar-off grid market is still in its infancy, as the following practical part of the thesis will show.

Part II: Marketing OOLUX in Rural Zambia

5 The Zambian Solar Off-Grid Market

5.1 Introduction

The second part of this thesis is dedicated to the particular case of marketing OOLUX in rural Zambia. First, it will investigate the market OOLUX is entering, outlining current market trends as well as existing market players and products. This analysis will contribute to situate OOLUX among competitors and give an idea of existing market structures that could be leveraged. In Chapter 6, the focus will be on the Zambian customer: it will analyse potential market segments and examine demands and preferences of the typical OOLUX target consumer. The objective of Chapter 7 is, first, to give a comprehensive understanding of the challenges of marketing OOLUX in rural Zambia. At the same time, it will examine promising strategies to overcome the challenges identified in a sustainable and scalable way within the context of Antenna's field-test partner. Finally, practical recommendations will be drawn for the OOLUX venture in Zambia.

Given that Zambia's solar lighting market is relatively little developed, there is not much existing research and literature on the current market trends, characteristics or customer needs. Notable exceptions are the Lighting Africa market research report on Zambia, analysing key market information on consumer needs, preferences and finances (Lighting Africa, 2008a and 2008b) and a project case study by the University of California (UC) Davis, investigating the minimum costs and performances requirements SPL must have to appeal to low-income consumers in Zambia (Pon, 2012; Kornbluth et al., 2012). Accordingly, the next sections are based on both secondary research as well as data gathered in the field.

5.2 Trends in The Private Solar Off-Grid Market

With the trend towards increased utilisation of solar energy, the number of retailers dealing with solar energy equipment is also growing. Solar panels can nowadays be found on every large marketplace, and a variety of general dealers in towns sell products relying on PV technology – primarily different sizes of SHS – among other electronics. While in many cases good quality and expertise are not a priority, some of the new players retail high-quality equipment to end-users in addition to offering maintenance, installation and professional advisory services (Government of Zambia, 2009: 9-1; own research). One example is Suntech,²⁶ a Lusaka-based company specialised in solar energy systems, also running an

²⁶ For more information, visit the website of the company: <http://www.suntech-zambia.com/>.

installation and maintenance training centre for other retailers (Suntech, 2013b). Other examples are SunPower Africa²⁷ and SolarVillage²⁸. Besides these professional stores, there exist many small dealers selling solar panels, batteries and inverters. The majority of their products are manufactured in the Far East and of fairly low quality.²⁹ Moreover, the retailers are often not able to give professional advice, resulting in clients installing their equipment inappropriately or buying parts that do not run optimally in combination (own research). Such trends can lead to market spoilage and wrong consumer conceptions about solar technology (Lighting Africa, 2012a: 81). Especially in remote villages, however, consumer awareness – if wrong or right – about solar technology is very limited. Despite the fact that solar panels can be found on larger village markets, the financial resources and the know-how to acquire and install them are usually missing. It also seems that in general, people's opinions about the usability and the personal value of the technology have not been formed yet (own research).

5.3 Public Projects

Next to these developments within the private sector, some donor-funded solar installation programmes have also been implemented in the country. Besides the programme led by the Rural Electrification Agency mentioned earlier, another major project is funded by the Swedish International Development Cooperation Agency (Sida)³⁰ and operated by so-called "Energy Service Companies" (ESCOs). These commercial energy suppliers lease SHS to their clients, usually people of the upper-middle class like teachers, government employees or farmers. Furthermore, a Zambia Social Investment Fund (ZAMSIF) project provides solar systems to schools and health centres and SHS of various sizes for individual households. Finally, the Zambian Government funded the installation of SHS systems in various schools and chief's palaces (Government of Zambia, 2009: 9-1ff). These efforts have been made despite some negative previous experience with the installation of SHS in the framework of such programmes, especially regarding long-term sustainability. After initial excitement, users became disappointed with the system due to their limitations compared to grid power. Moreover, the maintenance of installed institutional PV systems posed major challenges, as did the identification of potential private companies with the financial capabilities and technical know-how to develop the necessary technology (Dastgeer et al., 2011: 23ff).

5.4 The SPL Market: Major Actors

The development of the Zambian SPL market lags somewhat behind the fast-growing African market in general. The market has not yet penetrated many rural areas and also in more

²⁷ For more information, visit the website of the company: <http://sunpower-africa.com/index.html>.

²⁸ For more information, visit the website of the company: <http://www.solarvillage.co.zm/>.

²⁹ It should be mentioned that China is Zambia's largest trading partner and that the Zambian market, in particular of electronics, is flooded with low-quality products manufactured in China (World Bank, 2012: vii).

³⁰ For more information, visit the website of the agency: <http://www.sida.se/English/>.

accessible locations, SPL are not commonly used yet. Nevertheless, the trend certainly goes in the same direction with an increasing number of players reaching more and more areas. There are currently two SPL distributors that reach rural consumers in various parts of the country – Zamsolar³¹ and SunnyMoney³². Other ventures operate on a smaller scale, sometimes on a project-basis or in a limited area (as OOLUX does at the current stage). A small number of SPL can also be found in stores of specialised dealers of PV technology like Suntech and SunPower Africa mentioned above and in a few large supermarkets (mostly products from d.light, Barefoot Power and Greenlight Planet) (own research).

Having set up solid distribution networks, the examples and experience of Zamsolar and Sunnymoney will in the following discussions variously be referred to. It is therefore appropriate to present the two distributors briefly. First, it should be noted that unlike OOLUX, the two institutions are not manufacturers themselves, but distribute SPL that are on the Lighting Africa list of quality assured products (Lighting Africa, 2013a). While Zamsolar only operates in Zambia, SunnyMoney is one of the largest distributors in Africa and also present in Kenya, Malawi and Tanzania. Zamsolar is an American-Zambian company, founded in 2011. Their aim is to connect supply and demand by delivering affordable, high-quality solar products to the rural population in Zambia. Zamsolar has been establishing a network of rural sales agents who market their products on commission basis. This system allows them to reach remote areas and generate incomes while keeping costs low (Interview with Zamsolar, 2013; Zamsolar, 2013). SunnyMoney is a social enterprise owned by the British charity SolarAid.³³ They distribute high-performing, affordable solar products with the goal of building a solar lighting market. When launching the distribution in a new region, SunnyMoney first organises school campaigns: They promote their products through head teachers who will sell them to parents and other community members with a small discount. Once trust and awareness have been built, SunnyMoney looks for local partners – mostly shopkeepers – who will sell their goods at a standard retail price (Interview with SunnyMoney, 2013; Miller et al., 2013: 4).

Other SPL distributors on the Zambian market operate on a smaller scale. They include, among others, the following (own research): Azuri Technologies,³⁴ which promotes their *Indigo* solar power technology and business solution. Combining mobile phone and solar technology, this solution allows customers to pay for the usage of their solar products in instalments with scratch cards (Eight19, 2012). The social venture *Lighting The Way*³⁵, a joint project of the Zambian NGO DISACARE and the Program for International Energy

³¹ For more information, visit the website of the company: www.zamsolar.com.

³² For more information, visit the website of the company: <http://www.sunnymoney.org/#Zambia>.

³³ For more information, visit the website of the organisation: <http://www.solar-aid.org/>.

³⁴ For more information, visit the website of the company: <http://www.azuri-technologies.com/>.

³⁵ For more information, visit the website of the company: <http://lightingthewayzambia.org/>.

Technologies of the University of California (UC), Davis distributes their *SMART Light*, a simple, inexpensive lamp with one LED bulb specifically designed to avoid the typically high up-front cost of solar lights (Lighting The Way, 2013). HiNation³⁶, a Swedish company, delivers its HiLight, a portable LED light with a mobile phone charging option on a project basis (HiNation, 2012a).³⁷

The fact that the Zambian SPL market is less developed than for instance in Kenya or Tanzania makes it more challenging, especially for small ventures, to enter the market. Yet, there is a high potential for the distribution of SPL in Zambia; and entering the market at the present stage also means getting the opportunity to contribute to shaping it.

5.5 Lighting and Charging Substitutes

Considering the limited number of players in the Zambian solar energy market, it is not surprising that the range of direct substitutes for OOLUX – namely quality SPL – is still fairly small as well. Most quality SPL offered can be found on the list of quality assured products of Lighting Africa (Lighting Africa, 2013a) and are manufactured by well-known brands including in particular Greenlight Planet and d.light, Barefoot Power and Bboxx. These manufacturers distribute their products primarily through Zamsolar, SunnyMoney and specialised dealers of PV technology (see Annexe 1 for an overview of the range and the prices of quality SPL commonly offered in Zambia). Among these competitor products, OOLUX belongs to the higher end with regard to capabilities and capacity of the kit, as well as concerning the price. With its ability to charge various 5V devices and several phones, and due to its cutting-edge technology, it offers more than most similar products. Yet, the price is quite high even compared to substitutes with similar functions. It was stated on various occasions that OOLUX's most direct competitor product in Zambia is Greenlight Planet's Sun King Pro. The latter also constitutes a high quality product but has less overall abilities than the OOLUX kit (among others, the solar panel power is only 2.5W, it includes just one lamp and the battery capacity is considerably lower). Yet, with an end-consumer price of ZMW 210-220³⁸ (USD 40-42), the Sun King Pro is significantly less expensive than OOLUX, which costs ZMW 650 (USD 124), (Greenlight Planet, 2013; own research; see also Annex 1). Furthermore, there are some substitutes with similar or slightly higher capabilities than OOLUX (ability to power

³⁶ For more information, visit the website of the company: <http://hination.com/>.

³⁷ It should be noted that the author's on-the-ground investigations on SPL ventures were concentrated on the areas of Ndola and Lusaka and that it was quite difficult to find comprehensive secondary information on actors in the Zambian SPL market. Moreover, the market may develop quickly, so it is likely that there are a number of new or in the meantime more established market players that would be worth mentioning too.

³⁸ Zambia uses the Zambian Kwacha (ZMW). This year, the currency was rebased at a fixed conversion rate of 1000 (old) ZMK = 1 (new) ZMW (XE.com, 3013). At the time the author was in Zambia, currency sites in the web still used the old currency rate, while prices in Zambia were already calculated in the new currency. Hence, while the author calculated prices with rates based on the old currency, the numbers in this thesis are adapted to the new currency (divided by 1000). For all USD – ZMW calculations in the paper, the currency rate of 01.06.2013 is used: 1 USD = 5225.6495 ZMK (Exchange Rates.org, 2013).

1-4 light bulbs and to charge small devices of 5 or 12V) but are qualitatively inferior and have a less elaborated design. Such products are offered in the shops of general dealers in cities like Lusaka or Ndola. Their manufacturers are not well known – the sales assistants could in most cases not name the brand and it was not made obvious on the package. The price of these ‘kits’ seems to be somewhat lower than OOLUX, ranging from ZMW 450 to 600 (USD 86-115). Interestingly, all the products the author encountered were sold exclusively in cash – none was offered with any kind of flexible payment system (own research).³⁹

6 The Zambian Customer

6.1 Typical Target Customers

The customer group OOLUX targets matches the typical target customers of SPL distributors, namely un-electrified, low-income households in the developing world. To illustrate, SolarAid (the charity owning of SunnyMoney) aims at reaching “the 598 million people living off-grid in rural Africa” (SolarAid, 2013), while Zamsolar targets the “ten million Zambians living in rural areas [and lacking] access to products that could save them money such as solar-powered lights” (Zamsolar, 2013). These statements match OOLUX’s primary target customers, namely the “people without access to electricity living in the global South” (Antenna, 2013a: 1). This is quite a broad definition, leaving space for sub-segments and country- or region-specific differentiations. In fact, a majority of the Zambian population falls under OOLUX’s target group: 97% of the rural, and more than 50% of the urban population do not have access to the grid and have little chance of being connected soon (Government of Zambia, 2009: 4-3; Kornbluth et al., 2012: 6739). While most of these target customers have little financial resources, they have diverse needs and preferences, depending on their level of income, the region they live in or their professional activity. In addition, there are other customer segments that could also be interesting for OOLUX. For the further development of product and business model, it is therefore appropriate to distinguish in more detail between the customer segments within OOLUX’s primary target group and to identify additional segments, reflecting different consumer demands.

6.2 Market Segments for OOLUX

Given that OOLUX is a project with a social goal, the primary market segment includes those people relying on low and irregular incomes. Mostly living in rural areas and being poorly educated, they are likely to neither be aware of the benefits of solar energy nor of high-

³⁹ It should be highlighted that the author’s research in that regard was restricted due to the limited time period and geographical scope of the field research. There may thus well be SPL distributors that do offer flexible payment terms. For instance, Azuri Technologies distributes its products with a flexible payment system but the author did not have the opportunity to learn more about their business in Zambia.

quality products in general. Such households or micro businesses may in the longer-term derive important financial advantages from OOLUX, as a large part of their budget is spent on covering their energy needs (Lighting Africa, 2010: 16; own research). Yet, the price of the kit is very high for this customer segment and a purchase of a kit probably regarded as out of reach. What is more – and as will be further discussed in chapter 8 –, the cost of reaching this market segment is very high for obvious reasons like long travelling times, bad roads and the lack of established infrastructure and distribution networks. At the same time, these customers need comprehensive after-sales support to ensure proper installation and use of the product and to follow-up in case problems occur (IFS, 2012: 56).

A second, more immediate market segment for OOLUX at the present stage consists of villagers having some capital available, like shop owners, priests, teachers, and other salaried employees. They can afford a product like OOLUX and can be expected to understand the potential benefits such a device can bring. Being less risk-averse, such customers may act as early movers and buy the product even without previous experience with it (own research). Having witnessed how a product is used and thus established confidence in its performance, other villagers with lower incomes may follow (Howe et al., 2012: 12ff). While part of the early movers can be expected to buy the product in cash, followers are likely to choose flexible payment terms and may need support with the installation and maintenance. Naturally, this customer segment includes small businesses too, who can in particular benefit from increased revenues through longer opening hours and through the business with mobile phone charging (Lighting Africa, 2008b: 70ff).

Households and small shops in peri-urban districts, in Zambia known as compounds, constitute a further market segment. Despite their proximity to the city, these unplanned or sometimes informal settlements usually do not benefit from the urban water, sewage or electricity networks (Kornbluth, 2011, p.6739). People therefore also rely on traditional energy sources to cover their lighting and charging needs. Undoubtedly, OOLUX would be useful for this customer segment. While the present thesis only looks at rural markets, it would be interesting for the future distribution of OOLUX in Zambia to also investigate strategies to deliver urban low-income markets.

It should be highlighted that also people connected to the grid constitute potential customers. As Lighting Africa observes, power outages are particularly frequent in Zambia so a power backup may be much appreciated (Lighting Africa, 2011: 21). Some of them belong to the lower middle class and may not own large electronic devices like TVs, fridges or laptops, so their energy needs do not substantially differ from those of the former customer segments. Others have very different needs than the primary target group, namely people from the higher income segment who appreciate the quality and the flexibility of the OOLUX kit and who can be expected to buy the product off the shelf. Some may use it as a backup for

power cuts; others might take it with them when making trips to the countryside. Finally, lodges and camps in rural areas have also shown interest in OOLUX, as the kit is ideal for small cottages with no power supply. A solar kit also fits better in a concept of offering the guests a ‘stay in the bush’ than a diesel generator (own research).

Although high-income consumers will not be prioritised in the development of OOLUX, marketing the kit to this segment has several benefits: it can contribute to market creation and awareness-raising about solar energy, and generate immediate revenues (such customers will pay in cash), adding financial flexibility for further business development. In accordance with OOLUX’s mission, however, this thesis focuses on the un-electrified, rural population relying on little financial resources. The following characterisation of the typical Zambian target customers will help to better grasp their needs and financial capabilities. Eventually, it may also contribute to adapt product and business model accordingly.

6.3 A Profile of the Zambian Target Customer

The size of houses or dwellings of a typical target customer is usually quite small. Normally, families live in anything from a single room used for both living and sleeping to a three-room structure. The typical number of permanent household members varies between two and five in urban areas, and between two and seven in rural settings. Cooking is often done outside with a basic charcoal or wood cooking stove (Lighting Africa, 2008a: 22ff; own research). Households typically lighten at least two rooms simultaneously between 2-5 hours each night (Pon, 2012: 13). Many potential OOLUX customers indicated that if they owned – or could afford – more lighting sources, they would lighten more rooms than they currently do (own research). Small businesses often operate outside, selling their goods from stalls or kiosks. Others have premises with one or two rooms, sometimes serving the purpose of both home and business. But even if only one room or stall needs to be lit, many would appreciate having more than one light source in order to sufficiently lighten the place (Lighting Africa, 2008a: 32ff; own research).

According to a Lighting Africa survey of 2008, the average monthly household income in Zambia is around USD 150 (Lighting Africa, 2008b: 23ff). In accordance with the results of the UC Davis study (Pon, 2012: 13), the author’s own observations suggest that this average is somewhat lower – at least in the area of Mishikishi, where monthly incomes of USD 50 (ZMW 260)⁴⁰ are not unusual (so even if two people in the household have an income, it only amounts to USD 100) (own research). The Lighting Africa survey further suggests that Zambians spend on average USD 3.50-4.70 on lighting per month (not including the initial investment of buying lamps) (Lighting Africa, 2008b: 102). The UC Davis’ results indicate a slightly higher monthly expenditure of USD 4-8 (Pon, 2012: 13). Households in the area of

⁴⁰ All numbers are rounded.

the OOLUX field test easily spend more than USD 10 (ZMW 52) on lighting (own research). This corresponds to how Zamsolar portrays its typical customers: with an average monthly income of USD 55, they spend around USD 15.50 on lighting per month (Zamsolar, 2013). Most Zambians use primarily candles (79%) and not kerosene lamps (14%) for lighting. This stands in sharp contrast with Kenya (and most other sub-Saharan countries), where more than two-thirds of the consumers rely on kerosene (Lighting Africa, 2008b: 81). Indeed, in the region of the field test, households did not use kerosene for lighting (own research). While Lighting Africa mentions the cost of kerosene as a possible reason for the overwhelming preference for candles (Lighting Africa, 2008b: 53), the UC Davis study does not find a satisfactory answer why Zambians' habits should differ substantially from their neighbours' (while the interviewees stated to prefer candles as they burn cleaner, with less smut and fumes, candles cost slightly more than kerosene) (Pon, 2012: 14). With the spread of cheap Chinese electronic products in recent years, battery-powered torches have become an increasingly common lighting source; they are available on village markets. Candles are purchased on a regular basis in small quantities from small village shops or markets. Normally, one candle per day per room is needed, meaning that 60 candles are purchased per month if a household lightens two rooms per day with candles. While households differ in what lighting source they use preferably, many resort to both candles and torches (own research). Table 1 gives an overview of the costs of the different lighting sources and charging services (own research):

Table 1: Cost of Lighting Sources and Charging Needs⁴¹

Product or Service	Price/Amount in USD	Price/Amount in ZMW
Battery-powered torch per piece	2.70	14
Monthly cost of batteries for torch	3.80	20
Candle per piece	0.20	1
Monthly cost of candles (60 pieces)	12	60
Fee for charging one mobile phone	0.3	2
Monthly expenditure for phone charging	4.60	24
Monthly expenditure on phone charging and lighting	10-20	50-100

⁴¹ Numbers are rounded and represent the approximate prices in the region of the field test.

Almost more important than lighting is the charging of mobile phones and other electronic devices. Virtually any household possesses at least one mobile phone and some also own a small radio. Most people charge their phones against a small fee in the closest shop that has access to the grid or another power source. Sometimes they walk long distances to get there – but the phone is important enough for people to take on that burden. Given that a phone needs to be charged about three times a week, the expenditure on charging amounts to USD 4.60 a month if the phone is charged regularly (which probably depends on how close the next charging facility is) (Zamsolar, 2013; own research). These calculations indicate that targeted households' monthly expenditure on lighting and charging generally ranges from USD 10 to 20 (ZMW 50-100) (and quite a lot more if a household possesses more than one phone). The accuracy of this figure is supported by the fact that the first OOLUX customers chose a payment plan that envisages monthly instalments of around USD 20. Interestingly, it is also about the same amount as an ordinary household or small shop with grid connection spends on the monthly electricity bill (it should be noted though, that these households are likely to use charcoal or wood for cooking). For the reader to better grasp these figures, Table 2 depicts other expenditures and revenues of potential customers (own research):

Table 2: Typical Expenditures and Incomes of Potential Customers⁴²

Type of expenditure/income	Amount in USD	Amount in ZMW
Official minimum wage	134	700
Actual salary of employed workers on e.g. a rural farm	48-86	250-450
Daily remuneration for harvesting job	1.55	8
Farmer's income on a market day in fertile periods	60-380	300-2,000
Yearly public school fees	32-42	170-220
Yearly private school fees	290	1,500
Bus journey from Mishikishi to Ndola and back (50km each way)	5.75	30
Soft drink	0.50	2.50
Beer	1.15	6
Decent meal in restaurant	3-4	15-20

⁴² Numbers are rounded and represent the approximate prices in the region of the field test.

Table 2 shows that both formal and informal salaries on the countryside are often lower than the minimum wage. Poor villagers are prepared to do day work, for instance help out with the harvesting of maize, for very little money. Farmers' incomes are highly volatile, depending on the period of the year. A key expenditure of an ordinary household is the schools fees for the children, even if they go to a public school.

7 The OOLUX Venture in Zambia

The field test in Zambia is carried out in collaboration with Mr Bucher, a Swiss agriculturist living in Zambia.⁴³ Mr Bucher currently runs and develops a Zambian farm in the framework of a four-year development cooperation project organised by Bethlehem Mission Immensee (BMI).⁴⁴ The farm is part of the Mishikishi Mission, owned by the Catholic Diocese of Ndola. Mr Bucher is based in Mishikishi, a small village in the Copperbelt Province, located 50 km South of Ndola on the main road to Lusaka. The OOLUX field test took place in the relatively close surroundings of the village. As mentioned before, the Copperbelt region is relatively densely populated and economically more developed than most other provinces (Foster and Dominguez, 2010: 5). Mishikishi further benefits from the fact that its centre is located at the main road between Lusaka and Ndola, one of the most frequented traffic axes in the country. On Sundays and Mondays there is a large market, which attracts people from the surroundings including farmers living quite far away. Contrary to most of the neighbouring villages that are not directly by the roadside, it is connected to the national grid network. This does not mean, however, that grid connection is the norm among villagers. Only the mission (including the farm), the school and the shops along the main road actually do have grid connection, leaving the large majority of households without proper electricity access.

The author accompanied the field test for a period of seven weeks (01.05-20.06.13). The first weeks were dedicated to the preparation of the marketing of the kit, as well as to research on existing market structures, competitor products and energy-related needs of the local population. Living in a village, the author had many opportunities to speak to the community members and learn about their daily needs and habits. At a later stage, the focus was on the actual marketing of the OOLUX kits and the training and support of the retailers. Numerous kit demonstrations were organised in Mishikishi and the other as well as in other villages, missions and schools. These meetings not only allowed promoting the kit, but also receiving

⁴³ Mr Bucher joined OOLUX through Alois Müller (Seecon GmbH), a long-time friend of his and member of the advisory board of the SmarLight Project

⁴⁴ For more information, visit the website of the organisation <http://www.bethlehem-mission.ch/>.

valuable feedback on the product and the retail concept. The sales started successfully in mid-May and by the time the author left, 16 kits were sold.⁴⁵

7.1 Current Distribution System

Antenna's field test partner is the sole distributor for the OOLUX kits in Zambia at the present stage. As illustrated in figure 2, he functions both as a retailer and as a distributor: Next to the direct sales to end consumers in Mishikishi, a small number of kits are gradually sold to a second retailer. For this purpose, a contract specifying the conditions of sale was signed between the two, allowing the second retailer to pay back the kits in instalments, as the dotted arrow in figure 2 shows (see also section 8.2.3). According to this setting, Antenna's partner will subsequently also be referred to as the OOLUX distributor or, depending on his function in question, retailer 1. The second retailer will be referred to as retailer 2.⁴⁶

Given that the field test in Zambia is carried out by individual entrepreneurs rather than by institutional partners, the marketing of the kit has been set up quite informally. None of the two retailers operates from a store or draws on an established commercial business or network to retail OOLUX. According to the OOLUX business model, both retailers offer their customers flexible payment schemes. Again, the dotted arrows in figure 2 illustrate the resulting instalment payments and the corresponding gradual activation of the customers' PowerBoxes. It should be noted that while most first clients chose to pay in instalments, both retailers also offer direct sales (not represented in figure 2).

In Mishikishi, the sale of the kits can be regarded as an additional activity carried out on the farm. While Antenna's partner keeps the overall responsibility over the business, he entrusted one of his farm workers with the retailing and after-sales services of OOLUX. This sales agent dedicates part of his working time to OOLUX and receives a commission on the kits he sells, as the curved arrow in figure 2 illustrates.⁴⁷ The plan is to gradually hand over more responsibility to the agent, which will also facilitate the transmission of knowledge and the continuity of the OOLUX business when Antenna's partner will leave Zambia in 2014 and his successors on the BMI project in Mishikishi will take over the lead of the venture.

The second retailer is a businessman with an in-dept knowledge of the local market and the needs and habits of the local population. Next to running a relatively large farm in the region of Ndola and managing a seeds company, retailer 2 is establishing a company selling local fish in a store in Ndola. One idea for a later stage is to combine the fishing business with OOLUX and sell the kits to the communities living in the fishing villages he buys the fish

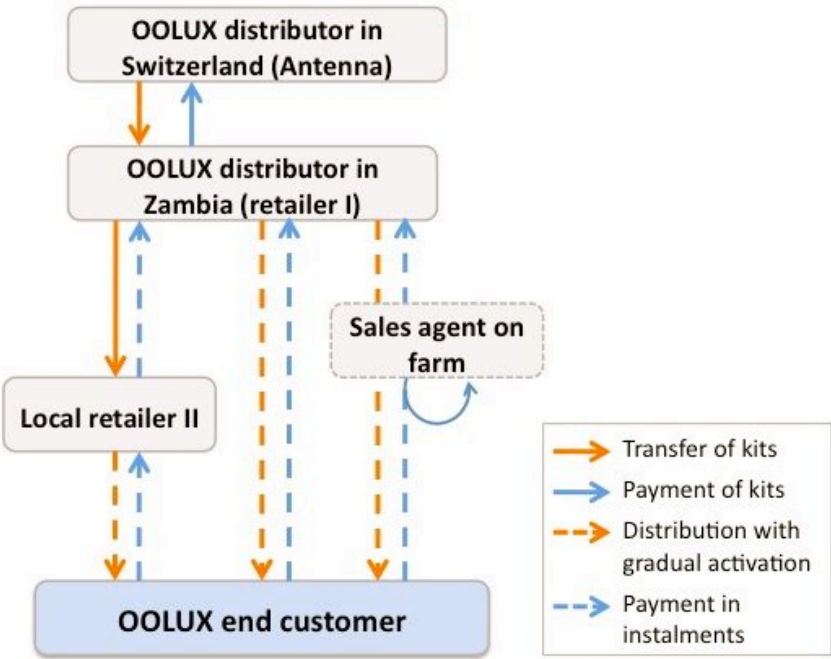
⁴⁵ Unfortunately, sales had to be stopped in the beginning June due to a software problem causing some of the PowerBoxes to constantly block. The last two weeks of the author's stay were therefore dedicated to the attention of affected customers and identifying and solving the problem in coordination with the local retailers, the other field testers and the Antenna headquarters in Geneva. Sales could be resumed a month later when a new version of the software was developed and installed on all devices.

⁴⁶ For reasons of privacy protection, the names of local people involved in OOLUX are not named in this thesis.

⁴⁷ The commission amounts to USD 3.80 (ZMW 20) per kit and is added to his fixed salary.

from. While retailer 2 has hitherto personally taken charge of the marketing, his plan is to assign that task to one of his farm workers. If the business grows and more sales agents will be needed, he envisages strategies such as hiring agents who will go to local markets to sell and top up OOLUX kits, or engaging shopkeepers in remoter villages who will market the product in their communities. So far, the retailer has been selling the kits in several small un-electrified villages on the main road South of Mishikishi.

Figure 2: OOLUX Distribution System for Field Test



Source: own illustration.

As Figure 2 illustrates, already the current, small-scale distribution system involves several levels of actors. Once the venture scales, the network will become more complex. It is thus necessary to clarify how the various actors involved in the local supply chain will be designated in the following discussion: When referring generally to actors selling the product to end consumers at the last mile, the term ‘sales agents’ will be used. The term ‘retailer’ will specifically designate actors who buy the kit from the distributor and resell it to end customer (including Antenna’s partner in his function as an actor selling the kit to end consumers). They can do that either personally or through employed or commissioned sales agents.

8 The Challenges of Serving the Rural Zambian Market

The following discussion aims at providing a comprehensive understanding of the challenges of marketing SPL in rural Zambia as a BOP market. On that basis, it will examine how OOLUX could be marketed to overcome the obstacles identified. Thereby, it will touch upon possible distribution channels, financing mechanisms as well as strategies to educate consumers and raise awareness on solar technology. The purpose is not to establish a complete marketing strategy for OOLUX. It is rather about understanding and addressing the *specific challenges* of marketing OOLUX in rural Zambia. The discussion is based on a catalogue of obstacles distributors commonly face in rural BOP markets. As mentioned before, this catalogue is subject of the working paper on “The Challenges of Serving Rural BOP Markets” (Moser et al., 2013). Drawing on secondary literature on BOP marketing, the working paper identifies a list of common challenges of serving rural BOP markets as well as respective business solutions. Both challenges and solutions are classified according to the “4A Framework” proposed by Jamie Andersen and Niels Billou (2007). These authors suggest that in order to successfully “serve the poor” a venture must follow a strategy that delivers the 4As, namely availability, affordability, acceptability and awareness (Andersen and Billou, 2007: 14).

Accordingly, the same 4As also provide the basic structure of the present chapter, which is thus divided into four sections. Each of the 4As will first be introduced with a brief overview of the theory. The list of ‘sub-challenges’ identified in the working paper will serve as a further reference to structure the discussion under each A. These more specific challenges will be put directly in the Zambian context in order to analyse the particular set of obstacles in the local market and their implications for the OOLUX venture. On that basis, different strategies will be discussed to overcome these challenges. While the analysis focuses on the marketing of OOLUX, it also draws on the experience and strategies of other distributors, in particular of Zamsolar and Sunnymoney, with whom semi-interviews were conducted.

To begin with, it should be highlighted that high-quality solar lighting and charging solutions as well as innovative financing, marketing and distribution models exist. However, in many cases quality products do not reach the un-electrified target consumers, and novel business strategies are not translated into practice (Interview with Zamsolar, 2013). It can thus be said that the overarching challenge for SPL businesses is to find the appropriate mix of strategies and models for each market they are entering. Focussing on the specific context of the rural Zambian market, the following discussion analyses such marketing strategies at the last mile, looking at the delivery of the kits to OOLUX sales agents and assessing the distribution and promotion of the kit to end consumers (see e.g. Lighting Africa, 2010a).

8.1 Availability

Guaranteeing the availability of goods and services has been seen as one of the biggest challenges of serving BOP markets, as distribution channels are often fragmented or even inexistent (Andersen and Billou, 2007: 14; Moser et al., 2013). The subsequent discussion will show that this is more than true in Zambia, where the population is highly dispersed and infrastructure networks poorly developed. Creating a sustainable and scalable distribution network is not an easy task in such a challenging environment (Neuwirth, 2012: 7).

On a general note, the choice of appropriate distribution channels highly depends on industry characteristics, market dynamics as well as the specific product that is offered.⁴⁸ While some distribution models for SPL are more suitable for certain contexts than others, there is not one ideal model that stands out (Lighting Africa, 2010: 40-41). Successfully distributing OOLUX at scale will require understanding local contexts and learning from local communities. As Viswanathan emphasises, businesses should start by studying the consumers, entrepreneurs and marketplaces at the microlevel (Viswanathan, 2011: 157).

8.1.1 Reaching Target Markets with Missing Infrastructure

Depending on a country or region's size, geography and population density, missing infrastructure can be a bigger or a smaller obstacle to successfully distribute a product. In Zambia, it is certainly a major issue: In addition to the low population density and the wide dispersion of households, road conditions and road accessibility in rural areas are remarkably poor compared to other countries. To illustrate, barely one fifth of the majority of Zambians depending on agriculture live within 2 km of an all-season road. In addition, almost 80% of rural roads are in bad condition (Foster and Dominguez, 2010: 8ff). The situation is aggravated by the fact that there are few established transportation networks. Outside urban centres public transport provision is basically lacking (Interview with Zamsolar, 2013; Interview with SunnyMoney, 2013; own research). One can add that private transporters charge very high tariffs, making this option unattractive and inaccessible for many businesses. On the countryside, people therefore use ox-carts and bicycles, or catch lifts on pickups or on the main road on trucks (Davis, 2000: 1ff; own research). Both SunnyMoney and Zamsolar confirmed that the lack of basic hard infrastructure is a particular challenge for distributing their products. In that context, SunnyMoney referred to the low population density and the highly dispersed customer base as the main distribution challenge in Zambia.

⁴⁸ To illustrate, the fact that OOLUX is a consumer durable has important implications for its distribution: in contrast to fast-moving consumer goods (FMCG) – goods for the every-day use like groceries or toiletries –, consumer durables are not sold on a frequent, constant basis and are usually not available in small sizes (and thus more expensive to acquire). Final sales agents take a much higher risk when dealing with consumer durables: Not only do they have to invest a considerable amount of money to acquire a stock of goods, but they also face unpredictable demand and thus volatile cash-flows, especially when the product is new and unknown like OOLUX. Hence, final agents want a higher profit margin on the sales of consumer durables than for FMCG (Interview with Zamsolar, 2013; Shukla et al., 2011: 13ff; Neuwirth, 2012: 7).

Zamsolar similarly mentioned the fact that it is a huge country as a key challenge specific to Zambia. A further challenge is the deficient public transport network: while SunnyMoney in Tanzania has the possibility to work together with the Postal Bus to bring the goods to the villages, such a service does not exist in Zambia. Consequently, company-own vehicles as well as enough staff to make the long delivery-journeys are a requirement. For these reasons, it is particularly difficult to reach target customers at a certain scale (Interview with Zamsolar, 2013; Interview with SunnyMoney; 2013).

Another obstacle to doing business is the unavailability of proper electricity supply in many parts of the country. Indeed, only a mere 6% of rural micro, small and medium-sized enterprises (MSME) are connected to the grid, making the use of, for instance, laptops for business impossible (ZBS, 2010: 29ff). Further key factors impeding business – especially among rural MSME – are the lack of access to finance (mainly due to the high cost of getting access to formal banking) and to communication technology, as well as the poor education levels of the entrepreneurs (ZBS, 2010: 41; Forster and Dominguez, 2010: 4; Clarke et al., 2010: 50). Accordingly, Zamsolar highlighted that the low education levels of the available work force were a particular challenge with regards to building a sound distribution network (Interview with Zamsolar, 2013).

These infrastructural gaps have several obvious implications for the distribution of OOLUX the way it is organised at present: If the two retailers want to reach a customer base that goes beyond their close surroundings, it will require a lot of time: Travelling to other villages, even in the region, can take several hours. Furthermore, the retailers need a personal car both to deliver the kits and to attend customers in general. As individual entrepreneurs who only devote a relatively small part of their time to OOLUX, it would not be feasible for them to scale the distribution of OOLUX with the current system. Of course, they can engage some of their current employees to dedicate all or part of their working time to OOLUX, but the system would still reach its limits soon. It is evident that in order to scale the OOLUX venture, the retailers will either have to find ways to harness the infrastructure of other organisations or develop a comprehensive strategy to establish a network of local sales agents.

8.1.1.1 Harnessing existing networks

One commonly propagated strategy to overcome the challenges related to missing infrastructure is the establishment of partnerships with existing organisations that can provide the networks to distribute the products and services. These may include governmental agencies, NGOs, microfinance institutions, cooperatives or private enterprises (Agrawal and Dutt, 2013; WEF, 2009; IFC, 2012a; Jenkins et al., 2009). Ideally, a distribution partner for OOLUX reaches a considerable part of rural, un-electrified Zambians and has the ability to educate consumers, build trust and handle the micro-finance system. Yet, as Agrawal and

Dutt highlight, existing networks that are leveraged must not necessarily be set up for distribution themselves (Agrawal and Dutt, 2013: 4). A good example is SunnyMoney's network of schoolteachers as intermediaries to reach potential customers.⁴⁹ Schoolteachers probably provide one of the most extensive networks to reach rural Zambians. Schools exist even in remote areas, dispose of certain storage facilities and have a regular exchange with rural communities. Furthermore, being relatively well educated, teachers can be expected to manage the sales of SPL; and given that they are put in charge by their employer (the Ministry of Education), the teachers distribute the lights without receiving a commission or additional salary. A similar strategy for OOLUX could be to leverage the affiliation of Antenna's partner to the Catholic Diocese of Ndola, as the Catholic Church has an extensive reach in much of the country. There is a considerable number of missions, some of them even managing schools. Like schoolteachers, people working for the missions are generally trusted personalities and have a good level of education. Missions could further provide storage facilities, and if there *is* electricity in an area, the mission will certainly be connected to the grid. Belonging to an established institution, Catholic missions may even be able to manage delayed revenue streams. These considerations remain speculative, however, and would need to be further assessed on the ground.

8.1.1.2 Standard retail channels

The OOLUX distributor could also look into distributing the product through the traditional supply chain of consumer durables. These channels typically consist of various players, including general dealers as well as retailers who act as the point of contact with the end consumer, selling the kit alongside other similar goods at a fixed location (Lighting Africa, 2010a: 37; Shukla et al., 2011: 46). Standard retail channels are often combined with other distribution networks. SunnyMoney, for instance, successfully distributes its products through conventional retailers in cities and in regions where awareness has already been created through the school campaigns. However, there are several drawbacks to distributing OOLUX through such traditional distribution networks of consumer durables. First, the kit would most likely only be sold in cash. None of the conventional retailers the author spoke with would have been willing to sell a product with a flexible payment system – the effort and the risk would be too high. Second, given Zambia's dispersed population and the immaturity of markets in remote areas, eligible distributors and retailers would most likely not penetrate far into rural areas. So while it may be a suitable strategy to distribute OOLUX in urban and peri-urban areas, a large part of OOLUX's core target group could not be reached by standard

⁴⁹ SunnyMoney partners with the Ministry of Education, from which they get the general authorisation for their school campaigns. On the regional level, the collaboration involves the District Education Board Secretary, which provides them with a permit and a list of all the schools in that zone. The next step is to organise a meeting with the head teachers of the schools of an area where they receive basic training, promotional material and a free solar light (Interview with SunnyMoney, 2013).

retail channels (own research). Finally, existing larger distributors dealing with consumer durables – in Zambia often called general dealers – may demand a very high margin (Interview with Zamsolar, 2013). It may thus be necessary to target retailers of consumer durables themselves instead of working through large distributors. These considerations lead to the conclusion that if a standard retail strategy were chosen for OOLUX in Zambia, it would not be used as a primary channel but to complement another distribution network.

A question arising at that point is if it would be possible to distribute OOLUX via SunnyMoney or Zamsolar – even if that strategy concerns a partnership at the level of Antenna and not the OOLUX distributor in Zambia. While they both found a good strategy to set up a far-reaching distribution network, it is debatable whether their current networks would be suitable to distribute OOLUX as an additional product, especially in the case of SunnyMoney. The main reason is the OOLUX micro-finance system, which complicates the management of the distribution network and activities considerably. SunnyMoney’s teachers could not be expected to manage the instalment payments of a broader customer base in addition to their normal work – and that without being paid for it. Furthermore, next to evident constraints such as lacking electricity to power laptops and even smartphones, or the challenge of continuous personal customer contact, it would also require a considerable training effort of the sales force of both organisations to introduce OOLUX into the product range (own research). Most importantly, none of the two organisations would be willing and able to manage the delayed revenue streams resulting from the micro-finance system at their scale (Interview with SunnyMoney, 2013; Interview with Zamsolar, 2013).⁵⁰

8.1.1.3 Village Entrepreneurs

A third possible strategy to distribute OOLUX at a certain scale is via village entrepreneurs (VE). Dutt defines a VE as “an individual who acts as a ‘touch point’ between a business and local customers” (Dutt, 2012: 1). VE are typically recruited from the village where they will operate and earn a commission for selling goods and services offered by a company (Dutt, 2012: 1). Often, companies offer their entrepreneurs franchising packages including training, marketing support or financing (Lighting Africa, 2010: 40). Working in a limited area and being familiar with local contexts and habits, VE know how to take advantage of local distribution methods (Dutt, 2012: 1ff). Employing and training a network of micro entrepreneurs has been a common approach among successful SPL distributors, including d.light and Greenlight Planet in India or Barefoot Power in Kenya and Tanzania (IFS, 2012: 52). In Zambia, Zamsolar has established a similar system: It employs a network of rural agents – so-called “Solar Scouts” – who earn a commission for selling Zamsolar’s products.

⁵⁰ Besides these remaining challenges, both organisations only take SPL in their product range that are on the Lighting Africa list of quality-assured products. OOLUX is currently not on that list so partnerships with these distributors are not possible at the current stage.

In fact, in Zambia a massive low-cost labour force is available, prepared to work at USD 1.5 a day. Zamsolar engages people from this abundant labour force and gives them a bigger share than what they would get by selling fast-moving consumer goods (FMCG). Recruited from local communities, the scouts are close to the target customers and know the most effective ways to distribute the products at the last mile⁵¹ (Interview with Zamsolar, 2013).

Implementing a VE system for OOLUX in Zambia would, to begin with, fit the pace of project development quite well: As the production of OOLUX is not going to scale very quickly in the near future, there would be time to gradually establish a network. Additional VE could be engaged as the business grows and it would allow the current retailers to set up the network according to their capabilities and in line with their other businesses (VE could for instance be recruited in villages where their farms/companies sell or buy other goods already). Furthermore, there is no shortage of potential micro entrepreneurs. For instance, small shops could upgrade their business with one shopkeeper becoming an OOLUX entrepreneur. One could also tap the pool of dealers selling cheap electronic goods on village markets. So far, they have all been selling exactly the same basket of goods – why not make some of them sell OOLUX on the different markets in the region instead? Additionally, Antenna's partner could take advantage of his affiliation to the Catholic Diocese. Other missions could help recruiting VE in their communities and maybe even provide storage facilities or support VE with promotional activities (own research).

As Lighting Africa notes, the VE model is suitable for a product like OOLUX that requires quite a lot of after-sales support, as the entrepreneurs are close to the customers (Lighting Africa, 2010a: 41). On the other hand, the relative technical complexity of OOLUX as well as its payment system requires entrepreneurs to be well trained in order to be able to provide the necessary support for the installation of the kit or the management of the micro-finance system. This challenge is reinforced by the fact that the labour force is generally low skilled. As Zamsolar emphasised, comprehensive training needs to be provided to establish an effective sales network – and this is not an easy task (Interview with Zamsolar, 2013).⁵²

As Antenna is currently developing an OOLUX manager app for smartphones and also looking into other ways of managing the payment system, it is worth to look briefly into the compatibility of such systems with a VE network. The app solution has the important advantage that a smartphone can be powered with the OOLUX kit itself. Also, it would probably be easier for entrepreneurs to learn how to manage an app than to deal with a laptop-based system. Yet, it would still require the entrepreneurs to read and understand

⁵¹ Zamsolar evidently still faces the challenge of bringing the products to their scouts – which they organise with company-own cars and staff from the head office (Interview with Zamsolar, 2013).

⁵² Barefoot Power, for instance, provides its micro-franchise entrepreneurs with 2-3 days of entrepreneur training and 1-2 days of technical training. Those who continue the business get additional technical training and tools to expand the services they offer (e.g. repair services) (BiD Network, 2013).

English (unless the app is available in a local language). Equipping each VE with a smartphone further implies considerable capital costs either for the retailer commissioning the VE or the VE themselves. A second promising solution to manage payments Antenna currently assesses relies on USB sticks. The retailers provide their entrepreneurs with USB sticks. These are loaded with ‘top-up credits’ that the entrepreneurs purchase from their retailers. To activate a customer’s PowerBox, entrepreneurs only need to connect their sticks to the PowerBox and a certain amount of credits is transferred to the box, activating it for the next period. This system is designed to facilitate the expansion the network of entrepreneurs. USB sticks are less expensive and easier to handle than an app or a laptop-based system. No English skills are needed and there is less risk of fraud or theft.⁵³

Concerning the way in which the VE are remunerated, it may be advisable to deviate from the “pure” VE model where the entrepreneurs only receive a commission on sales. As Dutt (2012) emphasises, the distribution of new or unknown products of which the value may not be tangible in the short-term can be too risky for a franchised VE (Dutt, 2012: 2). Indeed, the demand for OOLUX is uncertain and irregular, and the high level of financial risk involved for the VE is further reinforced by the flexible payment system. It should therefore be considered to implement a “hybrid VE model”, where the retailers employs the VE, who receive a fixed salary in addition to the commission. The advantage is that the entrepreneurs do not carry the financial risk and gain more income stability. To address the problem of the high upfront capital investment needed to acquire the kits, the retailer could, as an employer, additionally take over these costs, further facilitating the deal for the VE (Dutt, 2012; own research).

8.1.2 Making Products and Services Continuously Available

A further challenge is to ensure the *continuous* availability of the product, spare parts as well as after-sales services (Moser et al., 2013). Especially in sparsely populated areas with low levels of product penetration like in the case of OOLUX in Zambia, providing comprehensive after-sales service can be very costly (Lighting Africa, 2012a: 78). Yet, to address the concern of increasing electronic (and other) waste, establishing a repair and replacement system is paramount. Guaranteeing on-going, customer-friendly after-sales service is also crucial for the longer-term acceptability and market success of the product, as section 8.3 on acceptability will show in more detail (Aron et al., 2009: 37).

For those OOLUX customers living in the surroundings of Mishikishi, after-sales service is not difficult to provide. Antenna’s partner not only stocks the kits and spare parts, but is also the person in direct contact with the distributor in Switzerland. Furthermore, as customers in Mishikishi know their retailers personally, they are likely to get back to them when problems

⁵³ Note that both solutions were at least at the time of writing not yet developed to a sufficient degree for the author to make final considerations on their implications on the ground.

occur. However, as soon as a wider distribution network is set up, the infrastructure challenges discussed above come into play again: even with a limited expansion of the customer base, the distributor or the retailers will have to travel large distances to deliver spare parts from the central stock. As SunnyMoney states, distributing their products to each of the schools themselves from the central office would be too costly and time-consuming. They therefore set up “zonal centres” that serve as hubs for the storage of a certain stock of goods (Interview with SunnyMoney, 2013). Once setting up a wider distribution network, OOLUX will also have to establish such a storage system. Depending on the distribution channel, storage facilities could be provided by missions, leaders of social projects similar to Antenna’s partner or by sales agents themselves (own research).

Ensuring the continuous availability of spare parts and batteries further requires a repair, replacement and recycling strategy involving all stakeholders of the distribution network. According to first experience in Mishikishi, this strategy must address several issues: Firstly, a proper communication system between all stakeholders in the local supply chain should be set up. SunnyMoney, for instance, has made positive experience with their system of communicating with the teachers via phone or text message to manage product orderings (Interview with SunnyMoney, 2013). Secondly, and more specifically, there should be a common standard on how to report warranty replacements. For instance, sales agents could be provided with a simple template to fill in all warranty issues. Thirdly, it must be ensured that all sales agents know how to do basic repair works and that they try repairing broken devices before replacing them. While a manual explaining troubleshooting processes can be a useful reminder, it is most important that sales agents receive practical training, which is clearly preferred over written instructions (own research). Fourthly, all sales agents must be educated in what a warranty is and what it entitles OOLUX customers to, so that they can transmit this information to their clients (Lighting Africa, 2012a: 78).⁵⁴ Similarly, to ensure battery recycling, customers must thus be incited to bring back the old batteries. In that regard, it was suggested to give a token on batteries that are brought back. Other possibilities include offering free replacement services or discounts on new batteries. Finally, the experience in Mishikishi confirmed the literature in that regular contact with customers, including maintenance visits, helps to ensure that the product is handled properly and that broken parts are replaced (Gradl and Knobloch, 2011: 27; own research). When customers can reach sales agents by phone, it can further facilitate communication and proper after-sales service. It also enhances customers’ confidence that their concerns will be taken care of (Lighting Africa, 2012a: 80).

⁵⁴ If repairs and replacements are ensured or not, the devices will have to be recycled one day – and it is certain that not all waste parts will be shipped back to Antenna to be recycled. This reality should be considered when designing the product: if it is simply and safely demountable, single parts may be used for other purposes. In fact, in BOP markets, “things of value are reused as a matter of course” (Gradl and Knobloch, 2011: 29).

8.1.3 Managing and Controlling Complex Distribution Networks

Assuming that a scalable OOLUX distribution network reaching rural villages is set up, a last sub-challenge of guaranteeing the availability of OOLUX is the management of that network. As Zamsolar highlighted, it requires a huge data management to keep track of their whole value chain and monitor and control all the activities and agents (Interview with Zamsolar, 2013). The OOLUX payment system further complicates the matter as the retailer may want to supervise the software activities of his or her sales agents, for instance to prevent fraud (a software can be copied to other computers, and PowerBoxes could be hacked and topped up ‘illegally’) (own research). It has even been asserted that an entrepreneur-based distribution system at a certain scale would not be feasible with a flexible payment system like the one of OOLUX: It would be very difficult to keep the whole value chain in place for the period of the instalment payments (Interview with Zamsolar, 2013). Indeed, keeping continuity in staff has been identified as a common challenge among “BOP marketers”, leading to high recruitment and training costs (Hystra, 2013: 13). The retailers should therefore try to align and motivate the sales agents so that they stay with OOLUX on a longer term (see e.g. WEF, 2009: 22). They could not only be better trained, but the risk of fraud would also be reduced. Like Zamsolar, the OOLUX retailers should ensure that the sales agents get a competitive compensation, making them attractive employers. Furthermore, sales agents could be motivated and aligned by receiving opportunities to develop their skills and to carry out additional tasks if they stay with the employer. In that regard, workshops and training in financing, marketing, IT or solar technology could be offered.⁵⁵

8.2 Affordability

Given that Zambia belongs to the least developed countries and that 60% of the population live under the national poverty line (World Bank, 2013c), any business targeting the country’s rural population will face the challenge of making products and services affordable to consumers (see e.g. Anderson and Billou, 2007: 9; WEF, 2009: 5). The challenge is reinforced in the case of novel products like SPL with high upfront costs and for which no established market exists yet (Lighting Africa, 2012a: 55). OOLUX is not only expensive compared to other available products in Zambia, but also a risky investment for a consumer who is unaware of the benefits of such modern lighting and charging solutions (Lighting Africa, 2012a: 73; Gradl and Knobloch, 2011).

⁵⁵ The author made very positive experience with the IT training she gave the OOLUX sales agent on the farm in Mishikishi. He acquired many useful skills in a short period – not only about the management of the OOLUX software application, but also about the use of a laptop, of computer programmes and of the Internet.

8.2.1 Low Purchasing Power and Income Volatility

The majority of rural Zambians are typical BOP consumers: Having low disposable incomes and relying on volatile and unpredictable income flows, they have to weigh up smartly between different purchasing choices and cannot take risks when making investments (WEF, 2009: 5ff; Moser et al., 2013: 5). To illustrate, the only time in the year the numerous small-scale farmers earn a decent amount of money is when the maize is harvested (those farmers who manage to grow vegetables or fruit have longer 'peak income periods' as they have a longer harvest season) (Finmark, 2012: 53; own research). Moreover, salaries on the countryside are generally very low, which is probably partly due to the fact that the majority of employment is informal (Davis, 2000: 12; own research). Many villagers therefore grow some maize in their backyards to earn an additional income. Some rural households further receive remittances from relatives in town, where incomes and employment opportunities are higher. What is more, in some remote villages people do not always work with cash but rather trade things (Interview with SunnyMoney, 2013; Davis, 2000: 12).

Unsurprisingly, most rural Zambians have no access to credit and savings institutions. As Napier (2011) finds, only one fourth of the population has access to formal bank accounts or another regulated financial institution like an MFI. 12% use informal financial mechanisms (e.g. rotating savings and credit associations (ROSCAs)) and a majority of 62% use no financial product or service at all (Napier, 2011: 10). Opening a bank account is very costly: Appropriate documentation is needed and banks usually do not have rural branches. The process of registration can take several days during which the customer has to stay in town (Finmark, 2012: 49; own research). The fact that the lending interest rate of formal banks has recently been lowered from around 20% to 12.1% does therefore not change much for rural, low-income households (World Bank, 2013c). At the same time, the Zambian microfinance sector is exceptionally undeveloped, even by regional standards (MF*Transparency*, 2011: 5). A promising development, however, is mobile money (transactions conducted via mobile phone), which is rapidly gaining in importance (FinMark Trust, 2012: 14ff).

The literature basically proposes two strategies to enhance consumers' affordability of energy products like SPL: consumer financing and flexible payment methods (Moser et al., 2013: 5ff). The first refers to providing customers with access to credit, which can either be done in-house or by partnering with NGOs, MFIs, banks or semi-formal or informal financial institutions. OOLUX's approach corresponds to the second strategy, namely allowing flexible payment schemes so customers can pay back the acquired product over several months (IFC, 2012a: 58; Lighting Africa, 2012: 61ff). Its micro-finance system being a key component of the OOLUX product and concept, consumer financing through credit will not be discussed further in this paper. Rather, the focus is on assessing the potential of the present system to facilitate consumer affordability.

To provide a basis for the examination of the current payment system, table 3 gives an overview of the specific schemes the two retailers have set up for the period of the field-test.

Table 3: Current Payment Schemes⁵⁶

	OOLUX retailer 1		OOLUX retailer 2	
	ZMW	USD	ZMW	USD
Total cash price of the kit	650	124	650	124
Increase of total price for each additional month of instalment period⁵⁷	5	0.95	5	0.95
Down payment	200	38	200	38
Mandatory first instalment (added to down payment)	100	19	150	28.50
Payment schemes offered	<ul style="list-style-type: none"> - direct purchase - 3 months - 6 months - 12 months 		<ul style="list-style-type: none"> - direct purchase - 3 months (or less) 	
Instalment payment terms	Customers are basically free when to pay the instalment but are encouraged to do so monthly.		Customers pay in maximum three instalments of ZMW 105 (USD 20) each.	

As table 3 shows, the two retailers chose similar prices and rates, which is in particular due to the fact that they operate in the same region. However, the customers of retailer 2 have fewer options, the choice being restricted to direct purchases and instalment periods of three months. They also pay a slightly higher first mandatory instalment than the customers of retailer 1 and have less flexibility with regard to paying back their instalments. Retailer 2 additionally included a paragraph in the payment contract that determines that the kit will be used as a collateral in case the customer does not pay the total price of the kit within the agreed period.⁵⁸ The reason for these adaptations is the high risk retailer 2 perceives when customers stop paying their instalments if the payment period stretches over several months – a concern that was shared by several other conversation partners as well (own research).

⁵⁶ Numbers in USD are rounded.

⁵⁷ To illustrate, with an instalment period of three months, the total price is ZMW 665; for a period of six months, the price amounts to ZMW 680.

⁵⁸ The payment contract states: "If the customer does not pay the total price of the kit within the period agreed upon in the sales contract, the kit will not become a property of the customer and the retailer has the permission to take the whole kit back".

It becomes obvious that with the payment scheme as it is currently implemented, the issue of product affordability is not fully resolved. In fact, there is a dilemma between the rather high down payment that retailers feel they have to insist on and the low disposable incomes of rural Zambians, which OOLUX explicitly intends to reach. The two retailers have found different ways to deal with that dilemma. Retailer 1 started by selling the kits to his employees. To make the purchase affordable, he proposes them to renounce their share of the annual profit of the farm (usually paid in June) and instead acquire an OOLUX kit without a down payment. To facilitate payments and further reduce default risk, he deduces each instalment from their monthly salary. This system is effective, but evidently not scalable. A more scalable solution is to target customers with a certain financial backing. Indeed, next to the employees of the farm, the first OOLUX clients are people with a regular income like shop owners or salaried workers (own research). To really make OOLUX affordable for low-income households, however, the down payment would have to be further reduced. One way to tackle that challenge is to lower the perceived default risk for the retailer.

8.2.1.1 Reducing the perceived default risk for retailers

One reason for the high perceived risk may be that flexible payment systems and micro-loans related to social purposes are not well-known in the region of the field test. Small shops sometimes offer flexible payment terms informally (Finmark, 2012: 52), but institutional arrangements to purchase goods on credit (e.g. services from MFIs or ROSCAs) did not seem to be commonly used (own research). It may therefore need some time for retailers to make their experiences with the system. Furthermore, as the experience from the field test shows, the perceived default risk for retailers is lower when they know the customers personally or live in the same community. An ongoing contact between retailers and customers – or, when business scales, between their sales agents and customers– also helps to align clients over time and establish a relation of trust. The importance of the relationship of trust is illustrated by the fact that both retailers have so far preferred to select their customers, choosing only people that they perceived as trustworthy and educated enough to understand the payment system (own research).

Now how much would the down payment of OOLUX have to be lowered to be affordable? A teacher from SunnyMoney's network estimated that a price of around ZMW 160 would be affordable for 'ordinary Zambians'. While this matches the estimation of other conversation partners, the customer segment they had in mind were probably not the poorest villagers (own research). Yet, it seems to be a reasonable target down payment price for OOLUX at the present stage. It should further be noted that given the very volatile incomes of many rural Zambians, that amount can be affordable on one day or month but not on another. Accordingly, the best time to sell a relatively expensive product is after maize harvest.

Several conversation partners further suggested offering the option of paying the upfront costs in crops. This would help expanding the customer base to poorer households – at least during the harvesting season (own research; see also Gradl and Knobloch, 2011: 25).⁵⁹

Finally, on the longer term, down payments may be lowered somewhat automatically as the OOLUX business evolves. In fact, once confidence in the product is enhanced, a market established and the OOLUX business consolidated, the risk for both customers and retailers may well be reduced (IFC, 2012a: 14ff; Lighting Africa, 2012: 54ff). If the current retailers first target consumers that can afford the high down payment, other customers may become convinced of the product's usability and benefits. Also, it gives retailers time to become acquainted with the OOLUX concept and micro-finance system. To reinforce that process, early adopters could even be used as marketing agents to promote the product and catch the early majority (IFC, 2012a: 51). On that basis, the retailers can consolidate their business, which will hopefully lead to more stable income flows. Reaching that stage, they may be able to set up more flexible payment schemes and try out lower down payments.

8.2.1.2 Rental systems

Another strategy to tackle the problem of the down payment is to implement a rental or leasing system (see e.g. IFC, 2012a; Lighting Africa 2010a and 2012a; Anisuzzaman and Urmee, 2006). Instead of selling the OOLUX kit, the sales agents would lease the use of it to customers, thereby avoiding the down payment (Lighting Africa, 2012a: 71). Lighting Africa describes the system as involving contracted or franchised micro entrepreneurs who establish so-called "solar charging kiosks". These entrepreneurs either offer SPL rentals on an hourly or daily basis, or sell the lamps/batteries without a power source and offer charging for a fixed fee. For OOLUX, the first option seems more feasible as it takes at least an entire day to recharge the PowerBox. While rental systems have variously been implemented successfully, their feasibility for OOLUX in Zambia is debatable. On the one hand, Lighting Africa finds that rental systems suit undeveloped markets with lacking infrastructure and few existing sales and marketing channels like Zambia (Lighting Africa, 2010a: 40-41). On the other hand, the high dispersion of the Zambian population again presents a major obstacle. A rental model requires a very regular physical contact between sales agent and customer. But even single villages are often very widespread, so in many places it would be impossible to have one sales agent serving a reasonable number of customers without the latter travelling a long distance (own research). Evidently, the model is more suitable for densely

⁵⁹ The Zambian Government has recently established a system to support small-scale farmers: it allows them to sell their maize to the government who pays them a higher price than the market price. But the system is not very well organised, requires much time and effort for the farmers. In addition, it obliges farmers to have a bank account. Paying the OOLUX kit in crops could therefore be an attractive solution for customers, sparing them the effort of selling their crops to the government. From the viewpoint of the retailers, this system could be conceivable especially if they cultivate maize themselves, like on Mishikishi Mission Farm (own research).

populated areas (Lighting Africa, 2010a: 40ff). Furthermore, the model entails a high capital investment for the sales agents in order to build a charging station and a product inventory including a number of complete OOLUX kits. It would thus require an elaborated financing scheme for the agents, who will by the majority not be able to make that investment (own research). Yet, if OOLUX should at a later stage be distributed in peri-urban, more densely populated areas, it may be worth looking into rental models in more detail.

8.2.2 Product Affordability

Of course, to increase affordability companies can also work at reducing the actual price of the product offered. In the case of OOLUX, however, there is not much room for that if the overall concept and value propositions are to be kept. Making design and technology simpler, for instance, would reduce the price but stand against the aim of offering a nice-looking, high-quality product. Furthermore, it is difficult to offer OOLUX in smaller, thus less expensive packages, a strategy that has been successful for FMCG (WEF, 2009, p.25). What would be feasible is to make the OOLUX kit smaller, for instance by renouncing on the lamp stand⁶⁰ and on one lamp. Yet, this would stand in contrast with potential customers' stated need to have at least two lamps to lighten their home appropriately (own research). It could also be in conflict with the strategy of promoting OOLUX as a lifestyle product (see section 8.3.1.3). On the other hand, lamps and other parts could then be sold individually so those who can afford it have the possibility to 'upgrade' their kit.

There are many other cost-reduction strategies that concern the organisation of the supply chain, from the manufacturer until the end consumer. While it would be interesting to look at the possibilities to rearrange the OOLUX supply chain in order to reduce costs, these considerations are not within the scope of this paper.

8.2.3 Limited Financial Capabilities and Low Access to Capital of Small Enterprises

Naturally, affordability is not only a challenge for end consumers, but also for the actors involved in the local distribution network – be it at the level of the distributor, of the retailers or of commissioned sales agents (Shukla et al., 2011: 9). In fact, the two current retailers themselves have limited financial resources. Without financial support, they will hardly be able to acquire a larger stock of OOLUX kits once production is scaled. Yet, access to financial services remains out of reach for many Zambian entrepreneurs who are unable to even afford access to the most basic financial services (Clarke et al., 2010: 50).

SunnyMoney reduces its own financial constraints by working with the Ministry of Education and the local education authorities, thereby gaining access to an extensive working force without having to pay them. As far as the teachers are concerned, a system was introduced

⁶⁰ Indeed, the kits of the next OOLUX series will not include the lamp stand anymore.

that omits their need for seed capital to acquire the lights from SunnyMoney. Instead of having a product stock, they take orders and collect the money from the customers previous to the actual delivery of the lights. Orders are regularly transmitted to SunnyMoney, which collects the money from the teachers when making the delivery (Interview with SunnyMoney, 2013). The system works differently for SunnyMoney's standard retail channels. While these ordinary retailers of consumer durables do have to acquire an initial product stock, they are only involved in the distribution "once enough demand and momentum has been created" for the market to grow sustainably (Miller et al., 2013: 4). Hence, they face a smaller risk than when the product is unknown and sales unpredictable. Nevertheless, suitable retailers must have enough financial resources to directly purchase the lights: SunnyMoney did at the time of research not offer credit to their retailers (Interview with SunnyMoney, 2013).

In the case of OOLUX, limited financial capabilities and access to capital present obstacles at various levels of the distribution network. At the level of Antenna's partner, a formal loan with a bank could be considered. One could also look into the possibility of finding a social investor or another financing partner sharing the social mission of the project. This may, however, require the support of Antenna or another institution that has the experience and the network to find such a partner. The need for capital at that level increases if Antenna's partner chooses to provide credit to his retailer(s). For the period of the field test, Antenna's partner and retailer 2 have agreed on flexible payment terms, allowing the latter to pay back the kits he purchased from the former over a certain period of time corresponding to the payment schemes offered to his customers.⁶¹ Such a flexible payment scheme, adapted to the instalment periods of the clients, could also be expanded to the level of the sales agents distributing the product to the last mile. If an extensive VE distribution network should be built, however, this would require the distributor or retailer commissioning the entrepreneurs to manage diverse delayed revenue streams. As mentioned before, a 'hybrid VE model' where the VE do not have to acquire the kits themselves may thus be preferable. However, further research will be necessary to assess the feasibility and the benefits of these financing strategies, as well as their compatibility with various distribution channels (own research).

8.3 Acceptability

In order to enhance the willingness of actors in BOP markets to distribute, retail or consume a product or service, it must be adapted to their distinct needs (Anderson and Billou, 2007: 15ff). One aim of the field test was therefore to understand consumers' daily lives and needs

⁶¹ Their contract envisages the following payment scheme: Retailer 2 may pay back the kits in instalments and within a maximum period of three months, corresponding to the payment schemes of his customers. In addition, he is only allowed to purchase the next stock of kits once he has paid 70% of the total price of the previous purchase. If the total price is not paid after three months, retailer 2 is charged a fee per piece and month of non-payment. It should also be noted that Antenna's partner has been selling retailer 2 the kits for a price that is only slightly higher than the FOB price. His goal was not to make a good profit – such a deal would not be possible within a commercial supply chain.

as well as to become familiar with the local business environment. Gaining such insights is crucial to localise both product and customer services, to build trust around the brand and ultimately to achieve acceptability of a product (Moser et al., 2013: 6ff).

8.3.1 Initial Lack of Trust in New Products and Brands

In Zambia, OOLUX is not only a new brand entering the market but also constitutes a type of product that was previously unknown to most people in rural regions. While the villagers in the area of research knew about solar energy, they had not heard of SPL before and were unaware of their benefits. For these potential customers, there is a high risk associated with a purchase of OOLUX. This risk is reinforced by the fact that many of them are not experienced in estimating the technical performance, reliability and usability of a high-quality product like OOLUX (own research). Moreover, the reluctance to accept a new kind of lighting device can be reinforced if consumers' experience with non-traditional lighting sources is restricted to low-quality products with poor performances and a short lifespan (Lighting Africa, 2012a: 81). Indeed, non-conventional lighting options available in rural Zambia are often cheap, battery-powered lamps that are not much brighter than candles (own research).

8.3.1.1 Offering real, tangible benefits

Products that can offer real economic benefits like SPL are more likely to gain acceptability among potential customers. To overcome the initial lack of trust, these benefits should be made as tangible as possible, using simple and clear economic arguments (Hystra, 2013: 5). SunnyMoney's promotion strategy, for instance, focuses on the main benefits of the product. These include potential savings in the longer term, durability as well as reliable and healthy energy. One of their flyers states: "Study More. Save More.", referring to economic benefits in simple words. Furthermore, calculations are made together with potential customers to illustrate how much they spend on candles a year and put that amount in relation to the price of a solar light (Interview with SunnyMoney, 2013). OOLUX retailers also used that strategy, which additionally allowed giving potential customers an estimation of how much they could earn with the kit by charging phones of neighbours or clients in the case of shopkeepers.

But even if potential customers principally understand the economic benefits the product promises to bring, they may still fear to be disappointed by its actual performance (Hystra, 2013: 6), especially when not familiar with the notion of quality or technologically superior electronic products with a long lifespan. Clear messages must therefore be completed with product testing and demonstrations, giving people the opportunity to experience the product firsthand (WEF, 2009: 12). Making potential customers try out themselves how OOLUX works has indeed been recognised as a successful way to gain acceptability from Zambian consumers. During product demonstrations, the audience was actively involved and encouraged to try out the kit's functions. They were also taken inside a house so they could

see the brightness of the OOLUX lights in comparison to known alternatives. Moreover, several phones of people from the audience were plugged to the PowerBox simultaneously, which not only made this ability of the kit more tangible but also delighted customers who got some free charging time. More importantly, these strategies enabled potential customers to make out their personal benefits in the kit. Finally, people involved in the distribution of OOLUX as well as a few potential early adopters were offered to try out the kit for a few nights. The feedback from such product testing was very positive, as the trials allowed experiencing the product's benefits in the home environment and thereby making out potential personal advantages (own research).

8.3.1.2 Working with entrusted personalities

Effectively gaining trust and acceptability also depends on the person who communicates the marketing messages. In that sense, people's confidence in a product and brand can be enhanced if the benefits are transmitted by entrusted personalities. As SolarAid states, "[h]eadteachers have a unique relationship of trust with community members" and are therefore very effective at promoting the solar lights at an early stage when awareness and demand are still limited (Miller et al., 2013: 5). Similarly, Zamsolar's scouts operate in the community they come from and are thus better able to build trust among villagers than outsiders (Interview with Zamsolar, 2013). Indeed, Antenna's partner being a trusted personality in Mishikishi, his involvement in OOLUX seemed to give greater weight to the product's value propositions (own research). Moreover, both early adopters and trusted personalities who promote the product may effectively generate positive word-of-mouth, which is essential to create general acceptability and demand for the product (Hystra, 2013: 11; IFC, 2012a: 51ff; Interview with SunnyMoney, 2013). This is especially true for people with lower incomes, who wait for friends and relatives to make first experiences before they accept an unknown product themselves (Interview with Zamsolar, 2013).

Finally, it is crucial that all stakeholders involved in the local supply chain are both well informed about OOLUX's advantages and value propositions and themselves convinced of its benefits. A priority for the distributor must thus be to gain their acceptance for OOLUX. This is especially true since local sales agents – knowing the preferences and needs of potential customers – are very good at adapting the product's value propositions to the local context and using the right words to explain and promote the kit (own research).

8.3.1.3 Making a lifestyle proposition

The initial lack of trust in a new brand and product must be balanced against many people's affinity for novel products that are perceived as enhancing their social status (Hystra, 2013: 6). The impressions from the field test lead to assume that target customers generally like possessing novel and nice-looking things that may attract the attention of friends and

neighbours. Indeed, OOLUX has been perceived as an attractive product that is quite obviously distinguishable from cheaper alternatives: both the devices and the package look nice and stylish; and the kit not only offers a two-in-one solution (lighting and charging) but also constitutes an entire 'mini solar home system'. Hence, OOLUX seems to be very suitable to be marketed as a "lifestyle accessory" retaining an aspirational value (Avato and Madeira, 2010: 8; own research). Especially in the first phase of the distribution when early adopters are targeted, a marketing strategy evolving (among others) around this lifestyle proposition may work well (Avato and Madeira, 2010: 8). The experience from first marketing efforts in Zambia reinforces that statement: Those who were attracted first by the promotions were mostly the curious people, and those who want to be first in adopting a novel product. For them, OOLUX certainly had an aspirational value (own research).

8.3.1.4 Offering after-sales services

Finally, trust-building in new brands and products is influenced by the service customers are offered *after* the actual purchase of the product. If people know that they can rely on the sales agent to assist them in case of a problem or defect, the risk involved with the purchase of an unknown product is further reduced (IFC, 2012a: 56). The warranty of two years provides a first guarantee to customers that broken devices will actually be repaired. Trust can be enhanced further by making the sales agents' contact details available to customers. This can also help to gain acceptability on the longer-term, as the next section will discuss.

8.3.2 *Managing Longer-Term Acceptability*

Gaining acceptability does not only depend on people's willingness to purchase or market OOLUX in the first place, but also on their longer-term willingness to use the product. It has been observed that products remain unused when the consumer would have to make a proactive effort in order to keep on using it, for instance when the battery needs to be replaced (Moser et al., 2013: 8; Hystra, 2013: 11). As mentioned before, those electronics available in rural Zambia are rather short-lived – quality and robustness are not central. Furthermore, as Lighting Africa notes, customers are often not aware of warranty entitlements and after-sales services, so no assistance is sought when a product breaks and it is simply wrote off as a bad investment (Lighting Africa, 2012a: 78). It is therefore particularly important not only to offer professional after-sales services but also to promote these services so that customers know what they can rely on (Hystra, 2013: 11). OOLUX sales agents should explain to their customers what the warranty entails and what the procedure is in case something brakes. Furthermore, maintenance and replacement procedures must be simple and easily accessible for the customer. What has worked well for OOLUX was to first try to give advice to customers over the phone and, if necessary, visit them at home and follow up with the problem. First experiences have also shown that

especially when customers installed their kit on their own, it is worth paying them a visit to check if it is put up properly and to give advice on its use (own research). In the longer-term, attention should be put on assessing user satisfaction. Once the kit has been fully paid, sales agents should still follow up with customers to learn about their experience with the product beyond the phase of initial excitement (Hystra, 2013: 11). In addition, if the battery lifespan cycle is calculated correctly, sales agents can contact or visit their clients when replacement is likely to be needed (Shukla et al., 2011: 9).

Another way to tackle the challenge of long-term acceptability is to sell additional or improved parts: For instance, OOLUX could sell individual lamps so users can expand their system. Moreover, OOLUX sales agents should be encouraged to offer accessories such as compatible radios, fans or small TVs. As in Zambia most radios run with 3, 6 or 9V while the kit can power 5V devices, inexpensive 5V radios could be imported and sold in addition to the kit. Also, sales agents should promote the possibility of charging devices up to 9V, like small TVs, directly with the solar panel. This could further enhance the value of the kit for the customer and open possibilities of gradually upgrading the system (see also IFC, 2012b: 36). The offer of complementary products also enhances the possibility of adapting the product to the needs and preferences of local customers (Shukla et al., 2011: 10). In fact, while the basic value propositions of OOLUX are the same in all markets, its modularity is a key feature to 'localise' the product. In that regard, the field tests have been key in identifying country-specific needs or circumstances that require an adaption of the basic OOLUX concept (see also IFC, 2012a: 45). Especially the contact with both people knowing local markets and business practices as well as with potential customers were extremely valuable to get advice on the localisation of the product and the marketing strategies. For instance, several conversation partners indicated that phone charging and listening to music are more important to Zambians than having good light in their house – so marketing efforts put more emphasis on these features of the kit (Interview with Zamsolar, 2013; own research).

8.4 Awareness

When introducing a new product like OOLUX to BOP markets, businesses first have to create awareness about its intended use and benefits – a key to build a market and establish demand for a product. As Lighting Africa notes, once consumers become more familiar with solar products and their benefits, their willingness to pay increases substantially (Lighting Africa, 2010: 65ff). Yet, creating awareness can be a challenging task when conventional advertising channels are not commonly used and when low education levels complicate communication (Anderson and Billou, 2007: 19; Vachani and Smith, 2010: 6).

In Zambia, the process of awareness creation on solar lighting and charging devices has indeed only just started. According to SPL distributors, people in other countries in the region

are already much more sensitive to solar alternatives to traditional lighting source (Interview with Zamsolar, 2013; Interview with SunnyMoney, 2013). The SPL market is only about to be created: distributors in Zambia are now at a stage where early adopters have started buying the lights while other potential customers are still forming their opinion (Interview with Zamsolar, 2013). What is more, many rural Zambians have little experience with good light in general. An interesting observation highlighting Zambian consumers' limited awareness of different light qualities was made by Lighting Africa (2008b: 51): a majority of respondents whose houses were poorly lit claimed that they would improve the lighting situation in their homes by adding more lights (and not, for instance, increase the amount of light from each device). Many people did not seem to be aware of the fact that a light with a higher output could make a room much brighter than simply adding more low-quality lights.⁶² For the distribution of OOLUX in Zambia, this means that awareness creation must at the current stage be a cornerstone of the business activities. Now through what channels can people be reached? And what messages are appropriate to create awareness of solar lighting devices?

8.4.1 Limited Access to Modern Communication and Media Platforms

Like in many BOP markets, access to mass communication is low among target consumers in Zambia, restricting the ways of awareness creation used in developed countries. Most Zambians in rural areas do not use the Internet and possess neither a TV nor a laptop. A national media survey found that only 27% of the rural population have access to a television and that an even lower percentage reads newspapers. A determining factor in the limited use of these media is the poor knowledge of English, especially among low-income groups (in less-developed provinces, 38-46% do not understand English). In contrast, radios are widely used among all population groups and have thus been identified as an effective means to reach a large, diverse set of people (Murthy et al., 2010: 16ff). The same may soon apply for mobile phones, which are more and more commonly used among all income segments and thus have a large potential to become important means to access news and information (AudienceScapes, 2010). Interestingly for OOLUX, a major impediment to the use of modern media is the lack of electricity to power the devices (Murthy et al., 2010: 27) – a problem that OOLUX can resolve in the case of small radios and mobile phones. AudienceScapes further identifies friends and family as a key source for accessing news and information, particularly among the rural, low-income population (AudienceScapes, 2010).

8.4.1.1 Using unconventional marketing channels

This leads to the assumption that next to radio and possibly mobile phone campaigns, strategies to broadly create awareness about a new offer and brand like OOLUX must focus

⁶² It should of course be noted that the Lighting Africa survey was conducted in 2008 and that the process of awareness creating may since have advanced.

on positive word-of-mouth creation and personal interaction with consumers. In accordance, Lighting Africa notes that in the SPL market, “word-of-mouth remains the most important channel to spread awareness and generate consumer confidence” (Lighting Africa, 2012a: 75). Road demonstrations, product trials as well as door-to-door marketing have further been recognised as well suitable to raise awareness among customers, impact their behaviour and build brand loyalty (Lighting Africa, 2012a: 76). These findings correspond to the strategies of solar distributors in Zambia. In the case of SunnyMoney, awareness raising and trust building happens to a large part through the teachers’ network. Teachers are close to the community members and thus able to personally reach potential customers to create awareness and trigger positive word-of-mouth (Interview with SunnyMoney, 2013). The author visited one school selling lights for SunnyMoney – at that school, the system worked very well: demand was created quickly and has remained high for the whole product range (own research). Similarly, Zamsolar creates awareness through their network of sales agents who go door to door in their communities to promote the company’s products. In addition to personally reaching out to potential customers, the sales agents – knowing their local community – can find the right messages to communicate with the people (Interview with Zamsolar, .2013). The first OOLUX marketing efforts concentrated on product demonstrations in village shops, schools and at the Mishikishi Mission Farm. They have shown positive effects and reinforced the statement that personal interaction and word-of-mouth are crucial marketing channels: Word spread very fast about the OOLUX kit, or “solar”, as it was simply called, and villagers who had heard about it approached retailers with interest. Also, the reactions from the quite interactive product demonstrations were very positive. To reinforce the process of awareness creation, it was suggested to distribute flyers to the audience of demonstrations. This would provide them with a reminder of OOLUX while they take their time to form an opinion about the product and possibly even make a purchasing decision. Similarly, posters could be put up in village shops or schools where the kit was demonstrated (own research). While demonstrations have so far been organised informally and on an ad hoc basis, retailers could start specifically targeting village markets to promote the OOLUX kit, thereby broadening the audience. These markets usually take place once or twice a week in larger villages like Mishikishi and are frequented by many people in the surroundings areas. Markets are quite busy places – if a novel, thus interesting product like OOLUX were promoted on the market, it would get a lot of attention and word about it would certainly spread fast. As various conversation partners stressed, markets would therefore be an ideal place to promote OOLUX. A small tent could be put up to demonstrate the kit, educate people about the benefits of solar lights and distribute flyers (own research).⁶³

⁶³ Markets could also be a suitable location to sell OOLUX and top up PowerBoxes. Even if one can thereby not attend customers in an equally flexible way as when going door to door, quite a broad base of customers could

8.4.1.2 Using locally available marketing platforms

Another way to promote OOLUX – although to a different audience – is at fairs or expositions, such as the annual *Zambian Agricultural and Commercial Show*⁶⁴ aiming at improving the country's agriculture and living standards, or the recently launched *Green Expo Zambia*⁶⁵, a yearly event in Lusaka promoting sustainable lifestyles and creating awareness of available eco-friendly products and services. Although the typical visitors of such fairs are not part of the primary target group of OOLUX, such a platform can help creating awareness about the brand, the product and the benefits of solar energy. Furthermore, it can be an opportunity to expand the network and find potential distribution partners, including NGOs and local businesses (own research). As SunnyMoney's experience at Green Expo shows, it can even be an opportunity to advertise the product on television and to access other advertising channels (SolarAid, 2013b).

8.4.2 Low Literacy and Education Levels

Even if information is available to consumers, it does not have an impact unless people can derive value from it. As Vachani and Smith note, poorly educated people suffer a natural disadvantage in building the knowledge and skills to extract the benefits of the information provided (Vachani and Smith, 2010: 6-7). In Zambia, even if more than 90% of pupils reach seventh grade, there are concerns about the quality of education (UNDP, 2013a: 22-23). The author's observations confirm such concerns: there are students even in higher grades knowing only very little English even if the language is taught already in grade one. Also, familiarity with basic terminology about financing, for instance, is very low among Zambians (Melzer et al., 2010: 32-33). Also, in rural areas there is often no choice but to send children to nearby schools where proper facilities are lacking and the pupil-teacher ration is very high – private schools are not affordable for many households (own research; UNDP, 2013a: 23). Given the low education levels of many potential customers, it is a particular challenge to create a proper understanding of solar energy and related products. Even if using familiar marketing channels certainly increases the comprehensibility of information, the messages themselves need to be understandable and put into the local context (WEF, 2009: 28). In that regard, several conversation partners have raised concerns that all the customers will understand OOLUX micro-finance system. It is therefore crucial that local people explain how it works in their words and language. Furthermore, the explanations should be given orally, as people seem to attach much more value from oral information than to written texts. For instance, customers preferred to ask the retailers directly rather than consulting the owner's

still be reached regularly, as many people frequent the market. This would require sales agents to attend certain markets every week and be flexible to sometimes also visit customers at other times if problems occur (own research). Further research on the ground could look into such a marketing system in more detail.

⁶⁴ For more information, visit the website of the event: <http://www.acsz.co.zm/>.

⁶⁵ For more information, visit the website of the event: <http://www.thegreenexpozambia.com/>.

manual (own research). Moreover, as for building trust in a new product or brand, providing the opportunity to experience a product first hand can further help even little educated consumers to derive value from the information given (WEF, 2009: 28).

Again, hiring local sales agents can also enable a better comprehensibility of the new information and thereby contribute to creating awareness to a broad, little educated public. The field tests showed that locals have a good feeling how to communicate the product's value propositions in an understandable way. The people involved in the marketing of OOLUX not only came up themselves with effective marketing approaches (such as making people experience the light at night and in comparison to candles) but they also adapted the value propositions of OOLUX to the local context, using examples from everyday life.⁶⁶ It was further helpful to encourage the audience of demonstrations to ask questions and engage in discussions (own research). As far as flyers or posters are concerned, the same applies as for consumer education: too much written text does not add value to the message. As put forward by the OOLUX retailers, on a flyer there should be nice pictures of the product, some key words about the most important benefits, the price as well as the contact details of the sales agent (own research).

Due to the limited scope of the research, the author did not have the chance to investigate the promotion via radio campaigns or social media. Nevertheless, especially with the spread of mobile phones that allow listening to the radio and accessing the Internet, further research in this regard would certainly be of value for SPL marketers. Nevertheless, in the near future, advertisements on the radio or in social media will not replace product demonstrations, trials and door-to-door marketing in creating broad awareness about solar technology, and in particular about OOLUX, especially at the beginning of market creation (own research).

8.5 Recommendations for the OOLUX Venture in Zambia

Based on the preceding discussion on various challenges and corresponding marketing strategies, this last section will draw practical recommendations for the OOLUX venture in Zambia. These do not address Antenna's field test partner specifically but concern all current and future stakeholders involved in the marketing of OOLUX in Zambia. The section intends to give a more concise answer to the second research question, namely how OOLUX could be marketed to overcome the challenges in rural Zambia successfully. Hopefully, the analysis also includes useful advice for other SPL distributors entering the Zambian market.

First, to elaborate effective marketing channels, the venture should get a clear idea of the target customers. An overall focus on OOLUX's primary target group makes sense given the goals of the project leaders. Especially for the distribution in the area of the field test, the

⁶⁶ One of the retailers further spoke of "us" during product demonstration, including himself when speaking about the need for lighting and mobile phone charging thereby effectively creating a sense of all being in the same boat.

primary focus could remain on that group – it suits the business context and the potential market. At the same time, the venture should look into reaching middle- to high-income consumers in towns: they will pay in cash, thus helping to generate revenues necessary to scale up. Once these marketing channels are established, it is worth looking into potential partners with a presence in compounds and carrying out a market assessment and a field test in peri-urban areas.

Secondly, to make the product available to these customer segments, a combination of several distribution channels is needed. For the distribution of the first few product series, a focus on a limited region could allow the OOLUX venture to gain experience and develop a distribution network. To reach the main target group, a network based on village entrepreneurs who receive a fixed salary seems promising due to the relatively wide reach of a net of VE as well as their knowledge of local contexts and communities. A strategy to set up such a network should be elaborated upon arrival of the next product series and must incorporate the adapted micro-finance system Antenna is currently developing. One major focus of that strategy must be the (continuous) training of the entrepreneurs – a well-trained, motivated workforce is key to a successful distribution of the product; another focus should be on simple, convenient delivery and replacement procedures. It is furthermore worth looking into the marketing of OOLUX on village markets, which would facilitate reaching a broad customer base. Moreover, partnerships with selected general dealers of consumer durables in towns could be established to reach higher income customers (note that they may sell the kit at a higher price and without the payment system). In parallel, the distributor in Mishikishi could explore possibilities of collaboration with the Catholic Diocese or individual missions in the region. Such partnerships could in particular provide opportunities to find and recruit VE and to establish storage centres for products and warranty stocks.

Thirdly, with regards to making OOLUX affordable, it is quite obvious that the current down payment must be lowered (by around half of the current amount of ZMW 300) in order to reach the primary target customers widely. A condition is to reduce the perceived default risk for the retailers. Therefore, in the starting phase of the business, retailers should have the possibility to focus on selected customers and gain experience with the financing mechanism. The goal should be that once a network and trust in the micro-finance system are established, down payment is lowered. Given the volatile incomes of Zambians throughout the year, marketing efforts could be intensified in the periods when money is available, primarily after maize harvest. While a rental system is not suitable for the dispersed villages in rural Zambia, this option should be investigated further if peri-urban, more densely populated areas are targeted later on. Furthermore, due to the limited financial capabilities of retailers on the one hand, and delayed revenue streams and unpredictable demand for OOLUX on the other hand, flexible payment terms or credit schemes are needed

to enable retailers to acquire a stock of kits. These terms are best adapted to the payment schemes offered to customers (and of course to the new application of the micro-finance system currently being developed). Further research is needed on available financing options for actors involved in the local supply chain. In that regard, Antenna could support its local partners by providing a platform where best practices among all partners are shared.

Fourthly, given that OOLUX is an unknown brand and product in a little developed market, gaining acceptability and raising awareness among target customers will need a lot of effort. The strategy of using clear and simple economic arguments to promote the real economic benefits it offers proved to work well. At the same time, product demonstrations that actively involve participants as well as free product-trials for potential early-adopters and actors involved in the marketing of OOLUX contribute to making these benefits tangible for each individual. It is thereby key to generate positive word-of-mouth, probably the most important way of promoting a new product and brand. Posters and flyers can help reinforce the process of word-of-mouth. Also, trusted personalities should be involved in the promotion as they have more leverage to establish confidence within their communities. In general, oral instructions and demonstrations are much more effective than written text, so promotional material should focus on key words and pictures. Finally, relationships of trust should be established between sales agents– who are best recruited locally – and customers. The former must be easily reachable by clients and should actively follow up with customers on their satisfaction with the product. Proper after-sales service must be guaranteed and sales agents ready to dedicate considerable time to the attention of customers.

9 Conclusion

The latent demand for affordable, modern energy sources in Africa is huge. Grid extension cannot keep pace with population growth or is simply too expensive in sparsely populated, rural areas. BOP households thus rely on expensive and unsustainable energy sources. The exceptional growth of the African markets of small solar off-grid lighting and charging devices, however, demonstrates that both innovative technological solutions as well as successful business models exist to serve the needs for lighting and charging phones of un-electrified, low-income households.

The aim of this thesis was to assess the challenges of marketing such a solar off-grid solution to BOP households in rural Zambia and to elaborate possible marketing strategies to successfully address these challenges in the case of OOLUX. The analysis of the Zambian energy market and electrification trends provided the bigger picture of the market OOLUX enters. It highlighted the widespread and continuous demand for modern energy sources in rural Zambia despite ambitious governmental plans to expand the grid. The study further

found that while solar energy is not widespread yet, PV technology is becoming more popular both in the private market as well as in public programmes.

Looking at Africa-wide trends in the SPL market and examining the status of SPL in Zambia, the thesis showed that the latter is comparatively little developed. Yet, while only few distributors currently reach a broad customer base in rural areas in Zambia, the number of actors in the market is growing and current players are expanding. Among the transparent but increasing number of competitor products, OOLUX belongs to the higher end, offering high capabilities but also being relatively expensive.

The investigation of the specific challenges of marketing OOLUX in the rural Zambian market depicted the typical characteristics of BOP markets. The key challenge found can be summarised as the lack of infrastructure networks to reach a dispersed population in a vast country. In the case of a relatively expensive product like OOLUX, another major challenge is the affordability for both target customers and actors involved in the local supply chain. The analysis further showed that high commitment from local stakeholders is required to build trust in OOLUX as a new product and brand, and to raise awareness of the benefits of solar energy in general. A lot of face-to-face marketing but also continuous interaction with customers are needed to generate positive word-of-mouth, the most important channel to create awareness and trust.

Some limitations of this thesis should be pointed out here: First, due to the limited regional scope of the field test, it is based on data and experience gathered in a small area of Zambia. The conclusions may therefore not apply for other provinces or less accessible and developed areas. Also, due to the limited scope of the thesis, many propositions are only briefly touched upon and would have to be investigated in more depth in order to make well-founded conclusions. Further research would be necessary in particular on different financing schemes enabling small businesses to take part in the distribution of OOLUX, as well as on the feasibility of different distribution channels, in particular on a network relying on village entrepreneurs. Finally, many considerations remain hypothetical due to the fact that only few plans on how to market OOLUX at a larger scale existed at the time of research. Given that there is currently no institution involved in the distribution of OOLUX in Zambia, it was difficult to elaborate specific recommendations, as there are no existing structures or networks.

Beside these limitations, the thesis delivered useful insights in the marketing of a novel solar lighting and charging device in a rural Zambian village. In particular the experience and valuable insights shared by many individuals – including villagers, OOLUX customers and retailers, as well as other people involved in the solar off-grid market – contributed to the development of a comprehensive overview of the challenges of serving rural Zambian markets and to elaborate elements of successful strategies to overcome these challenges.

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Interviews

Interview with SunnyMoney (2013). Semi-structured interview with Claire Arthurs, Lusaka, 31th May 2013.

Interview with Zamsolar (2013). Semi-structured interview with Thomas Smyth, Lusaka, 27th May 2013.

Appendix

Annex 1: SPL Product Range and Prices in Zambia

The following table depicts the range and prices of the solar portable lights (SPL) offered by the distributors with offices in Lusaka that the author of this thesis visited during the field research. These include SunnyMoney¹, SunPower Africa, Suntech and Zamsolar. Prices enlisted correspond to the end-consumer prices in May 2013. It should be noted that the four distributors do not each sell all of the products listed in the table.

Manufacturer	Product	Price in ZMW	Approx. price in USD ²
Barefoot Power	<i>PawaPack 2.5W</i>	380	72.50
	<i>PawaPack 5W</i>	650-720	124.50-138
	<i>Barefoot fly mobile</i>	140	27
Bboxx	<i>BB5 Solar Kit</i> (offer includes a small TV)	1'500	287
d.light	<i>S2</i>	60	11.50
	<i>S10</i>	75	14.50
	<i>S250</i>	260	50
Greenlight Planet	<i>SunKing Eco</i>	75	14.50
	<i>SunKing Pro</i>	210-220	40-42
Phocos	<i>Premium Set</i>	806.40	154
	<i>Premium Plus Set</i>	1'417	271
Trony	<i>Sundial TSL01</i>	250	48
	<i>Sundial TSL02</i>	350	67

Sources: Interview with SunnyMoney, 2013; Interview with Zamsolar, 2013; SunPower Africa, 2013; Suntech, 2013a; own research.

¹ In the case of SunnyMoney, the prices taken into consideration in this table correspond to the standard retail prices. At the schools, the products are sold at a slightly lower price.

² The prices in USD are calculated with the currency rate of 01.06.2013: 1 USD = 5225.6495 ZMK and adapted to the new currency ZMW (divided by 1000). Numbers are rounded.

Annex 2: Questionnaire for Semi-Structured Interviews

Questionnaire for Semi-Structured Interviews with SPL Distributors, May 2013, Zambia

Introduction: Research for master thesis, which is linked to OOLUX (brief presentation of project). Thesis' objective: identification of challenges of marketing solar lighting devices to customers with low incomes living in rural areas and examination of possible solutions; 4As as the theoretical basis => questions on distribution system and related challenges are structured accordingly.

Introductory questions

1. What are the main objectives and activities of your institution?
2. Who are your target customers?
3. Could you please explain the structure of your distribution network, including the key steps and actors involved in getting the product to the end consumer?

Availability

4. What are the main challenges regarding the physical distribution of your products and services? (e.g. bad roads, no fuel, geo dispersion, communication/energy network. Physical distribution = enable the customer to readily acquire and use a product or service)
5. What ways are there to overcome these challenges?
6. Are there any existing distribution networks that you do/could build on?
7. What are the main challenges with regards to the recruiting, training and/or managing of your sales force?

Affordability

8. What are the challenges regarding making goods and services affordable to target customers?
9. What solutions are/could be chosen to increase affordability? (e.g. flexible payment system, microloans, payment with crops)
10. How can purchasing power of the target customers be increased? (if not answered with previous question)
11. [If the institution sells their products to retailers] Could you please explain how your products are sold to the retailers and point out the related challenges?

Acceptability

12. Did you face any problems regarding the acceptability of your products and services by both retailers and consumers?
13. How can a product or service be adapted to local needs and market mechanisms?

Awareness

14. Is there a need for creating awareness of your products/services among your target customers? If yes, how do you address this issue?
15. What marketing/communication channels do you use?
16. What elements of the market are already in place and what elements need to be created?

Particularities Zambia

17. In your experience, are there any market features or challenges that are specific to Zambia?

Annex 3: Working Paper on the Challenges of Serving Rural BOP Markets

The challenges of serving rural BOP markets

Working paper for the practical case studies and the OOLUX field test

Introduction

The following paper intends to give an overview of the various challenges of serving people at the bottom of the economic pyramid as well the respective approaches to these challenges. Based on existing academic and business literature, the purpose of this working paper is to build a framework for the three practical case studies on the challenges of serving rural low-income markets in India, Tanzania and Zambia. The practical research for each case study is carried out in the framework of the OOLUX field test organised by Antenna Technologies. OOLUX is a product, which has been developed in the collaborative SmartLight project including Antenna Technologies, Caritas Switzerland and the Bern University of Applied Sciences. The project intends to distribute a high quality solar-powered lighting and charging device to households in rural areas. The case studies will examine if the challenges identified in theory correspond to the country-specific situation on the ground, and analyse the conditions for successfully addressing them. The ultimate goal is to evaluate the potential of the OOLUX Business Model and to provide Antenna Technologies with recommendations on possible adaptations and developments.

The following list of distribution challenges is classified according to the so-called “4-A Framework” proposed by Jamie Anderson and Niels Billou (2007). The two authors suggest that those businesses which have successfully developed and delivered products and services to people living at the bottom of the economic pyramid, have adopted a common approach which has been key to their success: the delivering of four A’s, namely availability, affordability, acceptability and awareness (Anderson and Billou, 2007, p.14). While Anderson and Billou’s framework is not specifically related to distribution challenges (but rather to how and with which products and services BOP markets should be served), it nevertheless provides a useful basis for the present classification. It should also be noted that the four A’s are not themselves challenges but serve as categories for our list of challenges.

Each category of challenges is structured in the same way. After a brief introduction to what the respective “A” means, the corresponding challenges found in the literature are specified.

A short explanation of the particular challenge is each followed by a list of the most pertinent strategies to address that challenge.

The list includes challenges on two different levels: one level represents the conditions that one finds on the ground, like bad roads or illiterate consumers. The other level concerns the business itself, such as the difficulty of managing adoption processes. The challenges on the second level are related to the first inasmuch as they may be a result of the complex environment of BOP markets. Challenges that relate to aspects of the business model that are not relevant for the practical case studies, like the organisation of manufacturing, are not considered in the present paper.

Availability

According to Anderson and Billou (2007, p. 14-16) ensuring availability of products and services depicts one of the biggest challenges in BOP marketing. Overcoming the obstacle of operating with fragmented or even inexistent distribution channels has been a major issue for many companies trying to enter this allegedly lucrative market of the world's poor. Anderson and Billou put it as follows: "[...] while there might be a market of more than 700 million poor Indians, delivering goods and services to them is not easy." The particular challenge of guaranteeing availability of products and services characterizes an important issue of a conventional distribution channel where goods get passed down the chain from one entity to the next until they reach the end-consumer. The interlinked delivery elements possess specific features that have to be adapted to this unique operational environment (Shukla et al., 2011, p.8). The main challenges and the most pertinent strategies in order to procure availability of products and services in the BOP market are the following:

1. **Reaching target markets with missing hard infrastructure:** Enterprises focusing on customers in low-income groups may have to overcome infrastructure gaps that hinder market activity as well as value creation and have to be addressed through business-led solutions. Gaps in hard infrastructure include lacking access to storage facilities, adequate transportation, communication networks as well as to energy and water supply (WEF, 2009, p.18). What is more, rural BOP markets are often characterized by adverse weather conditions, long distances due to geographical dispersion and hostile terrain often combined with bad roads (Shukla et al., 2011, p.7).

Strategies:

- a. **Distributing via small and micro enterprises** can be an increasingly successful strategy in order to reach BOP customers. These actors benefit

from better market penetration due to their ability to operate with smaller volumes and their higher chances to establish relationships of trust with local communities (Jenkins et al., 2009, p.7). It may also contribute to an expanded network of storage facilities (Shukla et al., 2011, p.8).

- b. **Distributing via Village Entrepreneurs (VLEs):** VLEs, usually recruited from within a village and earning their income on a commission basis by selling specific products and services (Dutt, 2012, p.1), may operate more effectively than a company-owned retail network. Being familiar with their neighborhood and operating in a restricted area, VLEs are well placed to take advantage of proven local distribution methods, for instance by using alternative means of transport like rickshaws and canoes (Anderson and Billou, 2007, p.16).
- c. **Partnering with others and leveraging shared resources.** Examples would be leveraging shared or bidirectional distribution channels (with products and services flowing in two directions, e.g. agents who both stimulate purchases from farmers and sell them goods) (Vachani and Smith, 2010, p. 26), sharing infrastructure with other companies and organizations by allocating common plots and offices or partnering with NGOs, donors and governments in order to combine organizational capabilities (Jenkins et al., 2009, p.14; WEF, 2009, p.7).

- 2. **Reaching target markets with missing soft infrastructure:** Next to missing hard infrastructure there might also be a lack of soft features such as missing financial services, market information, producer organizations, education programs or policies and regulations that strengthen business operations (WEF, 2009, p.18; Clarke et al., 2010, p.9). Both types of infrastructure gaps are typically considered to be a public responsibility, however, many BOP customers live in remote regions, where public services are underdeveloped (WEF, 2009, p.18).

Strategies:

- a. **Rearranging the value chain:** It may be useful and cost-effective to create a distribution system that sources from local producers and leverages existing local distribution channels in order to overcome soft infrastructure constraints that otherwise hinder distribution for non-local companies. A coordinated supply chain can grow into a platform that facilitates business operations and may bring benefits to the producers as well as the consumers (WEF, 2009, p.26).

- b. **Forming active partnerships with the public sector and local communities as well as unconventional market-players.** In order to guarantee long-term profitability in low-income markets, private action needs to address institutional misalignments by collaborating with local communities, public actors and organizations that have established networks with deeper reach. For instance, partnering with universities, development agencies or even competitors can help address a lack of skilled people, low access to market information or inexistent quality standards (WEF, 2009, p.18; p.29-30); IFC, 2012, p.66-68).

- 3. **Making products and services continuously available:** Ensuring availability of products and services in the BOP market means that post-sale services must be guaranteed continuously. This is especially important for organizations delivering products with relatively high degrees of technical complexity and maintenance requirements (Shukla et al., 2011, p.9). Especially in sparsely populated areas, ensuring comprehensive, formalized after-sales service can be complex and expensive, so creative and flexible approaches are needed.
Strategies:
 - a. **Optimize the placement of storage facilities as well as maintenance and repair service centres** to lay the basis for a continuous post-sales service meeting customers' needs.
 - b. **Manage inventory correctly**, deploy technological tools and operational processes and provide necessary training to ensure inventory control.
 - c. **Arranging maintenance infrastructure and calculating repair cycles** adequately helps establishing after-sales services as well as a continuous delivery of products and spare parts (Shukla et al., 2011, p. 9).

- 4. **Managing and controlling complex distribution networks:** Given the fact that rural BOP markets are very dispersed and distribution channels often adapted to local contexts, a complex distribution network involving diverse stakeholders with different perspectives and needing different incentives may have to be managed. This leads to high transaction costs, for instance in the area of recruitment, management and training of last mile distribution sales forces. (Hystra, 2013, p.13).
Strategies:

- a. **Decentralizing and externalizing:** working with local institutions and entrepreneurs and give them decision-making power leads to high responsiveness and more collaborative relationships between companies, consumers and entrepreneurs (Viswanathan, 2011, p.157ff).
- b. **Motivated and skilled employees/entrepreneurs** facilitate the management of complex distribution networks as well. By developing shared goals and values, offering career opportunities and organizing team events, a company can ensure an attractive work environment. Providing competitive compensation particularly enhances the satisfaction and thus the reliability of employees, thereby leading to continuity in staff (Hystra, 2013, p.13; WEF, 2009, p.22).
- c. **Make an effort to find the right staff and partners.** Leveraging partnerships, global and local networks as well as personal connections – if necessary with a lot of persistence – can help finding the right staff for positions at various levels (or finding partners that will support the recruitment of suitable employees) (Hammond, 2011, p.197ff).

Affordability

Anderson and Billou state that the second overarching barrier for doing business at the BOP is to ensure that products or services on offer are affordable (Anderson and Billou, 2007, p.9). This barrier is obvious, given the fact that the 3.7 billion people comprising the “base of the pyramid” (BOP) earn USD 8 per day or less, deal with fluctuating, uncertain income and have generally limited access to credit or insurances. These circumstances make BOP customers smart shoppers and risk-averse investors (WEF, 2009, p.5). The main market challenges related to this barrier, as well as relevant business strategies to increase affordability are the following:

1. **Low purchasing power and income volatility:** Rural BOP customers typically have both low income per capita, and low disposable incomes. Income flows of BOP households are further often volatile and unpredictable. In addition, access to saving and affordable credit institutions is low (WEF, 2009, p.11).

Strategies:

- a. **Consumer financing:** Increase affordability through the provision of access to credit, thereby raising the end customer’s ability to pay for product and service offerings. Possible strategies to provide financial products and services that are accessible, convenient, flexible, continuous and affordable include

providing in-house credit and partnering with NGOs, microfinance institutions or rural banks (IFC, 2012, p.58).

- b. **Flexible payment methods:** Maximize affordability through the implementation of flexible payment methods better suitable for the volatile income patterns of many BOP customers. (IFC, 2012, p.61).

2. **Product Affordability:** As BOP customers are characterized by low incomes and little savings, they are reluctant to make large up-front purchases. However, even though BOP customers are price sensitive, they cannot afford to invest their money into products with a short lifespan and thus are often ready to pay a premium for quality and reliability (WEF, 2009, p.25).

Strategies:

- a. **Innovative packaging and product design:** Maximize affordability through innovative packaging, like offering products in very small units, and/or intelligent cost-effective product design (Anderson & Billou, 2007, p.16-17).

Contrary to the challenges listed above, the subsequent challenge does not concern affordability on the end-customer level, but on the level of small and medium enterprises and other stakeholders securing the last-mile distribution.

3. **SME's barriers (low access to capital):** Small and medium enterprises involved in the local distribution chains often have little financial capabilities and lack access to capital.

Strategies:

- a. **Channel financing:** Ensure the proper functioning of channel operations by providing partners with access to financing through partnerships with social investors, microfinance institutions and rural banks (Shukla et al., 2011, p 9).

Strategies to cut costs and increase affordability exist for almost every stage of a supply chain and are thus not explicitly mentioned in this section. While cost efficiency in distribution systems is addressed under "availability", strategies to cut production costs are not considered in this paper, because this stage of the value chain will not be evaluated in the field test.

Acceptability

Another critical factor when serving the world's poor is, according to Anderson and Billou (2007, p.15ff), gaining acceptability – or willingness to consume, distribute or sell – for the

product or service offered. To achieve acceptability, products or services need to be adapted to the distinct needs of both target consumers and the actors involved in their distribution and sale. There can be country- or region-specific aspects, or distinctive local business practices that distributors have to take into account. As with all consumers, it is crucial to understand their daily lives and the related needs¹ (Anderson and Billou, 2007, p.18). The following distribution challenges as well as the most relevant strategies to address them relate to the fact that business must in some way ensure the acceptance of their products and services by target users:

1. **Initial lack of trust in new products and brands:** Rural, low-income consumers usually prefer known brands and products (Hystra, 2013, p.9; IFS, 2012, p.51). One major reason is their risk-averseness. There is often a fear that something will go wrong with unproven offerings, or that the purchase is not worthwhile the investment: BOP consumers may be unaware of future benefits – it takes some time for customers to see themselves that a product was worthwhile the investment – or wary of potential technical issues, maintenance and replacements (IFS, 2012, p.63; Hystra, 2013, p.2ff; Shukla et al., 2011, p.3ff).

Strategies:

- a. **Offer real economic benefits** – and make them as tangible as possible, best using marketing slogans with straightforward economic arguments (Hystra, 2013, p.5).
- b. **Lower the (perceived) risk of being disappointed.** One way is to make people experience themselves how much they can actually benefit from and/or save with an improved device (like a cooking stove or a solar lantern),² or in what ways it brings advantages over alternative choices. Another is to provide complementary services dealing with the perceived risks (Hystra, 2013, p.6; Shukla et al., p.11).
- c. Try to understand and **leverage local institutions and village politics.** Such strategies may include seeking the endorsement of community chiefs, engage entrusted locals or making opinion leaders test the product for free, and

¹ A good example is the Chinese appliance maker Haier, who discovered that rural, low-income customers in China did not seem to perceive the purchase of a washing machine just for laundering clothes an investment worth the money. Instead, they used the machines also for other purposes like cleaning vegetables. Haier took this habit serious and consequently developed a washing machine for the dual usage of laundry and vegetable cleaning, and another model to make goat cheese. Similarly, Coca-Cola provides their distributors in BOP markets with iceboxes due to the frequent lack of electricity and refrigerators (Anderson and Billou, 2007, p.18).

² One example is Toyola, who proposed the customers of their cooking stoves to hire the stove for a certain period, during which they are encouraged to deposit the savings from reduced charcoal usage to see how much they save (Hystra, 2013, p.6).

hopefully lead to positive word-of-mouth (Hystra, 2013, p.10; see also “Awareness” point 1.a).

- d. **Build consumer trust**, for instance by developing a recognisable brand, hiring reputable locals as sales or marketing agents or leveraging existing consumer brands (e.g. partnering with a well-known company to distribute a product) (Hystra, 2013, p.6; IFS, 2012, p.60ff).
- e. **Incite potential customers to adopt a new product or brand** by designing products and services that (seemingly) enhance their social status, for instance by offering a basic as well as an improved version of a product (Hystra, 2013, p.6).
- f. **Offer a warranty as well as professional and consumer-friendly after-sales service**, for instance by engaging a trained agent in each village, ensuring that broken parts can easily be repaired or replaced (IFS 2012, p.56 ff). This requires the agents to have a stock of spare parts and to know how to service the devices (Vachani and Smith, 2010, p.13).

- 2. **Manage longer-term acceptability**: Sometimes a product is not used anymore when customers would have to make a proactive effort in order to allow a continuous use. How can customers be incited to make proactive efforts in case of technical problems or replacements? (Hystra, 2013, p.11).

Strategies:

- a. **Avert negative word-to-mouth** by evaluating and instantly following up with customer dissatisfaction (Hystra, 2013, p.11).
- b. **Provide professional after-sales services** and promote these services to make sure potential customers know what they will be offered (Hystra, 2013, p.11; see also point 1.f).

- 3. **Localisation of products/services and delivery processes**: Offerings and delivery channels must be fitted and shaped according to the needs of target customers in order to be successful (Shukla et al., 2011, p.10). Yet, it may not be easy for outsiders to understand local markets and the diverse consumer preferences and needs (Debelak, 2011, p.23).

Strategies:

- a. **Conduct primary and secondary research** (on population, usage rates, demographics, behavioural patterns, alternate product choices and lifestyle)

and collect and distribute intelligence information about the marketing environment to understand the different needs of various customer segments (Shukla et al., 2011, p.10). **Field research**, with staff extensively dealing with local communities and partners, particularly helps to understand consumer needs. The insights gathered must then be integrated in the product development in order to design appropriate, possibly customized offerings (IFS, 2012, p.45).

- b. **Offer complementary products** in order to modify or complete the product portfolio so that it best matches customer needs and preferences (Shukla et al., 2011, p.10).
 - c. **Collaborate with local intermediaries, village level entrepreneurs and/or opinion leaders** who have a deep understanding of local economic processes, consumer needs and pathways to influence local businesses, households and individuals. Also, potential buyers should be involved in developing and communicating the value propositions of a product or service (Shukla et al., 2011, p.10).
4. **Adapt to cultural diversity and overcome cultural barriers:** Decisions of local consumers as well as staff members are influenced by cultural norms, preconceived notions or conventional wisdom that may be difficult to understand for outsiders (Vachani and Smith, 2010, p.8; Shukla et al., 2011, p.4ff). In addition, target markets are often characterised by high cultural diversity, so distribution channels must be apt to handle different cultural groups (Debelak, 2011, p.23).

Strategies:

- a. **Collaborate with local communities** and partner with organisations that are deeply familiar with the region in order to develop a good understanding of the local cultural circumstances (WEF, 2009, p.29).
- b. Staff of foreign companies or organisations should carry out **field research** in order to get familiar with the local social and cultural context (IFS, 2012, p.45).

Awareness

Awareness refers to the extent to which consumers know about a product or service (Anderson and Billou, 2007, p.15). The lack of access to conventional advertising media like television and Internet makes awareness-building among low-income consumers an important challenge. Companies must find alternative information channels like billboards

along roads, marketing material tailored for small shops, street performances and product demonstrations in the local communities (Anderson and Billou, 2007, p.19). What is more, rural low-income consumers often have low education levels and may thus not be able to derive value from existing information (Vachani and Smith, 2010, p.6ff). The following challenges and related strategies to successfully tackle them exist under the category of awareness:

1. **Limited access to modern communication and media platforms:** Even if mobile phone subscriptions and Internet access have increased a lot in recent years, access to communication infrastructure is still often unsatisfactory in rural areas, leaving BOP consumers unfamiliar with new offerings and their proposed benefits. The **lack of electricity** is an additional obstacle to straightforward access to information (Vachani and Smith, 2010, p.8; WEF, 2009, p.28).

Strategies:

- a. **Use unconventional marketing channels:** While billboards or radio ads can contribute to raising awareness, the best publicity is good experience of friends and relatives and individual experience from testing a product. Business should thus in particular capitalise word-of-mouth and relationships at local level, for instance by offering free trials to opinion leaders. Village-level demonstrations or road shows are also important, allowing target customers to experience and test the product themselves⁶⁸ (IFS, 2012, p.51; Hystra, 2013, p.9ff; WEF, 2009, p.12)
- b. Related to the strategy above is the need to put emphasis on **measuring and ensuring customer satisfaction**, which in turn generates positive mouth-of-word (Hystra, 2013, p.11).
- c. **Set up a communication infrastructure oneself**, for instance by procuring one farmer per village with a computer so that he can access information, e.g. on current market prices or agricultural practices provided on a special website for farmers. Such a setting will facilitate the circulation of valuable market information among the community members so productivity can be enhanced and more informed purchases made (Vachani and Smith, 2010, p.8).

⁶⁸ Greenlight Planet, for instance, pour water on their solar panels to demonstrate that they are waterproof; and d.light throw their lanterns on the floor to give proof of their robustness (Hystra, 2013, p.10).

2. **Low literacy and education levels:** rural BOP consumers often do not have enough knowledge and skills to understand and analyse market information, and consequently to derive value from it (Vachani and Smith, 2010, p.6ff). In addition, poor education levels prevent the development of conventional, cost effective marketing and communication materials resulting in information asymmetries and prolonging new product introductions. Rural BOP consumers do thus often not possess accurate information to make informed purchasing decisions (Shukla et al., 2011, p.4).

Strategies:

- a. **Educate end consumers about product offerings and benefits**, for instance through farmer-training programmes or promoters visiting villages to educate community members. Such strategies can involve guided product testing, or training village agents (including women!) to communicate relevant information to fellow villagers. The latter additionally generates income, which may contribute to a better education of the children (Vachani and Smith, 2010, p.14ff; WEF, 2009, p.28).
- b. **Elaborate powerful messaging** which is easily understandable for target consumers and which incites them to take action (Shukla et al., 2011, p.9).
- c. **Install Internet community portals** using voice-over design in the local language (Vachani and Smith, 2010, p.14ff).
- d. **Identify and partner with opinion leaders or local media**, who can play an important role in mobilising early adopters and followers (Shukla et al., 2011, p.6; WEF, 2009, p.28).

Conclusion

This paper intended to identify a variety of strategies to overcome the most pertinent distribution challenges in the BOP market. Anderson's and Billou's (2007) "4-A's" served as a framework for categorizing these challenges and proximate strategies addressing the complex requirements of last-mile distribution. All the findings have been compiled from existing academic and business literature and should eventually serve as a mean to evaluate the potential of the OOLUX Business Model and to provide Antenna Technologies recommendations on possible adaptations and developments for marketing its product successfully in BOP regions around the globe.

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