TÉCNICO LISBOA

The Energy Kiosk Model for Electrification

Status Quo and Future Strategies

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Abstract

The energy kiosk model is an approach to provide electricity to low income households in underserved regions. A variety of actors – including multi-national companies, start-ups, governmental initiatives, and non-governmental organisations – are engaged in energy kiosk initiatives. Different kiosk models are being tested, ranging from charging stations for lamps and batteries to multi-service stations offering entertainment and education. Successful showcases have been implemented especially in Sub-Saharan Africa and India. However, only few projects have gone beyond the pilot stage. Although the model works in principle, it seems difficult to create, scale, and replicate projects with positive social impact and long-term economic viability. Not-for-profit initiatives and business-oriented projects face challenges in the upscaling phase and struggle to create sustainable structures likewise.

In interviews with energy kiosk practitioners, the present state and further development of the energy kiosk model is analysed. Different from other studies on electrification approaches, which look mainly at technology options and institutional setup, the focus is put on economic viability and interaction with local actors as entrepreneurs and customers. This study describes the status of energy kiosk initiatives, identifies key challenges and successful practices of operational projects, and outlines future strategies. As several initiatives carry their projects in directions diverging from the original energy kiosk approach, key success factors for these new strategies are identified in interviews with experts from different sectors. The information provided should facilitate the knowledge and experience exchange between energy kiosk initiatives and their stakeholders as a contribution to their joint efforts in electrification.

Key words: Electrification, off-grid, inclusive business models, energy kiosk, charging station

Resumo

O modelo de quiosque de energia é uma abordagem de fornecimento elétrico a famílias com baixo rendimento em regiões desfavorecidas. Uma variedade de entidades – que inclui companhias multinacionais, empresas *start-ups*, iniciativas governamentais e organizações não-governamentais – estão envolvidas em iniciativas de quiosques de energia. Diferentes modelos de quiosque estão a ser testados, desde estações de carregamento para lâmpadas e baterias, até estações multi-serviços que oferecem entretenimento e educação. Exemplos de sucesso têm sido implementados, especialmente nas regiões da África subsaariana e Índia, contudo, apenas alguns projetos têm ido para além da fase piloto. Apesar do modelo funcionar em teoria, parece ser difícil criar, dimensionar e replicar projetos com impacto social positivo e viabilidade económica a longo prazo. Iniciativas de caráter não-lucrativo e projetos de negócio deparam-se com desafios na fase de *upscale* e debatem-se igualmente para criar estruturas sustentáveis.

Em entrevistas com utilizadores do quiosque de energia é analisado o estado atual e desenvolvimentos futuros deste modelo. Diferente de outros estudos de abordagens de eletrificação, que têm em conta maioritariamente opções tecnológicas e configurações institucionais, este projeto foca-se na viabilidade económica e na interação com indivíduos locais como empreendedores e clientes. Este estudo descreve o estado atual das iniciativas de quiosque de energia, identifica desafios-chave e exemplos de práticas de sucesso de projetos operacionais, e esboça estratégias futuras. Como diversas iniciativas conduzem os seus projetos em direções opostas à abordagem original do modelo de quiosque de energia, fatores de sucesso chave para estas novas estratégias são identificados em entrevistas com especialistas oriundos de diferentes setores. A informação recolhida deve facilitar o conhecimento e a troca de experiência entre iniciativas de quiosque de energia e as partes interessadas como uma contribuição para os seus esforços conjuntos na eletrificação.

Palavras-chave: Eletrificação, off-grid, modelos de negócios inclusivos, quiosque de energia, estação de carregamento

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Nomenclature

BoP	Bottom of the Pyramid
B2B	Business-to-Business
B2P	Business-to-Public
CEO	Chief Executive Officer
CSR	Corporate Social Responsibility
HR	Human Resources
IT	Information Technology
n/a	not available
NGO	Non-Governmental Organisation
PV	Photovoltaic
kW	kilo Watt
SHS	Solar Home System
UNDP	United Nations Development Programme
W	Watt
%	per cent

The long forms of abbreviated company names are provided in Appendix A1.

1. Introduction

Access to modern energy services for underserved populations is one of the central challenges in development cooperation. One specific approach for electrification, the energy kiosk model, is evaluated in this report. The present chapter informs the reader about the background of the research project, provides a definition of the energy kiosk model and outlines the scope and structure of this thesis.

1.1 Background

Provision of electricity is an important contribution to economic development [1, p. 13] and quality of life [2, p. 2267] in underserved regions of the world. Many different approaches to facilitate access to modern energy services for the poor are implemented, including grid and off-grid solutions. These energy delivery models involve a wide selection of conventional and renewable technologies, different partners and contributors from the public and private sector, diverse sources of funding and countless management concepts. None of the existing concepts is able to meet the challenge alone, but all contribute their share to close the energy access gap of 1.3 billion underserved people worldwide [3, p. 88].

In order to truly serve the poor, electrification projects need to fulfil a broad variety of prerequisites that are diverse and often difficult to combine. Projects should be environmentally and socially sustainable, providing positive social impact and including local actors. At the same time, economical sustainability should be ensured over the entire life cycle, and the replication of the applied model and its adaptability to different contexts should be facilitated [4, p. 10]. Only few electrification initiatives succeed in meeting all these aspects. While social impact and appropriate technology are in the centre of attention, many initiatives do not manage to capitalise and replicate models, even if they have moved beyond the technology demonstration phase. Significant effort is necessary to create long-term viable concepts and establish structures for maintenance, finance and continuous operation around functioning technology; an effort many initiatives do not undertake [5, p. 49]. However, with the enhancement of private sector initiative in electrification, factors such as economic sustainability and replication get more important. Most of the business-driven energy access projects did not gain significant scale yet [6, p. 11]. However, in order to enhance economic sustainability, the business model perspective on energy access projects is spreading in the private and public sector likewise.

One approach for electrification is the energy kiosk model, which is examined in this report. Also in case of energy kiosks, practitioners face challenges in scaling up and replicating their projects. Compared to other solutions for electrification such as mini-grids or stand-alone household systems, the energy kiosk model is a relatively uncommon concept. This might also be the reason why there has not been carried out any detailed research on the model and on the challenges that keep it from reaching its full potential. This research project intends to fill this gap, providing an overview of the existing energy kiosk projects and their past, present and future development.

Although the energy kiosk model specifically has not been assessed much, a broad range of studies on other electrification approaches has been carried out. The overwhelming majority of these examinations focus on the technology and institutional setup of projects. Little attention has been paid to their economic viability and revenue models. Furthermore, user-centric evaluations focusing on the needs of and interaction with local customers are scarce [7, pp. 692, 693]. As these factors are considered fundamental for the success of electrification projects in general [7, p. 688] and the energy kiosk model in particular, the present assessment takes them into account.

1.2 Scope of Work

1.2.1. Context and Motivation

This research project on the energy kiosk model is carried out in cooperation with Endeva, an independent research and consulting institute located in Berlin that builds, shares and applies knowledge around the topic of private sector involvement in development.

The outline of this project was developed jointly between the author of this thesis and Endeva. While the former had gained practical experience in designing an energy kiosk project during her Master studies, the latter brings in experience in consulting several energy kiosk businesses in Africa. In discussions, the need for a thorough evaluation of the model and its limitations was identified.

This led to the idea of linking the existent practical know-how of the team with a theoretical analysis of the model, taking advantage of the established network of energy kiosk actors in the field. In interviews with representatives of energy kiosk initiatives, an overall picture of the energy kiosk model should be drawn; focusing on current challenges and solution strategies the individual projects apply.

This research project intends to provide an overview to governments, donors, development organisations and other parties that are linked directly or indirectly to energy kiosk activities. At the same time, the study aims at informing the interested public on the status quo and development of one specific approach for electrification. The most important motivation for the research is however to facilitate knowledge exchange and enhance mutual learning between energy kiosk practitioners in order to support their efforts in electrification.

1.2.2. Research Questions

The research starts from the impression gained in practical work that – despite the promising approach – there does not exist a replicable model for sustainable operation of energy kiosks yet. The research question is therefore framed as: "**What is keeping energy kiosk businesses from reaching their full potential?**"

As the evaluation of the energy kiosk model should refer both to the presence and future of the model, two sub-questions were formulated. The first question refers to the status quo with "**What are the challenges and successful practices for energy kiosk businesses**

- **regarding their product mix,**
- **in meeting the market demand,**

- **in the customer interface,**
- **linked to local human resources (HR), and**
- **for sustainable financial planning?**

The second question looks at the future with "**What are key success factors for the future strategy scenarios of the energy kiosk model?**" Chapter 3 provides further insights in the emergence of these questions and the methods employed to answer them.

1.3 Definition of the Energy Kiosk Model

In order to answer the research question within the project scope, boundaries need to be set to the energy kiosk concept. There is no universally valid definition of the term "energy kiosk" established, and each project follows an individual approach. Yet, a number of core characteristics were set at the beginning of this research. This was done in order to identify relevant cases for the study and ensure comparability among those.

Energy kiosks[1] are **central stations for electricity production and provision** to consumers, usually in remote rural areas far off the central grid. The source of electricity can vary from renewable sources such as solar photovoltaic, wind turbines, or hydropower to conventional sources such as diesel generators. The aspect of centrality distinguishes energy kiosks from Solar Home Systems (SHS). Both models deliver electricity to individual households. In the case of energy kiosks, the electricity needs to be transported from the central station to the household in the form of charged devices while with SHS it is possible to provide electricity directly at the customer's home.

In order to be considered as an energy kiosk, an **electricity charging service** must be part of the business model. Charged devices can range from mobile phones, batteries of different sizes or various other items containing a battery. Examples for such devices are lanterns, torches, or radios. The charging service is targeted to households without access to grid electricity. By the provision of charged lanterns, batteries or other devices the basic needs of electricity for lighting, mobile phone use, and entertainment of these households can be satisfied.

A common approach for energy kiosk businesses is the **offer of other services** next to charging. Those services, for example provision of internet access, entertainment services or printing, often require electricity in the first place. Another option is the **sale of energy related products** such as panels, lanterns, batteries, or SHS next to the charging service.

In most non-electrified areas in developing countries, small charging stations especially for mobile phones exist in most villages. Those informal local micro-businesses are not considered in this research project. Here, only projects that comprise **several energy kiosks with a centralised management structure** are regarded as formal energy kiosk businesses. These initiatives aim at multiplying the system on different sites and at scaling up the model to achieve overall profitability.

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[1] Next to the term "energy kiosk", the expressions of "charging station", or simply "kiosk" or "station" are used in this document. All of these names refer to the model described above.

1.4 Structure of the Thesis

This document is divided into eight overall chapters. Chapter 1 “Introduction” informs about the background of the energy kiosk study and the scope of the research project.

Chapter 2 “Literature Research” sketches the conditions in the environment of energy kiosks projects. It describes the energy access challenge and its implications for economic development, and lists existing electrification solutions. Furthermore, it explains how the private sector is involved in energy access topics and depicts the implications, i.e. the development of a business perspective, for electrification projects. Finally, a summary of the research on business models and the concept of inclusive business is provided.

Chapter 3 “Methodology” outlines the methods of research for data collection, analysis, and interpretation and explains how the methods applied connect to the research questions.

Chapter 4 “Status Quo of Energy Kiosk Operation” gives an overview of the existing energy kiosk projects and sheds light on differences among them concerning regional distribution, rollout phases, kiosk layout, and operation.

Chapter 5 “Practical Challenges and Best Practices for Energy Kiosks” clusters existing challenges and best practices of energy kiosk companies in the subcategories of market, customer interface, local human resources and finances based on the interview statements of kiosk company representatives.

Chapter 6 “Future Strategies for the Energy Kiosk Business Model” explains the different options the evaluated projects have with regards to their future development, and outlines which path they follow respectively. As especially the strategies of business-oriented for-profit initiatives are partly fundamentally different from the original energy kiosk concept, the chapter tries to foresee key success factors for each strategy, based on statements of experts from other sectors.

Chapter 7 “Possible Contribution of Ecosystem Actors” transfers the findings for energy kiosk actors to other stakeholders in the business environment. The chapter gives recommendations to external actors on how to alleviate the challenges energy kiosk projects face and how to facilitate their sustainable growth.

Chapter 8 “Concluding Remarks” summarises the findings and draws practical and theoretical conclusions for this project and further research.

2. Literature Research

Before the energy kiosk model is assessed in detail, the current chapter outlines the underlying problem of energy poverty in developing countries and provides an overview of electrification approaches. Furthermore, the concept of inclusive business in developing countries is defined and related to the context of energy access provision. This literature research serves as a base for better understanding of the challenges of energy kiosk business and gives the reader an idea of the context in which they operate.

2.1 Energy Poverty in Developing Countries

Providing access to energy is at the heart of the development challenge. Although not explicitly formulated as one of the Millennium Development Goals [8], access to modern energy services relates to many of the eight goals directly or indirectly [3, p. 87]. The challenge of electrification refers hereby to the provision of electricity as one form of modern energy. Although electrification cannot be the solution to all development problems, access to electricity supply is a precondition for many other forms of development assistance and is therefore of central relevance in the struggle for social and economic advancement in developing countries [9, p. 263].

With access to electricity, the **time use and habits of individuals** change significantly. Light provision prolongs waking hours and shifts activities to the evening, and more time is spent reading and using media such as TV, radio, or computers [10, p. 45]. **Education opportunities** are improved significantly, both through access to information channels such as TV and radio, and through more evening time spent with books and – in case of children – homework [10, p. 46]. The access to media also improves health **knowledge**, adding on to better nutrition through cooled storage and improved health facilities [10, p. 42]. Also **productivity** can be affected by electricity provision, resulting from more opportunities and longer business hours of small enterprises [10, p. 47], and indirectly from improved health and education opportunities [11, p. 20]. Access to electricity affects herein the Human Development Index[2], the strongest positive contribution occurring for the first kilowatt hour (kW) that is accessed. According to this, also small amounts of electricity for individuals can have a high positive impact on development [2, p. 2267]. Although it is difficult to estimate the exact monetary benefits of electrification [10, p. 48], **overall access to electricity can be considered an essential element in the efforts of poverty reduction worldwide**.

These efforts are directed towards the nearly 4 billion people, constituting 70 per cent (%) of the world population, who live on less than two dollars per day. This part of the world population is often referred to as the "base of the pyramid" (BoP). Some scholars also describe the BoP as the population segment with an average annual income of less than 3000 dollars. Although several definitions exist, all of them describe the BoP as a major part of the world population with very low purchasing power.

[2] "The Human Development Index is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions." [33]

The BoP is physically located not only in the least developed countries, but also in remote regions of developing and emerging economies [12, p. 1] [12, p. 5]. Characteristic for the BoP population is the lack of property, limited access to health care and formal education, low level of skills and social exclusion [13, p. 13].

Despite considerable progress in electrification in the past decade, **1.3 billion people at the BoP were still without access to electricity in 2011** [3, p. 88]. Due to rapid population growth, the access gap was narrowed by only 9 million people between 2010 and 2011, with large differences in progress between individual countries and regions [3, p. 88]. Two thirds of the people provided with electricity access between 2010 and 2011 live in urban areas, while the electrification rates in rural areas are decreasing [3, p. 88]. The between the least served regions and countries worldwide are depicted in Figure 1. While the rates of un-electrified people are at around 18% worldwide and 23% in developing countries[3], they are at 57% for Africa and even 68% when looking only at Sub-Sahara Africa. The region with the highest absolute number of people without access to electricity is developing Asia[4] with 615 million people, India being the country with the largest un-electrified population of 306 million people. Current trends indicate that Sub-Sahara Africa will overtake in the near future [3, p. 88].

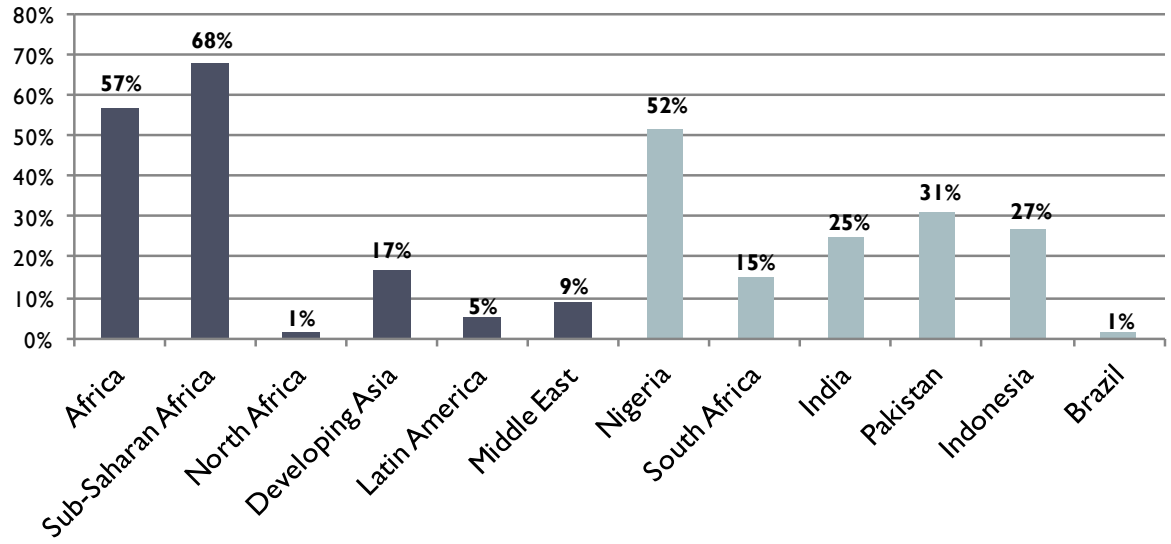

Figure 1: Percentage of population without access to modern energy services in 2011, derived from [3, p. 89]

In order to reduce the energy access gap and enable the BoP population to escape poverty, policy goals and measures are established on national and international levels. The United Nations suggest to put universal access to modern energy services on the post-2015 Development Agenda, while the United States of America started the Power Africa initiative, aiming at increasing energy access in Sub-Saharan Africa by 100% within five years. In total 77 countries, organisations and businesses are part of the UN Sustainable Energy for All initiative, shedding light on the high relevance of the topic [3, p. 87]. Many countries in developing Asia, Latin America, and Africa have explicit electrification plans

[3] The term “developing country” refers herein to countries in which the majority of the population lives at the BoP.
[4] The term “developing Asia” refers to Asia excluding China.h

established and founded electrification agencies and other supporting institutions. The International Energy Agency (2013) projected the results of these national and international efforts in a scenario for 2030, assuming that all current plans and policies will be put in practice. In this scenario, 1.7 billion more people will gain access to modern energy services until 2030. The overall reduction of the un-electrified population is however partially offset by a projected population growth of 1.4 billion people until 2030. Although the global trend is a positive one, the projected regional development of electricity provision is very diverse [3, p. 91]. In fact, Sub-Sahara Africa is expected to be the only region with an increasing absolute number of un-electrified people. This will increase the region's share of the total global population without access from less than 50% to over two thirds in 2030. In case not all currently planned policies are realised, the global and regional development of electrification rates is projected to be significantly less positive [3, p. 91].

2.2 Electrification Approaches

2.2.1. Technology Options for Electrification

In order to close the energy access gap and provide BoP households with electricity, a variety of technologies is employed. The electrification efforts of developing and emerging countries differ regarding source of electricity, service level, operation model, and costs. Approaches include both on-grid and off-grid electrification [9, p. 260]. Figure 2 provides and overview of the different approaches to extend access to electricity in underserved regions.

On-grid electrification		Off-grid electrification			
Central grid coverage		Decentralised grid coverage	Stand-alone systems		
Grid extension	Grid densification	Mini-grid setup	Pico systems	SHS	Energy kiosks
Extension of the national power lines to areas which are not covered yet	Densification of the existing national electricity grid to connect communities and households within the covered region	Decentralised grid infrastructure, connecting households and small businesses to a local generation unit (a diesel generator, or a hybrid system with solar and/or wind)	Solar-driven lanterns, including a small panel and a battery for lighting and eventually limited charging	Fixed solar systems for individual households, for lighting and home appliances, storage of a few days	Central charging station for lanterns, batteries, and phones, often offering additional energy services

Figure 2: Overview of electrification approaches, derived from [14, p. 29]

On-grid electrification refers to the coverage of the **central electricity grid**, which is enhanced through extension and densification of national power lines. Regularly, high upfront costs are associated to connecting regions and individual households to the central grid; the unit electricity costs are however low. Central grid connections provide high service levels to customers, enabling the use of any electric household appliances and the operation of industrial machinery [9, p. 260].

An alternative requiring much lower investment costs in remote regions with widely scattered settlements are **decentralised mini-grids**. These are independent structures without connection to the central grid infrastructure. They are mostly powered by diesel, eventually complemented with solar and wind energy in a hybrid system. Mini-grids can replace a central grid infrastructure completely; they are however much more expensive to operate due to high fuel costs. For this reason, mini-grids are often only operated for a few evening hours, and serve the needs of households and small businesses in the first place [9, p. 260].

A second category of off-grid electrification solutions are **stand-alone systems** for individual households or a group of customers. Stand-alone systems do not require any distribution infrastructure. The unit costs of electricity are high, and the service level towards customers is rather low. Stand-alone systems provide small amounts of electricity, only sufficient to satisfy basic needs for light, phone charging or radio and TV use [9, p. 260]. This category includes systems of very small scale, cost and electric capacity – so-called pico solutions – such as lamps or phone chargers powered by solar photovoltaic technology. It also includes larger SHS, which are fixed installations that provide electricity to individual households, and energy kiosks as defined in chapter 1.3 [15, p. 57].

The ambitious political electrification goals cannot be achieved by employing one of the available approaches alone. Experts agree that further research and development and the inclusion of all renewable energy options is necessary in order to achieve universal access to modern energy services [15, p. 39]. The best way to provide access to a specific region, community, or household is herein highly context dependent. Undoubtedly, central grid connections provide the highest service quality and most significant development impact of all options. At the same time, grid extensions to remote areas can be linked to very high investment costs and transmission losses, which are out of all proportion to the low amounts of electricity consumed in those regions [3, p. 93]. The needs of households and small businesses in rural areas are often limited to lighting in the hours after sunset, and the operation of small appliances. The base load in a grid system would be very low in rural areas until the local economy reaches a certain activity level [15, p. 40]. Stand-alone systems are the most viable solutions in many cases, providing the best cost-benefit ratio to remote low-demand communities relying on candles and kerosene as alternatives [10, p. 51]. They can serve as short-term solutions until central grid connection is available, or as future plug-ins for energy grids [15, p. 39]. Although the amount of electricity provided by off-grid systems without distribution infrastructure is small in quantum, the socio-economic impact on the development of rural communities is high [2, p. 2270].

Energy kiosks as stand-alone systems are one solution in this context, addressing a very specific market segment. They provide charged batteries and lanterns for household use, replacing mainly kerosene lamps for domestic lighting and enabling customers to operate small devices. Especially solar lanterns are easily accepted by new customers due to their similarity to kerosene lanterns, their portability, and versatility [15, pp. 60, 61]. The option of owning an own solar lantern or SHS is more common and also more attractive to most customers than using a charging service [16, p. 1]. Surveys indicate that the overall cost of renting a charged device is significantly higher than owning an own solar-based system and operating it at home [16, p. 8]. However, the energy kiosk model is a viable

option for customers who cannot afford to buy a pico photovoltaic (PV) lantern or a SHS themselves. The charging service shifts the risk of technology failure to the station operator who is maintaining the PV system. Customers with irregular income can take advantage of the service whenever they can pay for it, providing the same flexibility as the purchase of kerosene for lighting [15, p. 60], [16, p. 2]. Additionally, surplus electricity produced at the energy kiosks can be used for services to the community, providing access to purified water, internet, or TV; services that many BoP customers could not afford on an individual basis [16, p. 7].

2.2.2. Private Sector Involvement in Electrification

Modern energy services are considered a basic good and necessary driver for further economic development. The provision of electricity through a central grid infrastructure is in the responsibility of governments and public electrification institutions. Although private companies partake in central grid extension and densification projects, they are only to realise with public funds [9, p. 262]. In the case of small independent grid systems, public and private initiatives are realised. Often, external technical and financial support is required, and subsidies for micro-grids are common practice in developing countries [9, p. 263]. Stand-alone systems on the contrary mostly cannot rely on capital subsidies, but often have to be financed through credit institutions, private households or communities [9, p. 263].

In fact, private companies begin to regard the huge base of BoP households as potential customers for electricity sale [17, p. 2]. While their overall income level is very low, the poor spend a large portion of it – often 10% and more – on basic energy provision [14, p. 26]. Having realised that the low-income customer at the BoP sum up to a market of significant size, many start-ups and multinational companies start to target the poor as customers. More and more companies engage in the sector, arranging especially off-grid models, identifying sites and managing operation and maintenance in cooperation with local partners [18, p. 212]. The energy sector can herein learn from health and agriculture business innovations in low-income markets, as similar decentralised structures have been built up in those sectors [14, p. 25]. Another option are public-private partnerships, combining public funding and institutional support with private sector knowhow [19, p. 91]. The United Nations Development Programme (UNDP) (2004) distinguishes for example four basic models for delivery of electricity in low-income markets, referring specifically to solar-based projects: The first option is a commercial model, driven by suppliers and dealers with little or no involvement of public partners [20, p. 47]. Multi-stakeholder programmatic models are the second option, involving governments, finance organisations and international and local suppliers in order to provide access to electricity [20, p. 47]. The utility model as third option usually operates with a fee-for-service concept, supported by public funds in many cases. The grant-based model finally has an institutional focus, providing electricity to institutions such as schools or clinics [20, p. 50].

The involvement of companies setting up electrification projects for profit is an essential aspect of some of the most promising models for scaling up off-grid electricity supply [18, p. 212]. The limited availability of public funds makes it necessary to include the private sector as much as possible in the provision of clean energy. Moreover, companies do not only provide finances, but also key skills and knowledge to scale up infrastructure projects and to manage them successfully [19, p. 92].

Taking the key role of private sector initiative into account, the importance of public support is still to recognize. The contribution of policy makers and donors is essential to catalyze private sector action and serve those population parts that cannot be reached commercially [14, p. 26]. Companies need to collaborate with governmental institutions for the sake of a regulatory environment, capacity building, infrastructure provision, financing, and other implementation support [19, p. 93].

While public institutions set up projects based on development goals and desired social impact, companies think in terms of market demand, availability of credit, and service provision. While neither of both approaches can solve the electrification challenge alone, a balance between market-pull and donor-push strategies needs to be found [2, pp. 2268, 2269]. The involvement of private sector actors already brought a widespread view on electrification projects from a business model perspective. Involving the BoP population as equal business partners or customers in projects proved to increase the chances of success. Realising this, also governments and public donors start setting up electrification projects with a business model approach, even in projects not aiming at profit creation or involvement of corporate partners. In this context, the concept of inclusive business models emerged. Inclusive business refers to the creation of value at the BoP, including the poor as consumers, producers, or entrepreneurs [21].

2.3 Inclusive Business Models for Electrification

In order to determine the cornerstones of inclusive business, the term “business model” needs to be defined first. In a second step, the specific conditions in BoP markets are taken into account to explain the context and design of inclusive business models, with a focus on electrification projects.

2.3.1. Business Model Research

Despite extensive literature on the topic, there is no agreement on what a business model exactly is [22, p. 2]. Zott et al. [22] found a broad variety of definitions in their extensive literature research, referring to the business model as “a statement, a description, a representation, an architecture, a conceptual tool or model, a structural template, a method, a framework, a pattern, and a set” [22, p. 4]. All these expressions emphasise that business models refer to the **structure of businesses** in some way. However, in many publications, the business model is not linked to an explicit concept or inherent components. The existing concepts and component descriptions are also only partially congruent [22, p. 4].

Having emerged as a term already decades before, the business model concept became prevalent in the 1990s. Many scholars link this to the development of the internet, growing BoP markets and post-industrial technologies [22, p. 4]. This explains why the business model has been used in three contexts specifically. Business models are explaining and categorising e-businesses, referring to innovation and technology management, and addressing value creation and capture in companies [22, p. 5], the last one being the most relevant perspective when referring to inclusive business models in a second step.

E-business models refer to internet-based business and have been classified in different types. Also here, the literature provides a broad variety of definitions, represented in different graphical and textual forms [22, pp. 7, 8]. The research on business models linked to innovation and technology takes a rather functional perspective, perceiving technology as a complementary enabler of the business model. A second research stream in this context is looking at the business model itself as subject of innovation, adding on to innovation efforts in process, product and organisation [22, pp. 14, 16].

Thirdly and most importantly, the business model concept is used to explain the **value creation and value capture** of companies. The business model frames not only what businesses do, but also how business is conducted to deliver value to stakeholders [23, p. 222]. Next to the value proposition of a company, the role of the customers is at the core of the business model. Zott et al. [22] emphasise the focus of the business model concept on cooperation, partnership and joint value creation, directing attention towards the **different actors** – consumers, producers, and partners – connected to each other within the business model [22, pp. 11, 13]. Taking this thought further, Zott et al. [23] zargue for the business model as a **system of activities, linked by transactions** [23, p. 219]. From this perspective, a business model defines which activities are carried out and who performs them. An important aspect is furthermore the **interrelatedness of activities**, i.e. how the activities are linked and complement each other [23, p. 220].

2.3.2. Inclusive Business Design

Business conditions at the BoP

Enormous social needs and high population growth makes the BoP in developing countries an increasingly interesting target market for companies [12, p. 7]. The conditions in these markets differ significantly from those in industrialised countries, and companies often lack knowledge on how to tap into their potential [12, p. 7]. However, only little empirical research on strategies and business model adaptations in BoP markets has been carried out [17, p. 2]. Multi-national companies and small start-ups likewise struggle to understand local markets and create value through entrepreneurship [12, p. 8].

Looking at the business model elements identified, the main differences between industrialised and developing markets are presumably the actors involved and the kind of value to be delivered. The customers at the BoP as well as potential local partners or employees face significant barriers for sustainable development. Low availability of resources, knowledge, and skills, low awareness of own needs and available products and limited income resulting in limited affordability make it difficult to include BoP actors in business models [24, p. 15]. Business models at the BoP often refer to the satisfaction of basic human needs such as clean water, energy, or sanitation. The value created is in many cases not only of economic nature, but has extensive social impact. This is in line with Seelos et al. [25] [26] who refer value creation in business models also to social strategic objectives [25, p. 53].

Next to these direct implications on actors and value creation for business models in low-income economies, also the business ecosystem in these markets highly affects the design of the business model. The business ecosystem consists of a variety of interconnected and interdependent actors from the private and public sector. The ecosystem implies four primary pillars that enable inclusive businesses to function: **Access to information** on the market segment, commercial **incentives** as a reason to engage, access to financial **investment** and support for the **implementation** of the business. [26, pp. 9, 22]. In BoP markets, these pillars are often absent or defect what hinders market functioning, market development and market participation in many cases [13, p. 8]. Furthermore, entering formal markets is expensive and complicated. Therefore, informal markets, which are grounded on social instead of legal arrangements, constitute a significant part of BoP economies [17, p. 3].

Key factors for inclusive business

These and other social, cultural, and institutional characteristics force companies to re-think products, services and management processes [25, p. 50]. It is not clear whether the markets in the developing world will adopt the structures and mechanisms of industrialised countries over time. Therefore, strategies that only focus on balancing out shortcomings in BoP markets compared to western markets will not be enough for successful market penetration in developing countries [17, p. 17]. Instead, business actors need to adapt to underserved customers, social value creation and a challenging environment with a different business structure, different products, and different interconnected activities – in other words, set up radically different business models [17, p. 11].

Key success factors in this are the collaboration with non-traditional partners, the co-invention of custom solutions, and local capacity building [17, p. 12]. Experiences suggest that **collaboration with local partners** who are familiar with social and cultural norms is essential. These partners are not necessarily local businesses operating in the respective countries, which often rather direct their efforts towards the high and middle class instead of the BoP. Rather, non-profit organisations, local governments, and community groups can provide insights and build up trust among the local poor [17, p. 12]. In order to assess context-specific information, participatory approaches involving local entrepreneurs and end users are suggested. This **co-invention process** both of products and business models, including local customers, producers and entrepreneurs in the design of products and services, enables companies to respond to specific local needs and preferences which are otherwise difficult to evaluate [17, pp. 13, 14, 16]. **Capacity building** as a third component for inclusive businesses should be incorporated directly in the business model. Training programs, awareness raising, and other support structures for customers, producers, and entrepreneurs are not only philanthropic activities, but also an essential factor to make business models in BoP markets work [17, p. 14].

In general, companies engaging in emerging markets need to develop a deep understanding of the local context and an ability to detect and leverage opportunities and strengths of the local environment. This so-called "**social embeddedness**" enables companies to navigate in informal markets and generate bottom up development [17, p. 15]. London and Hart (2004) mention "scalability, flexibility, decentralization, knowledge sharing, local sourcing, fragmented distribution, non-traditional partners, societal performance, and local entrepreneurship" as important elements for the success of inclusive businesses in low-income markets of developing countries [17, p. 18]. This suggests that decentralised and small-scale businesses might even have better chances than large centralised institutions [17, p. 5]. From this point of view, the lack of regulation and formal market mechanisms opens up opportunities for social entrepreneurs who want to create monetary and social value in BoP markets [13, p. 22].

Business models for electrification

While there exists no formal definition of business models for electrification, several attempts to categorise concepts based on ownership, institutional arrangement, technology, and partner involvement were made [18, p. 189]. One example is the perspective suggested by UNDP (2004), clustering electrification business models in four categories as outlined in chapter 2.2.2. However, business models for energy access provision vary widely depending on demand profiles, type of consumers, techno-economic viability, and social and cultural context [18, p. 218].

Despite fundamental differences between the existing concepts, **the involvement of local actors** – organisations, entrepreneurs, and customers – is the one key challenge all electrification business models have in common. Participation of consumers on community level is needed in order to create acceptance and ownership. However, complete dependence on the community can lead to the failure of projects [18, p. 222]. Finding the right way of involving customers, answering their specific needs, and making them adopt the product is much more challenging than in higher income segments and other sectors [12, p. 11].

Therefore, in their work on inclusive business models for energy access, Endeva (2011) concluded that transactions with customers are the most unusual challenge at the BoP especially for energy businesses. According to Endeva's research, the **customer interface** is at the centre of all business model considerations [6, p. 16]. At the same time, operations have to be sustained in a way that costs are recuperated without exploiting the local underserved society [12, p. 11]. The necessary resources for this are clustered in four categories: **insights into the market, a product that fits the demand and local conditions, HR management and sound financial planning** [6, p. 17]. In the business model generator outlined in Figure 3, Endeva proposes these as necessary components next to the customer interface. Having the overall five elements in place enables inclusive businesses to transform a value proposition into a sustainable business model in BoP markets [6, p. 16]. Throughout this generator, the already mentioned key success factors for inclusive business, i.e. non-traditional partners, co-invention, capacity building, and social embeddedness, play an important role.

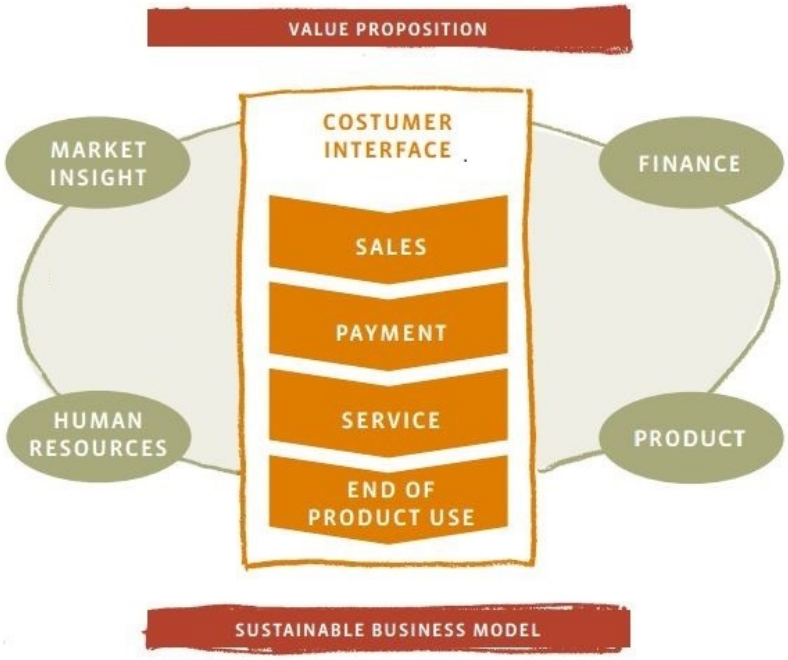

Figure 3: Business Model Generator of Endeva [6, p. 17]

3. Methodology

This research project uses qualitative methods in order to assess the business model of energy kiosks. Qualitative tools are considered particularly applicable for examining relationships, abstract concepts, and implicit assumptions. Many aspects regarding business strategies in emerging economies are difficult to assess with quantitative empirical tools; qualitative research is the preferred option [17, p. 7]. According to Yin (2010), qualitative research studies real world conditions considering the context while contributing to existing or emerging concepts. Also, qualitative research uses multiple sources of evidence [27, p. 29]. Exactly this has been realised in online research and various interviews with energy kiosk actors.

The overall research question in the project is: "**What is keeping energy kiosk businesses from reaching their full potential?**" In order to gather answers to this question, a deductive research approach was chosen [27, p. 119]. This means that the concept of the business model generator from Figure 3 was used to categorize sub-questions in the respective five components of the model, assuming those would be the most relevant in regards to the research question. This approach led to five more practical sub-questions, namely:

- What are challenges and successful practices for energy kiosk businesses regarding their **product mix**?
- What are challenges and successful practices for energy kiosk businesses in meeting the **market demand**?
- What are challenges and successful practices for energy kiosk businesses in the **customer interface**?
- What are challenges and successful practices for energy kiosk businesses linked to **local HR**?
- What are challenges and successful practices for energy kiosk businesses for sustainable **financial planning**?

After a first round of data collection through online research and in interviews with energy kiosk entrepreneurs, several future strategies for energy kiosk businesses could be identified. As these strategies differed quite much from the initial concept of energy kiosks, the need for another sub-question was identified. This question was framed as: "**What are key success factors for the future strategy scenarios of the energy kiosk model?**" In a second round of data collection, interviews with representatives of companies following similar strategies in different sectors were carried out. This happened with an inductive approach: Instead of setting a framework beforehand, the collected data lead to conceptual conclusions for the future strategies of energy kiosk businesses [27, p. 119].

Data collection in the first round was carried out in three different ways: Web-based research, email or online questionnaires, and phone or Skype interviews with energy kiosk company representatives. The web-based research was accomplished in the initial phase to investigate all relevant energy kiosk projects and accumulate basic information. After prioritising and choosing the relevant cases[5], all of

[5] The excluded projects are listed in Appendix A1, the reason for exclusion is mentioned.

them were contacted with interview requests. Before or during each interview, interview partners answered an online questionnaire for self-evaluation. Interviews in the first round were carried out in a structured way, following an interview script as far as possible[6] [27, p. 160]. In parallel to oral interviews, companies answered enquiries per email.

The second round of data collection was accomplished mainly through qualitative interviews with company representatives from different sectors: Due to the differences in business models and approaches, a structured set of questions could not be developed. Instead, interview partners were asked to share experiences and recommendations, and specific questions were adapted to the respective context and interview partner [27, p. 161].

During the data collection in both rounds, all answers were compiled and sorted in interview notes. These compiled notes were then broken down into smaller fragments in a disassembling procedure [27, p. 208]. The fragments of the first collection round were reorganised according to challenges and best practices identified for energy kiosk businesses. In this process, it became clear that assumed challenges regarding the product portfolio strongly relate to either the market demand satisfaction or the financial planning of energy kiosk companies. Therefore, the identified challenges and best practices were clustered into the four categories of market demand, customer interface, local HR, and finances. Sub-categories as outlined in chapter 5 were identified and challenges were linked to fitting best practices in this reassembling procedure [27, p. 208].

The interview fragments of the second round of qualitative interviews were clustered according to the future strategies they could refer to as recommendations. Also here, the reassembling procedure resulted in several sub-categories of recommendations for each strategy.

In the data analysis, the principle of triangulation was used wherever possible: Especially for the identification of challenges of energy kiosk businesses and in the definition of future strategies, at least three different references for verification were sought for reasons of validity [27, p. 108]. The case was different for best practices to meet the mentioned challenges. Here, also solutions applied successfully in only one or two examples are considered worth being shared with other companies as an option to meet the respective challenge. In the case of key success factors for future strategies, the triangulation principle could not always be followed due to the limited amount of data collected.

The interpretation of the reassembled data describes and explains the findings of both data collection rounds and formulates recommended actions for energy kiosk companies. The attempt to identify overall patterns regarding the status of energy kiosk businesses and their future development was undertaken in order to increase the comprehensiveness of outcomes [27, p. 124]. Further conclusions of the research take the form of recommendations towards the ecosystem of energy kiosk companies.

[6] As no closed-ended questions were asked, it was sometimes impossible to follow the intended structure.

4. Status Quo of Energy Kiosk Operation

A variety of different actors has been realising energy kiosk projects in the past years. This chapter provides an overview over the sector, including all relevant initiatives that could be identified. The regional distribution of energy kiosk companies across the globe is outlined next to the development of the currently operational energy kiosk projects over time. Further insight is also provided in the differences regarding kiosk layout, operation, and finances between all benchmarked cases. The typology of all existing energy kiosk initiatives provides an overview over the status quo before concrete challenges and future strategies of the business model are discussed in the subsequent chapters. All data represented in graphs and text in this chapter is based on interviews, emails, and online research. The respective sources are found in Appendix A4, in the Excel file *Chapter 4_Status Quo_resulting from Benchmarking.*

4.1 Existing Projects

In the benchmarking carried out in the scope of this research, 24 relevant cases of energy kiosk initiatives were identified. These cases vary regarding their administrative structure and historic development. Start-ups, multinational companies, governmental institutions, and non-governmental organisations (NGOs) have initiated energy kiosk projects, differing in their operational setup and motives. Although not all of these initiatives have a corporate character, for reasons of simplicity they will be referred to as “energy kiosk companies” in the following. In the present chapter, all 24 benchmarked companies are considered, whereas chapter 5 is based on the statements of the 18 energy kiosk companies assessed in interviews[7] and does not consider the six cases, which were benchmarked, but not interviewed[8]. Further details on the benchmarked energy kiosk companies and cases that were excluded are presented in Appendix A1.

4.2 Regional Distribution

In order to determine the regional distribution of energy kiosks, the active energy kiosk initiatives are clustered according to the UN macro geographical continental regions [28] in Figure 4. The overview includes all benchmarked companies (B1 and B2), and accounts for every country where the respective company has placed energy kiosks. This means that a company operating kiosks in two regions would be considered in both shares respectively.

Figure 4 indicates that 13 companies are operational in Eastern Africa, followed by five companies in Southern Asia and four companies in Western Africa. The Southern Asian share represents four initiatives in India – OMC, SPEED, TERI LaBL and SELCO Labs – as the only Southern Asian initiatives realising energy kiosk projects. Also in other regions, namely in Cambodia, Haiti, Botswana, and South Africa, individual companies operate. As several companies are active in more than one region, the sum in Figure 4 exceeds the total amount of 24 energy kiosk companies.

[7] The abbreviation for the 18 interviewed companies is “B1”
[8] The abbreviation for the six companies that were benchmarked, but not interviewed is “B2“

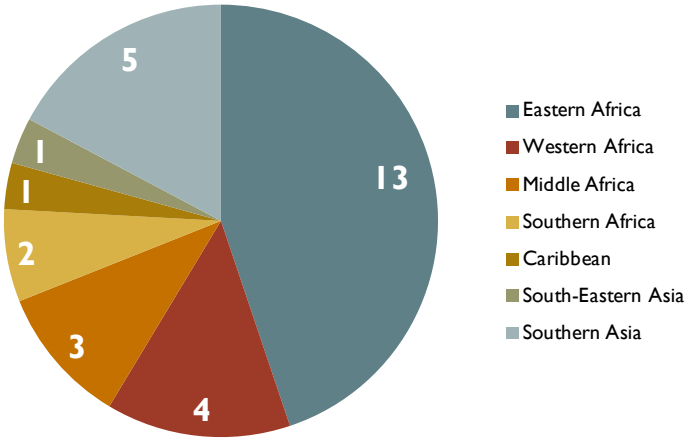

Figure 4: Companies operating energy kiosks; absolute number per region (B1, B2)[9]

Looking at the number of operational kiosks per region, the picture is different. Figure 5 shows that more than 90% of all active kiosks are situated in Southern Asia – in this case India. The reason for this is the statement of TERI LaBL to operate 2300 energy kiosks in rural India[10]. In comparison, only 89 energy kiosks are placed in Eastern Africa, a similar amount to Western Africa with 78 kiosks. The initiatives in Middle Africa, Southern Africa, The Caribbean, and South-Eastern Asia are small projects with four to 14 active kiosks respectively.

Although energy kiosk operations focus on the Global South, the location of the company headquarters is often in northern industrialised countries. As indicated in Figure 6, 12 out of 24 companies have their headquarters in the United States or Europe. The other twelve headquarters in Asia and Africa are situated in the country of main operational activity of the respective company.

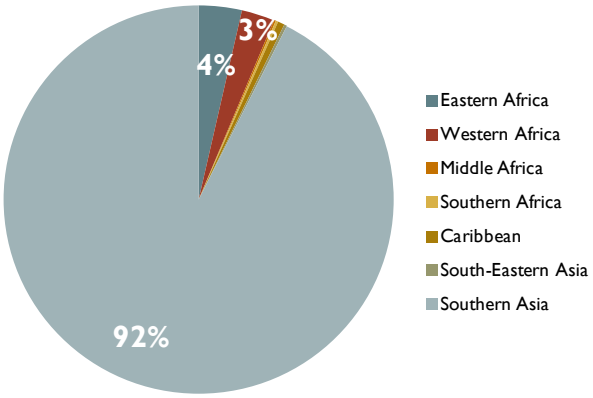

Figure 5: Operational energy kiosks per region (B1, B2)

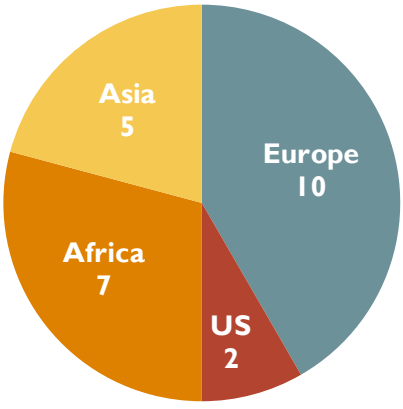

Figure 6: Continent of company headquarters (B1, B2)

[9] This indicates which energy kiosk companies are considered for the graph; further details in Appendix A1.

[10] TERI LaBL was not among the interview partners; only a short fact check per phone was carried out. Therefore, this statement could not be verified. Further information on TERI LaBL can be found in Appendix A1.

4.3 Project Rollout

The concept of energy kiosks for electrification has been discussed and prototyped during the last decade; projects implemented before 2006 could not be identified. Figure 7 shows the clear tendency for company foundations between 2008 and 2013, with peaks in 2009 and 2012. Only two energy kiosk companies were initiated before this period. From 2009 on, between three and five companies were founded per year. The number of new initiatives stagnated in 2013 with only three new companies and decreased to zero identified new projects in 2014.

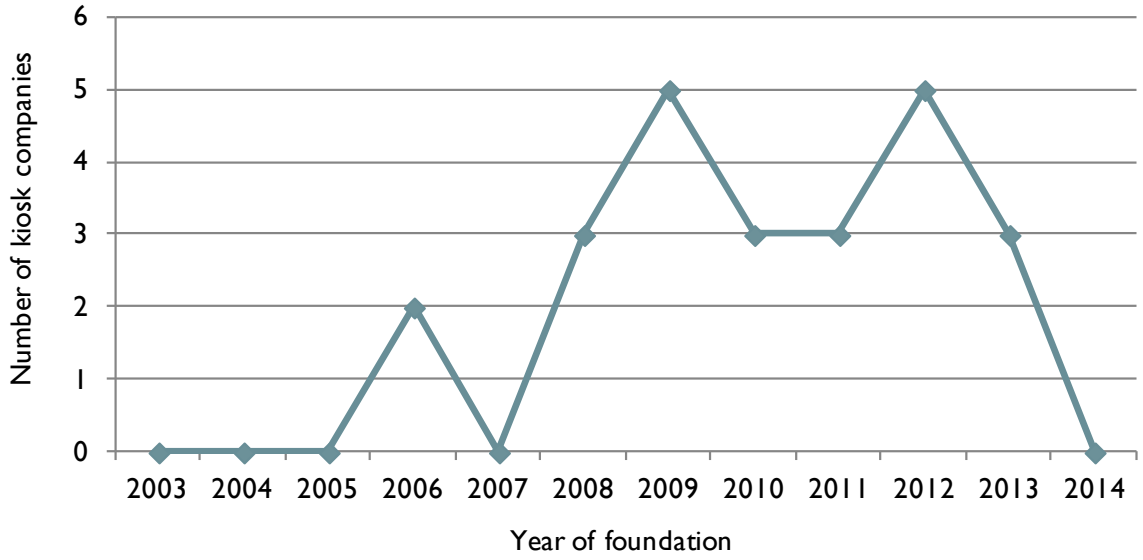

Figure 7: Number of kiosk company foundations per year; 2003-2014 (B1, B2)

As most kiosk projects date back only some years, the number of operational kiosks per company is low in most cases. Figure 8 visualises the operational kiosks per company in 2014. Only two projects have more than 25 stations running; both EnDev Mali and TERI LaBL are governmental programmes which are mainly funded by donations and public grants. Six companies have between eleven and 25 energy kiosks in operation. The remaining 16 initiatives – these are two thirds of all benchmarked companies and organisations – are running less than ten energy kiosks each.

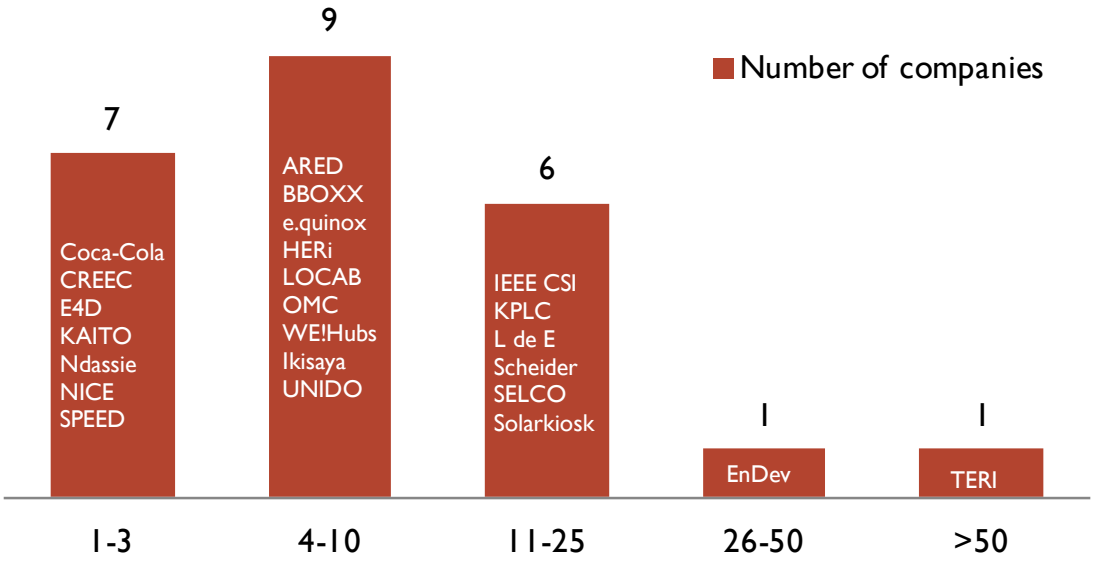

Figure 8: Number of active energy kiosks per company (B1, B2)

Figure 9 shows in which different phases of development the benchmarked companies are in 2014. Five companies are operating their existing stations, but not growing in numbers any more. The reasons for this vary. EnDev Mali is a publicly funded project, which was only setting up energy kiosks for a defined time span[11], KAITO and e.quinox could not proof their business model to be economically sustainable, but are operating the already set up stations with a positive social impact. The UNIDO CPCs and NICE Gambia are dependent on further public or private funding. The second group of companies – nine in total – is currently testing their technical and business model, setting up prototypes and first trial series of their energy kiosk version. Most of these companies have less than ten kiosks set up. Exceptions are KPLC and Schneider BipBop, which set up projects funded through corporate social responsibility (CSR) budgets or public funding and are hence able to start with larger numbers of prototype sites. Two companies have to be located between the prototyping and replication phase. Both BBOXX and LOCAB have tested their model several times, but are only building new energy kiosks if a third party requests a station and provides funds. These companies are therefore operational, but not striving for further growth or development of their model; instead, they focus on other technologies as core business. Eight out of 24 companies entered the phase of replication. They state to have their technical design and operation model validated and are trying to scale up their business. The clustering of companies in four categories in Figure 9 is based on the indications provided by the companies regarding their plans for the future. The current situation and future strategies of the energy kiosk companies is further analysed in chapter 6.

[11] EnDev Mali is realising other electrification activities instead

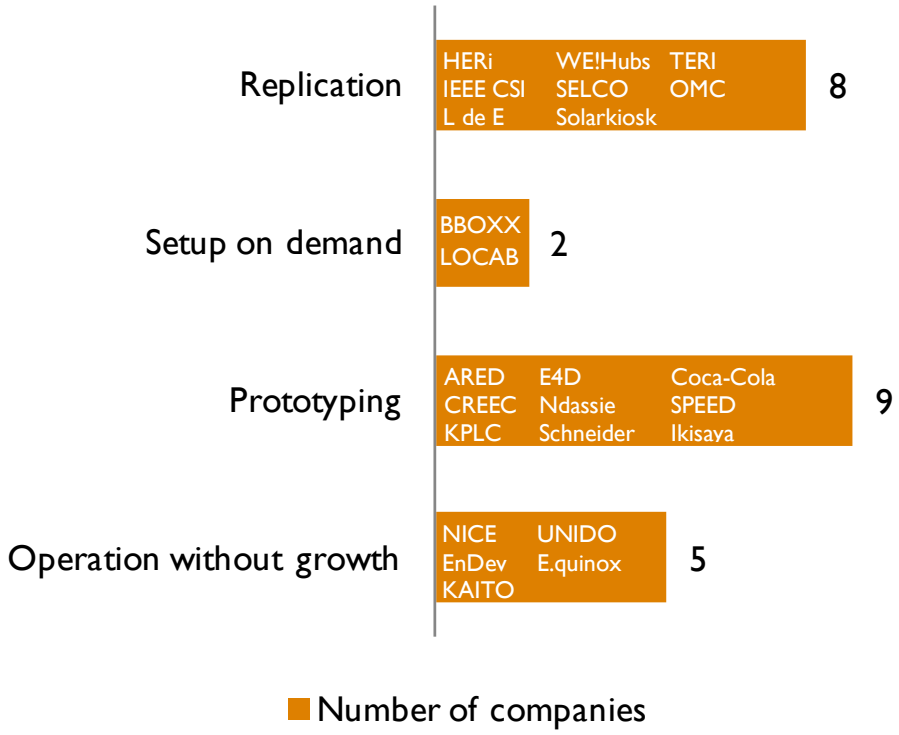

Figure 9: Phases of kiosk projects; companies sorted by their status in 2014 (B1, B2)

4.4 Kiosk Layout

The layout and design of all energy kiosks in operation is relatively similar. Although different sources of electricity could be employed in theory, the vast majority of stations are based on solar PV in practice. They consist of a solar PV panel mounted on a housing structure, eventually a battery for backup and a charge controller, and several charging points for batteries, lanterns, and mobile phones. Figure 10 indicates the most common solutions to house the charging station.

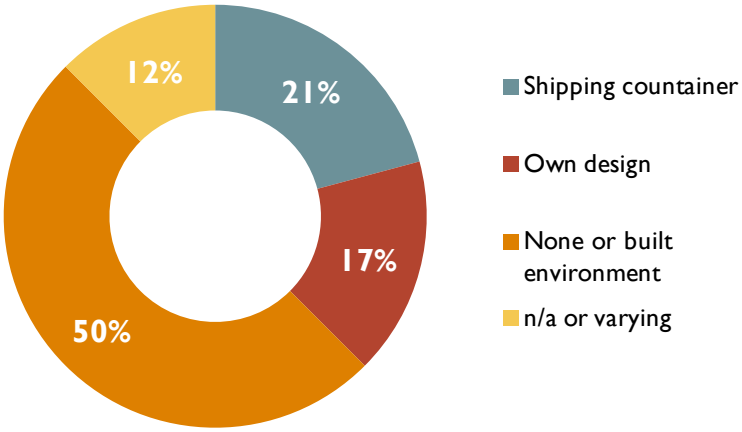

Figure 10: Kiosk housing; percentage of companies employing the respective solution (B1, B2)

Standard shipping containers are employed in 21% of all cases. This is especially attractive if kiosk companies ship the whole system or components from overseas and need to transport them within the country; yet this is a very expensive solution. A particular design for the energy kiosk is developed by 17% of companies, examples being Solarkiosk and HERi. A special case in this category constitutes

the mobile kiosk of ARED, which can be moved on rubber tires. Half of the kiosks companies do not provide a housing but use the existing built environment in villages. Figure 11 shows examples for kiosk layouts of selected energy kiosk companies.

Figure 11: Examples of kiosk layouts – own design of HERi, shipping container of Coca-Cola, mobile kiosk of ARED, built environment of e.quinox (clockwise, from upper left corner)

Some energy kiosks are combined with a grid infrastructure for small businesses or wealthier households; so in the case of OMC, E4D, SPEED and the UNIDO CPCs. In these systems, a diesel or biogas generator complements the solar PV array in order to increase the system stability. Furthermore, e.quinox, for instance, is operating one charging station based on a pico hydro turbine. All other kiosks included in this study are solar kiosks as described above. The generation capacity of most energy kiosks based on solar photovoltaic varies between 80 Watts (W) and 2kW. There are however also several cases with a capacity of seven to up to 20 kW power capacity.

The number of households reached by each kiosk is difficult to assess. This does not only depend on the generation capacity of each kiosk, but also on the number of available chargeable devices, i.e. lanterns or batteries, and the demand of customers. Figure 12 gives an indication of the average number of households reached by one kiosk. Ten companies state to reach less than 100 households per charging station. One reason for this could be a very low generation capacity, so in the case of ARED kiosks which only charge on average 30 mobile phones daily with a 80W solar panel. Another reason could be the too low demand in rural areas in order to make full use of the electricity generated and all chargeable devices available. Four companies are operating kiosks reaching between 100 and 500 households.

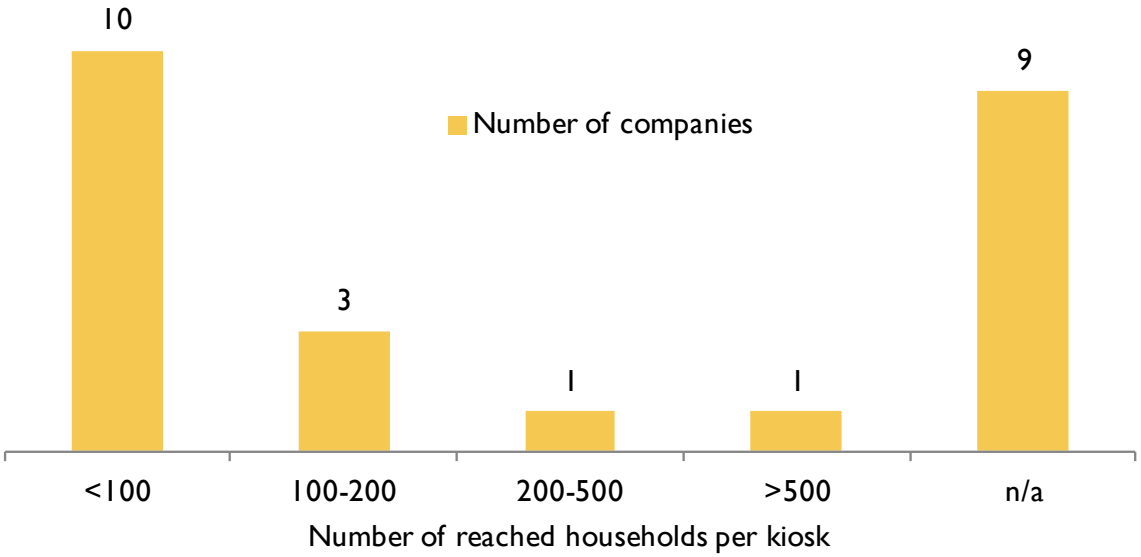

Figure 12: Average number of reached households per kiosk (B1, B2)

4.5 Operation and Finance

4.5.1. Products and Services

As chapter 1.3 outlined, charging of electric devices is the initial and often central service offered in energy kiosks. Customers come to the station to charge batteries, lanterns, or phones. In case of batteries and lanterns, it is not expected of customers to bring their own batteries. Instead, companies provide charged devices that they own. The charging fee can be interpreted as rental fee for a charged device. Only EnDev Mali and LOCAB indicate that customers need to bring own batteries or lanterns to the charging station.

In some cases – especially if heavy batteries are used – a kiosk employee delivers the charged devices to the households. The frequency of recharging depends on the size of the battery, the usage pattern in households and the seasonally varying income of customers. Most companies stated that customers frequent the kiosk between one and seven times per week. In some cases, customers only come once every 10 to 14 days. For a phone charge, less than ten cents[12] are common. For batteries and lanterns, prices vary between ten cents and two Euro for a one-day charge.

[12] All prices are given in Euro, converted on http://www.oanda.com/lang/de/currency/converter/

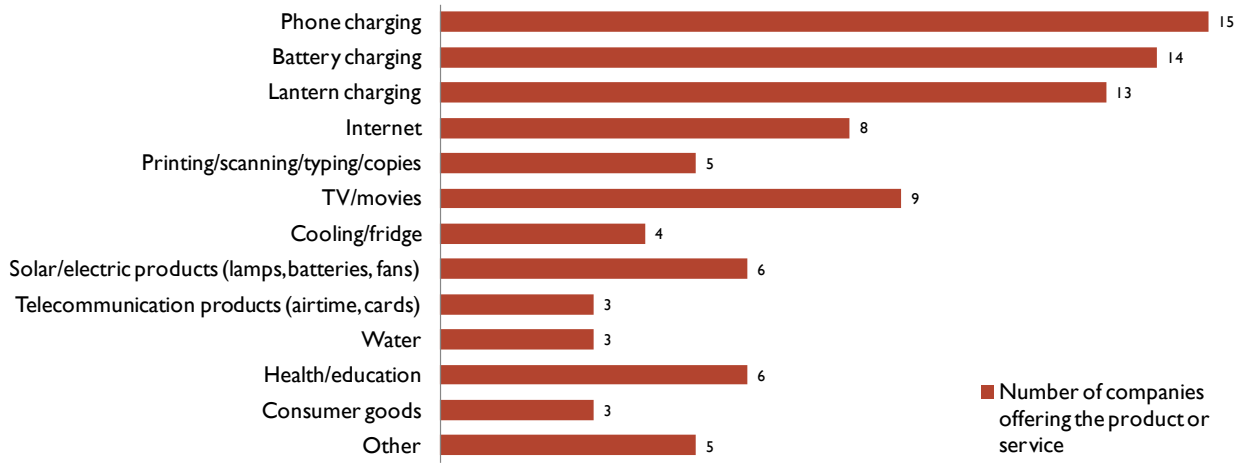

Figure 13: Variety of services and products offered in the energy kiosks (B1, B2)

Figure 13 shows that battery, phone and lantern charging are the predominant services offered. However, 7 out of 24 kiosk companies also provide entertainment services, in the form of TV screenings of movies and football matches. Seven companies have computers at their station to offer internet services, five of them state to also include printing, scanning, copying, and typing in their portfolio. Another option, realised by six companies, is the sale of solar or electric products such as torches, batteries, or devices that can be used in combination with charged batteries, e.g. fans, light bulbs and radios. Some companies also use parts of the generated electricity for cooling, other offers products not directly linked to energy, such as telecommunication products, clean water, consumer goods, or health and skills workshops.

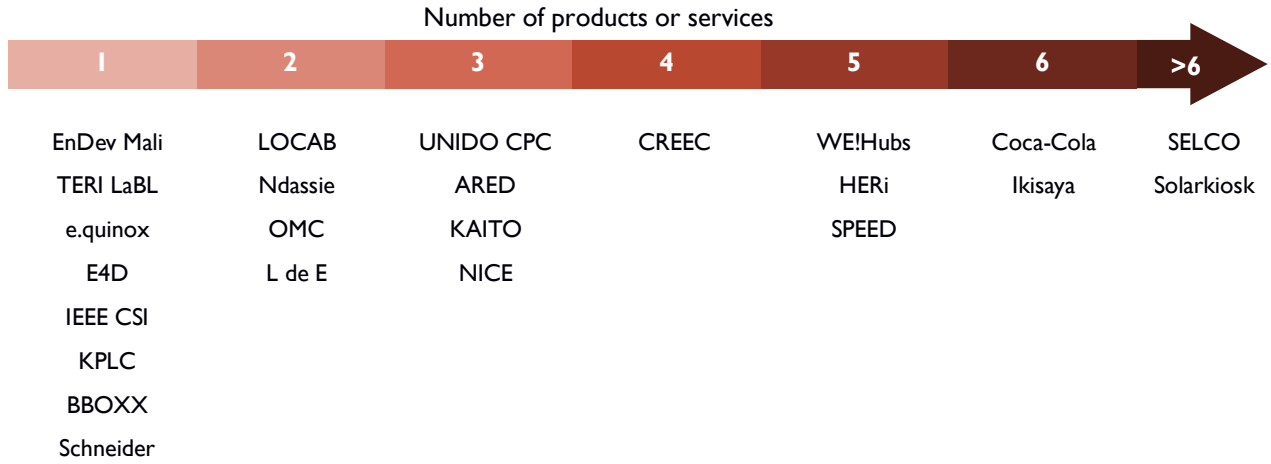

Figure 14: Number of products and services on offer at the companies' kiosks (B1, B2)

Figure 14 gives an idea of the product and service variety in different kiosks initiatives. The numbers of products or services refer to the categories mentioned in Figure 13, with phone, battery and lantern charging counting as one service altogether. A company charging different devices at its kiosk sites is considered to be offering one service. Each additional category counts as one more product or service in the portfolio. While some kiosks focus on the charging services or offer only one or two additional services, others expand to a broad portfolio with charging of electric devices as one of many activities.

Which portfolio of products and services is offered depends not only on the demand in the village where the kiosk is placed, but also on the initiative of the local operator. In addition, the business

model and growth strategy of the kiosk company heavily influence the kiosk offer; this will be discussed further in chapter 6.

4.5.2. Human resources

Part of the energy kiosk business model is the local operation of the stations. Only two companies – BBOXX and LOCAB – sell the kiosks directly to an NGO, community, or private person without getting involved in the operation of the stations. Most companies keep the kiosk infrastructure as an asset and collaborate with local actors for the daily operation of the kiosk. Figure 15 provides an overview of the different forms of such collaboration. In most cases, one or two locals are operating each kiosk. Only the charging stations which are complemented by grid infrastructure and the WE!Hubs have several people in charge.

As Figure 15 outlines, 5 out of 24 companies employ operators directly. The operator is part of the company's team and is paid a fixed monthly salary for the tasks he/she is accomplishing. In the case of franchising and commission-based service, the operator is an entrepreneur on own responsibility. He/she manages the kiosk business on own account, receiving support from the company. Franchising is a contractual agreement, which transfers the licence for a business concept from a franchisor to a franchisee [29, p. 505]. Franchisees are acting as entrepreneurs who pay a fixed franchise fee in exchange for equipment, marketing, and other support; seven companies choose this option. Three companies favour the commission-based model. Here, the entrepreneur passes on a certain percentage of his/her incomes through charging devices or through the sale of other services and products.

In case of independent management, there is no direct operational relation or financial regulation established between the kiosk company and the operator. Most independently managed kiosk sites are run in a collaborative approach. A village committee or association will appoint an operator or take turns operating the energy kiosk themselves. The kiosk companies are not directly involved in the kiosk management. In contrast to BBOXX and LOCAB, they often provide background support in order to ensure successful operation. The seven companies that established independent management at their kiosk sites are rather philanthropic initiatives; profit creation is difficult to achieve with this approach. The motives and profit creation strategies of kiosk companies are detailed further in the following section.

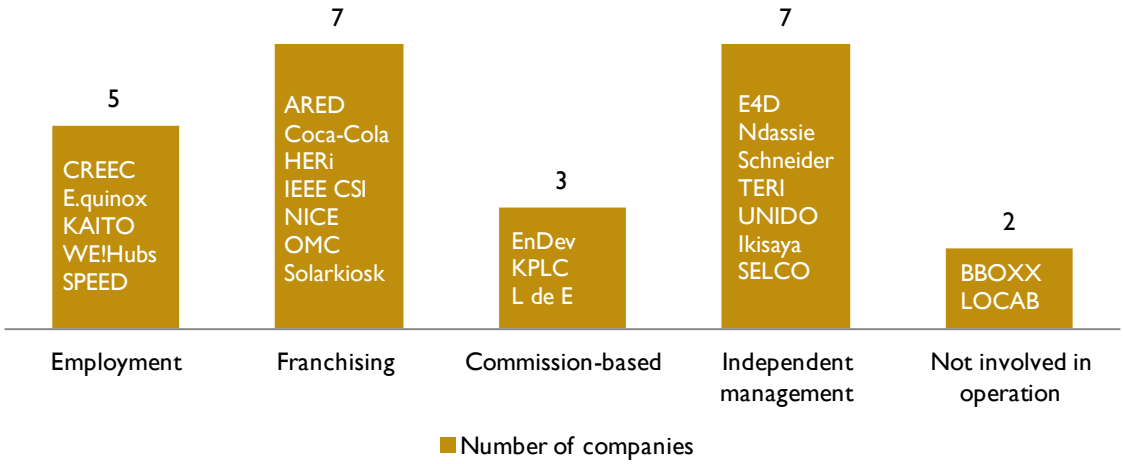

Figure 15: Local operation model of energy kiosks (B1, B2)

For overall tasks such as marketing, funding, accounting, research and development, a central management team is established in all energy kiosk initiatives. Figure 16 indicates the size of the management overhead for energy kiosk companies. Only 16% of all benchmarked companies have more than three employees in their management, including the Chief Executive Officer (CEO). Seventeen per cent of all companies employ one to three managers respectively. The vast majority – 67% of all companies – are run without any official overhead. The "zero overhead" cases include all companies that are managed as side or CSR projects next to another core business (e.g. BBOXX, Coca-Cola), development organisations which finance their overhead through public or private donors (e.g. EnDev Mali, TERI LaBL), and voluntary projects run by students or professionals without compensation (e.g. e.quinox, IEEE CSI).

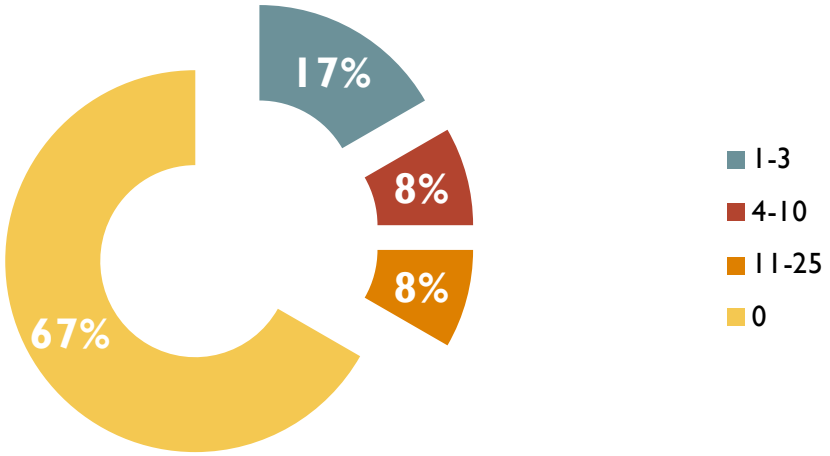

Figure 16: International management overhead to be covered by kiosk revenues; number of employees (B1, B2)

4.5.3. Profit Creation and Funding

One major characteristic distinguishing the different energy kiosk initiatives is their financial sourcing. Access to funding is crucial for the success of the kiosk projects; Figure 17 shows the different strategies of companies.

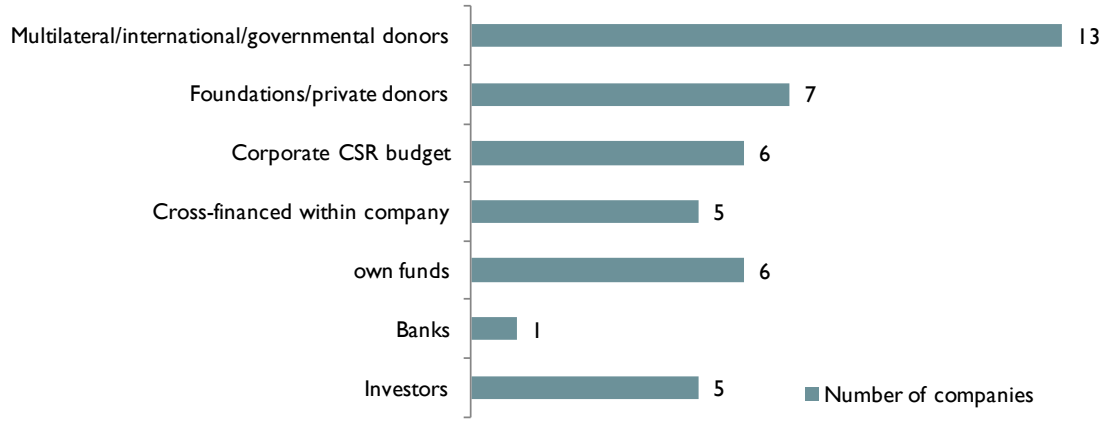

Figure 17: Different sources of financing for energy kiosk initiatives (B1, B2)

As shown, 13 out of 24 benchmarked companies rely fully or partly on multilateral, international, or governmental donors. Other common sources of funding are foundations, private donors, and corporate CSR budgets. Cross-financing through other activities is realised by six companies which are complementing their energy kiosk business with other activities such as SHS sale or consultancy services. Only very few companies refer to their own funds, banks or investors in order to finance their business. Almost 50% of all benchmarked companies combine several sources of financing. This is why the total amount of companies indicated in Figure 17 is larger than the total of 24 companies benchmarked.

Next to their sources of funding, the initiatives differ regarding the importance they attach to profit creation in general. Some of them have a non-profit approach borne by philanthropic or CSR purposes. Other initiatives are raised with the clear goal of profit creation and maximisation. The matrix in Figure 18 distinguishes five levels of the role of profits in its columns. These levels can be described as follows:

1 – Profit creation does not matter; all that matters is the social impact.
2 – Profit is only an indicator for sustainable social impact.
3 – Social impact matters, but the business must sustain itself.
4 – Profit creation and social impact have the same importance in the decision making.
5 – Profit creation is the main goal of the venture.

Figure 18 shows the relation between profit creation and the source of funding. While the columns indicate the motivation or focus on profit creation as described above, the rows name the main source of financing the respective company is relying on. Half of all benchmarked companies can be defined as non-profit initiatives where profit is – if at all – only considered as an indicator for sustainability. It is noticeable that all companies clustered as non-profits are predominantly funded through public or private donors or through corporate CSR budgets. The energy kiosk companies that do consider profit creation as a relevant indicator and aim at setting up sustainable business models vary in their main

source of financing. They either cross-finance their kiosk businesses with other activities, or refer to investors, banks and own funds in order to cover their upfront costs. Only three profit-oriented companies – SPEED, e.quinox, and the WE!Hubs – cooperate with private and public donors as their main financiers.

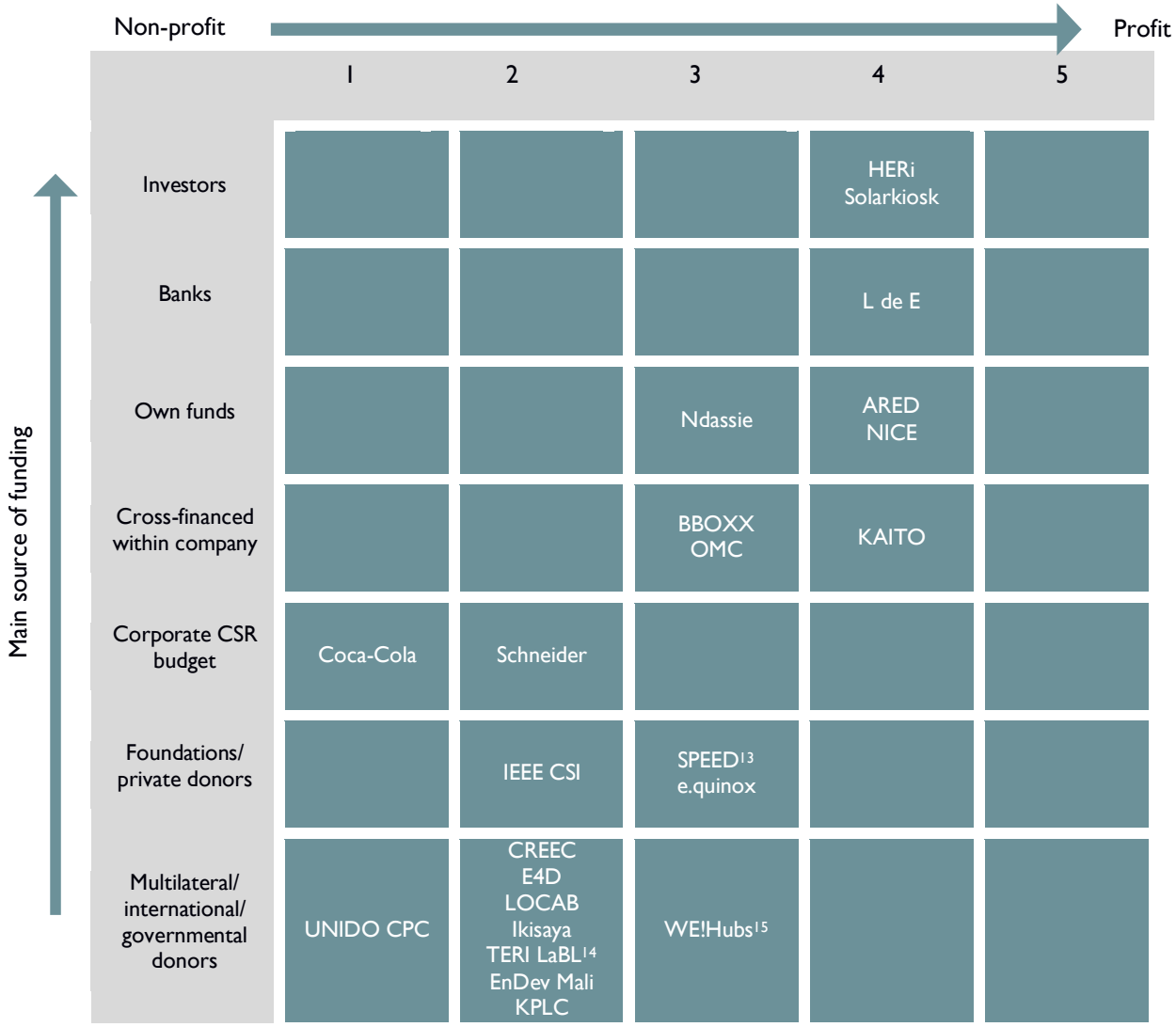

Figure 18: Companies clustered according to main source of funding and relevance of profit creation (B1, B2 except SELCO[16])

[13] Private donations are used for project development and community engagement in the SPEED project, while technology, infrastructure and manpower is covered by an investing energy supply partner company

[14] Private donations and equity are also significant for the funding of the TERI LaBL initiative.

[15] The WE!Hubs are also funded through foundations/private donors and corporate CSR budget

[16] SELCO is not included in this matrix due to its complex and diverse setup which does not allow any general statement on the profit creation of its Integrated Energy Centers.

5. Practical Challenges and Best Practices for Energy Kiosks

The preceding chapter described the existing variations of energy kiosks regarding layout, management and funding. Looking at the currently active initiatives, one common characteristic can be observed: All energy kiosk companies are struggling to bring their projects to scale and replicate their model in order to create sustainable businesses. The reasons for this are manifold, as each company operates in a different environment and with diverse approaches.

This chapter clusters all obstacles and difficulties named by the interview partners in order to identify the main challenges energy kiosk projects have in common. At the same time, it lists possible solution strategies and best practices, sorted in four subchapters: Market demand, customer interface, local HR, and overall financial situation. In a first step, the interview partners were asked to evaluate their own business with numerical values regarding these four aspects; their self-assessment is presented at the beginning of each chapter. The scale for evaluation ranges from one to six, with one meaning "very good" and six meaning "very poorly". Considered in this assessment are all interviewed companies except Coca-Cola[17]; including two evaluations from representatives of NICE[18]. In a second step, the challenges and solution strategies of all interviewed companies are visualised in a graphical overview and subsequently described in detail.

The information presented in this chapter bases on interviews with energy kiosk company representatives. The Excel file *Chapter 5_Challenges and Best Practices_resulting from Interview Notes* in Appendix A4 indicates the exact interview quotes that are linked to each statement in the text.

5.1 Market

As outlined in the literature review in chapter 2.3, electrification businesses are facing very specific and challenging conditions in remote low-income markets. The market segment for energy kiosk projects is even more particular. Figure 19 shows the results on the self-evaluation of the kiosk companies regarding market demand. The question companies were asked is: "On a scale from one to six, how well is your offer fitting to the actual demand of your market?"

Four companies rated themselves as "very good" regarding the satisfaction of the demand. Only two companies give themselves grades worse than three. The companies seem to feel confident about having identified the market demand; however, most also see potential for improvement. The energy kiosk companies named demand satisfaction, competitive pricing, and awareness raising as the most challenging aspects for market penetration. In the following, the critical issues regarding these three pillars are discussed further in relation to best practices employed by kiosk companies active in the market.

[17] The Coca-Cola EKOcenters interview partner did not self-evaluate as operations are just starting.
[18] NICE Intl refers to the evaluation of the founder of NICE International, which is now dissolved. NICE Gambia refers to the evaluation CEO of the local subsidiary, which is still operational.

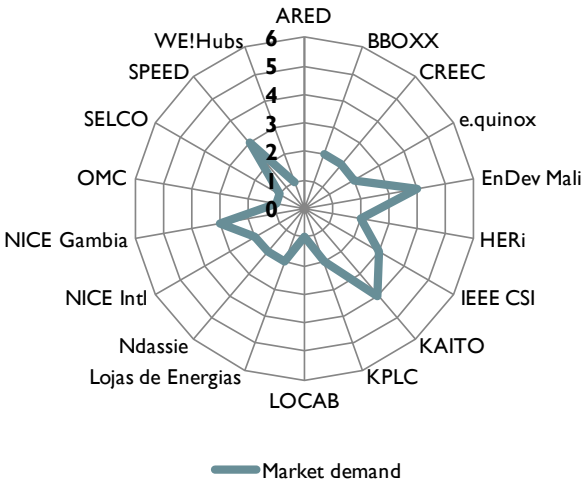

Figure 19: Self-evaluation of companies regarding demand satisfaction; 1=very good, 6=very poorly (B1, except Coca-Cola)

5.1.1. Demand Satisfaction

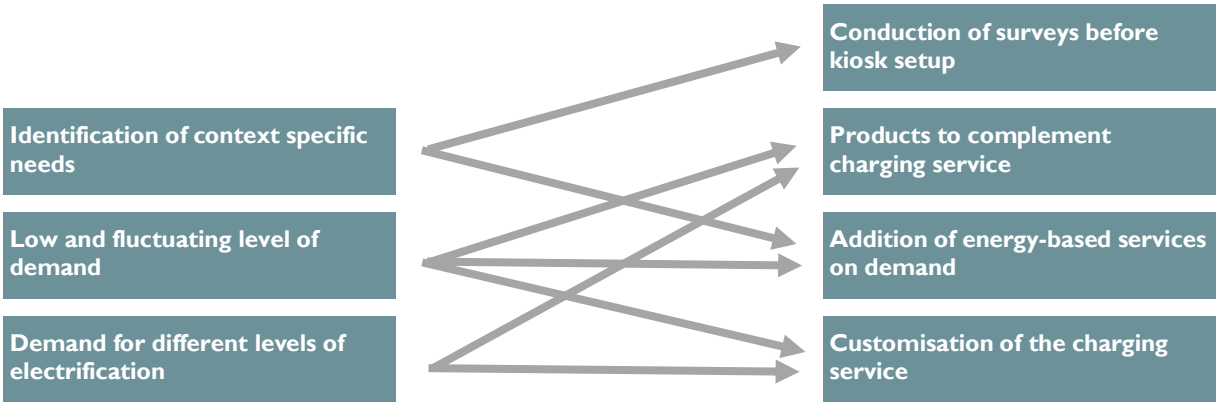

Figure 20: Overview of challenges and solutions regarding demand satisfaction

Energy kiosk businesses refer their offer to households which cannot afford an own SHS or grid connection. These households have specific needs related to energy services, resulting in a certain demand for electricity. However, the needs of households and the resulting demand profile varies according to local conditions, income level, and other factors. Resulting challenges and best practices to overcome these are depicted in Figure 20. First, it is important to **identify the needs in each target area** in order to prevent low sales numbers and wrong initial investment decisions. The strategy suggested by five companies is to **conduct surveys and personal customer assessments** before a new energy kiosk is set up. This helps clarify the potential use of electricity, the current energy expenditure, and the willingness to pay for electricity and to gauge the interest of customers in specific energy related products. A second solution is to start the charging business in its basic version and to **add other energy-based services on demand**, such as cooling, or printing. This strategy is also relevant because some services are requested only seasonally, e.g. the demand for printing services during school exam times. WE!Hubs and NICE mention the necessity to involve local actors in the development of new services in order to ensure their relevance and applicability in the local context.

Even if the energy kiosk company is able to identify the needs of customers and to assess the demand correctly, the **rate of customers who require charging services often remains low**. Four

companies explicitly state that the attendance rates of their charging stations are lower than expected and too low to create a sustainable business model. Reasons for this are the low ability to pay of many rural households as well as the seasonal fluctuation due to their dependence on agricultural activity. While most rural households can afford the charging service in times of relatively high income, they are not able to cover the costs in time of no or low income. This in turn results in low and irregular incomes for the energy kiosk businesses, which mention different strategies to meet this challenge. First, several energy kiosk projects rent out chargeable devices with different electric capacities that have different brightness levels of lamps or different durations of battery discharge. The companies align the prices for these devices to the respective capacity, allowing customers to adapt their electricity expenditure to their current financial situation. This **customisation of the charging service** is realised by HERi, CREEC and the WE!Hubs among others. Secondly, the **offer of energy-based services according to local demand** could help to balance the instable charging revenues. Customers tend to spend money on entertainment and information technology (IT) services even if their household income is low. Many companies are currently just testing these services. Up to this point, classical charging – especially phone charging – creates the largest part of most kiosks' revenues. A third strategy to cope with low and fluctuating rates in the charging business is the **offer of additional products** at the energy kiosk. In some cases, companies offer energy related products such as light bulbs, torches, or small batteries. A few energy kiosks have also started offering products that have no direct link to energy, such as agricultural products or consumer goods, in order to stabilise their revenues and to be less dependent on the fluctuations in the charging business.

Complementary to the challenge of low and fluctuating demand of very poor households, wealthier households confront the energy kiosk projects with the **claim for a higher standard of electrification**. Even in remote rural areas, many people are aware of the advantages of an electricity connection at home and are not willing to commute to a charging station regularly. In addition, higher income households are not satisfied with the provision of energy for lighting and phone charging. Those customers would like to run TVs, fridges and other electric household equipment; the load of such devices is usually too high for a rechargeable battery. The option of **customising the charging service** is alleviating the problem. Higher income households can refer to large batteries and can charge those more frequently in order to satisfy their demand to a certain extent. Some energy kiosks offer batteries that can run radios and even small TVs. Several companies deliver recharged devices to the households which solves the transportation issue for heavy high-capacity batteries; this is further explained in chapter 5.2. Nevertheless, rechargeable batteries with large capacity are seldom able to run off-the-shelf TVs or fridges. In order to solve this problem, several energy kiosk companies **offer specific devices as complementary products**, which customers can use in combination with rechargeable batteries. Examples of these devices include fans, small radios or TVs, lamps, and electric razors. They mainly operate on direct current, i.e. can be run on the battery directly without requiring an inverter, and consume relatively small amounts of electricity. BBOXX, LOCAB, OMC and the WE!Hubs offer such devices, either for purchase or for rental. Despite these promising approaches, not all needs of higher income households can be satisfied. Several energy kiosk companies such as Lojas de Energias, Ndassie, SELCO and BBOXX are therefore selling SHS next to their charging business, covering a broader market segment. Another option realised by OMC, SPEED

and IEEE CSI is the combination of a charging station with a micro grid. This enables small businesses and high-income households to satisfy their demand for electricity while low-income households are still served with rechargeable batteries or lanterns. These strategies are admittedly not solving the market demand challenges of energy kiosk businesses directly, but are rather switching to a different business and electrification model. The diversification of these companies reveals the fact that classic charging services can only be a solution for the lower income segments.

5.1.2. Competitive Pricing

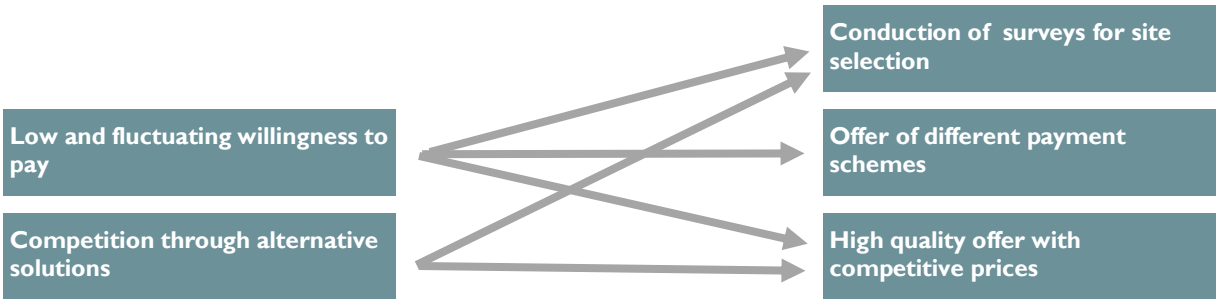

Figure 21: Overview of challenges and solutions regarding competitive pricing

Further challenges for energy kiosk companies are linked to competition and pricing strategies, as outlined in Figure 21. Although there is a need for the provision of modern energy services in underdeveloped rural areas, the **willingness and ability to pay for most customers is very low**. This relates to the low level of monetary income and the unstable financial situation of most rural households. In order to win and keep this segment as customers, the price of electricity, i.e. the rental fee for a battery or price per charge, must be affordable. Many energy kiosk companies base their prices on the average household spending for kerosene, paraffin and candles, which are the alternative sources used if no electricity is available.

The price for electricity at the energy kiosk is then **equal or lower than what households would pay for fuel-based lighting** for the same amount of hours. For other products and services such as internet provision, clean water or mobile phone products, the respective kiosk companies **align their prices to the local competitors' price level**. These strategies ensure that households can take advantage of the services and products offered at the energy kiosk at an affordable price. However, despite the fact that charging and other services are generally affordable for the target group, the **irregularity of household incomes** is a significant challenge. This irregularity leads to the fluctuations in demand mentioned in chapter 5.1.1. KAITO mentions that electricity has a relatively low priority for most households. They often revert to candles or kerosene for lighting in times of low income, as these can be bought in very small quantities. In order to enable customers to use electricity regularly on the one hand and to stabilise kiosk revenues on the other hand, the energy kiosk companies have developed **different payment schemes**. Although kiosk companies like e.quinox would prefer monthly battery or lantern rental for greater stability and easier planning, they also offer short-term payment schemes per week, per day or per charge. This imitates the advantage of kerosene and candles, which customer can purchase in very small amounts according to their current ability to pay. Some companies leave the decision on payment schemes to the operator, depending also on the operation model of the energy kiosk. SELCO mentions that some operators even offer

credit systems to balance their customers' fluctuating income and to be able to provide them with electricity continuously. For some energy kiosk companies, these measures are not enough to increase and stabilise their revenues. KPLC and the WE!Hubs for example also target small businesses or farmers, which tend to be more reliable regarding their payment patterns and have a higher willingness to pay. In this context, the evaluation of the customers' monetary income and the resulting ability to pay before kiosk setup plays an important role. This refers back to the **conducting of market surveys** already mentioned in chapter 5.1.1.

As has been previously pointed out, the **battery or lantern charging service has to compete with kerosene and candles** as existing alternatives at most sites. Next to that, more and more SHS distributors reach rural areas, providing another competitive solution. Some energy kiosks are even located in areas that the central grid covers. The kiosk companies follow different strategies to compete with these approaches. The **low price level of the charging service** is one of the most important arguments for the approach – especially when looking at investment costs for SHS and expensive grid connection fees. Another reason for switching from kerosene and candles is the overall higher costs of using these sources in the long term compared to the price of charging at an energy kiosk. One energy kiosk company also mentions that an advantage compared to SHS is that customers do not carry the risk of technical failure, as the kiosk operator is responsible for the maintenance and replacement of devices. According to several companies, the main competitive edge of charging services in comparison to fuel-based lighting is the **higher quality of light** and the reduction of health hazards through avoided emissions from kerosene lamps and candles. Overall, kiosk companies can reduce or avoid the threat of tough competition by informed decision making during the kiosk setup phase. Choosing sites far off the grid, where no alternatives such as SHS are available, is likely to ease the market penetration stage for energy kiosk services significantly. Also in this context, **initial surveys** investigating the local competition are of high importance in order to identify truly underserved areas and avoid regions with strong competition.

5.1.3. Marketing and Awareness Raising

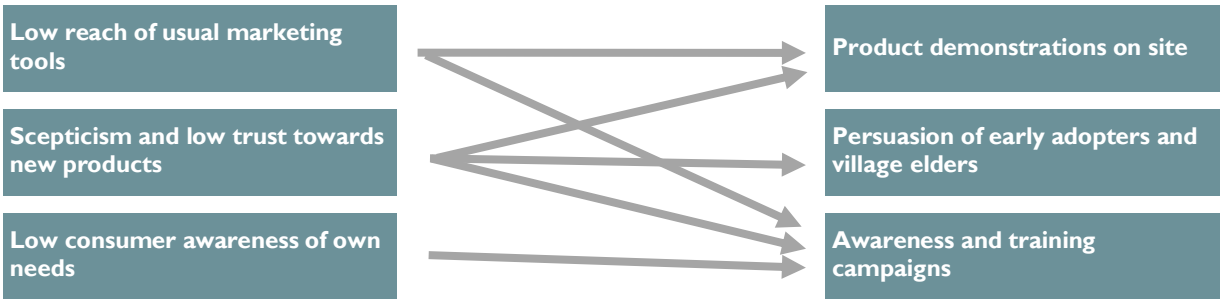

Figure 22: Overview of challenges and solutions regarding marketing and awareness raising

Marketing and awareness raising towards potential customers is necessary in order to draw the attention of the target group to the benefits of new products and services and attract households to the energy kiosk offer. Figure 22 lists potential best practices for the challenges in this field. Some companies, such as HERi and NICE, rely on traditional marketing tools such as leaflets and posters in the villages. However, **conventional marketing tools often fail** due to a lack of radios, TVs, or computers, and due to the illiteracy of the majority of the population in the targeted areas. This is why many of the energy kiosk companies carry out marketing on site and in person. **Product demonstrations at the kiosk and in door-to-door campaigns** are realised by HERi, OMC and BBOXX among others.

An additional reason for the need of on-site demonstrations and personal contact to potential customers is to help overcome the **initial scepticism of the rural population** towards new companies and products. Several kiosk companies state that people have low trust in new technologies due to a lack of knowledge – or because they have already experienced failure of low-quality solar equipment in the past. **Demonstrating the battery and lantern charging service** can reduce suspicion and raise interest. Almost half of all interviewed companies seem to rely on mouth-to-mouth propaganda in order to market their products. For this strategy to be successful, it is important to **convince key actors in the villages**. This can include the village chiefs, respected elders, members of the local government or owners of local businesses. SELCO and the WE!Hubs are for example following this strategy. Both made the experience that winning new customers is not difficult once a critical number of followers have been reached. Overall, many of the kiosk companies agree that building trust takes time and resources. In building up this trust, a high quality of service is as important as the continuous presence of the kiosk over several years.

Awareness raising through training and information meetings plays a key role, as **many customers do not realise, understand, or believe the negative effects associated with the use of kerosene and candles**. Health risks, danger arising from open light sources and environmental consequences need to be more widely explained and demonstrated, while viable and healthy alternatives are proposed at the same time. Also the argument of cost savings for households through the usage of charging service is only effective if customers with limited ability to read, write, and calculate understand the sustainable impact of this fact on their lives. The awareness of long-term economic benefits also increases the willingness to pay an upfront deposit for batteries and lanterns (further details follow in chapter 5.2.3.).

5.2 Customer Interface

Alongside the challenge of market penetration, the maintenance of continuous relations with individual customers constitutes another difficult task for the energy kiosk companies and local operators. Figure 23 shows the companies' answers to the question: "On a scale from one to six, how well do you perform in winning and keeping your customers?" Only one company gives itself the highest grade, and five companies rate themselves with a three. KAITO even evaluates its own ability to win and keep customers as "very poor".

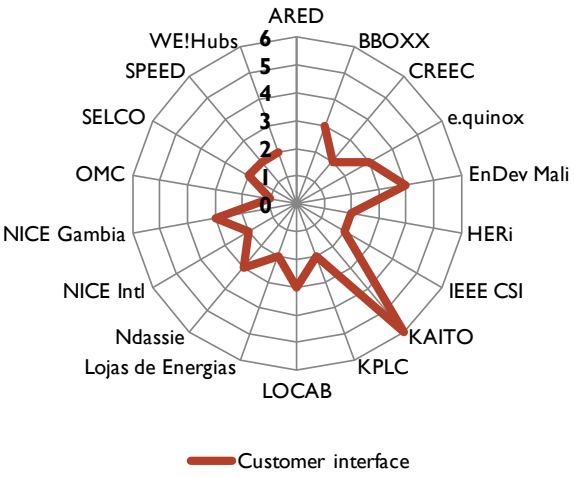

Figure 23: Self-evaluation of companies regarding customer interface; 1=very good, 6=very poorly (B1, except Coca-Cola)

Customer satisfaction is of major importance for all operating kiosk companies. The challenges in the customer interface include delivery of services and supply of products, sustainable aftersales activities, and all other efforts to ensure customer loyalty.

5.2.1. Delivery and Payment

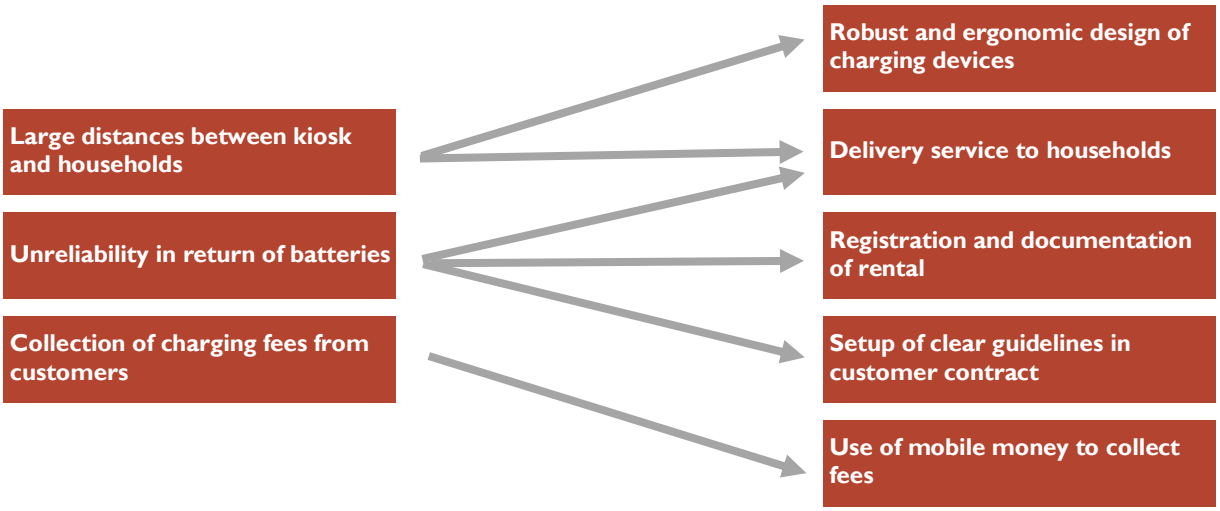

Figure 24: Overview of challenges and solutions regarding delivery and payment

One of the characteristics of the energy kiosk model is the central provision of services. As an effect of this centrality, transportation of charged devices – mostly batteries and lanterns – from the kiosk to the households is required, and central payment has to be carried out. The challenges linked to delivery and payment are met through a variety of solution strategies, outlined in Figure 24. In many rural settings, houses are scattered over a large area; **customers often live several kilometres away from the charging station**. Customers often bring and fetch batteries and lanterns by foot or bike. Depending on the capacity and the usage pattern they sometimes have to commute daily, but at least weekly. This raises the need for **robust and waterproof devices** that are resistant to shocks. At the same time, the lanterns and especially batteries are often heavy and need to be ergonomic so that women or children can carry them as well. Several companies such as e.quinox, SELCO and OMC have **specifically designed battery boxes in order to ease the transportation challenge**. A second solution to the transportation problem is the organised **delivery of batteries and lanterns** by the kiosk operator or a local assistant. SPEED and OMC both established such a service, picking up devices by motorcycle in the morning and returning them fully charged in the late afternoon. This doorstep delivery method is convenient for customers and prevents mistreatment of batteries. However, it is associated to costs for motorcycles and staff for the energy kiosk companies. Another option in discussion is the setup of several small local charging stations in order to have the service located closer to customers. This is mentioned as an idea by several companies and will be discussed as a future strategy in chapter 6.3.

Another challenge resolved by the delivery of devices through the kiosk operator is the **unreliable return of empty batteries and lanterns**. Several companies face a situation in which customers keep discharged devices for several weeks without returning them. This not only restrains the kiosk operations, but also negatively affects the performance of the batteries. In one case, it was reported that customers even tried to sell the rented devices to a third party. Another possible solution – next to the **delivery of devices by the operator**, as mentioned – is the **registration of batteries and lanterns**; either through scan codes or by documenting rentals in a customer sheet as a cheaper alternative. By tracking the current owner and last recharge date, it is possible to detect missing and delayed items and contact the respective customer directly if required. E.quinox made good experiences with **setting up a customer contract** that clarifies the ownership of the devices and indicates the rules for the rental service.

Similar to the delivery and return of batteries and lanterns, the **collection of fees for the charging service** can be challenging. Requesting fees from the households and transferring them to the company headquarters via the operator is a complex procedure that can result in delays frequently. Two companies state having tested **mobile payment schemes**. One of them is having positive experiences while the other company is meeting technical difficulties. Other strategies to ensure timely payment were not mentioned, while it is also unclear how many companies struggle with this aspect.

5.2.2. Aftersales Service

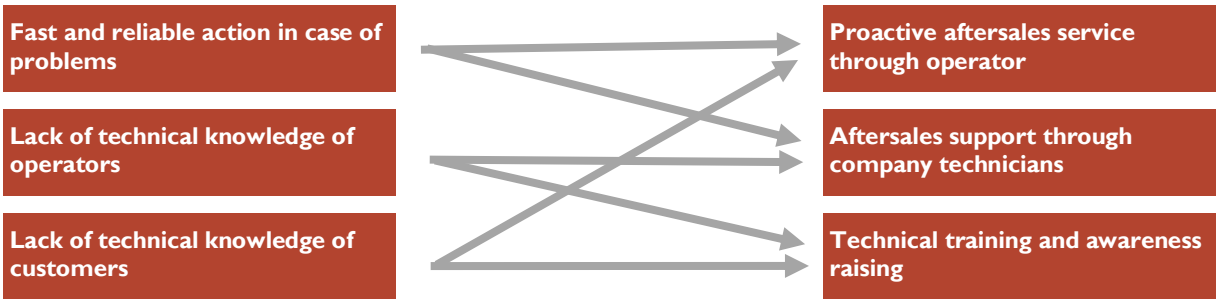

Figure 25: Overview of challenges and solutions regarding aftersales service

The charging service offered by energy kiosks works on batteries or devices that include batteries. These batteries are sensitive and require proper treatment and maintenance. At the same time, most customers renting a battery lack adequate knowledge on how the device functions and how it should be handled. This makes intense technical support, framed as “aftersales” in this context, necessary. Figure 25 provides an overview of existing challenges and potential solutions in this field. In case of technical failure of the charging devices, **fast and reliable action is required**. The lack of skilled technicians in targeted regions often leads to long waiting times until a device is repaired. This reduces the trust and satisfaction levels of customers. Consequently, several energy kiosk companies **provide aftersales services centrally**, sending company technicians from the headquarters to the villages regularly or on request. As an alternative, the **local kiosk operators can be in charge of replacement and maintenance support**. Examples are BBOXX and OMC who offer aftersales services at the kiosk hub. There, customers can approach the technically skilled operator during service times for advice and repair. Lojas de Energias chose a more proactive approach, in which operators visit customers frequently in order to check the devices and monitor their performance. Aftersales service carried out by operators is only feasible if the kiosk companies have skilled and reliable local partners in place. In many cases, the **low level of knowledge and skills** makes intense training of operators necessary. None of the interviewed companies mentions this aspect as a specific challenge in their aftersales support. **Training of operators** however is a major local HR challenge and is discussed further in chapter 5.3.

The **low awareness and education level of customers** is an additional reason why an aftersales structure needs to be in place. Several kiosk companies mention this challenge and are conscious of the need for detailed explanations for customers before renting out devices. **Technical training and demonstrations** help familiarise the rural population with the technology and can help to reduce the number of technical problems.

5.2.3. Customer Loyalty

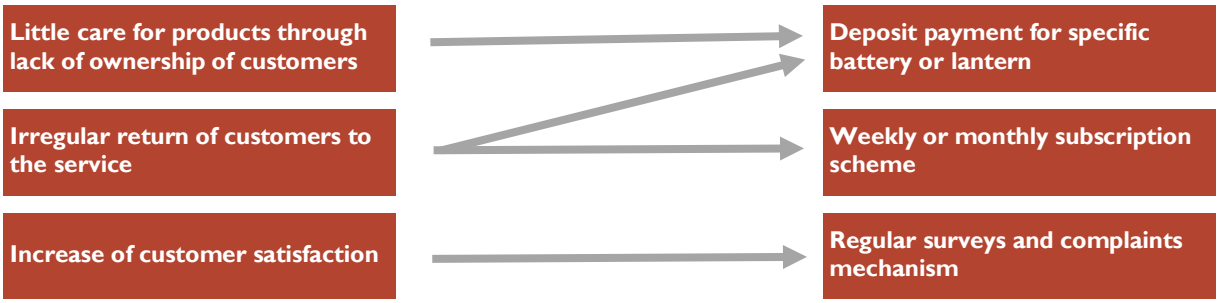

Figure 26: Overview of challenges and solutions regarding customer loyalty

Most energy kiosks operate in rural areas with a limited number of potential customers within reach. In such a setting, customer loyalty is of high importance, especially when considering the effort it takes to overcome scepticism and to build trust. The strategies to enhance customer loyalty are summarised in Figure 26. One basic problem is the **low feeling of ownership** customers may have for the devices they rent. Different from a SHS or a grid connection, the households do not own the device they use for electricity generation and transformation. Therefore, they often treat it with less care and appear to be less motivated to use the charging service frequently. Several kiosk companies have noticed this factor and have introduced a **refundable deposit**. If customers want to rent a battery or lantern, they have to pay an upfront fee. They will only get it back when they stop using the charging service and return the battery in good condition. IEEE CSI and CREEC link this deposit to one specific device in order to give customers a feeling of ownership, whereas a swapping system whereby customers get a different battery every time reduces this ownership effect. In addition, the deposit system is making customers **return more frequently to the charging service** so that they do not to lose their "right" on the battery. Another way to affect the kiosk frequentation rate of customers is through the **choice of subscription or payment schemes**. As already discussed in chapter 5.1.2, there are several options to collect service fees – per electricity charge or in daily, weekly, or monthly subscriptions. The latter option makes customers pay for a certain timeframe enabling them to recharge their devices as often as they wish. This way, customers are incentivised to frequent the kiosk on a regular basis in order to take advantage of the fee paid. A downside of the time bound subscription is the low adaptability to fluctuations in the customers' income as explained in chapter 5.1.2.

In order to ensure customer retention, the kiosk companies and operators have to ensure that customers are **satisfied with the products and services offered**. Several companies reported complaints related to technical problems with devices, the low quality of the charging service and inadequate aftersales support provided. In order to adapt to the needs and wishes of customers, **regular surveys and collection of feedback through a complaint form** can be helpful. In addition, the contact to village key persons was mentioned as an essential channel to collect feedback from the community, as they often have a clear picture of opinions and satisfaction of their fellows.

Several other strategies to increase customer satisfaction are currently being tested. Founding a customer association could increase inclusion and ownership of individuals, while incentives such as loyalty stamp cards for frequent charging can help bind customers to the energy kiosk company. Most important, however, is the quality of products and services provided; this is key to customer loyalty.

Kiosk companies that do not consider this are likely to fail with any of the additional customer relation strategies mentioned as they will not manage to build trust among their clients.

5.3 Local Human Resources

In order to manage the charging service and other potential energy kiosk activities, the kiosk companies cooperate with local partners as operators. Chapter 4.5.2 described the four main operation models: employment, franchising, commission-based cooperation, and independent management. On the question “On a scale from one to six, how well does the cooperation with local actors (entrepreneurs/employees) go?”, three companies answered with “very good”, one rated itself with four, as illustrated in Figure 27. All others are in the lower midrange, self-assessed with two or three. Also here, it is noticeable that many companies indicate room for improvement, while still being able to control the arising challenges. Scouting and training reliable, skilled, and motivated local partners is one of these challenges. In parallel, companies need to find ways to prevent fraud, motivate operators, and enhance their entrepreneurial thinking.

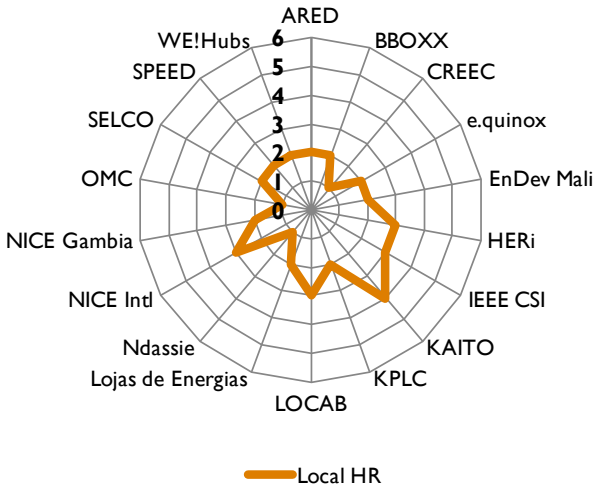

Figure 27: Self-evaluation of companies regarding local HR management; 1=very good, 6=very poorly (B1, except Coca-Cola)

5.3.1. Selection and Support

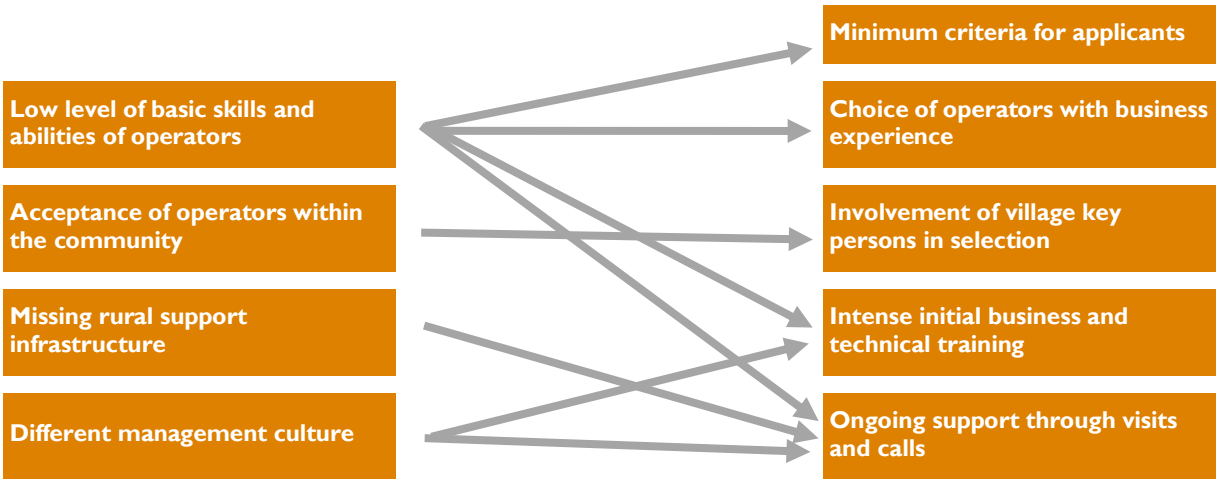

Figure 28: Overview of challenges and solutions regarding operator selection and support

The success of a charging station depends in big parts on the entrepreneur. At the same time, access to talent is considered a challenge in many companies. Figure 28 shows how energy kiosk companies manage the selection and support of operators in order to ensure high quality services. The **lack of skills of applicants** in remote rural area is one major aspect in this. In order to make sure that the prospective operators are able to run the station independently, most of the energy kiosk companies set **minimum criteria for applicants**. Points mentioned are the ability to read and write, basic computer skills, English and local language skills, and basic accounting or maths skills. IEEE CSI also requests experience in mechanics or electronics in order to employ operators also as aftersales technicians. Five kiosk companies explicitly stated to **prefer operators who already have experience as businesspersons and show entrepreneurial spirit**. Next to setting those criteria, some companies check the reputation and background of the applicants to reduce the probability of fraud and other undesired behaviour. Two companies mentioned their preference for female operators as they often show more responsibility due to their position in the family and in the village. Although exceptions exist, operators are regularly recruited from the same village or region where the energy kiosk is placed.

Another aspect to consider is the **acceptance of the community,** which is essential for the operator's success. This is why many kiosk companies **involve local actors in the selection of operators**, asking for advice or suggestions. This can be the village leader, a local NGO, a community-based organisation or the local government.

Despite careful selection, the applicants' skills and knowledge are in most cases not sufficient to operate an energy kiosk. The majority of companies are therefore **carrying out training programs** with varying focus and intensity. The training education ranges from one day in the case of e.quinox to one month with SPEED and CREEC, sometimes followed up with continuous long-term training. The education comprises sales skills, technical aspects, knowledge on payment and bookkeeping, market development aspects, complaint management, and reporting practices. The sessions partly take place centrally, partly on site in the kiosk as on-the-job training. After the initial training course, the kiosk operators fulfil their tasks independently, as entrepreneur or employee according to the operation

model of the company. Most companies provide however **continuous central support** in matters that are difficult to fulfil for the operators. Technical aftersales can be one of these areas as well as effective marketing campaigns. Frequent personal visits through company representatives are common; five companies stated to pass by their kiosks regularly, in turns of two weeks up to two months. The main reason for this is the **lack of support structures** for such activities in rural areas. At the same time IT infrastructure and regulation are weak, resulting in unstable connections and interrupted and slow information flow when communicating remotely.

Another reason for the importance of intense training and continuous support are the **differences in management culture** between professionals from different continents. This is relevant for those companies that have their headquarters in Europe or the United States, but run energy kiosks in the Global South. In many cases, these companies collaborate with a local management team to ensure smooth operations. Two companies with seat in Europe reported the need for training, coaching and provision of templates as the local management practices would not live up to western standards. One of these companies active in Africa suggested that sending European managers instead would save more money for supervision as it would generate additional costs.

5.3.2. Performance of Operators

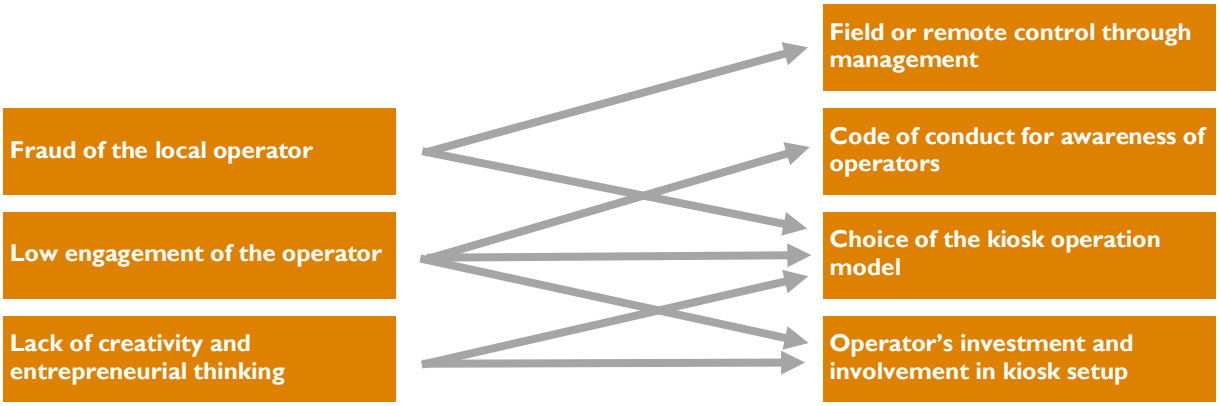

Figure 29: Overview of challenges and solutions regarding performance of operators

Next to selection, training, and supervision, Figure 29 lists several more strategies in order to enhance the performance of operators and reduce problems and conflicts in the cooperation. Seven out of 18 interviewed companies detected **fraud or criminal activity of individual operators** in the past. This could be small incidents, but also severe fraud as repeated theft of money. To minimize this risk, **regular control visits** through company representatives – going hand in hand with supervision and support activities – are necessary. As a second point, the **choice of operation model** regulates the opportunities to cheat. In employment or working commission based, it is easy and tempting to cheat, considering the limited financial means of most operators. Two companies suggest that a franchising system gives less opportunity for fraud as operators pay a fixed fee to the company and are otherwise responsible for their business themselves. Another mechanism, mainly employed by initiatives running their kiosks with a community approach, is group control. In this strategy, local associations or village committees are responsible for the operator's behaviour and decide how to deal with misbehaviour.

Other reported incidents linked to local partners relate to **lack of motivation and low identification with the energy kiosk business**. In some cases, operators do not show up at the kiosk during core

business times, do not maintain the station properly, and show little cooperation in general. It also happens that kiosk operators leave to bigger cities after having gained skills and reputation through the charging business. To avoid this and increase the engagement of local partners, several kiosk companies make operators **invest in the kiosk infrastructure and involve them in the setup of the station**. These initial hurdles make sure that candidates bring the necessary commitment. At the same time, it creates ownership for operators and **enhances their entrepreneurial thinking**. Some energy kiosk companies hope that if investing money and effort, operators will be more aware of the kiosk performance as they are carrying part of the risk. Low engagement can however also result from lack of awareness of duties and correct behaviour. OMC made good experiences with a **code of conduct** to raise awareness for rules and obligations as operator. Another relevant factor for local engagement is financial security of operators, which is again linked to the **choice of operation model**. With too low incomes, it will not be attractive to invest time and effort in the charging business. This risk is high in case of franchising, as the amount of revenues has a direct impact on the operator's private finances and might discourage him/her to continue the service. This on the one hand is a reason for several companies to employ local partners directly. On the other hand, the logic is reverse when looking at the entrepreneurial spirit of operators. Three kiosk companies are convinced that operators only approach the charging business with an entrepreneurial and creative mindset if they own the business and are responsible for its success; this is only possible with a franchising or commission-based approach.

5.4 Finances

Figure 30 shows that the financial situation is the most critical aspect for the performance of most companies, according to their self-evaluation. On both questions "On a scale from one to six, how well does your product portfolio work to generate profit?" and "On a scale from one to six, how would you rate the financial situation of your company?" several companies answered to perform "poorly" or "very poorly". The comparison of the two curves, which partially show the same tendencies, shows that there is a connection between successful profit creation and overall financial stability. It is however obvious that profit generation through charging services is not enough for an overall stable financial situation. ARED, Ndassie, NICE, and others assess their overall financial situation to be significantly worse than their ability to create profits.

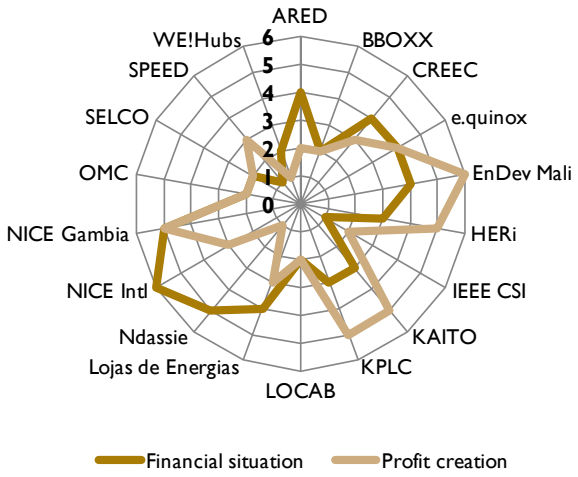

Figure 30: Self-evaluation of companies regarding profit creation and financial situation; 1=very good, 6=very poorly (B1, except Coca-Cola)

The reason for this is that financial sustainability of infrastructure projects in the Global South depends also on various external factors. Regardless the technical and business approach, all electrification projects face hurdles out of the context and environment in underdeveloped regions. Examples mentioned during interviews are the difficult access to public and private funds, and high loan interest rates. In addition, political and economic instability and insecurity lead to high land costs, high and unpredictable custom fees and bureaucratic hurdles in company setup and administration. All these external challenges affect energy kiosk companies in their struggle to achieve financial stability. At the same time, energy kiosk companies face various intrinsic financial obstacles that arise from the setup of the business model. For these internal challenges, different solution strategies are under discussion.

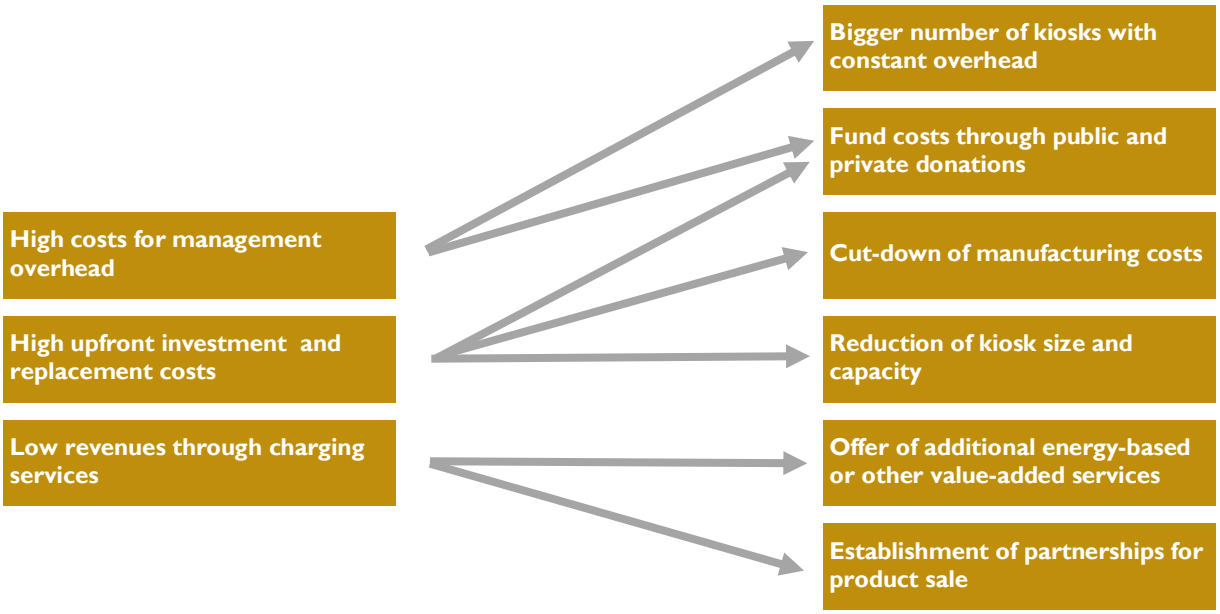

Figure 31: Overview of challenges and solutions regarding financial performance of companies

The goal of reaching financial sustainability is interpreted differently by the energy kiosk companies, depending on the role of profit creation outlined in Figure 18 on page 28. Profit-oriented companies on level three, four and five in the matrix refer to a situation where all fixed and variable costs are covered or surpassed by kiosk revenues. Sustainability for non-profit initiatives – on level one and two in Figure 18 – rather refers to a situation where operation can be ensured long-term, regardless of the coverage of initial costs.

As Figure 31 shows, profit-oriented companies face three major internal challenges regarding finances, which are very interlinked. First of all, those companies sustaining a management overhead as indicated Figure 16 on page 26 **struggle to cover the management salaries through kiosk revenues**. In order to pay the necessary management personnel, a **big number of kiosks** are required. These kiosks need to be profitable on unit level, i.e. create more revenues than operational expenses. The resulting profits on kiosk level could be used to cover the costs for the overall management. As the required overhead does not grow proportionally with to the number of operational kiosks, a high amount of kiosks will ease the coverage of overall management costs. Although several energy kiosk companies mention this solution or generally indicate their plans for rapid upscaling, none of them succeeded in this up to now. As an alternative, one energy kiosk company mentioned the option to decrease the international overhead by establishing the business in the country of operation and decreasing the management team to one or two people. Automation of payment and reporting procedures could reduce the need for managers. The same company clarifies however that this strategy affects the operational performance and makes upscaling very difficult.

The second challenge regarding finances for profit-oriented initiatives is the **high upfront and recurring investment costs** for energy kiosks. The investment costs for one charging station vary depending on size and equipment the company employs, ranging from 1400 Euro to 200.000 Euro for one kiosk. These variations indicate that a comparison and generalisation of kiosk projects regarding the investment cost coverage is difficult. However, high upfront investment costs are considered as one of the main financial hurdles. Seven companies explicitly mention that the investment costs for the kiosk infrastructure are too high to be recovered. This is why the **reduction of manufacturing costs** is an important aspect for many profit-oriented projects. One important factor is the simplification or exclusion of a kiosk housing, which often constitutes a significant part of the overall upfront costs. Another aspect is the high costs of batteries and other household devices. As the investment cost in charging devices grows with the capacity of the station and the number of customers served, upscaling of individual stations is not necessarily improving the financial performance of individual kiosks. In general, the high investment costs lead to the situation that a larger number of kiosks – which are needed in order to cover overhead costs – lead to higher investment costs that need to be covered through revenues. Several kiosk companies came to the conclusion that in order to become profitable, the **kiosk size has to be reduced significantly**. Chapter 6.3 takes up the idea of such micro-kiosks as a future strategy for energy kiosk businesses.

As already adumbrated, the challenge of cost recovery is closely interlinked with the revenue creation through the charging business. Chapter 5.1.2 outlines that the low purchasing power of rural households leads to a low price level for battery rental. Depending on the kiosk capacity and number

of households served, the revenues of one charging station range from ten to 400 Euro monthly; only one company indicated revenues of more than 1800 Euro. In the case of profit-oriented kiosk companies, the operating costs, the payback of the upfront investment and the company's management overhead need to be covered. In most cases, the **kiosk revenues are by far too low** for this; therefore, many companies work on strategies to increase their revenues significantly. As kiosk frequentation rates or customer numbers are difficult to raise, other solutions are currently being tested. The **provision of energy-based services** such as entertainment or IT services was mentioned before. In addition, two companies are testing **value-added services** such as skills workshops and job creation initiatives in order to attract more customers. As a second strategy, **partnerships with other companies and organisations** could be initiated. Examples are the provision-based sale of external products, renting of shelf space or kiosk rooms or marketing of products through the energy kiosk operator. So far, these ideas are not realised by any of the companies on a larger scale. In the future, they could constitute additional revenue streams without increasing investment or overhead costs significantly. This strategy of extending the service and product portfolio of a charging business to a retail and service hub is further discussed in chapter 6.2.

The situation is different for non-profit initiatives focusing on social impact. Their overhead costs are funded through **private or public donations**, CSR budgets or other options mentioned in Figure 17. Therefore, they are considered zero in the company's balance (compare Figure 16 on page 26) and do not need to be covered by the kiosk revenues. Same accounts for the upfront investment in kiosk infrastructure, which is financed through donor funds without payback. Kiosk revenues are necessary to cover all running costs, including operators' salary and maintenance. To reach sustainability in operations, also non-profit initiatives try to finance replacement costs of batteries and other equipment through the kiosk revenues. Four companies stated being successful in this, two more admitted difficulties to reach operational sustainability for all their kiosk sites.

Overall, the financial performance of their businesses is of different relevance for energy kiosk companies. Non-profit initiatives rather look for social impact and are satisfied with operational sustainability. For profit-oriented initiatives, the financial performance is decisive for the long-term existence and success. Different from other challenges, proven and concrete best practices to ensure financial sustainability are missing. However, several for-profit companies consider changing their overall strategy in order to stabilise their financial situation.

6. Future Strategies for the Energy Kiosk Business Model

The various challenges energy kiosk businesses face in the establishment and operation of their projects were described in chapter 5; the "make or break" challenge especially for profit-oriented companies is reaching financial sustainability. The solutions to overcome this challenge lead many companies in the direction of changing the initial business model of a classic charging kiosk fundamentally in order to either decrease costs or increase revenues. Three new strategies could be identified in the interviews with kiosk companies:

- **Business-to-business (B2B) or business-to-public (B2P):** In this concept, energy kiosk companies are not operating the charging kiosks themselves, but selling the kiosk infrastructure to a company or public institution as customer.
- **Retail hub:** This strategy extends the portfolio of classic energy kiosks by additional products and services. The resulting kiosks are a combination of a charging station and a retail- and service hub.
- **Business-in-a-box:** This approach decreases the size and investment cost of charging stations significantly. Small charging "boxes" are sold to the local operators via a payment scheme.

All information regarding these strategies is collected as interview quotes in the Excel file *Chapter 6_Future strategies_resulting from Interview Notes*, to find in Appendix A4.

In the matrix in Figure 32, all benchmarked energy kiosk companies (B1 and B2) are clustered according to their future strategy derived from statements during the interviews. The lines of the matrix indicate the current project phase of the respective initiatives in 2014; this information is transferred from Figure 9. The grey arrows show the direction in which the respective company would like to head implementing their future strategy.

Next to the three new strategies mentioned, a fourth strategy is to keep the traditional approach of an energy kiosk for charging services. Ten out of 24 benchmarked companies seem to continue with this option, labelled as "charging kiosk" in Figure 32. Looking at the cases clustered in the first column it is remarkable that all but four are non-profit initiatives[19]. This is in line with the analysis in chapter 5.4, according to which the classic charging business can work in a non-profit approach focused on social impact. The three for-profit companies that seem to keep on their initial strategy are special cases. NICE is only mentioned in brackets in Figure 32 as the company is planning to focus on consultancy in the future, operating one remaining station as a side business. OMC complements its energy kiosks with a grid to serve businesses and telecommunication towers or other anchor loads. Lojas de Energias is combining SHS sale with the charging service. The latter two examples show that energy kiosks could constitute a viable business in combination with other technologies for electrification, satisfying the needs of the lowest income group.

[19] Compare Figure 18; clustered on level one or two of the profit creation scale

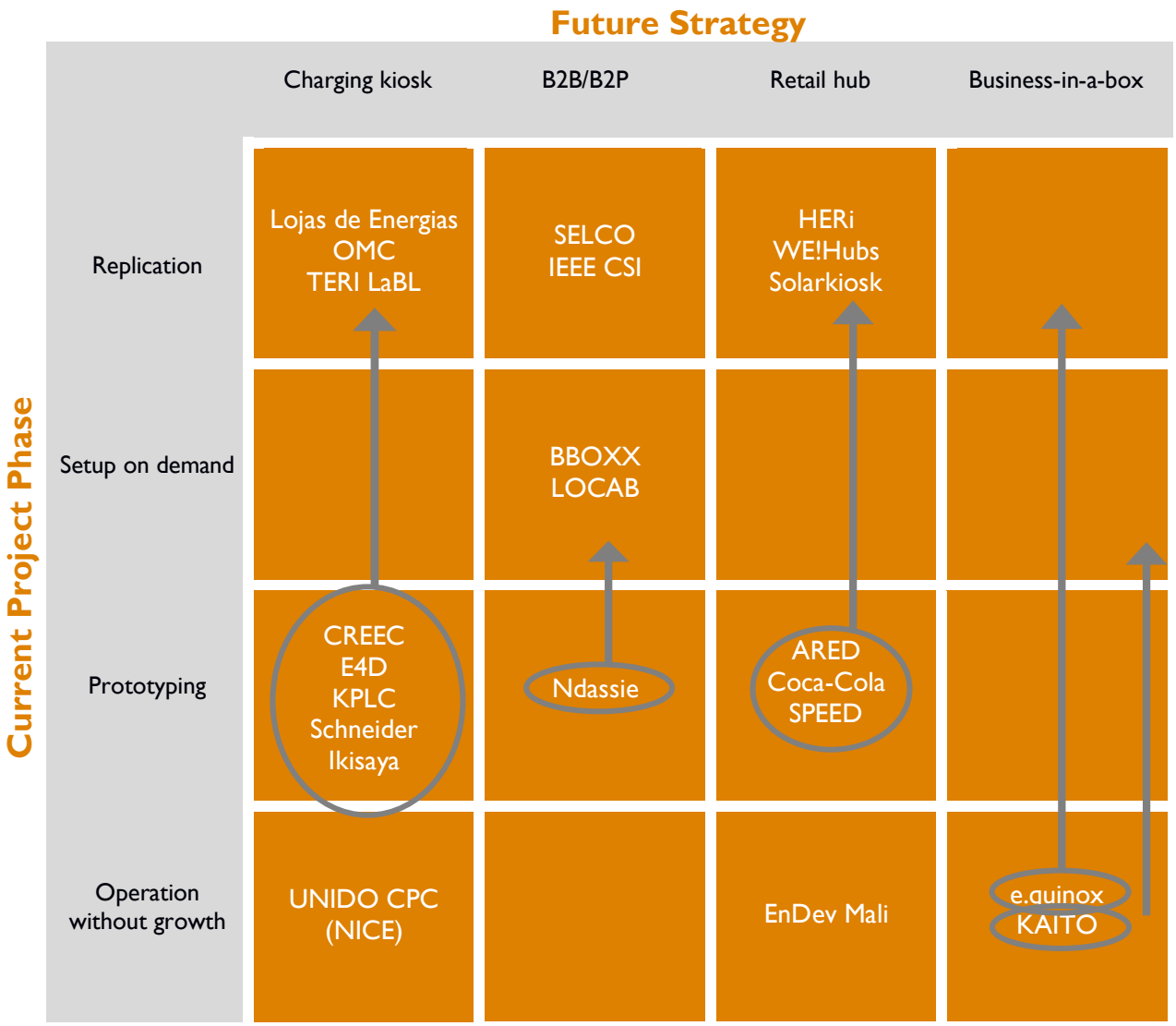

Figure 32: Companies clustered according to current project phase and future strategy (B1, B2)

The 14 companies that indicated in the interviews to follow an alternative strategy are clustered in the remaining three columns of Figure 32. Many of these companies have a relatively high focus on profit creation[20], but also some non-profit initiatives such as the IEEE CSI, LOCAB, EnDev Mali, Coca-Cola, and e.quinox believe in other winning strategies beyond the traditional charging station. The grey arrows show that e.quinox and KAITO – both stagnating with the classic energy kiosk approach – aim at replication or setup on demand implementing a new strategy. Ndassie, ARED, SPEED and Coca-Cola are currently prototyping their model with their respective new strategy. Seven companies already replicate their model or set up stations on demand. The vast majority of them is however just entering the replication phase or starting to experiment with the respective winning strategies. An example is Solarkiosk, setting up retail hubs while testing the B2B/B2P approach at the same time. Experiences with each of the new approaches are therefore limited to a few examples.

In order to take a glance at the future of the energy kiosk companies following the three new strategies, comparable success cases from different sectors were evaluated. This was realised

[20] Compare Figure 18; clustered on level three, four or five of the profit creation scale

through interviews with company representatives from different business sectors, which have already proven their model through replication. The central success factors of those cases were identified and transferred respectively to the B2B/B2P, retail hub and business-in-a-box strategy for energy kiosks.

Six out of eleven “expert” companies interviewed are selling SHS to end consumers. Mobisol and SolarNow are focusing on SHS sale as core business, while ONergy, Boond, EnerGcare, and Phaesun also offer other energy technology solutions such as lamps, efficient cookstoves, or micro-grids. The experiences of these companies provide insights for all three future strategies for energy kiosk companies. Other ventures involved are Villageboom, selling solar lanterns to NGOs and social enterprises, and a B2B/B2P provider of life-saving products. The evaluation of the approach of those two allows conclusions on the B2B/B2P model for energy kiosks. Experts with regards to retail hubs are ITC e-Choupal, a company operating IT and retail hubs for farmers in rural India, and the Child and Family Wellness Shops (CFW), a project setting up rural clinics with a franchise system. The comparison with the Microfranchise Accelerator (MFA) provides insights into the relation between kiosk companies and operators of retail hubs and business-in-a-box systems. A detailed list of the businesses mentioned and the interviewed company representatives is to be found in Appendix A2.

6.1 Business-to-Business

Five energy kiosk companies already realise or plan to carry out their activities with a B2B or B2P approach. The next sections will explain the characteristics of the B2B/B2P strategy as shaped by the energy kiosk companies. In addition, they will list potential critical points in the realisation of the B2B/B2P strategy. These points and the key success factors result from first experiences the five energy kiosk companies made and from the opinion of external actors in similar fields.

6.1.1. Description of the Business-to-Business Strategy

Companies following the B2B approach sell their products and services to other companies instead of individual end-consumers as customers [30]. The abbreviation is equivalently used as B2P for business-to-public, where the direct customers are public institutions such as governments, NGOs, or communities. In the case of energy kiosk businesses, this means that the B2B/B2P kiosk companies are technology providers, developing and selling the hardware for charging stations to direct public or private customers. Different from the classic energy kiosk model, the B2B/B2P kiosk company is not involved in the management of operations; this is the responsibility of the direct customer purchasing the kiosk. Revenues for the kiosk companies are not originating from the charging fees paid by end consumers, but from the sale of the kiosk infrastructure. The direct customer carries costs and risks associated to the operation.

Figure 32 indicates that BBOXX and LOCAB sell their stations to NGOs or companies on demand, building and customising kiosks upon request of those direct customers. Ndassie currently prototypes its first stations and aims at producing them on demand for NGOs and development organisations as a B2P business in the future. IEEE CSI has a different approach while still following a B2P strategy. This company actively looks for communities and NGOs as partners and customers to replicate its kiosks on a larger scale. The case of SELCO is a special one. The charging station infrastructure is bought

by a local NGO, which runs the kiosk in the community as a rental model. SELCO is not involved in operations, but provides knowledge and process transfer to NGOs to enable them to replicate the model on own behalf. Although SELCO does not sell energy kiosk systems directly as their main business, they are still classified as B2B/B2P business as they engage in transfer of technology and business know-how to local partners who are operating the energy kiosks independently.

6.1.2. Key Success Factors for B2B/B2P

Energy kiosk companies operating with a B2B or B2P strategy can ignore many problems that they would face with a classic charging kiosk approach. Examples are the challenges related to end consumer relations and the cooperation with local partners. However, several key success factors need to be considered for the B2B/B2P concept. The three main points mentioned by company representatives from Villageboom and other companies are outlined in Figure 33 and explained below.

Figure 33: Key success factors of the B2B/B2P model

Customer identification

In order to successfully market and sell energy kiosk hardware, the B2B/B2P companies need to identify potential direct customer groups. Important features are the motivation of companies or public institutions to pay the high upfront investment costs and carry all risks related to the kiosk operation – and their disposal of financial means to do so. Ndassie and LOCAB mention the challenge of winning direct customers; both indicate to refer to the non-profit field. Development agencies and international organisations seem to be solvent partners, having an interest to support rural development and the necessary financial means for this. SELCO and IEEE CSI follow a somewhat different approach, looking for contact to communities and local NGOs as partners to operate the energy kiosks. For this customer group, the need for an energy kiosk infrastructure arises from the immediate local circumstances. At the same time, the ability to cover the upfront costs needs to be investigated case by case.

Distribution partnerships

BBOXX and Lojas de Energias mention the problem that product delivery to the final site of operation is often associated with high costs and delays as distribution structures are for the most part absent in rural areas of the Global South. B2B/B2P companies such as Villageboom ship their products to central delivery points. This could be major cities with proper infrastructure, harbours, or clients' warehouses at central spots. The distribution from those delivery points is then in the responsibility of the direct customer or a partner operating in the country. Finding reliable partners for the distribution in the countries is a key success factor also applicable to B2B/B2P energy kiosk companies, as this makes the expensive setup of distribution channels for energy kiosk components redundant.

Aftersales structure

In case of technical failure, repair and replacement have to be provided. As long as guarantees are valid, this is the responsibility of the B2B/B2P kiosk company as technology provider. Communication and distribution channels need to be established so that all necessary information is transferred from the direct customer to the B2B/B2P kiosk company and can be processed. Also here, a distribution and communication infrastructure managed by local partners is the key to success according to Phaesun and Villageboom.

6.2 Retail Hub

Next to the B2B/B2P strategy, companies mentioned the option of creating retail hubs out of regular charging stations. Currently, seven companies refit their kiosks or start retail hub businesses from scratch, indicated in Figure 32. As most of the respective companies are still testing the model in 2014, experiences with the approach are limited. However, key success factors can be identified looking at similar hubs of ITC e-Choupal and CFW in the agriculture and healthcare sector.

6.2.1. Description of the Retail Hub Strategy

The provision of electricity makes the energy kiosks a focal point of each village. In addition, the energy kiosks are often the only brightly illuminated businesses after sunset. The availability of electricity and the central character of the kiosk make it an interesting multiplier for other products and services. This is why some companies decide to transform their charging kiosks to retail hubs by extending their portfolio. This could either happen by adding own products and services, or by renting out sales floor and offering advertising space to partner companies. The refitted kiosks become multi-purpose stations that create revenues not only from charging services, but also through other products and services. In many cases, battery, lantern, and phone charging become side businesses – or are even abandoned completely.

Among the respective energy kiosk companies following this strategy, there exist different approaches to equip retail hubs. While Solarkiosk focuses on the sale of consumer goods and solar products, HERi is investigating partnerships with agribusinesses and clean cookstove programs to extend its current offer focused on charging. The WE!Hubs are still creating the biggest part of their revenues through charging of batteries; they have however a broad variety of services like clean drinking water, IT services and skills training on offer. Both HERi and the WE!Hubs just start extending their energy kiosks to retail hubs, Solarkiosk has been operating retail hubs for several years now[21]. Two further energy kiosk businesses are currently prototyping the retail hub approach. Coca-Cola provides a broad variety of products and services in their first two EKOcenters; highest revenues are expected from phone charging and sale of cooled beverages. A second company currently testing the model is ARED, which plans to sell telecommunication products via its mobile kiosks and offer phone charging as a free service on the long term.

[21] The company was however not an interview partner in this study.

6.2.2. Key Success Factors for Retail Hubs

As retail hubs are managed very similarly to pure charging stations, the two strategies also share many challenges. Examples are issues regarding the customer interface, identification and satisfaction of the market demand and the cooperation with local operators. Retail hubs operate with a broader portfolio than regular charging kiosks and most companies plan to extend to a big number of hubs. This is why some of the challenges of the basic energy kiosk approach are even aggravated for companies choosing the retail hub approach. Although company representatives of SolarNow, Mobisol, and others mention these factors – especially challenges in local HR – they are not detailed in this chapter. Figure 34 indicates additional critical points that arise specifically for retail hubs.

Figure 34: Key success factors of the retail hub model

Distribution infrastructure

Shifting the offer from electricity charging services to the promotion and sale tangible products requires the establishment of last mile distribution channels. “Last mile distribution” refers to the delivery of goods both to the last retail point and to the end consumer [31, pp. 795-796]. Several energy kiosk and SHS companies mention the lack of distribution channels as a hurdle, and this challenge is existent for retail hub companies as well. In fact, the retail hubs as such already solve part of the distribution problem in remote areas. Experts from ITC e-Choupal and Boond point out that extended energy kiosks are central retail stations in villages as they act as focal points to aggregate individual demands and provide services. However, the delivery of products to the retail hub is also challenging in most rural areas. For smooth distribution, companies operating in similar fields establish regional inventory points or warehouses. This is for example done by ITC e-Choupal, EnerGcare and ONergy.

Reporting and tracking system

With the diversification of the portfolio and increase of hub numbers, it becomes more challenging to keep an overview over all company activities and data. A structured reporting and tracking system is a key success factor to keep all activities in line and reduce inefficiencies and misunderstandings. For this, a high level of standardisation with clear guidelines and responsibilities is necessary. Boond and SolarNow mention the need for real time tracking of orders, activities, and deliveries online or over cell phone. Despite the need for standardisation of procedures, successful last mile retail companies such as ITC e-Choupal and SolarNow recommend to rather establish guidelines implicitly instead of setting up strict rules. Retail hub companies could not enforce such rules; they would only reduce the feeling of ownership operators develop. Instead, continuous case-to-case contact and supervision of hub operators is necessary. Similar as outlined for classic charging stations in chapter 5.3.1, personal weekly or monthly visits of company representatives on site are required in order to maintain personal

contact with the operator and to assist with overcoming any local challenges. According to EnerGcare, CFW, and SolarNow, one company representative based in a regional office or in the company headquarters can manage 5 to 20 local hubs. There is a growing tendency to manage day-to-day issues online or over cell phone. Examples of this are the money transfer via the existing mobile network or online record keeping.

Control of logistic costs

Due to extensive distribution activities, the management overhead might be significantly higher for retail hub than for charging kiosk businesses. Transport of people and goods is associated with high costs; especially regular site visits are expensive. According to SolarNow, Boond, and CFW, one key success factor is therefore the control of transportation costs in order to ensure long-term profitability. Logistic costs are an important factor when looking at the unit level profitability of hubs. For hubs at very remote locations, logistic costs might be too high in relation to the revenues. Retail hub companies have to consider this in their upscaling plans. Boond, ITC e-Choupal and ONergy suggest pre-order for expensive products, e.g. electrical equipment, as pulling back of products creates additional costs. ARED and HERi, both kiosk companies testing the retail hub strategy, want to establish partnerships with companies that take care of the product distribution themselves. This can save parts of the costs; transportation of staff for hub supervision is however still necessary.

6.3 Business-in-a-Box

A third option for energy kiosk companies is the change of strategy from a regular charging station to a business-in-a-box model. On closer inspection, the business-in-a-box strategy is a B2B strategy as well. However, due to its varying key success factors it is listed separately in this context.

6.3.1. Description of the Business-in-a-Box Strategy

With the business-in-a-box approach, kiosk companies are selling charging stations to local micro-entrepreneurs. In order to be affordable for local actors, the size of the charging kiosks is significantly smaller than in the energy kiosk model described in chapter 4.4. The micro-kiosks do not include a housing structure and have a significantly smaller power capacity, similar to a SHS. One system is usually designed to charge 10-20 phones or lanterns at a time. The charging systems can be installed in private households to serve the immediate neighbourhood of the local entrepreneur.

The hardware is sold to the local micro-entrepreneur; revenues of the kiosk company result from the technology sale. The entrepreneur is operating his/her charging business independently from the company. In order to make the business-in-a-box affordable for local partners, the kiosk companies apply payment schemes with a payback time of several months or years.

Two of the benchmarked energy kiosk companies already shifted their business model from a classic charging station towards a business-in-a-box approach. KAITO developed so-called charging boxes after unsuccessfully operating energy kiosks. The boxes are provided upon request; KAITO is however not actively promoting and replicating the model. The case of e.quinox is different, as this initiative considers the business-in-a-box approach as a future growth strategy and aims for replication while handing over its classic energy kiosks to the local management. Next to KAITO and e.quinox,

several other companies already realise the business-in-a-box model for charging stations successfully. Most of these companies sell SHS as their core business. Examples are Mobisol, the Phaesun "Business Opportunities with Solar Systems" (BOSS) kits, and Grameen Shakti, refitting solar household solutions to small charging stations. In addition, there are two non-profit programs realising the approach, the Schneider BipBop project in India and EnDev in Burundi[22]. Energy kiosk companies looking for orientation can directly apply the experiences of these companies and projects.

6.3.2. Key Success Factors for Business-in-a-Box

The business-in-a-box strategy for energy kiosks targets partly the same customer segments as regular charging kiosk businesses. Therefore, some key success factors are equivalent to the solution strategies for traditional charging stations, an example being the selection of micro-entrepreneurs and operators respectively. However, due to the different setup in the business-in-a-box scenario, many aspects such as the control and support of operators have to be redefined. The key success factors identified in this context are outlined in Figure 35.

Figure 35: Key success factors of the business-in-a-box model

Demand satisfaction

The micro-kiosks set up in the business-in-a-box approach have a relatively low power capacity. Thus, the kiosks can only cover very basic needs of customers, such as lighting and phone charging. Classic charging stations of bigger size could potentially serve customers that claim electricity for larger appliances such as TVs or fans; micro-kiosks cannot satisfy this demand. In order to run the business-in-a-box model successfully, it has to be clarified if low-level demand for electricity is present locally. Several experts state that the business-in-a-box strategy therefore works only in specific remote locations where other options for low-income customers are not available.

Minimal control effort

The term "business-in-a-box" is often used synonymous to microfranchising. Microfranchising is analogous to traditional franchising regarding the general business setup. However, the franchise agreements are much smaller with regards to investments and impact, putting the well-being of the microfranchisee in focus [29, p. 506]. In both the microfranchising and business-in-a-box approach, local entrepreneurs pay a fee to the central company. However, a microfranchising system requires common operational standards and a certain amount of control and follow-up through the franchisor according to the MFA. In case of an energy kiosk company, this would result in extensive personnel

[22] Those business-in-a-box initiatives are not part of the energy kiosk company benchmarking in Appendix A1 due to their different focus. Nevertheless, some of them shared their expert view on this strategy.

effort and high costs. For the business-in-a-box sale of small charging stations, this is not necessary. The experts from the MFA, ONergy and others agree on not setting restrictions concerning operations to the local micro-kiosk entrepreneurs. Guidelines are provided in a short initial training and in an instruction manual with general information on the setup of the micro-business.

Aftersales and marketing support

Despite not imposing rules, certain support structures are a critical point for ensuring the success of the local micro-business. Company representatives from the MFA, ONergy, Mobisol, and EnerGcare agree that technical support for aftersales service and marketing is indispensable, as the micro-entrepreneurs often do not have the necessary skills to accomplish this on their own. They also often lack the time and the financial resources needed to prepare marketing materials and to distribute them to a wider audience of people located in different communities. The companies working with a business-in-a-box approach for charging kiosks currently are also selling SHS in most cases. Therefore, they can carry out the aftersales support for the micro-entrepreneurs via their existing local services stations or by using their regional hubs for SHS maintenance and repair. Mobisol points out that for kiosk companies entering the market to exclusively sell business-in-a-box charging stations to rural entrepreneurs, these structures are very expensive to set up. Costs for transport and field staff easily reach high levels due to large distances and the need for extensive support. Looking at the often limited financial resources of kiosk companies, the importance of keeping these costs to a low level appears to be of importance also in the business-in-a-box scenario.

System payback

According to the MFA and Mobisol, it is essential for financial sustainability to sell enough systems with a payback time of one to three years maximum in order to ensure liquidity and financial sustainability of the respective company. At the same time, kiosk companies need to ensure that the operators make enough profits as micro-entrepreneurs so that it is attractive for him/her to continue the business and pay back the kiosk hardware.

7. Possible Contribution of Ecosystem Actors

Energy kiosk companies, just as other inclusive businesses, heavily depend on the environment in which they engage. Chapter 2.3.2 mentions the four pillars of inclusive business ecosystems – information, incentives, investment, and implementation support – on which the success of inclusive businesses highly depends [26, pp. 9, 22].

In the interviews with representatives from energy kiosk projects, the focus has been on best practices and hands-on solutions the companies can apply themselves. Hence, the recommendations of this research project refer mainly to the practitioners in the field, and provide strategies on how to meet arising challenges themselves. Examples mentioned in chapter 5 are trainings for local entrepreneurs in order to make up for the lack of a public education system, or the conduction of customer surveys before kiosk setup as there is no market information available.

The fact that kiosk companies employ these practices in order to balance out ecosystem deficiencies shows that they learned to deal with the difficult business environment at the BoP. However, high effort, costs, and time losses come with these compensatory activities. Some issues are also too big to be tackled by one company individually. Examples are the improvement of road infrastructure and telecommunication networks in order to enable transport and supervision of the energy kiosks.

A functional ecosystem that actively supports inclusive business activities would significantly increase the chances for success of energy kiosk companies. For many of the challenges mentioned by energy kiosk companies, systemic effort and collaboration of several ecosystem parties is required. The actors addressed specifically are governmental institutions and development organisations, companies convening in collective private sector action, financial institutions and local and international NGOs.

This chapter draws the attention to the possible contribution of external actors in order to strengthen the four ecosystem pillars. Some interview partners explicitly mentioned the need for ecosystem support[23]; others only look for constructive solutions within their sphere of influence. The following calls for action expressed towards the ecosystem were not in all cases directly expressed by the interview partners. Recommendations are rather derived from the challenges the energy kiosk companies mentioned, which link to the ecosystem responsibilities listed in the UNDP report on inclusive business ecosystems [26, p. 24].

[23] The statements claiming ecosystem contribution can be found in the Excel table in Appendix A4, in the Excel file *Chapter 7_Ecosystem Contribution_derived from Interview Notes*

7.1 Governments and Development Partners

Infrastructure provision

Public sector partners such as governments, development agencies, and international organisations play a key role in supporting the implementation of inclusive businesses. The provision of infrastructure is one important aspect. Several interview partners mention the bad condition or lack of roads as significant obstacle, both for customers who have to transport charged devices and for company representatives visiting kiosk operators for supervision and coaching. Adequate infrastructure is an important factor for many companies when selecting kiosk sites. This can be a major disadvantage for remote regions out of reach of public infrastructure projects. Governments, supported by development partners from industrialised countries, should invest in road infrastructure not only around urban centres, but also in those regions.

Several kiosk companies regarded the ongoing contact with and support of kiosk operators as one of their core activities. Personal site visits in remote areas are costly and time intense, this is why operators are often contacted via mobile phone and email. Record keeping and accounting is done online, and several interview partners stated to employ remote control of the technology. For all this, telecommunication and IT infrastructure is essential. Targeted investments and regulation for fast and reliable internet and phone connections need to be initiated by the public sector.

Capacity building

Energy kiosk companies struggle with the lack of basic skills of operators. Although it can be seen as the companies' task to deliver knowledge in accounting, business and technology, governments are in the duty of making basic education in reading, writing, and maths available to the people. Increasing overall standards and providing access to higher education beyond primary school also to the rural population of developing countries will make it easier for energy kiosk projects to find fitting local partners. This is only to achieve with governmental initiatives and the support of development agencies or international organisations.

As a second effect access to education is the increase of awareness for electrification opportunities and health hazards through conventional light sources such as kerosene. Energy kiosk companies will need to spend less effort on convincing potential customers and fighting scepticism if supported by governmental authorities with training and awareness campaigns on this matter.

One major bottleneck for the sustainable upscaling of electrification projects is the lack of skilled technicians to provide maintenance and repair services. National plans for education of electricians and solar technicians could facilitate the setup of aftersales structures in rural areas.

Renewable energy legislation

Next to support in the implementation of energy kiosk companies, governments should also provide incentives for off-grid and renewable energy investments. Part of this are congruent and reliable custom regulations for electric equipment, which save time and money to energy kiosk companies importing components from overseas. Stable subsidy and tax schemes for renewable energy and off-grid projects would provide incentives and planning security to kiosk companies entering the market.

Administrative barriers

Several interviewed companies stated to struggle with administrative hurdles in the company setup. Clear and supportive governmental regulations would make it more attractive for energy kiosk companies to establish new projects. National governments could for example lower requirements and fees for company setup, while supra-national organisations such as the European Union should decrease stipulations in the disbursement of grants, which can come too costly for small companies.

National statistics

Information on the market is scare especially for remote areas with low economic activity. Many developing countries do not collect statistical data in a regular and scientific manner. This would however be very helpful for companies in the assessment of the market potential, customers needs and competitive situation. Access to such data would decrease the need for extensive customer surveys and pre-studies, which can be very time consuming and expensive for energy kiosk companies, and might not be reliable and comprehensive enough.

Financing support

Access to finance is one of the central success factors for energy kiosk projects. Governments and international development partners can step in by providing investment guarantees and patient capital to small companies in the start-up phase.

Other public services

Many public services are a matter of course in the western world, but not in developing countries. An example for a public service that supports the establishment and success of energy kiosk businesses is a functioning recycling infrastructure for kiosk components, especially for batteries that need to replaced after few years.

Also the enforcement of laws, for example regarding land ownership, and prevention of criminal acts such as fraud and theft are essential tasks of national or regional governments. If the respective institutions cannot fulfil this, support of international organisations is required in order to make the operation of energy kiosks possible at all.

7.2 Collective Private Sector Effort

Infrastructure provision

Next to public institutions, also the private sector can do its part to foster inclusive businesses such as energy kiosk companies. One example is the establishment of road and telecommunication infrastructure. If public incentives are present, both multi-national and national companies could – and already do –engage in the setup of such infrastructure profitably. However, individual companies do not have the power to change the ecosystem alone. As in the case of missing infrastructure in rural areas, the existent gaps often are of systemic nature, and collective action of whole industries or sectors is required.

Market information

Also missing market information can be provided by private sector initiatives. Research institutes observing the market development could ease the demand identification and site selection for energy kiosk companies. Additionally, companies already active in the local market could share the results of realised surveys and assessments with each other.

Replacement of public services

Several points mentioned as task for governments and development partners could also be covered by private companies. If public recycling infrastructure is not available, this could for example also be organised by the private sector. Also here, costs are too high and benefits for individual companies too small to motivate individual actors to take action. Instead, industry-wide agreements and initiatives are needed to cover such services. Another example for public service coverage is the provision of training to local actors, replacing public education services. Most energy kiosk companies are aware of the low level of education and include training and awareness raising of local staff and potential customers as one of their core activities for operations in BoP markets.

7.3 Financial Institutions

Credit conditions

Investment is one of the essential pillars in the inclusive business ecosystem. Governments and private companies can only enable access to finance to a certain degree; the cooperation and active contribution of banks and investors is required. Many interviewed energy kiosk companies criticize the harsh credit conditions of banks and microfinance institutions. Financial institutions could contribute to the setup of an inclusive business ecosystem by adapting the payback conditions, interest rates, and general access to capital to the conditions in the inclusive business sector.

Patient investment

Also investors and development banks need to adapt funding conditions to BoP markets. The provision of patient capital through impact investment can be one solution. Patient investors acknowledge the challenging conditions in BoP markets and take the long-term impact of the supported projects into account. Instead of expecting quick profits, investors need to provide capital long term in order to stabilise energy kiosk projects and give them the opportunity to settle in the market.

7.4 NGOs and local actors

Capacity building

Next to the ecosystem actors mentioned, more external parties impact the business environment of energy kiosk companies. Among those are locally active NGOs and other parties which have a high influence on the conditions at the energy kiosk sites. These actors could support awareness raising and persuasion of village key person in order to facilitate the market entry of energy kiosk companies. Local NGOs are important for decreasing scepticism of the population towards new companies and products and building trust.

Local market information

Even if both public and private sector fail to provide market information regarding income levels, spending patterns, energy use, and other aspects, local NGOs can fill this gap. Having been present in the respective region over several years, they can often provide very context specific and detailed information on local market conditions.

Enforcement of rules

Several interview partners mentioned to face difficulties with land ownership, theft of components and fraud of local operators. In such conflicts, locally active organisations that are widely respected can play a key role in stabilising the situation and enforcing rules and laws.

All in all, many factors in the environment of energy kiosk companies can be significantly influenced by ecosystem actors. The absence of infrastructure, investment, implementation support, and incentives complicates market entry and sustainable operation of energy kiosk projects. Kiosk companies can compensate some ecosystem deficits by own initiative. The presence of support structures increases the chances for success of energy kiosk companies significantly.

The role of the ecosystem for the setup and operation of energy kiosk businesses should not be underestimated. Although the focus of this research project was on intrinsic factors and activities within energy kiosk companies, the impact of the environment and ecosystem actors became apparent in most interviews. Further research should have a closer look at the role of ecosystems for energy kiosk businesses, extending the leverage points and recommendations identified in this chapter.

8. Concluding Remarks

Summary of outcomes

Throughout this research project, the energy kiosk model was examined from a variety of perspectives. A picture of the status quo of existing energy kiosk projects was drawn, including quantitative data on kiosk setup and management as well as qualitative evaluations of energy kiosk actors regarding challenges and opportunities in their business. Beyond that, possible future developments of the model were outlined and several winning strategies were identified.

The overall research question of this project is: "What is keeping energy kiosk businesses from reaching their full potential?" The answer to this question requires differentiation: Energy kiosk companies seem to face very specific and context-related challenges regarding

- their market, i.e. the identification and satisfaction of the local needs, a competitive pricing scheme, and fitting marketing and awareness campaigns,
- their customer interface, i.e. the delivery of electricity to their customer, the design of aftersales services, and gaining the trust and loyalty of the local population,
- their local HR, i.e. the selection of operators, their continuous support, and the quality of their performance.

To master these challenges, companies need to understand and respond to local conditions. This social embeddedness enables them to collaborate with non-traditional partners such as village elders and local NGOs as consultants or community members as operators. It furthermore fosters the co-invention of customised solutions adapted to the environment, such as delivery services for charged devices, payment schemes for the charging service, or the offer of services adapted to the local demand. Social embeddedness is also needed for all training, support, and capacity building activities in order to understand needs and thinking patterns of the local population. Overall, the best practices employed by energy kiosk companies to meet the operational challenges regarding market, customer interface and local HR relate very much to the factors mentioned in chapter 2.3.2 as core characteristics of successful inclusive business models.

The fourth factor analysed specifically is the financial performance of companies. In this context, the core concept of business models, the value creation, comes into play. As outlined in the literature research, inclusive business models create social value in many cases, which cannot always be expressed in monetary terms. Looking at the different levels of profit creation the energy kiosk companies aim at, it becomes apparent that they have different viewpoints on the value to be created.

On the one hand, half of all identified initiatives focus on social and economic value creation for the population, without expecting economic value for the company in return. These initiatives, which run energy kiosk companies as a contribution to poverty reduction and development efforts, are mostly supported through private or public donor funds. Often, energy kiosks are set up as complementary element to a central grid, micro grid infrastructure, or SHS sale in order to provide electricity also to the lowest income segment. For these companies, sustainable operation of energy kiosks refers mainly to long-term positive impact on economic development and life quality for the local poor.

On the other hand, many of the kiosk companies do not aim at creating economic and social value for their customers and operators alone, but also for themselves at the same time. These companies have a higher focus on profit creation, and seem to define sustainability mainly as economic sustainability that leads to social impact. For those companies, the classic energy kiosk model requires too high investment and operation costs and provides too low revenues to be sustainable as a business[24]. Most companies aiming at economic sustainability without donor support follow strategies that differ from the classic charging kiosk approach. The main three strategic paths identified – retail hub, B2B/B2P, and business-in-a-box – either require significantly lower investment costs or enable companies to increase and stabilise their revenues. These strategies are currently tested. Conclusions on their viability cannot be drawn yet, although potential key success factors were identified within this research project.

The impact of ecosystem actors such as governments, industry sectors, financial institutions, and local NGOs on energy kiosk projects is immense. The benefits of a supportive business environment are described shortly. The consequences of lacking structures and cooperation partners are difficult to quantify due to the different setup and ecosystem conditions for the respective kiosk initiatives.

Another obstacle for the exact comparison of success cases is the socio-technical nature of electrification projects. In order to evaluate an energy kiosk approach, technical factors have to be considered next to business model design, cultural background, and societal and political conditions. The interlinkages between these diverse aspects make it very difficult to draw general conclusions and replicate projects in different settings. At the same time, the complexity of relevant factors in the energy kiosk setup provides opportunities for improvement and variation on many different levels.

Evaluation of the research approach

The business model generator of Endeva, which was used as a skeleton for the sub-questions of the research, proved to be slightly incongruous with the actual setup of energy kiosk business models. Drawing conclusions from the interview statements, the central role of the customer interface cannot be confirmed. In fact, local actors are one central factor for the success of energy kiosk businesses, however, including local operators likewise. Also the product category in the Endeva business model generator turned out to be too closely linked to market and finance aspects in order to be evaluated individually. Despite these shortcomings, the model provided a sufficient frame for the evaluation of energy kiosk business models from a practitioner's perspective.

Generally, creating schematics and clustering the energy kiosk projects in categories proved to be difficult. Generalisations as the four business models identified by UNDP (2004) or the future strategies of companies defined in this document cannot do full justice to the complex and diverse approaches of the different initiatives. The line between generalisation for the sake of clarity and individual representation for the sake of accuracy is thin. In this research project, categories were created wherever clear tendencies could be recognised and generalisation is adding value to the comprehensiveness of outcomes [27, p. 124].

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[24] A few companies state that this is possible, however, none of them could present a viable financial planning.

Limitations and questions for further research

This research project focuses on the viewpoint of energy kiosk practitioners, taking into account the parameters that affect operation and management of energy kiosk companies. This angle allowed a sharp focus on local and operational aspects, while intentionally leaving aside a number of other relevant questions.

Little attention was paid to the institutional setup and the comparison of different technology options. Overall, a detailed assessment of the social and economic impact of energy kiosk projects should be carried out. Their contribution to education, health and productivity aspects, and their role in overall poverty reduction is not yet assessed. Also the ecologic impact of energy kiosk businesses, including avoided emissions, recycling of batteries and the full life cycle of energy kiosks, should be evaluated. Moreover, the customers' perspective on energy kiosk products and services would be of interest. Field surveys and direct responses from local consumers, but also from local operators and key village members might shed a different light on the role and future of the energy kiosk model.

Further research is also needed regarding the identified future strategies of energy kiosk companies. Despite the promising ideas they involve, these strategies leave many questions unanswered. For example, it is not clear whether they can keep up to the hopes for economic sustainability, and how the key success factors for these strategies can be met. Furthermore, the social value that is created through energy kiosks following these new paths with different business models has to be analysed.

All these points could not be addressed in the scope of this thesis, but are considered highly relevant for future research on the topic.

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Appendices

A1 List of Energy Kiosk Companies

Energy kiosk companies – interviewed (B1)

Official name	Short form	Description	Interview partner
African Renewable Energy Distributor	ARED	ARED is a Rwandan company founded in 2012, providing energy solutions to rural and urban areas in East Africa. The product offered is a mobile phone charging station, called the Mobile Solar Kiosk (MSK). Independent entrepreneurs, in collaboration with ARED, run the stations. Information derived from: http://a-r-e-d.com/	Henri Nyakarundi, ARED founder
BBOXX	BBOXX	BBOXX is a UK company selling solar systems to individual households in various developing countries. BBOXX developed an energy kiosk model that is equipped with solar panels and the battery boxes designed by the company. The BBOXX founders are also the initiators of e.quinox, linking their expertise in kiosk setup to both initiatives. Information derived from: http://www.bboxx.co.uk	Christopher Baker-Brian, Chief Technology Officer BBOXX
The Coca-Cola Company EKOcenters	Coca-Cola	Coca-Cola is a multinational company selling beverages. The EKOcenter project was initiated in the scope of CSR activities. The stations are meant to deliver safe access to water and other necessities to communities in need. Information derived from: http://www.coca-colacompany.com/ekocenter#TCCC	Derk Hendriksen, Project Manager EKOcenters
Centre for Research in Energy and Energy Conservation	CREEC	C REEC is a Ugandan not-for-profit organization carrying out research, training, and consultancy. It works in close cooperation with the College of Engineering, Design, Art and Technology at Makerere University. One of their research projects is the solar field laboratory, serving as an energy kiosk at the same time. Information derived from: http://CREEC.or.ug/our-departments/solar-pv/field-laboratory/	Mary Suzan Abbo, Managing Director CREEC
e.quinox	e.quinox	e.quinox is a non-profit student initiative at Imperial College London. Its goal is to provide cost-effective, sustainable renewable energy to developing countries. e.quinox has been setting up one energy kiosk per year in the last five years; countries of activity are Rwanda and Tanzania. Information derived from: http://www.e.quinox.org/index.php/our-solutions/	Rushabh Mehta, Chairman e.quinox 2013-14
GIZ Energising Development Mali	EnDev Mali[25]	EnDev Mali is a multinational program of GIZ, providing sustainable access to modern energy services. In Mali, the program set up 50 battery charging stations that are still operational. Information derived from: http://endev.info/content/Mali	Derk de Haan, GIZ Headquarter support for EnDev Mali
HERi Madagascar	HERi	HERi is a social enterprise founded in 2012 in Madagascar, setting up solar energy kiosks in rural areas. Information derived from: Interview	Sylvain Martin, CEO HERi

[25] Abbreviation in some figures: EnDev

IEEE Community Solutions Initiative	IEEE CSI	CSI is a non-profit member group of the IEEE Power & Energy Society. The group is based on voluntary engagement and works on the delivery of energy solutions to the world's poorest. Among others, IEEE CSI set up charging stations in Haiti, South Sudan, and Nigeria. Information derived from: http://www.communitysolutionsinitiative.org/	Michael Wilson, CSI Program Manager
KAITO Energie AG	KAITO	KAITO is a German company providing energy technology solutions and consultancy in Senegal. Among others, KAITO has set up mobile charging stations for lantern and mobile phone charging. Information derived from: http://kaito-energie.de/ladestationen/	Wolfgang Hofstätter, Founder KAITO
Kenya Power Solar Stations	KPLC	KPLC is the Kenyan power utility, owning most of the electricity transmission and distribution system in the country. Its off-grid department is electrifying remote areas or Kenya. KPLC is managing energy kiosks in remote villages that are initiated and funded by the Solar Transitions Project of University of Oslo. Information derived from: http://www.kplc.co.ke/content/item/14 and Emails	Henry Gichungi, Head of Off-Grid Department KPLC
Local Capacity Builder	LOCAB	LOCAB is a non-profit organisation working on community development in Cambodia. Among others, LOCAB set up solar battery charging stations funded by UNDP. Information derived from: http://www.locab.org/	Pharith Kong, Chairman LOCAB
Lojas de Energias	Lojas de Energias[26]	Lojas de Energias is a SHS and charging station project in Mozambique. It was set up as a private-public partnership in cooperation of DEG, Phaesun and other actors. Information derived from: https://www.youtube.com/watch?v=ZFrpgQVkl4k	Gilda Monjane, Project Manager Lojas de Energias
NDASSIE Solar Energy Company	Ndassie	Ndassie is a Dutch company, designing and manufacturing solar charging stations for rural communities in Cameroon. Information derived from: http://www.ndassie.com/en/about-us/	Jean Seraphin Kepguep, Founder Ndassie
NICE Gambia independent	NICE	NICE was originally founded as NICE International in the Netherlands; by now, the company is sold to local management in The Gambia. This company is not a classical energy kiosk, but rather a solar-based internet hub, providing IT and document services. NICE is still included as it was initially planned as a charging station and still bases its offer on electricity provision. Information derived from: http://nice-international.com/	Ties Kroetzen, Founder NICE International Omar Njie, Manager NICE Gambia independent
Omnigrid Micropower Company	OMC	OMC is an Indian company providing micro power solutions for rural electrification. OMC sets up micro grids, combining them with battery and lantern charging stations. Information derived from: http://www.omcpower.com/communities	Dinesh Gupta, Chief Technology Officer OMC
SELCO Foundation	SELCO	The SELCO is an Indian non-profit organisation created by SELCO India in 2010. Its mission is to provide energy services to the poor. One of SELCO's projects are the integrated Energy Centres (IEC) in rural and urban areas, serving as community hubs with multiple services.http://www.selcofoundation.org/project/integrated-energy-centres/	Huda Jaffer, Lead Designer SELCO Foundation

[26] Abbreviation in some figures: L de E

Smart Power for Environmentally-sound Economic Development	SPEED	SPEED is a program initiated by TARA, cKinetics and others. It aims at providing clean and reliable energy services to the rural communities in India. One project of SPEED is a battery charging station complemented by a micro grid. Information derived from: http://smartpowerindia.org/Saran.aspx	Chaitanya Sure, Deputy Manager TARA, SPEED program
Water-Energy Hubs	WE!Hubs[27]	The WE!Hubs project in Kenya is a joint initiative of Osram, the Global Nature Fund, the Siemens Foundation and Thames Electrical. The WE!Hubs are battery and lantern charging stations which also provide clean water and other services to the rural population. Information derived from: http://www.we-hub.org/	Udo Gattenlöhner, Project Manager Global Nature Fund Gerhard Mair, Project Manager Osram for the WE!Hubs

Energy kiosk companies – not interviewed (B2)

Official name	Short form	Description
Energy for Development Network	E4D	The Energy for Development Network belongs to the Sustainable Energy Research Group at the University of Southampton. The network has implemented three micro grids combined with charging stations in Kenya and Cameroon. Information derived from: http://www.energyfordevelopment.net/
Schneider Electric BipBop Program	Schneider BipBop[28]	Schneider Electric is a technology provider for energy distribution and management solutions. Within its BipBop Program, Schneider Electric provides affordable energy access to the base of the pyramid. Among other projects, charging stations in combination with mini grids were established in Senegal and Nigeria. Information derived from: http://www2.schneider-electric.com/sites/corporate/en/group/sustainable-development-and-foundation/access-to-energy/solutions.page
Solarkiosk GmbH	Solarkiosk	Solarkiosk is a German company setting up and operating energy kiosks in Ethiopia, Kenya, and Botswana. The first kiosk was set up in 2011. Information derived from: http://www.solarkiosk.eu/?page_id=14
Solar Transitions Project Ikisaya	Solar Transitions Ikisaya[29]	The Solar Transitions Project is a research project at the University of Oslo, funded by the Research Council of Norway. In the scope of the project, a charging station/mini grid were set up in the Kenyan village Ikisaya. Information derived from: http://www.sv.uio.no/iss/english/research/projects/solar-transitions/
The Energy and Resources Institute – Lighting a Billion Lives Initiative	TERI LaBL[30]	The Lighting a Billion Lives Initiative is an Indian campaign coordinated by TERI, aiming at providing a large number of unelectrified households with modern energy services. Among others, the initiative sets up rural lantern charging stations. Information derived from: http://labl.teriin.org/index.php?option=com_content&view=article&id=6&Itemid=137
UNIDO Community Power Centres	UNIDO CPC[31]	The CPCs are an effort of UNIDO to electrify rural communities in Kenya. The power centres consist of a micro grid and a battery charging station and serve as community development centres with various services and activities at the same time. Information derived from: http://www.unido.org/fileadmin/user_media/UNIDO_Worldwide/Offices/UNIDO_Offices/Kenya/CPC_FLyer_2.pdf

[27] Abbreviation in some figures: WE!Hubs
[28] Abbreviation in some figures: Schneider
[29] Abbreviation in some figures: Ikisaya
[30] Abbreviation in some figures: TERI
[31] Abbreviation in some figures: UNIDO

Energy kiosk companies – excluded (B3)

Official name	Description	Reason for exclusion
ADES Madagascar	ADES is a Swiss association distribution solar cookers and efficient stoves in Madagascar. In addition, one model village was electrified, including a charging station for batteries. Information derived from: http://www.adesolaire.org/ and Endeva Case Study	Charging services are only a small part of the project, no contact person available
Afrisolar	Afrisolar is a German association working on energy access topics. They developed a mobile phone charging station called Nafore. Information derived from: http://www.afrisolar.org/themes/index.html	Website is outdated, no concrete information available
Ayuni Systems	Ayuni systems is a German company offering customized renewable energy solutions. Among others, they provide solar-based mini grids including a charging station. Information derived from: http://www.ayuni-systems.com/#!village-power-systems-ayuni/c1tmt	Information put online after the research phase, did not answer interview request
Desert Research Foundation of Namibia	The Desert Research Foundation of Namibia set up several charging stations in villages in the country. These energy shops provide charging services for phone charging, battery charging and haircutting. Information derived from: Endeva Case Study	Little information available online, did not answer interview request
Grünhelme	Grünhelme is a German association working on infrastructure setup in developing countries and conflict regions. They set up solar kiosks for charging services in Rwanda. Information derived from: http://www.grünhelme.org/?page_id=157 and Endeva Case Study	Only little information available, outdated
Highschool Marcel-Sembant	The highschool set up a charging station in Madagascar, funded by EDF and Eletricité Sans Frontière. The station is serving ten households and two schools in Madagascar. Information derived from: Endeva Case Study	Student project, no replication planned, little information available
Kamworks	Kamworks is a social enterprise providing solar solutions in Cambodia. In their Kamusanal approach, Kamworks set up battery charging stations in rural areas. Information derived from: http://www.kamworks.com/home/ and Endeva Case Study	Kamworks discarded the approach, no stations set up
Pamoja Cleantech	Pamoja is a Swedish social enterprise developing electrification solutions based on biomass and solar. Part of their systems are charging stations for electricity provision to rural households. Information derived from: http://www.pamojacleantech.com/business-model/charging/	Little information available online, did not answer interview request
Rural Spark	Rural spark is a Dutch start-up, providing lighting to rural households in India through lantern charging stations. Information derived from: http://ruralspark.com/about/	Little information available online, did not answer interview request
Solar World EA Ltd.	Solar World provides renewable energy solutions to customers in East and Central Africa. One of their project plans relates to a charging station providing batteries and lanterns for rental. Information derived from: http://wbi.worldbank.org/developmentmarketplace/idea/kodesha-mwangaza-%E2%80%93-rent-light	Company focuses on SHS, implementation of energy kiosks unclear
Sunlabob	Sunlabob is a Laos-based company providing renewable energy solutions for electrification. In Uganda, Sunlabob set up a charging station for lamps. Information derived from: http://www.sunlabob.com/ and Endeva Case Study	Has not used the rental model for several years

Thrive Solar	Thrive Solar is an Indian company providing LED lighting solutions. Among others, Thrive Solar offers so-called Solar Bulk Charging Systems to charge LED lights for schools or communities. Information derived from: http://www.thriveenergy.co.in/products/solar-bulk-charging-systems	Little information available online, did not answer interview request

A2 List of Experts on Future Strategies

Name of interview partner	Company	Description	Area of expertise
Varun Grover, Sales Manager BestNet	BestNet	BestNet is a European company selling life saving and life improving products to health ministries and relief organisations worldwide. Information derived from: http://www.bestneteurope.com/	BestNet is selling products to business and public partners in areas with little infrastructure. Conclusions for: B2B/B2P
Rustam Sengupta, CEO Boond	Boond	Boond sells SHS to the rural poor in India, setting up a distribution infrastructure. Information derived from: http://www.boond.net/whyboond.html	Boond implements last mile distribution for energy products in rural markets. Conclusions for: Retail hub
Ken Fullerton, Program Manager EnerGcare	EnerGcare	EnerGcare is setting up a network of independent distributors in South Africa to promote and sell energy efficient and renewable energy products such as solar lights and cookstoves. Information derived from: http://www.energcare.co.za/	EnerGcare has experience in working with micro-entrepreneurs and setting up last-mile distribution in BoP markets. Conclusions for: Business-in-a-box, retail hub
Derk de Haan, Project Manager EnDev Burundi	EnDev Burundi	In Burundi, EnDev is successfully operating mini charging stations in cooperation with local entrepreneurs. Information derived from: Interview	In the EnDev programme, different kinds of charging services are tested in different countries. Conclusions for: Business-in-a-box
Greg Starbird, CEO Healthstore Foundation	Healthstore Foundation Child & Family Wellness Shops (CFW)	CFW sets up rural clinics in order to improve healthcare and access to medicine in BoP markets. Information derived from: http://www.cfwshops.org/	CFW has experience with setting up a franchise systems and product distribution infrastructure in rural markets. Conclusions for: Retail hub
Shailesh Naik, General Manager and Head of e-Choupal	ITC e-Choupal	ITC is a large distribution company in India. Its e-Choupal project sets up IT centers for rural farmers and establishes a supply chain for agri products. Information derived from: http://www.itcportal.com/businesses/agri-business/e-choupal.aspx	ITC e-Choupal is setting up last-mile distribution, employing a hub structure. Conclusions for: Retail hub
Cecile Pompei, Founder of the MFA	The Microfranchise Accelerator (MFA)	The MFA is a centre that offers a portfolio of micro business-in-a-box opportunities to match the needs and aspirations of necessity entrepreneurs in South Africa. The MFA develops proven, commercially viable, and aspirational business solutions replicable at scale for the self employed. Information derived from: https://www.changemakers.com/powerofsmall/entries/microfranchise-accelerator	The MFA develops business models for micro-entrepreneurs and trains and supports micro-franchisees. Conclusions for: Business-in-a-box

Thomas Duveau, Head of Business Development Mobisol	Mobisol	Mobisol in a German company that sells SHS to rural households in East Africa. Mobisol also offers technology add-ons to rural entrepreneurs who want to use their SHS as a charging station. Information derived from: http://www.plugintheworld.com/mobisol/	Mobisol has experience in selling SHS based micro-charging stations to rural entrepreneurs. Furthermore, they set up distribution and aftersales systems for their SHS business. Conclusions for: Business-in-a-box, retail hub
Sundipta Dawn, Project Manager ONergy	ONergy	ONergy is a social enterprise in India, providing decentralised energy solutions to underserved households via a full service distribution infrastructure. Information derived from: http://onergy.in/about-us.php?s_id=1	The Renewable Energy Centres of ONergy serve as retail and aftersales hubs for their solar products and works with independent entrepreneurs. Conclusions for: Retail hub, business-in-a-box
Geraldine Quelle, Project Manager Phaesun	Phaesun	Phaesun is a German company that provides technology solutions for off-grid power supply. Among others, Phaesun developed kits that create energy based business opportunities for micro entrepreneurs, called Business Opportunities with Solar Systems (BOSS). Information derived from: http://www.phaesun.com/components/product-range/overview/kits/boss-kits.html	Phaesun starts to implement the business-in-a-box approach with its BOSS systems. They furthermore have experience in distribution of products in BoP markets. Conclusions for: B2B/B2P
Iliana Lykissa, Researcher for SolarNow	SolarNow	SolarNow sells SHS in different sizes to customers in Uganda. The services are carried out via a network of franchise hubs. Information derived from: http://www.solarnow.eu/index.php?option=com_content&view=article&id=6&Itemid=7	SolarNow successfully implemented a franchising system for their SHS sale and service. Conclusions for: Retail hub
Thomas Ricke	Villageboom	Villageboom sells solar lanterns to NGOs and social investors. Information derived from: http://www.villageboom.com/purpose.html	Villageboom sells products to philanthropic customers in the private sector. Conclusions for: B2B/B2P

A3 Raw Benchmarking and Interview Data – Confidential

The raw data this research is based on is collected in two Excel files:

Energy Kiosk_Benchmarking: This file contains a database of all interviewed (B1), not interviewed (B2), and excluded (B3) companies. All quantitative information used in the graphs of this document and in the text of chapter 4 is listed here, and the respective sources of information are indicated.

Energy Kiosk_Interview Notes: This file contains the notes taken during the interviews with energy kiosk companies and experts from other sectors, sorted according to interview partner and question asked. The notes for interviews carried out in German are translated into English.

For reasons of data protection, these files are kept confidential and only distributed to selected persons in a digital appendix.

A4 Clustered Benchmarking and Interview Data – Confidential

The raw data was disassembled and reassembled in four Excel sheets, clustered according to the chapters of this document:

Chapter 4_Status Quo_resulting from Benchmarking: This file is based on the benchmarking data, clustering it according to different topics in order to create the graphs depicted in this document.

Chapter 5_Challenges and Best Practices_resulting from Interview Notes: This file is based on the notes of interviews with the energy kiosk companies, clustering them according to sub-categories of market, customer interface, local HR and financing. In each tab, the left side shows the quotes from interviews while the right side indicates the identified logic of identical or complementing statements.

Chapter 6_Future strategies_resulting from Interview Notes: This file is based on the notes of interviews with both energy kiosk companies and company representatives from other fields. The interview statements are clustered in different tabs according to the different future strategies of energy kiosk companies. The first tab contains a summary of identified future strategies of all energy kiosk companies, derived from the benchmarking data.

Chapter 7_Ecosystem Contribution_resulting from Interview Notes: This file is based on the notes of interviews with both energy kiosk companies and company representatives from other fields. It collects all statements made regarding the ecosystem, which serve as indications for the recommendations formulated in chapter 7.

For reasons of data protection, these files are kept confidential and only distributed to selected persons in a digital appendix.

A5 Interview Recordings - Confidential

The interviews carried out with representatives of energy kiosk companies and other experts were recorded. The audio files serve as proof of data correctness and integrity. All interviews except three are available. The conversation with Wolfgang Hofstätter from KAITO (04.03.2014) and the short facts interviews with Dharia Dholakia from TERI LaBL (19.06.2014) and Géraldine Quelle from Phaesun (12.03.2014) could not be recorded due to technical problems.

Next to interviews, information was collected via email, a short online survey for self-evaluation and documents and presentations the respective companies provided. As this collection of sources comprises a relatively large amount of files, it is not included in the digital appendix. All emails and files are however documented in the benchmarking database and can be provided on request.

For reasons of data protection, these files are kept confidential and only distributed to selected persons in a digital appendix.

TÉCNICO LISBOA

DECLARAÇÃO

Eu, **Judith Maresa Hartl**, aluna do Instituto Superior Técnico nº **79565**, autor da dissertação para obtenção do Grau de Mestre em **Engenharia e Gestão da Energia**, com o título **Master of Science "Evironomical Pathways of Sustainable Energy Systems"**, concedo ao Instituto Superior Técnico uma licença perpétua, mas não exclusiva, para utilizar esta dissertação para fins de ensino ou investigação e autorizo-o a inseri-la, bem como ao seu resumo alargado, em formato pdf, na sua página da internet, com endereço www.tecnico.ulisboa.pt de modo a permitir a sua divulgação junto de todos os que acedam àquela página, e, com o mesmo propósito de divulgação, a responder favoravelmente aos pedidos de instituições de ensino ou de investigação e Centros de Documentação ou Bibliotecas, remetendo-lhes aqueles mesmos ficheiros em formato pdf, mas fazendo uma expressa menção, seja na sua página na internet seja quando da remessa atrás referida, à obrigação de quem assim aceda àquela minha dissertaçã e respectivo resumo alargado em salvaguardar os meus direitos de autor sobre estes documentos, que me são conferidos pelo Código do Direito de Autor e dos Direitos Conexos.

Berlin, 18.09.2014

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