Factors influencing commercialization phase of social innovation and entrepreneurship:

The case of rural renewable energy in Indonesia

Angginta Ramdani Ibrahim

MSc Management of Technology

Delft University of Technology

TU Delft

Factors influencing commercialization phase of social innovation and entrepreneurship:
The case of rural renewable energy in Indonesia

Master thesis submitted to Delft University of Technology

in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

in **Management of Technology**

Faculty of Technology, Policy and Management

by

Angginta Ramdani Ibrahim

Student number: 4824970

To be defended in public on September 24th 2020

Graduation committee

Chairperson	: Prof. dr. C. P. (Cees) van Beers, Section Economics of Technology and Innovation
First Supervisor	: Dr. J. O. Kroesen, Department Delft Center for Entrepreneurship
Second Supervisor	: Prof. dr. C. P. (Cees) van Beers, Section Economics of Technology and Innovation

Executive Summary

Almost 25 million people in Indonesia are still living in poverty. Most of these people are living in a rural area. Energy provision is considered as one of the first steps towards poverty alleviation. However, there are many challenges faced by the Indonesian government in providing electricity to the rural area, because most of the non-electrified villages are difficult to access by off-grid connection. Hence, renewable energy technology is widely considered as the most viable option for rural electrification that could stimulate economic growth without harming the environment. As technology provider agents, social entrepreneurs and NGOs have an essential role in technology development and knowledge transfer to people in a rural area. This highlights the importance of social entrepreneurship in supporting rural development and electrification. However, the implementation of rural renewable energy has high dependencies on charitable funding and grants. This addresses the most critical challenge for social enterprises and NGOs, that is to become financially and socially sustainable, especially after the launch of the innovation. Thus, identification and analysis of critical success factors for the commercialization phase of social innovation are needed.

This study aims to identify and analyze the critical success factors influencing social innovation and entrepreneurship, particularly in the rural renewable energy field. Then, possible recommendations can be proposed to overcome the barriers. A combination of research methodologies is used in this study, combining both primary and secondary data through literature review, interview, and case study with cross-case analysis. The case study will be conducted by analyzing three social entrepreneurs focusing on rural renewable energy in Indonesia, such as Lentera Bumi Nusantara (LBN) for the wind turbine, Renewable Energy Service Company (RESCO) Sumba for solar PV, and Institut Bisnis dan Ekonomi Kerakyatan (IBEKA) for micro-hydro. The main deliverables from this study are the framework of influencing factors for social innovation in the commercialization phase and recommendations to overcome the barriers. The proposed framework and suggestions can be used as a basis for future research in other cases of social innovation, not only limited to rural development and renewable energy field.

The study provides a final framework of 20 factors, which is based on these three levels: individual organization, civil society, and state. For the “individual organization” level, the factors are long-term goals and commitment, planning and targets, credibility and capability of the company, organizational culture and environment, qualified personnel, benefits for personnel, the role of company leaders, products and services, cost recovery model, natural resources, and standard procedures and practices. For the “civil society” level, the factors are target market readiness, benefits for users or community, community involvement and participation, network and partnership, financial support, and competition. For the “state” dimension, the factors are regulations and policies, administrative and bureaucratic procedures, and infrastructure.

Based on the findings of the case study, to sustain, the companies need to have a cost-recovery model. The cost recovery model of replacing fuels with RE sources should be possible; however, it is cancelled out by the obstacles present in the business activities, leading to extra costs that should be paid by the companies. The barriers and the additional costs make the cost recovery model still problematic. The main obstacles that affect the cost recovery model are the lack of long-term goals and commitment for the projects, lack of ability and willingness to pay of the local community, limited capacity and awareness of the local community, dependency on external financial support, ineffective regulations and imbalanced support from the government, unfair competition for private actors, and complicated bureaucratic procedures.

Therefore, to manage the commercialization phase successfully, a viable cost recovery model is needed so that the business can be self-sustaining. There are some points to consider to manage the commercialization phase: to promote local income-generating activities in the cost recovery model by exploring product diversification through other commercial lines of business, to encourage community involvement from the very beginning of the project by engaging the locals and building trust, to develop capacity building and learning activities by providing continuous training and peer-to-peer learning, to promote collaboration with other parties by establishing Public-Private Partnership (PPP) or Community-NGO-Public-Private Partnerships (CNPPP), and to apply subsidy for renewable energy sources by shifting part of government's fuel subsidies. The self-sustaining cost recovery model cannot be used immediately as it will require intervention from many parties. With the involvement and support from many parties, the business can be flourished.

Acknowledgements

When I booked a plane ticket to come to the Netherlands two years ago, I never imagine that my journey would be this magical. A lot of things happened in the past two years, coloured by both pleasant and unpleasant circumstances. I've met a lot of new faces from whom I learned a lot. I've visited a lot of new places from which I dreamed a lot. The opportunity to study abroad is the most life-changing moment for me. To be where I am standing right now, I know I am very blessed, and I am so grateful for that. Time flies really fast now that I am at the end of my thesis journey. The last six months (or more) have been full of surprise. Working on my thesis during corona time was not an easy task to do because there was a lot of restrictions and uncertainties, which required me to keep managing (if not lowering) my expectation. Nevertheless, it was still indeed an incredible journey.

This journey would not even be possible without these wonderful people. I would like to express my gratitude to my graduation committee, Dr. Otto Kroesen, as my first supervisor, who has always provided me with kind support. He is always willing to spare his time to listen to my questions and concerns and to give me valuable inputs when I am confused. Without a caring and supportive supervisor like him, it would not be easy for me to work on this thesis journey. I would also like to thank Prof. dr. C. P. (Cees) van Beers as my chair and second supervisor. His constructive and sharp feedbacks have helped me a lot in improving my results. I could not thank them enough for their time and insights that help me go through this thesis journey. I am glad to have them as my graduation committee.

I would also like to express my gratitude to my loving family in Indonesia for their endless support for me to pursue my aspirations. To my supportive parents, Ayah & Mama, thank you for always believing in me and never giving me pressure for everything that I do in my life. To my inspiring siblings, Bang Janu & Kak Santi, thank you for being a role model to pursue my dreams in education. To Kak Lia, Nala, and Saddam, thank you for being my source of happiness during the tiring times. Also, to my 24/7 go-to person, Rizky Ardhy Maulana, thank you for being a wonderful partner. Thank you for accompanying me to go to Ciheras Village to collect some data! Without your support, I would not come this far. And for my friends at TU Delft, thank you for making this journey memorable and more fun! A special thanks to Yasmin for helping me survive this master's journey in MoT. Also, thanks to Ryan for always being kind to listen to my stories. And, to my partner-in-crime, Kanya, thank you for sharing everything with me: stories, food, and even bed! Thank you for offering me a roof when I need that the most. I appreciate you guys a lot! Also, thank you to my friends in MoT, TPM, PPI Delft, Hehe, Valkensis, and many others for all the warm and happy moments. All the time we've spent together is a treasure.

Last but not least, thank you for Studeren in Nederland (StuNed) scholarship for making one of my biggest dreams come true. Without their support, I would not be able to get all of these experiences.

I hope all these learning experiences in TU Delft can be a provision for me to contribute more to my surroundings, as well as create betterment to myself, my family, and society. Signing off!

To live, to learn, and to give.

Angginta Ramdani Ibrahim

Delft, September 2020

Dedicated to my loving father,

as my greatest source of motivation to pursue higher education.

Table of Contents

List of Figures

List of Tables

1 Introduction

This chapter will cover the background information about rural electrification In Indonesia and the importance of social innovation and entrepreneurship. Then, this will lead to problem statement and knowledge gap exploration.

1.1 Background

Almost 25 million people in Indonesia are still living below the poverty line (Aviseina, 2020). These people are very vulnerable, as they have limited access to their basic needs. Most of these people are living in a rural area, proved by the high disparity of poverty rate between urban and rural area (in average 6.56% and 12.60% each) in September 2019 (Aviseina, 2020). Even in rural Maluku and Papua, the poverty rate is almost 30% (Aviseina, 2020). This shows that there are more poor people living in the village than those living in the city, proving the high gap of welfare between these two groups. Based on the analysis of The National Team for The Acceleration of Poverty Reduction of Indonesia (TNP2K), there is a strong correlation between electrification access and poverty rate. Electricity is part of the basic infrastructure needed, in addition to clean water and sanitation (TNP2K, 2016). Electricity can drive access to basic needs, such as education, health, and economic activities (TNP2K, 2016). Hence, rural electrification is an essential tool to eradicate poverty and accelerate the local economy, which can improve the welfare of people in a rural area.

According to Torra, in 2019, it was estimated that there are 10 million Indonesian rural households that have no access to reliable electricity, either with no electricity at all or with very unreliable supply. However, the commitment of Indonesian government to electrify every household in Indonesia can be seen as the electrification rate increased significantly from 80.51% in 2013 (Tim Komunikasi Kementerian ESDM, 2018) to 97.13% in the first semester of 2018 (Safii, 2018). The responsibilities to provide electricity to the whole country are borne almost solely by a state-owned company focusing on national electrification that is Perusahaan Listrik Negara (PLN) (Blum et al., 2013). There are many challenges faced by PLN in providing electricity to a rural area because most of the non-electrified villages are difficult to access, which make grid extension very expensive (Blum et al., 2013). Hence, the renewable stand-alone power system is widely considered as the most viable option for rural electrification, which can stimulate productivity and economic growth of the local communities without harming the environment. Moreover, the government also has set a target of 23% renewable sources' contribution to the national energy mix in 2025 (Septania, 2019).

To bring innovation to this most vulnerable target group could be a big challenge. Torra (2019) argued that the most successful model of partnerships for rural electrification are those which combine the capacities of non-profit, public, and private sectors, as well as the local communities. Hence, to realize one of the Indonesian governmental goals, that is "electricity for all", PLN cannot work alone and need support from other parties. As technology provider agents, Non-Governmental Organization (NGO) and

social enterprise have an essential role regarding project development and knowledge transfer (Purwanto et al., 2016). This highlights the importance of social innovation and entrepreneurship in supporting rural development and electrification. The term of 'social innovation' refers to a range of activities, both organizational and inter-organizational, designed to pursue social objectives and solve deep-rooted problems in society (Tracey et al., 2016), including rural electricity supply. With their social values, social entrepreneurs will create and maintain innovation while considering the society, along with its cultural and socio-economic conditions.

1.2 Problem Statement

The implementation of social innovation for rural electrification can support the locals with increased productivity and new business opportunities which can promote rural economic development. According to TNP2K (2016), this effort can eradicate poverty in the country. However, despite its importance, implementation of renewable energy for rural development have high dependencies on charitable funding and grants (Blum et al., 2013). This addresses the most common challenge of social innovation and entrepreneurship, that is to become financially and socially sustainable.

IBEKA's director, Tri Mumpuni, said that the rural electrification program, in general, is only project-based, so once the project is finished, there will be no assistance anymore (TNP2K, 2016). She also claimed that rural electrification program could not run well without empowering the local community after the RE implementation (TNP2K, 2016). Mondal et al. (2010) also claimed that most of the rural renewable energy programs are more focus on research and development, rather than considering the commercialization phase. These show that this back-end phase of the innovation is crucial but often neglected. Therefore, to be sustainable, the social entrepreneurs and other stakeholders involved have to think about how to manage the technological product after its launch to society. Thus, identification and analysis on critical success factors for the commercialization phase (back-end phase) in the social innovation process are needed to sustain renewable energy (RE) program and support the development of rural communities. This research will look for the answers to the questions: what are the influencing factors in the commercialization phase of rural renewable energy technology in Indonesia? What are the solutions to overcome the barriers or challenges incurred?

1.3 Knowledge Gap Exploration

Many researchers have done research analyzing innovation factors. However, they are mostly focused on exploring influencing factors for general innovation. Even though the field of social innovation is growing and the literature about it is becoming more accessible, comprehensive knowledge of its innovation factors, which includes internal and external factors, is still lacking. Meanwhile, innovation is a lengthy process, and the development of ideas into successful products or services may face many challenges. Little has been discussed about the later stage of the innovation process, that is after the launch of the technology or commercialization phase. According to Luoma et al. (2008), commercialization refers to the process of launching a new product or service to the market. This phase

is crucial in the innovation process because it will determine whether the product or service will be launched successfully or failed (Luoma et al., 2008).

Furthermore, there is an even less focus on the rural renewable energy domain. Hence, there is still a lack of knowledge in terms of factors influencing social innovation during the commercialization phase, particularly in the field of rural renewable energy. This research is conducted to fill that knowledge gap with the context of rural electrification in a developing country, particularly in Indonesia, so that it can give contribution and enrichment about the critical success factors influencing commercialization phase in the process of social innovation.

This study is an exploratory research which combines literature review and qualitative research through in-depth interview with rural renewable energy actors to gain an understanding of the real-life setting. This research aims to identify factors influencing social innovation in the commercialization phase. Furthermore, suggested recommendations to overcome the barriers or challenges will also be proposed.

2 Research Approach

This chapter will explain the approach that is taken to conduct the research, including the research objectives, the main research question and sub-questions, the research scope, the research methodology, and the expected deliverables and contributions this research will have, both scientifically and practically.

2.1 Research Objectives and Scope

The objective of this research is to contribute to the body of knowledge about social innovation by identifying and analyzing the innovation factors for social innovation, particularly in the rural renewable energy field. Then, possible solutions can be explored to overcome the barriers. By doing this study, I hope to increase understanding of the social innovation factors, especially in the rural renewable energy context, which is still under-explored at this moment. This research is an exploratory qualitative study in which literature study and case study will be undertaken. Verification with experts will also be done to gather more perspectives. The results will be analyzed, and recommendations for improvement will be proposed afterwards.

To narrow down the focus, the research scope will be limited to only study social innovation actors in Indonesia that focus on renewable energy domain, particularly to be implemented in a rural area. These social entrepreneurs are usually working in small-scale. The geographical focus in the rural area is to sharpen the discussion on how to bring technological innovation to one of the most vulnerable groups, which will be very relevant to the value of social innovation itself, that is to overcome problems in society by focusing on giving social impact. The focus of this research is only on the commercialization phase of the technology because this implementation part (after the launch to society) is crucial for the sustainability of the innovation but often neglected. Hence, the unit of analysis for this research is the small rural renewable energy players.

2.2 Research Questions

The main research question for this thesis is the following:

"How can social entrepreneurs successfully manage the commercialization phase of renewable energy technology in a rural area?"

Sub-research questions (SQ) have been formulated to answer the over-arching question:

- SQ1*: How can critical success factors for the commercialization phase of rural renewable energy which are identified from the basis of the literature, be integrated into a comprehensive research model for the study?*
- SQ2: *How do the critical success factors for the commercialization phase of rural renewable energy which are explored from the basis of the case study, work in the empirical situation?*
- SQ3: *How can the barriers in rural renewable energy be overcome to improve the commercialization phase of the innovation?*

The three sub-questions can contribute to answering my main research question. SQ1 contributes by identifying first the critical success factors form the basis of literature to develop a comprehensive research model. Then, with the basis of this model, SQ2 contributes in validating the critical success factors in real-life setting through a case study to know how these factors act in practice, also to know what are the barriers in implementing the technology. After that, SQ3 contributes to give solutions for the social entrepreneurs to overcome the barriers identified in SQ2, for them to be able to manage the commercialization phase of their rural renewable energy technology successfully.

2.3 Research Methodology

In answering the research question *"How can social entrepreneurs successfully manage the commercialization phase of renewable energy technology in a rural area?",* it is crucial to answering the three sub-research questions first which have been mentioned earlier. To answer these sub-research questions, a combination of research methodologies is used: literature review, interview, and case study with individual and cross-case analysis. The methods used to answer each sub-research question are presented below:

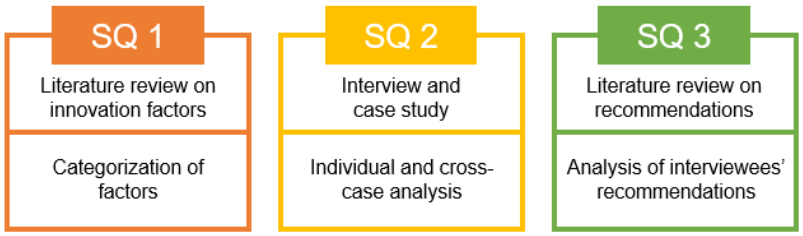

Figure 1 The overview of the methodology used to answer each sub-question (SQ)

A literature review is used for SQ1 because it will act as a basis in developing initial research model before going further to the case study, so this approach is the most suitable one because it is easy to access. Interview and case study are used for SQ2 because this sub-question aims to test the initial framework of factors in SQ1 to a real-life setting, so case study through in-depth interview and secondary data exploration will fit the purpose. SQ3 will use a combination of literature review and interview because this sub-question aims to consolidate suggestions for solutions from as many sources as possible to be able to overcome the barriers or challenges faced by social entrepreneurs in the rural renewable energy context.

2.3.1 Research Outline

This thesis would start with the introduction in which the topic and the problem was discussed briefly. In the second part, I would discuss the research approach, including research objectives, research questions, scope, methodology, as well as deliverables and contributions. In the third part, the literature review about the main theoretical elements that will be investigated in the research will be discussed. Then, in the fourth section, the research model or framework will be presented, followed by the details

of the case study in the fifth section. Then, the discussions and conclusions will be presented in the last two chapters. The outline of the thesis is presented below:

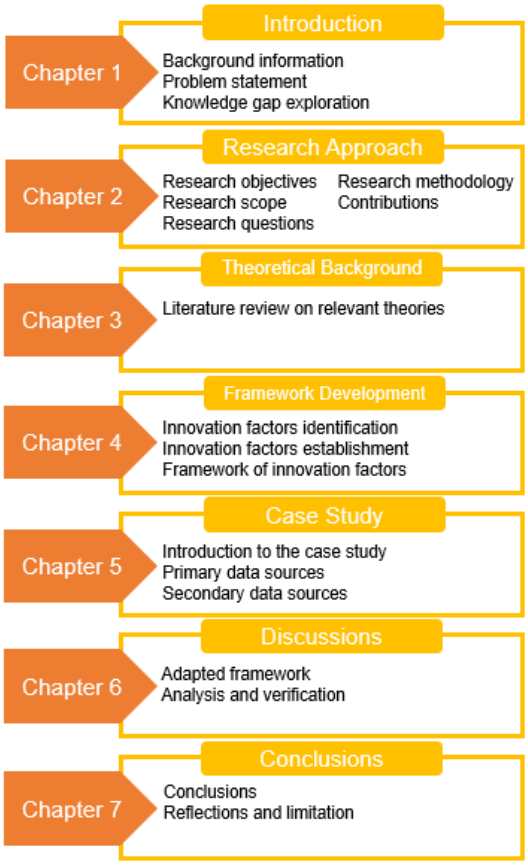

Figure 2 Thesis outline

2.3.2 Data Collection

The data will be collected through both primary and secondary data. The primary data will be done by conducting a field survey and in-depth (semi-structured) interview with the actors under the case study. The secondary data will be gained through reviewing the literature, online articles, and reports related to the organizations. The sequences of data collection are as follows:

- Collecting publicly available data (through literature, articles, reports, and so on) to build theoretical background and support other relevant theories.
- Conducting a literature review to identify and categorize the innovation factors from relevant studies and cases. Then, develop a preliminary framework of the factors specified to social innovation in a rural development context.
- Conducting a case study in LBN, RESCO, and IBEKA to gain an understanding of existing real-life context regarding influencing factors on social innovation. The data can be gained through field survey (if possible) and in-depth interview with relevant actors and stakeholders. It can also be combined with secondary data available online regarding the three organizations under study.

- Conducting an interview with experts (practitioners and academic experts) for verification of the framework and the results of the case study, also to discuss possible areas for improvement.
- Conducting secondary data review (through literature, articles, and so on) and analyze recommendations from the interviewees to propose solutions to overcome barriers.

Since this study aims to dig deeper on social innovation phenomena, also there is not much known about this (hence, not enough data to quantify), an exploratory qualitative method is best suited. The data will be collected by using the most common qualitative research tool, that is a case study. Yin (2013) defined a case study as *"an empirical enquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not evident"*. A multiple-case study is conducted to explore differences and similarities between cases to deliver more robust and reliable results. Because comparisons between cases will be drawn, it is essential to choose the cases carefully so that the researcher can predict similar results (a literal replication) or predict contrasting results with predictable reasons (a theoretical exploration) (Yin, 2003). There are three cases explored in this study in which the findings across cases will be replicated. The case study will be conducted in three social innovation companies in the Indonesian rural renewable energy domain: LBN, IBEKA, and RESCO. This qualitative case study can facilitate contextual exploration using a variety of sources: field survey, interview, and secondary data sources to fill any gap.

According to Ryan, Coughlan, and Cronin (2009), an interview is used in research to collect various information from the participants about a specific phenomenon, be it opinion, experiences, and beliefs. In this research, a semi-structured interview will be used because it allows for flexibility while still maintaining a structured approach to ensure the predetermined questions are still be considered (Ryan et al., 2009). In combination with in-depth interviews, a deep dive into the contextual social innovation phenomena will be done through a field study in one of the three companies, as well as through exploration of secondary data sources available online.

2.4 Expected Deliverables and Contributions

This thesis will contribute to scientific and practical relevance. In terms of scientific contribution, this thesis aims to enrich knowledge on innovation factors and fill the gap about social innovation factors in commercialization phase for rural renewable energy, because currently no theory fits with this particular context. Moreover, it will also be tested in an empirical study, so how these factors play in a real-life situation can be known. Due to its generalizability, the framework developed in this research can be used as a basis for future research on social innovation for other cases, not only limited to rural development and renewable energy field. From the perspective of a master's program in Management of Technology, the result of this study is also relevant because in general, this study discusses innovation management focusing on innovation factors and process. This study sees innovation and technology as a company's resource that needs to be well managed to sustain, considering both internal and external environment. Similar studies on innovation factors for social innovation in rural renewable

energy are very limited at the moment, so this study will expand the body of knowledge and provide the basis for future research in this field.

For the practical contribution, the result of this study will also be relevant for social entrepreneurs or companies, especially within the rural renewable energy field. It can be relevant to companies in other sectors as well to be able to manage their social innovations. The framework can be used in practice to understand and evaluate the implementation of technology in the field. The outcomes of this study can be useful for social innovators seeking to understand the factors influencing success and failure in launching their ideas to the market. The main deliverables from this study are:

1. The preliminary framework of social innovation factors in the commercialization phase
2. The final adapted framework of social innovation factors in the commercialization phase
3. Proposed recommendations of solutions to overcome the barriers

The main deliverables can act as guidance for the companies to assess themselves based on the innovation factors, how these factors are perceived, and what can be improved to be financially and socially sustainable.

3 Theoretical Background

This chapter will discuss the existing theoretical knowledge relevant to this research domain. There are six steps in searching and selecting the articles to develop the theoretical background. First, the central theme was defined as well as the sub-themes. The central theme was "social innovation". From this theme, the sub-themes were defined to categorize the articles, which goes a long way to help me in narrowing down the search process. The defined sub-themes were:

- Rural renewable energy in Indonesia in which three main types of technology relevant to this research will be discussed
- Social innovation and entrepreneurship in Indonesia which will give more in-depth insights about the concept and the context
- Innovation process models which will illustrate the innovation journey and the specific phase this study is focusing on

The second step was doing desktop research by using Google Scholars, ResearchGate, and Science Direct as my primary sources. In doing the research, several keywords were used for each sub-theme. For the 'rural electrification' sub-theme, I used several keywords as well as the synonyms of them, such as 'rural electrification', 'global rural electrification', 'rural electrification in Indonesia', and 'village electrification'. For the 'social entrepreneurship and innovation' sub-theme, the keywords and synonyms used were 'social innovation in Indonesia', 'social entrepreneurship in Indonesia', 'social enterprise Indonesia', and 'social entrepreneurship electrification Indonesia'. For the 'innovation process' sub-theme, I searched the articles with keywords of 'innovation process', 'innovation process model', and 'social innovation process model'. The third step was utilizing the recommendation list of articles provided on the ScienceDirect website. This was done to get the articles which also have necessary contents but did not show up in the search menu done in the previous step.

Screening the title was done in the fourth step. In this step, I looked at the title of the articles to check whether they were relevant for my choice of topic or not. The fifth step was doing a brief review of the content by skimming the abstract and the keywords in the articles to check the relevance of those articles. In this step, I chose to focus only on the articles that discuss Indonesia or developing countries context. This was changed from my previous plan to start from a global context then narrow it down to the Indonesian context, so this 'start global' decision is the road not taken for me. Next, in the sixth step, a more in-depth review was done to dig deeper into the contents of each article. This was done by reading through the most critical parts of the articles, aside from the abstract and keywords which were already done in the earlier step. I read the introduction part to get more basic knowledge on the topic and issues being discussed, skimmed through the headings and table of contents to know more about the structure of the articles briefly, and read the conclusion part. From this step, the most relevant articles were selected to be the basis of a literature review to delve deeper. Other than that, I also read Master thesis reports of other TU Delft students by accessing the TU Delft Repository website. From those reports, I looked at the list of references and read the articles that are relevant to my study. I also read the articles which used to be the study materials of the lectures I previously took.

3.1 Rural Renewable Energy in Indonesia

The implementation of renewable energy technology in the Indonesian rural context has a good prospect for rural development, but it faces several challenges as well. One of them is the lack of private investment which caused the low diffusion of renewable energy in a rural area (Blum et al., 2013). This private investment issue was caused by the diesel-based electricity subsidy from the government, cap in national electricity tariff, high transaction cost and uncertainties in regulation, technology and counterparts (Blum et al., 2013). The study conducted by Purwanto et al. (2016) showed that renewable energy technology developed for people in the rural area had a poor performance in terms of economic dimension, which could be caused the electricity tariff. Murni et al. (2012) argued that the success of rural renewable energy implementation depends not only on technical aspects but also on social and economic aspects. Therefore, to develop and implement renewable energy, one should consider society, along with their cultural, social, institutional, governance and economic conditions, as an essential aspect of the innovation system.

3.1.1 Wind Energy in Indonesia

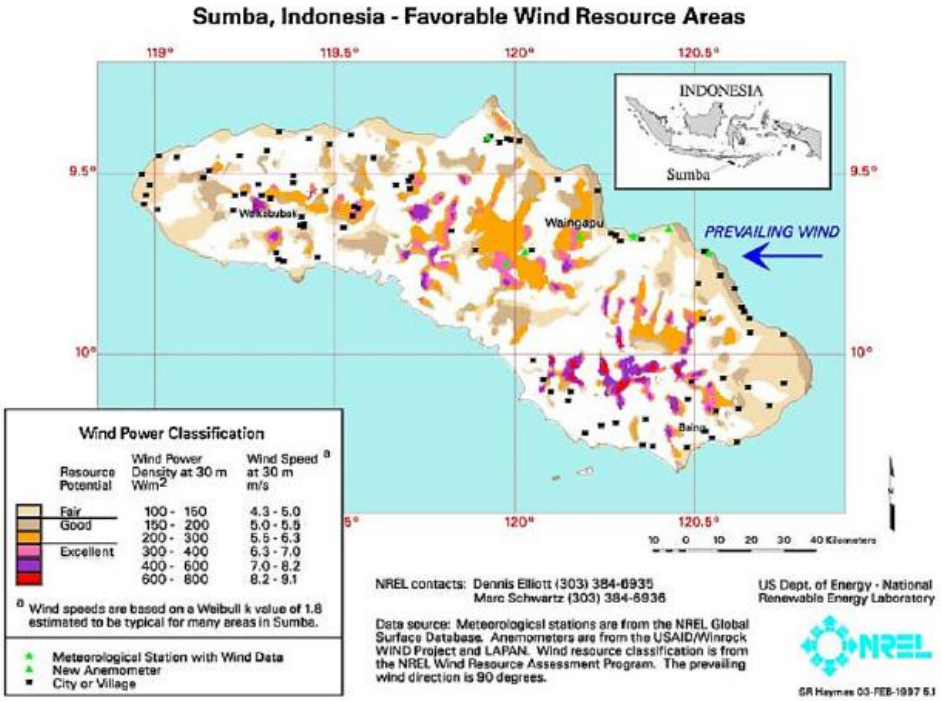

Figure 3 Energy Mapping in Sumba Island, East Nusa Tenggara

(Source: Global Energy World Institute, 2009)

Wind energy is generated through the conversion of wind speed from the wind turbines as mechanical power into energy or electricity (Holttinentt, 2006). Wind energy is considered as a form of green technology because it contributes minor impacts to the environment since it does not produce any pollutants or greenhouse gases (Myok et al., 2005). In Indonesia, wind power as an energy source has great potential to be developed and utilized, especially in coastal areas (Hasan et al., 2012). The speed

of the wind in Indonesia is between 2 and 6 m/s which makes the small (10 kW) and medium (10-100 kW) scale power generators the most suitable type to be implemented in Indonesia (Indonesia Energy Outlook & Statistic, 2006). Based on the study conducted by Institute of Aeronautics and Space Agency (Lapan), there are several areas in Indonesia which have wind speeds above 5 m/s: West Nusa Tenggara, East Nusa Tenggara, South Coast of Java and South Sulawesi (Kompas, 2007). These areas are potential for wind energy implementation.

3.1.2 Solar PV in Indonesia

Another renewable energy resource that is sustainable and viable to be implemented in Indonesia is solar energy because the sun shines throughout the year. For rural electrification, off-grid solar photovoltaic (PV) Systems is a competitive option due to the remoteness of the village (Blum et al., 2013). It is also considered as the best option for off-grid electrification in the areas where there is no grid (Ritter, 2011). Besides the vast potential of solar energy in Indonesia, the amount of installed capacity of PV systems is still less than its technical potentials (Sasetyaningtyas, 2017). This phenomenon happens because the adoption of solar PV in remote areas faces several challenges, such as regarding financing, operations, maintenance, distribution, and services (Sasetyaningtyas, 2017). Solar Home Systems (SHS) has been implemented in many rural areas in Indonesia which are carried by the government of Indonesia or NGOs as donor-driven social projects (Sasetyaningtyas, 2017). This leads to several implications, such as the lack of ownership of the system and dependency on financial support from donors (Hivos, 2014) which make the sustainability of the projects highly questionable.

3.1.3 Micro Hydro Power in Indonesia

The cost of power production generated by diesel generators in a rural area, for instance, in Sumba, is about 0.20-0.25 euro/kWh (Hivos, 2012). However, due to electricity tariff's policy, the selling price is subsidized by the government, resulting in the price of 0.06 euro/kWh (Hivos, 2012). At this price, micro-hydropower (MHP) could be very competitive since the price of electricity generated from this source is around 0.06 euro/kWh (Hivos, 2012). If the government gives a small part of the subsidy to MHP, the price would be much lower. The study conducted by Blum et al. (2013) also found MHP as the cheapest and best solution for rural electrification, followed by solar PV which was suggested to be implemented in places that are not supported by natural resources to run micro-hydro. It was also argued that if the government shifts the existing fuel subsidies to MHP solutions, the end-user price could still be kept very low. The government will also reap savings from the shift, since diesel's levelized electricity cost (LCOE) is far higher than the retail price, relative to MHP, thereby decreasing the overall amount of subsidies if MHP is installed instead of diesel. Purwanto et al. (2016) did a comparative study to assess the impact of techno socio-economic factors on the sustainability of two projects of MHP. The authors used sustainable development indicators for rural electrification as a basis, considering five dimensions of sustainability: technical, economic, social, environmental, and institutional. The results of the study showed that both projects had a poor performance in the economic dimension, but they had positive

performance in other dimensions. This was because the projects have no financial scheme, hence no consideration of electricity tariff, which makes economic sustainability questionable.

3.2 Social Innovation and Entrepreneurship in Indonesia

Social innovation and social entrepreneurship are two concepts that cannot be separated as they have a close relationship with each other. According to BEPA (2013), social innovations need to be marketed just like other innovations in general; hence social innovations should provide permanent benefits to the users while meeting social needs and improving social welfare. Consequently, Konda et al. (2015) argued that social entrepreneurship is social innovation because social entrepreneurs show how the combination of business with social and environmental aspects can be successful.

3.2.1 Social Innovation

The term 'social innovation' refers to a range of activities, both organizational and inter-organizational, designed to pursue social objectives and solve deep-rooted problems in society (Tracey et al., 2016). According to European Commission (2013), social innovation can be defined as the development and implementation of new ideas to meet social needs and demands as well as to create new collaborations and social interactions. The aim is to improve human well-being, so it is social in both its ends and its means. In social innovation, support mechanism is vital because a group of people from different backgrounds and expertise will work together toward a particular idea (Konda et al., 2015). Innovation is social when it can be diffused widely and accepted socially within a society or certain societal groups (Konda et al., 2015). Social innovations are not exclusive only for non-profit actors. Occasionally, an innovation that focuses more on economic benefits can also give contribution on human welfare development by expanding and diversifying its offering and provide long-lasting benefits to the users (Konda et al., 2015). Osburg and Schmidpeter (2013) explained about stages of socio-economic management thinking, which can be seen in the figure below:

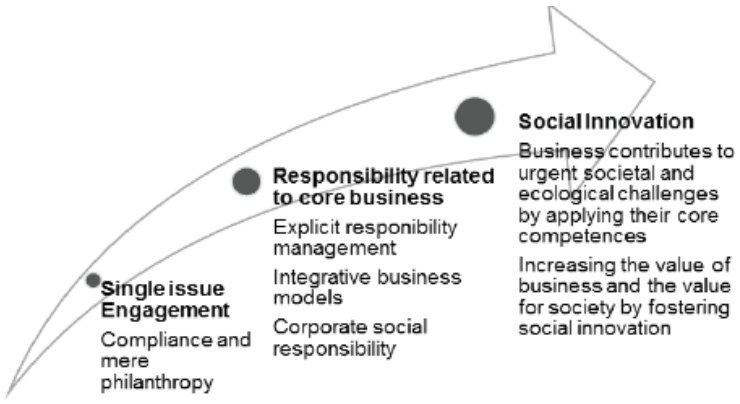

Figure 4 Stages of socio-economic management thinking

(Source: Osburg and Schmidpeter, 2013)

3.2.2 Social Entrepreneurship

Mair et al. (2012) referred to social entrepreneurship as *"opportunities and activities that leverage economic activity to pursue a social objective and implement social change".* Social entrepreneurship can contribute to social change which could improve quality of life, leading to economic growth because it could open access to financial sources, empower people, and create jobs (Sijabat, 2015). Thus, social entrepreneurship will have an impact on community building and development. Social entrepreneurs aim at a good cause and act as a vector of change, so their focus is not only about profit generation although they provide products and services to their customers (Konda et al., 2015). Sengupta et al. (2017) discussed the concept and framework of social entrepreneurship in the context of emerging economies. The frameworks are based on five critical social entrepreneurship dimensions, namely social welfare, social capital, social entrepreneur, economic value creation, and collective endurance. The authors argued that social enterprises are affected by diverse contextual complexities to pursue their social and economic goals. Therefore, social entrepreneurship is a contextual concept which is different for every case; thus, the specific characteristics of the society should be considered.

3.2.3 Social Innovation and Entrepreneurship in Indonesia

Historically speaking, although it is currently a democratic country, Indonesia had developed a culture that does not support business competition. It was because the economy control by Dutch colonial occupation and the dictatorship in the era of President Soekarno and President Soeharto, which led to limited freedom for a social organization to operate and little space for indigenous people to build a business (Sengupta et al., 2017). Eventually, in Indonesia, there is no specific legal entity called Social Enterprise, as there are only four types of registered business organizations: Limited Corporation, Cooperative, Foundation, and Association (Sengupta et al., 2017). However, social entrepreneurship and innovation are growing in Indonesia, which can be seen in the initiatives to support community-based social enterprises, for example by British Council Indonesia (BCI) and Indonesian Social Enterprise Organization (AKSI) (Sengupta et al., 2017). Branding is essential to draw support from people in Indonesia as it can increase credibility and trust for the social enterprises (Sengupta et al., 2017). Social entrepreneurs in Indonesia face challenges, such as getting the right recruits with shared values, creating a social network, long-term commitment to social change, lack of demands, lack of opportunities in capacity-building, limited support from the government, no legal identity, and lack of financial support (Sengupta et al., 2017).

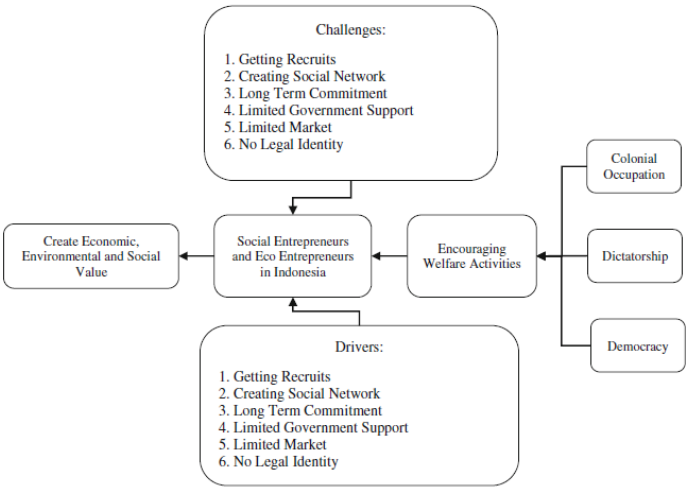

Figure 5 Social entrepreneurship in Indonesia

(Source: Sengupta et al., 2017)

3.3 Innovation Process

The innovation process is a journey of new ideas to become a tangible offering that is ready to be launched in the market for further exploitation through various activities (Schumpeter, 1981). Although there are various interchangeable terms to define these activities, they can be broadly classified into three phases: the front-end phase, development phase, and commercialization (or back-end) phase. The front-end phase covers idea generation, concept approval and verification for further development (Herstatt et al., 2001). This phase typically has a high degree of freedom and uncertainty. The second phase is the development of an idea into a product or service, which could result in a minimum viable product (MVP) for pilot testing. Then, the commercialization or back-end phase begins in which the idea will be launched to the market to gain economic benefits (Luoma et al., 2008). The figure below illustrates the innovation process in combination with an open innovation model:

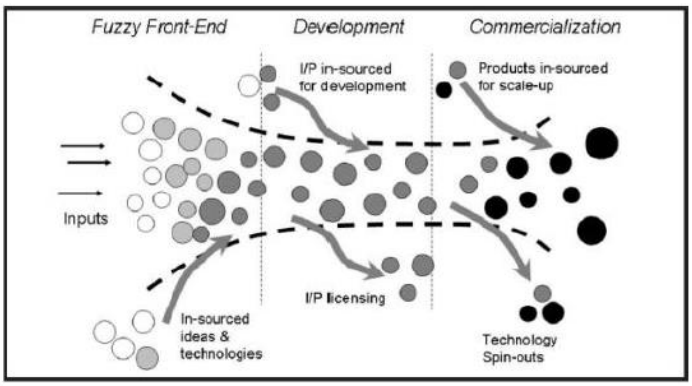

Figure 6 The open innovation process model and phases

(Source: du Preez et al., 2009)

Robert G. Cooper in 1986 introduced the concept called stage-gate, which explains the process from idea to launch. The stage-gate process consists of a series of stages which represent phases in which the team would perform any activity influencing the innovation process, such as obtaining information, collecting data, and analyzing data. It also consists of the gates which will follow after each stage. In the gates, the Go/Kill decision will be taken to the project to enter the next stages. The stage-gate process consists of five stages of different activities, such as scoping, building a business case, development, testing and validation, and launch. The output of these activities will be assessed and reviewed in the five gates. Factors which present in one stage can be different from factors which present in another stage. For instance, during the discovery phase, the driving factors might be more about the creativity of the team. At the same time, competencies in building a business case will be more useful to be implemented in the later phases. Bröring (2005) suggested that Cooper's stage-gate process can also be divided into three main phases: the front-end, development, and commercialization phase. It shows that every innovation generally will follow the three same phases, even though the details of each model can be different. To sharpen the research, the factors explored in this study will focus on the commercialization phase after the launch of an innovation.

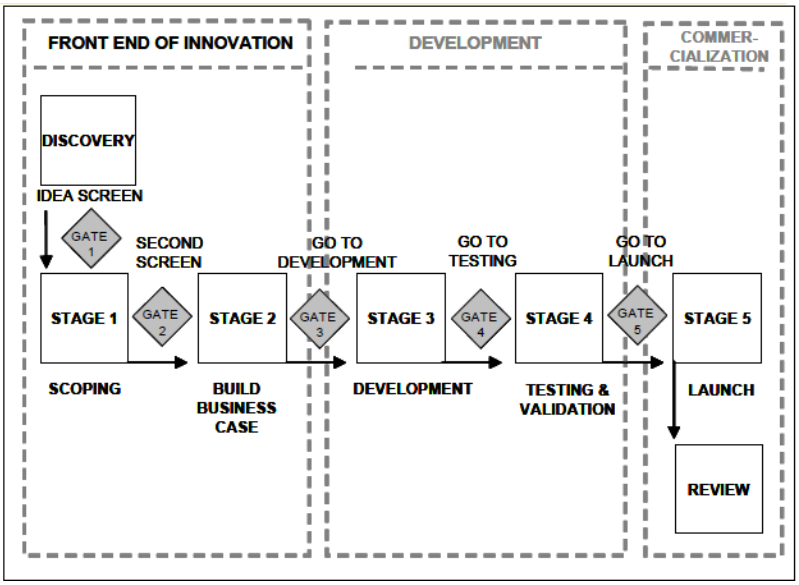

Figure 7 Stage-gate innovation process

(Source: Bröring, 2005–adapted from Cooper, 2001)

3.3.1 Social Innovation Process

Several authors have been discussed about the innovation process in the context of social innovation. Murray et al. (2011) discussed the process of social innovation. He divided the innovation process into six phases which can be seen below:

1. *Prompts, inspirations, and diagnoses*: In this phase, all the possible areas for innovation development are explored. The problems are identified to find the most appropriate ideas.

2. *Proposals and ideas:* Then, the ideas are generated by using several methods to develop creativity and innovativeness. It is essential to include a wide range of actors in this early process.
3. *Prototyping and pilots:* This phase is crucial to refining the ideas gathered through trial and error. Social innovators should act quickly to receive feedback from potential users and experts.
4. *Sustaining:* During this stage, only a few ideas that can survive. Continuous improvements are necessary to make the idea viable on the market, so the company can cover its expenses through products and services it offers.
5. *Scaling and diffusion:* In this phase, possible strategies are utilized to disseminate the innovation, such as through licensing, franchising, or other business models. This will rely on knowledge exchange with other organizations. The diffusion of social innovation can be enhanced if the involved actors also act as ambassadors to promote innovation.
6. *Systemic change:* This is the primary goal of social innovation. This change requires supportive social movements, business models, regulations, infrastructure, open mindset and actions. To be sustainable, the innovation needs to be economically viable with the support of reliable technologies, supply chains, institutions, skills/knowledge, as well as regulations.

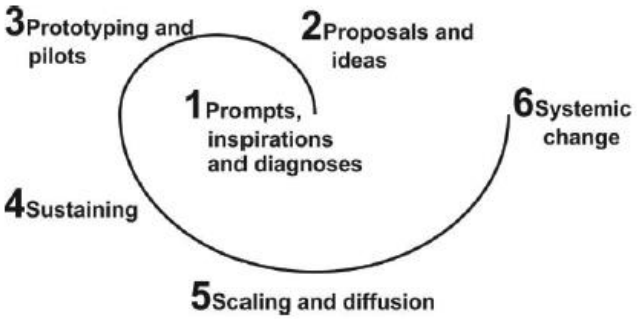

Figure 8 The process of social innovation

(Source: Murray et al., 2010)

Mulgan (2016) suggested that social innovation will go through four phases in its journey. This approach provides a good basis to think about innovation changes. However, these stages are not always consecutive. Feedback loops can also exist between every stage, so the innovation process more like spirals rather than straight lines. The four phases are:

1. *Generating Ideas by Understanding Needs and Identifying Potential Solutions*: In this phase, social innovators will explore an idea of a need that is not yet being fulfilled, to then come up with an idea of how to fulfil.
2. *Developing, Prototyping, and Piloting Ideas*: The idea needs to be tested in practice to see if the innovation can survive in reality. In between this phase and the next phase, there is the "chasm" that needs to be crossed as the innovation is passed from being promising pilot ideas to becoming marketable offerings. In this stage, uncertainty is unavoidable.

3. *Assessing, Scaling Up, and Diffusing Good Ideas*: This is the phase when an idea can be grown and adapted. To scale up an idea, the company needs an appropriate strategy, coherent vision, and the ability to use resources wisely. Often social entrepreneurs need to find support from other organizations to enable it to scale up. Organizational capacity and supportive environment are crucial in this phase.
4. *Learning and Evolving*: As innovation continues to change, learning and adaptation might be necessary. This highlights innovation as a learning curve that evolves continuously.

Oeij et al. (2018) also discussed the innovation journey in the context of social innovation. He classified the process into three main phases, namely:

1. *Initiation*: This includes incubation process in which people will engage to start developing an idea. In this phase, the innovators will experience shocks which require them to develop a concrete approach, plans, targets, and goals.
2. *Development*: To develop an idea into tangible offerings, the innovators or entrepreneurs should consider dissemination, setbacks, criteria changes, contributions of and relations with other stakeholders, as well as infrastructure development.
3. *Implementation (or ending/termination)*: In this phase, the adoption of innovation will depend on social values owned by the stakeholders. The innovation might have lack of appropriate business models so that it will depend on funding. Social innovation does not stop once its offerings have been implemented; it should be continued because it can solve social problems. The innovation might also experience failure, which forces it to be terminated.

From those three models, we can see that each model has different details, approach, and terms. However, in general, they talked about the same innovation journey as can be seen in the illustration below:

Innovation Process	Front-end Phase	Development Phase	Commercialization (Back-end) Phase
Murray et al. (2011)	• Prompts, inspirations and diagnoses • Proposals and ideas	• Prototyping and Pilots • Sustaining	• Scaling and diffusion • Systemic change
Mulgan (2016)	• Generating ideas	• Developing, Prototyping, and Piloting Ideas	• Assessing, Upscaling, and Diffusing • Learning and Evolving
Oeij et al. (2018)	• Initiation	• Development	• Implementation (or ending/termination)

Figure 9 The adapted general process of social innovation

Thus, the social innovation will go through the same three phases as other innovations in general: front-end phase, development phase, and commercialization (or back-end) phase. However, the use of 'commercialization' terminology to refer to the back-end phase of social innovation can lead to various interpretations. Commercialization is usually related to the economic gains of an innovation that may contradict with the social objectives of social innovation. Thus, in the context of this research, the

commercialization phase in social innovation refers to the phase of implementation or after the launch of the technology to the market, regardless whether the technology can be fully commercialized or not. In the commercialization phase, the company can also make use of financial resources other than commercial ones for its cost-recovery model. The company can also commercialize other products other than the technology itself.

3.4 Relevant Research Models

To develop social innovation factors framework or research model, there are three models which are relevant to the context of this study. The three models will be explained further in this section.

3.4.1 Social Transformation Model

Social transformation model (STM), introduced by Kroesen (2019), can help entrepreneurs, especially in the Global South (Africa and Asia) in mapping the challenges and developing strategies to deal with them. This model deals with four types of issues:

1. Internal management style
2. External relationships, partners, and customers
3. Governance and regulatory framework
4. Social transformation process

	System I		System II	
	Institutions	Values	Institutions	Values
State	Patrimonialism at the top, granting favors and privileges in return for services	Obedience and loyalty, hierarchy, status, personalized relationships, particularism	Rule of law, equal access, strong but accountable state institutions, property protection, contract enforcement	Universalism, equal access, justice, transparency
Civil society	Closed in-groups, vertical networks, little cooperation	Lifelong solidarity, adaptation to the group, traditionalism, uncertainty avoidance	Civil society, open cooperation at the bottom, changing coalitions (apart from family loyalty and state authority)	Open attitude, mutual adaptation, multiple memberships, pluralism of opinions
Individual enterprises	Family based, distributed activities, dependent on position and opportunities in the vertical network	Command and control, status through position, closed in-group ethos, loyalty counts more than efficiency, synchronic time management, privileged treatment of in-group members	Open labor market, contracts, instrumental working relations, both of competition and cooperation between competitors	Individual judgment, professional attitude, initiative, status by achievement, planning and innovation, cooperative attitude, equal treatment, teambuilding

Figure 10 Institutions and values for System I and System II in Social Transformation Model

(Source: Kroesen et al., 2019)

Entrepreneurship in this challenging environment can be successful if it considers the process of social transformation. It should operate at both traditional and innovative institutions. On the one hand, the institutions of the state in low-income economies are used to promote family or other vertical networks. On the other hand, there is also pressure for more transparency, equal access to institutions of the state, and law enforcement. The social system of personalized relationships within vertical networks is still essential. However, transparency and law enforcement are also necessary to establish anonymous trust and open collaboration in civil society. There is an ongoing transformation that takes place from System I to System II, as shown in the table below. System I is the traditional system in the Global South and System II is the modern system that is becoming more influential in the Global South. Most modern societies are somewhere in between the two systems.

3.4.2 Multi-Level Perspective

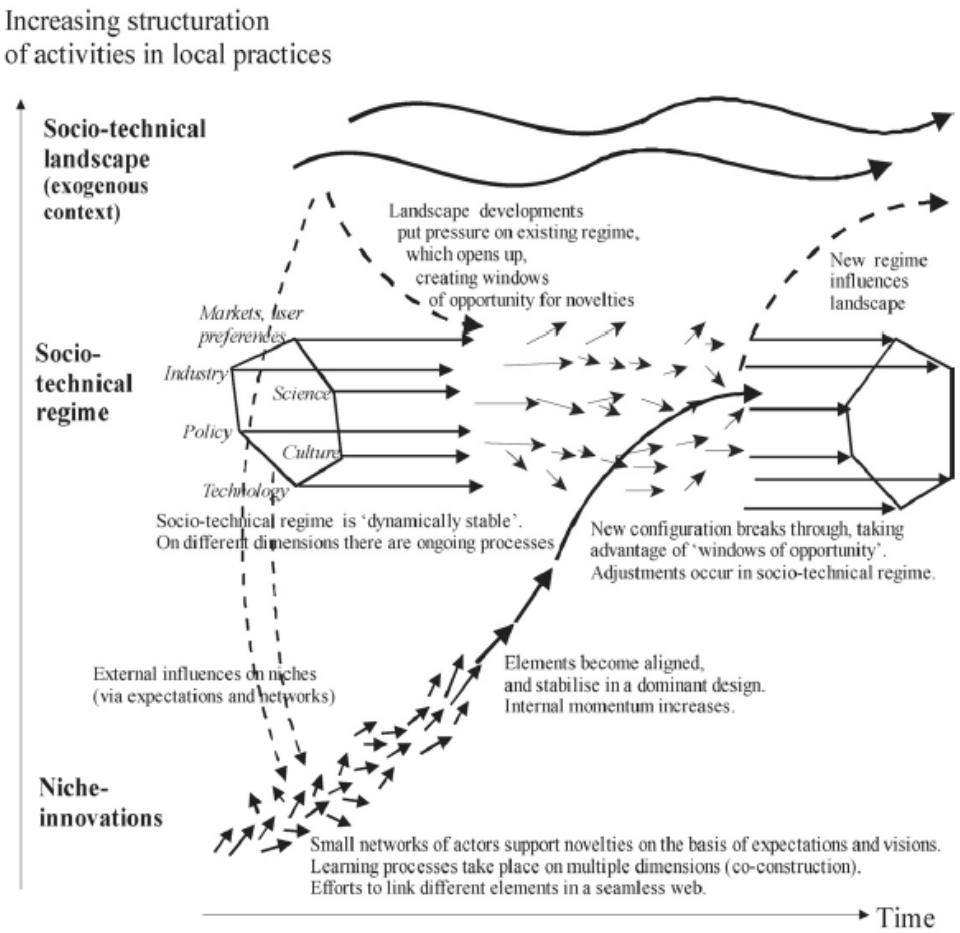

Figure 11 The multi-level perspective on transitions

(Source: Geels et al., 2007)

Multi-level perspective (MLP) is used to understand technology transitions as outcomes of alignment and developments in multiple levels (Geels et al., 2007). There are three levels of analytical concepts: technological niches, socio-technical regimes, and socio-technical

landscape (Geels et al., 2007). Technological niches refer to the micro-level of technological development where radical innovations emerge, carried by small networks of dedicated actors (Geels et al., 2007). The socio-technical regime is the shared cognitive routines in engineering community with the contribution of scientists, users, policymakers, and special-interest groups in patterning the technological development along 'technological trajectories' (Bijker, 1995). The socio-technical landscape refers to an external environment that influences niche and regime actors, such as economic, cultural, and political factors (Geels et al., 2007). MLP argues that transitions come from interactions between these three levels: technological niches create internal momentum, the socio-technical landscape creates pressure on the regime, and regime destabilization creates windows of opportunity for niche innovations (Geels et al., 2007). The alignment of these levels enables breakthrough innovations in mainstream markets where existing regimes compete with each other.

3.4.3 Transformative Social Innovation

Haxeltine et al. (2017) introduced the concept of transformative social innovation (TSI) which is defined as the process of changing and challenging the existing institutions' dominance in a specific context. Initiatives and networks in social innovation are the vital collective elements that stir up the transformative social innovation processes. Haxeltine et al. (2017) identified the four clusters in transformative social innovation processes by addressing different levels and sub-processes: the relations within SI initiatives, network formation processes, institutionalization processes, and the shaping of SI through the broader socio-material context.

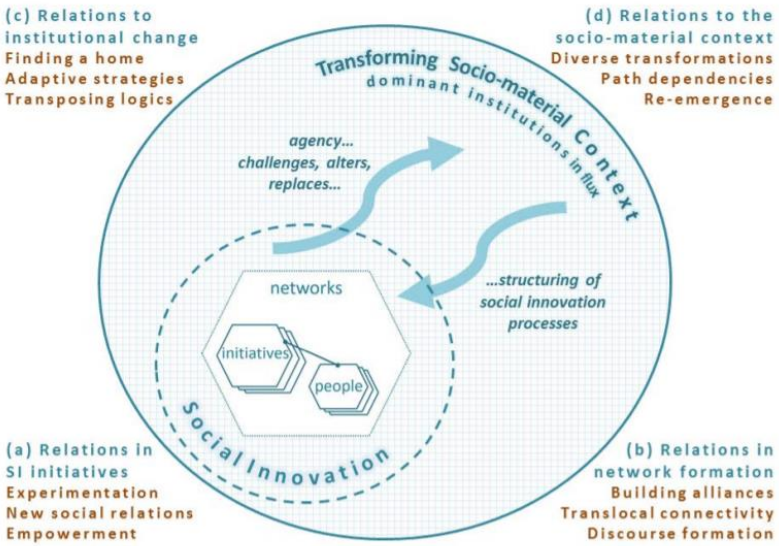

Figure 12 Transformative social innovation process and dynamics

(Source: Haxeltine et al., 2017)

For the relations within SI initiatives, TSI processes assume individuals have the motivation to form SI collectives. Processes of network formation with other initiatives and actors are

intertwined with the relations within SI initiatives. SI initiatives do not work in isolation, so they have to navigate dynamic arenas for development and find allies. This network formation process is linked up with the processes of institutional change. There are possibilities that the TSI will emerge and flourish, which are influenced by longer-term developments in the socio-material context, which involves the dynamics of path dependencies, re-emergence patterns, and diverse transformations.

To conclude, all the three theories are considering several levels of innovation, moving along from small scale (e.g. company, niche, initiatives) to large scale (e.g. state, landscape, institutions). Starting from small-scale level, STM discusses innovation transformation in the level of an individual organization, MLP discusses technology transitions in the level of technological niches, and TSI discusses transformation process in the level of SI initiatives. In the middle, the three models start to look at the innovation along with its social interactions and relations: STM discusses the transformation in the level of civil society, while MLP discusses socio-technical regimes and TSI discusses the relations in the network. In the large-scale level, the three models consider the role of the state (STM), socio-technical landscape (MLP), and relations to institutional change as well as socio-material context (TSI). For this research, I will utilize STM as a basis to develop innovation framework because the model integrates the other two, moving from small scale to large scale, so it will not be redundant and overlapping with each other.

4 Framework or Research Model Development

In this chapter, the innovation factors framework is developed based on the literature review on innovation factors, particularly in a social innovation context. The first section will delve into the identification of the innovation factors based on the literature. Then, a logical process of categorization will be performed in the second section, which will result in a preliminary framework in the third section.

4.1 Identifying Innovation Factors in The Literature

Bringing ideas to launch is a complex process which requires the interplay of both internal and external factors. In this research, innovation factors refer to factors present during the innovation process. These factors are essential in determining innovation success and failure.

4.1.1 Selection Guidance

To identify innovation factors by literature review, selection criteria are needed to select which literature that can be used as main references in this study. These criteria are determined to ensure the relevancy of the articles with the focus of this study, based on the central theme and sub-themes mentioned in the previous chapter.

The selection criteria are divided into two categories:

i. *General criteria*: A "must-have" criteria which need to exist in the selected articles.
ii. *Specific criteria*: Certain criteria which bring closer the relevancy of the literature with the specific purpose of this research. Due to the knowledge gap, articles which have these criteria will be scarce. Thus, these criteria are not a "must-have" requirement to exist in the selected articles.

Table 1 List of Literature Selection Criteria

Type of Criteria	Criteria	Notes
General criteria	1. Discuss influencing factors of social innovation or entrepreneurship	Based on the central theme of this research: social innovation
	2. Discuss social innovation in developing countries/areas	Based on the sub-theme: social innovation and entrepreneurship in Indonesia
Specific criteria	1. Focusing on rural innovation or development	Based on the sub-theme: rural renewable energy in Indonesia
	2. Focusing on renewable energy or electrification	Based on the sub-theme: rural renewable energy in Indonesia
	3. Dealing with commercialization (back-end) phase in the innovation process	Based on the sub-theme: innovation process

4.1.2 Initial Identification of Factors

During the search process, firstly, desktop research is being performed on Google Scholars with keywords: "social innovation factors", "social innovation factors in rural development", "social innovation factors in developing countries", "social innovation factors in a developing country rural renewable energy", "social innovation factors in developing country rural renewable energy commercialization". Secondly, based on the search results, literature with titles containing some of the relevant keywords are being investigated further by reading the abstract. I also make use of the recommendations feature available in database website to check other related articles. Other than that, I also read Master thesis reports of other TU Delft students by accessing the TU Delft Repository website. From those reports, I looked at the list of references and read the articles that are relevant to my study. I also read the articles which used to be the study materials of the lectures I previously took and recommended articles from my supervisor. Based on the articles' title and abstract, I will then read the selected literature, using the criteria mentioned above. The articles are then selected accordingly if they satisfy at least the general criteria. The main articles used to identify the factors and the reasoning behind their selection are detailed below:

Table 2 List of Selected Articles

Literature	**Brief Description**	**General Criteria Requirement**		**Specific Criteria Requirement**		
		General Criteria 1	**General Criteria 2**	**Specific Criteria 1**	**Specific Criteria 2**	**Specific Criteria 3**
Balachandra, P., Kristle Nathan, H., & Reddy, B. (2010). Commercialization of sustainable energy technologies. Renewable Energy, 35(8), 1842-1851.	This paper discusses the commercialization phase of sustainable energy technologies (SET) as well as technology commercialization framework. This also discusses technology generation and small-scale entrepreneurship. This paper also discusses innovation factors; hence this can be a basis to identify both driving and hindering factors of SET.	Yes. It discusses driving and hindering factors of social innovation or entrepreneurship	Yes. It discusses social innovation in developing countries	Partly. It does not explicitly focus on rural innovation, but more general (including rural innovation as well)	Yes. It focuses on renewable energy or electrification	Yes. It deals with commercialization (back-end) phase in the innovation process
Sengupta, S., Sahay, A., & Croce, F. (2017). Conceptualizing social entrepreneurship in the context of emerging economies: an integrative review of past research from BRIICS. *International Entrepreneurship And Management Journal*, *14*(4), 771-803.	This paper discusses social entrepreneurship in emerging economies. This provides a conceptual model of social entrepreneurship in BRIICS countries (Brazil, Russia, India, Indonesia, China, South Africa). This paper also discusses innovation factors; hence this can be a basis to identify both driving and hindering factors of social entrepreneurship in developing countries.	Yes. It discusses driving and hindering factors of social innovation or entrepreneurship	Yes. It discusses social innovation in developing countries	Partly. It does not explicitly focus on rural innovation, but more general (including rural innovation as well)	No. It focuses on social entrepreneurship in general	No. It focuses on social entrepreneurship in general

Rahman, M., Paatero, J., Poudyal, A., & Lahdelma, R. (2013). Driving and hindering factors for rural electrification in developing countries: Lessons from Bangladesh. *Energy Policy*, *61*, 840-851.	This paper discusses driving and hindering factors for rural electrification in developing countries; hence this can be the main reference in developing the framework of factors. This includes success factors (drivers) and setbacks (barriers) both for on-grid and off-grid technology.	Yes. It discusses driving and hindering factors of social innovation or entreprene urship	Yes. It discusses social innovation in developing countries	Yes. It focuses on rural innovation or developme nt	Yes. It focuses on renewable energy or electrificati on	No. It does not discuss the innovation process
Elmustapha, H., Hoppe, T., & Bressers, H. (2018). Understanding Stakeholders' Views and the Influence of the Socio-Cultural Dimension on the Adoption of Solar Energy Technology in Lebanon. *Sustainability*, *10* (2), 364.	This article investigates the views, roles and influence of stakeholders on the adoption/diffusion of solar energy technology in Lebanon. This also discusses socio-cultural factors (challenges and drivers) on the adoption of solar energy technology; hence this can be a basis to identify the social innovation factors within the context of renewable energy technology in a developing country.	Yes. It discusses driving and hindering factors of social innovation or entreprene urship	Yes. It discusses social innovation in developing countries or area	Partly. It does not explicitly focus on rural innovation, but more general (including rural innovation as well)	Yes. It focuses on renewable energy or electrificati on	Yes. It does not mention the term commercia lization phase, but it discusses innovation adoption and diffusion
Feron, S. (2016). Sustainability of Off-Grid Photovoltaic Systems for Rural Electrification in Developing Countries: A Review. *Sustainability*, *8*(1 2), 1326.	This paper discusses the sustainability of off-grid PV systems for rural electrification in developing countries. The indicators for the sustainability of off-grid PV systems in this paper can be used as a basis to identify innovation factors (mostly barriers).	Yes. It discusses driving and hindering factors of social innovation or entreprene urship	Yes. It discusses social innovation in developing countries or area	Yes. It focuses on rural innovation or developme nt	Yes. It focuses on renewable energy or electrificati on	No. It does not discuss the innovation process
Hirmer, S., & Cruickshank, H. (2014). The user-value of rural electrification: An analysis and adoption of existing models and theories. *Renewable And Sustainable Energy Reviews*, *34*, 145-154.	This paper discusses the framework of user-value mapping for rural electrification. This also discusses the barriers to realize the successful implementation of rural electrification projects. The value framework of rural electrification suggested in this paper can be used to identify the innovation factors.	Yes. It discusses driving and hindering factors of social innovation or entreprene urship	Yes. It discusses social innovation in developing countries or area	Yes. It focuses on rural innovation or developme nt	Yes. It focuses on renewable energy or electrificati on	No. It does not discuss the innovation process
Seetharaman, Moorthy, K., Patwa, N., Saravanan, & Gupta, Y. (2019). Breaking barriers in deployment of renewable energy. *Heliyon*, *5*(1), e01166.	This paper discusses the barriers of renewable energy technology (RET), such as social, economic, technological, and regulatory. Hence, this paper can be a basis for factors identification.	Yes. It discusses driving and hindering factors of social innovation or entreprene urship	Yes. It discusses social innovation in developing countries or area	No. The case is more general	Yes. It focuses on renewable energy or electrificati on	No. It does not discuss the innovation process
Alam Hossain Mondal, M., Kamp, L., & Pachova, N.	This paper discusses drivers, barriers, and	Yes. It discusses	Yes. It discusses	Yes. It focuses on	Yes. It focuses on	Yes. It does not

(2010). Drivers, barriers, and strategies for implementation of renewable energy technologies in rural areas in Bangladesh—An innovation system analysis. *Energy Policy*, *38*(8), 4626-4634.	strategies for renewable energy technology (RET) implementation in rural areas; hence this can be the main reference to identify the innovation factors. This paper also proposes recommendations of strategies for policymakers.	driving and hindering factors of social innovation or entrepreneurship	social innovation in developing countries or area	rural innovation or development	renewable energy or electrification	mention the term commercialization phase, but it discusses technology implementation

4.2 Establishing Innovation Factors

The influencing factors of social innovation identified from the literature are examined and adjusted to make sure that they are aligned with the context of this study. During the selection process, adjustment and analysis of the factors are applied logically to ensure that the factors selected are fit for purpose. This literature review produces a list of factors to develop a preliminary framework. There are 30 innovation factors identified and selected through the main articles:

Table 3 List of Innovation Factors

Factors	Literature Source	Explanation
F1. Long-Term Goals and Commitment	Balachandra et al. (2010) Mondal et al. (2010) Sengupta et al. (2017)	This refers to long-term vision, such as the vision for commercialization (in some cases, the company only focus on the research and development stage). This also refers to a long-term commitment to doing business while making social changes.
F2. Planning and Targets	Seetharaman et al. (2019) Hirmer et al. (2014) Rahman (2013)	This refers to concrete planning and achievable target settings as well as target evaluation (including time management).
F3. Qualified Personnel	Sengupta et al. (2017) Seetharaman et al. (2019)	This refers to human resources with qualified abilities and knowledge.
F4. Learning Opportunities for Personnel	Sengupta et al. (2017) Hirmer et al. (2014)	This refers to learning opportunities for people who work in the company (full-time and part-time workers, interns, volunteers, etc.), such as training, workshops, etc.
F5. Credibility and Capability of The Company	Feron (2016) Seetharaman et al. (2019) Mondal et al. (2010) Sengupta et al. (2017)	Knowledge and skills (expert know-how) owned by the company in developing, operating, and maintaining technology and running a business.
F6. Decision Making	Rahman (2013) Feron (2016)	Decision-making process that could involve the participation of employees and the community.
F7. Organizational Culture and Environment	Sengupta et al. (2017)	This refers to organizational culture and working environment, including hierarchy and gap between superiors and their subordinates.
F8. Role of Company Leaders	Sengupta et al. (2017)	Personal qualities of company leaders (chief, founder, director, etc.), such as leadership skills and other good qualities, can affect the level of trust of the public and employees. Their networking and expertise are also useful.
F9. Initial Costs	Elmustapha et al. (2018) Hirmer et al. (2014) Seetharaman et al. (2019) Mondal et al. (2010)	Initial cost or investment cost for RE could be an issue for the company because it is high.
F10. Cost Recovery Model	Elmustapha et al. (2018) Mondal et al. (2010) Sengupta et al. (2017)	Cost recovery model or customer payment scheme as a source of revenue, besides grants or charitable funds.

	Balachandra et al. (2010) Rahman (2013)	
F11. Standard Procedures and Practices	Rahman (2013) Seetharaman et al. (2019)	Standard Operational Procedure (SOP) is applied to be a guide and protocol in carrying out business and operational activities so that it can minimize errors and mistakes during business activities.
F12. Natural Resources	Balachandra et al. (2010) Sengupta et al. (2017)	Constraints on natural resources can hamper the operations of the technology (e.g. obstructed water flow for micro-hydro, the rainy season for solar PV, slow speed of wind for the wind turbine, etc.).
F13. Products and Services	Balachandra et al. (2010) Rahman (2013) Hirmer et al. (2014)	Reliable products with proven performance, safety and quality, combined with ease of use, can increase people's trust and desire to use the technology.
F14. Affordability of Products or Services	Sengupta et al. (2017) Rahman (2013) Feron (2016)	Affordability of the offerings needs to be considered so that it can minimize problems with payments.
F15. Technical Knowledge of Users	Elmustapha et al. (2018) Sengupta et al. (2017) Hirmer et al. (2014)	The technical knowledge of community members or users must be ensured so that they can operate and maintain the technology.
F16. Benefits for Users	Elmustapha et al. (2018) Feron (2016) Hirmer et al. (2014) Sengupta et al. (2017)	Financial benefits for the community members or users can maintain them to keep using the technology. The benefits (for example, savings from reducing electricity costs, income from productive activities, etc.) can also encourage more people to use the technology.
F17. Market Demands	Balachandra et al. (2010) Mondal et al. (2010) Sengupta et al. (2017) Elmustapha et al. (2018)	The availability of market demands can influence scalability and market expansion of the innovation.
F18. Public Awareness	Elmustapha et al. (2018) Feron (2016) Seetharaman et al. (2019) Mondal et al. (2010) Sengupta et al. (2017)	Public awareness about the company can promote the implementation and commercialization of the technology it offers.
F19. Community Involvement and Participation	Sengupta et al. (2017) Rahman (2013) Mondal et al. (2010)	The active involvement and participation of the community or the locals can support the implementation and commercialization of the technology (example: the community members participate in operating and maintaining technology, etc.)
F20. Sense of Ownership	Sengupta et al. (2017) Rahman (2013) Hirmer et al. (2014)	Sense of ownership of the community members towards the technology can support the implementation and commercialization of the technology because the community can participate in O&M.
F21. Local Economic and Entrepreneurship Development	Balachandra et al. (2010)	The company's active role in developing economic and entrepreneurship activities for the local community can support the commercialization of the technology while also supporting the economic empowerment of the local community.
F22. Financial Support	Sengupta et al. (2017) Rahman (2013) Seetharaman et al. (2019) Mondal et al. (2010) Elmustapha et al. (2018) Feron (2016)	This refers to the availability of financial support, including access to funding sources (sponsors, donors, and investors), grants and government subsidy, commitments of investors or donors, etc.
F23. Social Capital Network	Sengupta et al. (2017) Elmustapha et al. (2018) Balachandra et al. (2010)	This refers to the availability of social networks that are beneficial for the company by collaborating and working together, including suppliers, distributors, consultants, government agencies, etc.

F24. Coordination and Cooperation with Partners	Elmustapha et al. (2018) Mondal et al. (2010)	This refers to coordination and relationship with partners and other stakeholders, including communication and interaction.
F25. Competition	Balachandra et al. (2010) Sengupta et al. (2017) Elmustapha et al. (2018) Seetharaman et al. (2019)	This refers to competition with other energy or electricity providers, especially those who can offer lower rates (for example, the state-owned electricity company).
F26. Governmental Support	Balachandra et al. (2010) Sengupta et al. (2017) Elmustapha et al. (2018) Feron (2016) Seetharaman et al. (2019)	Support from the government towards RE (financial and non-financial) can help RE to flourish and sustained, hence giving more impact to society.
F27. National Electricity Tariffs Set by Government	Rahman (2013) Elmustapha et al. (2018)	National electricity tariffs set by the government is related to a massive subsidy. This can affect the purchasing decisions of local people.
F28. Regulations and Policies	Sengupta et al. (2017) Elmustapha et al. (2018) Feron (2016) Seetharaman et al. (2019) Mondal et al. (2010)	Regulations and policies regarding RE and energy in general, including incentive policy (for example, incentives for private companies to encourage them to work on renewable energy businesses)
F29. Administrative and Bureaucratic Procedures	Sengupta et al. (2017) Elmustapha et al. (2018) Seetharaman et al. (2019) Mondal et al. (2010)	This refers to the procedures of administrative and bureaucratic matters. For example, to fulfil legal requirements, to get permits or license, etc.
F30. Stability of Formal Institutions	Feron (2016)	Changes in formal institutions can cause changes in regulations and policies. It can also change the support for the business if the government officials are replaced.

4.2.1 Classification of Factors

After identification, the classification of factors will be done to develop the framework of factors. This is done to facilitate better understanding and analysis. The classification will be based on the three elements suggested in the Social Transformation Model by Kroesen (2019): individual organization, civil society, and state. I choose this model over the other two relevant models (Multi-level Perspective and Transformative Social Innovation) because of its comprehensiveness, broadness, contextual relevance, and generalizability potentials. Since I want to study the factors comprehensively influencing a social innovation by viewing the technology as an organization's resource, the knowledge of inside-out innovation environment will facilitate structured insights about the factors. Since I will also look at the broader perspective from the company's standpoint, the three distinct but interrelated elements (individual organization, civil society, and state) suggested in Social Transformation Model are the most suitable tools to develop the research model. Moreover, since all models provide continuum from small to large scale, STM can integrate the other two models, so they will not be redundant and overlapping with each other.

4.3 The framework of Innovation Factors

After identification and classification, a framework of social innovation factors influencing the commercialization phase of rural renewable energy is derived. These factors will be validated through empirical study within the rural renewable energy industry. They will be adapted by identifying the real factors that happened in real-life cases based on the results. The table below summarizes the

initial/preliminary framework of factors after doing classification process, showing 30 factors previously identified, ten categories of factors developed in the categorization process, and three dimensions developed from further classification.

Table 4 The preliminary framework of innovation factors with categories and dimensions

Social Innovation Factors	Category	Dimension
Long-Term Goals and Commitment	Vision and Mission	Individual Organization
Planning and Targets		
Qualified Personnel	Human Resource	
Learning Opportunities for Personnel		
Credibility and Capability of The Company		
Decision Making		
Organizational Culture		
Role of Company Leaders		
Initial Costs	Financial	
Cost Recovery Model		
Standard Procedures and Practices	Internal Business Process	
Natural Resources		
Products and Services	Technology	
Affordability of Products or Services	Customers	Civil Society
Technical Knowledge of Users		
Benefits for Users		
Market Demands		
Public Awareness	Community	
Community Involvement and Participation		
Sense of Ownership		
Local Economic and Entrepreneurship Development		
Financial Support	Network and Support	
Social Capital Network		
Coordination and Cooperation with Partners		
Competition	Competition	
Governmental Support	Bureaucracy and Policy	State
National Electricity Tariffs Set by Government		
Regulations and Policies		
Administrative and Bureaucratic Procedures		
Stability of Formal Institutions		

5 Case Study

This chapter will cover the second part of data collection, that is the case study in three social companies focusing on rural renewable energy in Indonesia. The first section will introduce the three companies. Then the second section will explain the interview structure and personal details of the participants, while the third section will focus more on secondary data sources used in the case study.

5.1 Introduction to The Case Study

Three case studies will be conducted to test the research model developed from the literature. The three companies are:

1. Lentera Bumi Nusantara (LBN)
2. Institut Bisnis dan Ekonomi Kerakyatan (IBEKA)
3. Renewable Energy Service Company (RESCO) Sumba

The three companies are social innovators who focus on rural innovation, particularly in the renewable energy domain. The three companies conduct renewable energy projects for a rural area in Indonesia. The case studies are divided into three different types of rural renewable energy projects: LBN for wind turbine technology, RESCO for solar PV technology, and IBEKA for micro-hydro power technology. The data will be collected by conducting an interview with related stakeholders in the three organizations as well as gaining secondary data if possible. A field survey was also conducted to one of the organizations, that is LBN in Ciheras Village, West Java.

5.1.1 Lentera Bumi Nusantara (LBN)

Lentera Bumi Nusantara (LBN) is a social enterprise founded in 2011 which focus on technological innovation development for rural areas in Indonesia, especially in the field of energy, food, and water. Its research centre and the office is at Ciheras Village, West Java. The number of members in the core team is eight people; however, it trains and empowers local people and university students to run operational activities of its business units as well as to develop and maintain its technological products. One of its business units is renewable energy with a wind turbine as its main technological product. It operates in several areas in Indonesia with two primary locations for the implementation of the wind turbine: Ciheras Village, West Java and Sumba Island, East Nusa Tenggara. However, the company faces many challenges to sustain its business. Based on the interview done by Peranginangin in 2019, the critical challenges faced by LBN are related to financial, infrastructure, institutional, and network:

1. Challenges on financial aspect:
    - Huge investment cost
    - Dependencies on charitable funds, grants and CSR
    - The company has tried to commercialize the electricity generated from the wind turbine technology, but local people do not make a regular payment for the electricity subscription due to their limited amount of income, and it influences the operations and maintenance of the wind turbine power plant

- Challenges in maintaining other business units to generate revenue

2. Challenges on infrastructure:
    - Its costumers live in remote areas which are supported by limited infrastructure
3. Challenges on governmental/institutional aspect:
    - Unclear regulations about renewable energy in Indonesia
    - No legal entity of social enterprise
    - Lack of initiatives from the government
4. Challenges on network/partnerships aspect:
    - In partnering with universities, the universities often do not fully support their students to study or do research in the energy field
    - It has a joint research project with PLN about wind turbines, but the differences in the expectation of electricity capacity make the project challenging

5.1.2 Institut Bisnis dan Ekonomi Kerakyatan (IBEKA)

Institut Bisnis dan Ekonomi Kerakyatan (IBEKA) or People-Centered Business and Economic Institute is a civil society organization founded in 1992 that focus on providing electricity to people in Indonesia, especially the ones in a rural area. Not only providing electricity, but IBEKA also develops the economic potential and empower local communities. The goal of IBEKA is to fight inequality by transferring knowledge and technology to people in rural areas, so it can increase welfare and drive the local communities to self-reliance and economic freedom by promoting smaller local social enterprises. It implements rural renewable energy programs, village coops, farming expansion, household enterprises, small manufacturers, and workshops for the locals. IBEKA is devoted itself to improve the social and economic condition of people in a rural area by utilizing local resources using appropriate technology, particularly for renewable energy programs. To date, 87 projects are running since 1992 in many locations in Indonesia. Most of the projects are using small-scale hydropower as electricity generators. 45 collaborators involve in IBEKA along with 12 social engineers and 11 technical engineers.

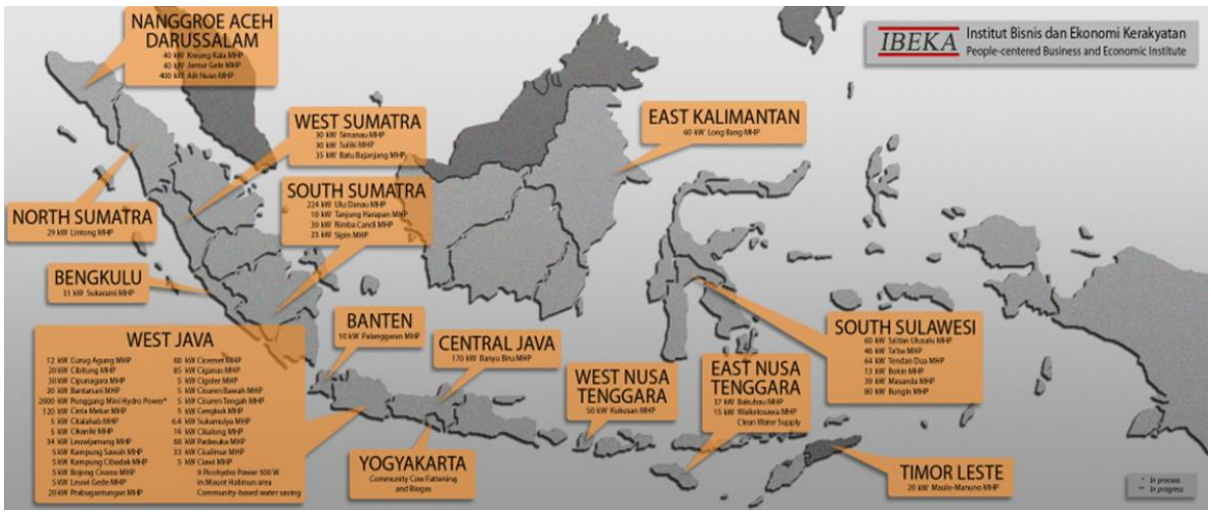

Figure 13 Renewable Energy Project Map of IBEKA (Source: IBEKA)

5.1.3 Renewable Energy Service Company (RESCO)

In 2010, a Dutch NGO namely Hivos introduced a rural renewable energy initiative called Sumba Iconic Island (SII). This initiative is supported by the Directorate General of New and Renewable Energy and Energy Conservation (DGNREEC) under the Ministry of Energy and Mineral Resources (MEMR) of the Republic of Indonesia. This initiative aims to "ensure the provision and utilization of the sources of renewable energy which can encourage inclusive economy and gender equality to improve the welfare of people in Sumba Island" (Hivos, 2014). In 2011, the local government of Sumba, the provincial government of East Nusa Tenggara, and PLN committed themselves to support the SII program. During 2012-2013, other international institutions, such as and The Norwegian Embassy for the Republic of Indonesia and Asian Development Bank (ADB) have also supported this program.

Figure 14 Distribution of RESCO units in Sumba (Source: RESCO, 2018)

In 2016, a local for-profit social enterprise was established by Hivos, namely Renewable Energy Service Company (RESCO) Sumba. RESCO started as a part of Hivos and then became an independent entity in 2016. The company focuses on the operations and maintenance aspect of solar PV technology in several villages in Sumba Island. The company mainly works on inspection, troubleshooting, repair and refurbishment of existing solar PV systems, installation of the new solar PV, commissioning solar PV and other renewable energy projects, and provide training and capacity building for solar PV and other renewable energy technologies. The company is also responsible for running solar lantern charging stations to give access to electricity for the locals. There are more than 40,000 people in Sumba Island who get access to sustainable energy services through 33 schools, 30 kiosks, 50 DC-agro processing and 2,700 PAYGO systems. RESCO also helps to support the local economy through energy provision that can promote income-generating activities which could be a step towards poverty alleviation.

5.2 Primary Data Sources

In this research, primary data are obtained through interview and written answers. The total of eleven interviews and one written answer was held for the case study with the three companies. The written answer method was used for one participant, based on his preference to provide the data. Two interviewees prefer to give written answer as well, in addition to the interview. The interviews were

conducted in a semi-structured manner as it allows for more flexibility during the interview session. However, to ensure that all predetermined questions answered, every interview has a similar general structure. Below, the general interview structure will be explained in more detailed.

Step 1: Introduction and Familiarization

- Introduction to the research
- Understanding the innovation and the interviewee's role in it

Step 2: Innovation Factors Framework

- Validation of innovation factors framework
- Understanding the influence of each factor in the real case
- Exploration of other influencing factors

Step 3: Suggestions

- Discussion of ideas for improvement and recommendations

Step 4: Others and Closing

- Other remarks
- Follow up

The interviews targeted not only the leaders of the company (chief, director, founder, etc.) but also the employees and community members (if possible) to enrich the insights regarding innovation factors from various point of views. The details of the interviewed participants are listed below:

Table 5 The list of interviewees for case study

No.	Interviewee Name	Company	Role or Position	Method	Data Collection Date
1.	Ricky Elson	LBN	Chairman and Founder	Interview	06/05/2020
2.	Inayah Zahra	LBN	Chief Executive Officer	Interview	26/08/2020
3.	Robiansyah	LBN	Engineer/Project Officer	Interview	17/05/2020
4.	Muhammad Al-Rosyadi	LBN	Engineer	Interview	17/05/2020
5.	Leni Hermawati	LBN	Agriculture Manager (Local Community Member)	Interview	19/05/2020
6.	Basir	LBN	Local Farmer	Interview	18/05/2020
7.	Sapto Nugroho	IBEKA	Managing Director	Interview	31/05/2020
8.	Adi Laksono	IBEKA	Community Development, Social, and Environmental Program Manager	Interview Written Answer	16/05/2020
9.	Pradygdha Jati	IBEKA	Supervisor/Engineer	Interview	23/05/2020
10.	Ibrahim Ukrin	IBEKA	Project Lead of IBEKA Farm	Interview	30/08/2020
11.	Dedy Haning	RESCO	Managing Director	Written Answer	19/08/2020
12.	Andre Susanto	RESCO	Co-founder and Commissioner	Interview Written Answer	30/05/2020

Other than that, two interviews were also conducted to academic and professional experts in the rural renewable energy field to do verification for the adapted framework based on the results of the case study. The interview structure will be:

Step 1: Introduction and Familiarization

- Introduction to the research
- Understanding interviewee's background in rural renewable energy

Step 2: Innovation Factors Framework

- Verification of the adapted innovation factors framework based on the case study

Step 3: Suggestions

- Discussion of ideas for improvement and recommendations

Step 4: Others and Closing

- Other remarks
- Follow up

The details of the interviewed participants are listed below:

Table 6 The list of interviewees for verification

Interviewee Name	Institution	Role or Position	Specialization	Interview Date
Henny Romijn	Eindhoven University of Technology	Associate Professor and Chair of Technology and Development in Technology, Innovation and Society TU/e	Technological innovation, entrepreneurship and sustainable development in the Global South (Eastern Africa and Indonesia), especially in renewable energy and sanitation domain.	06/07/2020
Atiek Fadhilah	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH	Advisor	Technical assistance for rural electrification projects in Indonesia (seeking new approaches to solving various rural mini-grid challenges, and engage with relevant stakeholders to devise solution).	08/07/2020

5.3 Secondary Data Sources

In addition to the interview, the case study was also explored by using secondary data sources relevant to the case of the three companies. This was done to enrich the knowledge about the three companies under study. The list of the secondary data sources used for the case study can be seen below:

Table 7 The list of secondary data sources for case study

Company	Sources
LBN	LBN's website: www.lenterabumi.com
IBEKA	IBEKA's website: http://3.ibeka.or.id/wp/index.php/en/home/
	IBEKA's Website - Sumba Story: http://3.ibeka.or.id/wp/index.php/en/projects-running/
	IBEKA's Website - Patriot Negeri Berau: http://3.ibeka.or.id/wp/index.php/en/projects-running/
	IBEKA's Website - Kedung Ombo: http://3.ibeka.or.id/wp/index.php/en/projects-running/
	IBEKA Farm's Website https://ibekafarm.wixsite.com/home
RESCO	RESCO's Website: http://rescosumba.com/
	The Jakarta Post: Septania (2019) https://www.thejakartapost.com/news/2019/07/15/indonesia-sees-growing-opportunities-green-jobs.html
	RESCO's Article: Resco (2018) http://rescosumba.com/lahir-untuk-memimpin-perempuan-teknisi-mendefinisi-ulang-batasan-batasan/
	RESCO's 24 Hours Video: https://youtu.be/8c_MMD_THfk
	CNN Indonesia: Agus (2018) https://www.cnnindonesia.com/nasional/20180130040306-20-272496/kios-energi-dan-lentera-penerang-warga-sumba
	CNN Indonesia: Primadhyta (2018) https://www.cnnindonesia.com/ekonomi/20180125115623-85-271472/terjerat-di-lingkaran-setan-proyek-energi-terbarukan
	ACEF - Haning's Presentation: https://youtu.be/ZOVxgKxQ-4E
	ACEF 2017 - Program Description: ACEF (2017) https://pronto-core-cdn.prontomarketing.com/581/wp-content/uploads/sites/2/2017/01/ACEF-Program-2017_31-May2017_WEB.pdf
	SII MONEV 2018: DAGI Consulting (2018) https://sumbaiconicisland.org/wp-content/uploads/2015/09/Laporan-Akhir-Monev-SII-2018-Bahasa-Indonesia.pdf
	Hivos Report - RESCO Model: Torra (2019) https://sumbaiconicisland.org/wp-content/uploads/2019/10/Report_Sustainable-Decentralised-Renewable-Energy-through-the-RESCO-Model-in-Indonesia_final.pdf
	RESCO's Case Description Document

6 Discussions

After the results from both interviews and secondary data studies have been gathered, a thorough discussion to analyze the collected information is done. The first section will explain the final adapted framework developed from the basis of a case study, followed by analysis and verification in the second section. Then, the suggestions will be consolidated and proposed to overcome barriers.

6.1 Adapted innovation factors framework

According to the case study results at LBN, IBEKA, and RESCO as well as the verification, which will be discussed in detail, an adapted framework can be obtained. This improved version of factors will be used as a basis for discussion/analysis. The final adapted framework can provide indications of influencing factors for social innovation in a rural area, which can be explored in-depth in future studies. The framework can be seen below:

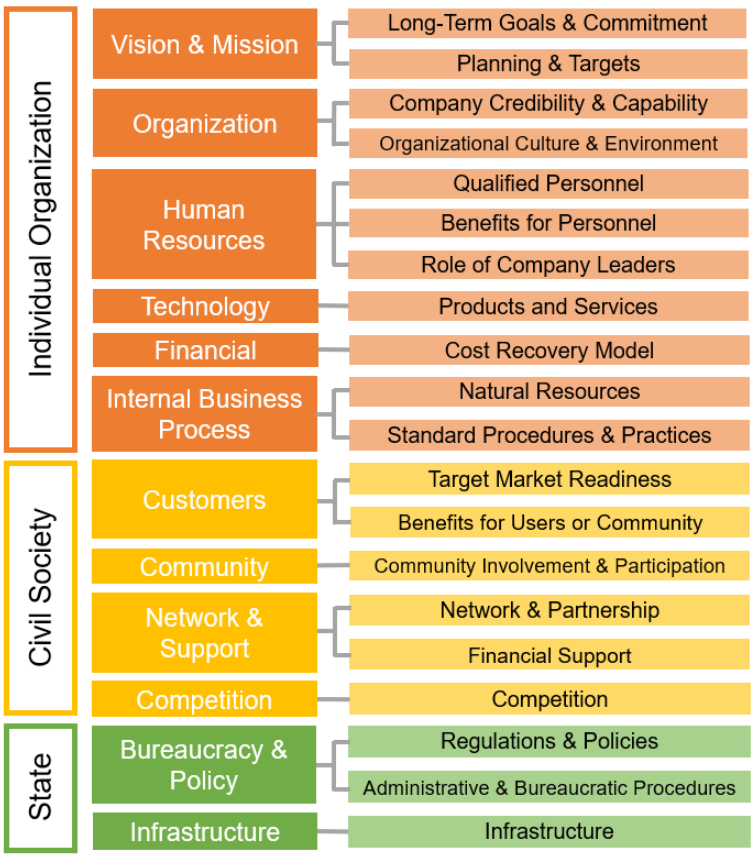

Figure 15 The final adapted framework

There are several modifications to improve the framework based on the case study:

1. Simplification: several factors are merged because they are closely related to each other or have a causal relationship. The discussion will be more comprehensive if these factors are discussed together, not as a separate entity because they will be overlapping with each other.

2. Addition: there is one additional factor gained from the case study that is also important for social innovation implementation in the rural renewable energy context. There is also other stuff to be included in certain existing factors, which will be discussed in further details.

Table 8 The final adapted framework modification

Factors	Modification	Category	Dimension
Long-Term Goals and Commitment	This factor is the same as the preliminary factor, which refers to company objectives, vision, values, and commitment. Although this factor is placed under "Individual Organization" dimension, the long-term goals and commitment are needed not only from the company but also from partners, employees, community, government and other stakeholders in promoting rural renewable energy. However, since the discussion mainly will talk about the goals and commitment within the internal company, and the external goals and commitment will be discussed as a supporting element, it is placed under the first dimension: Individual Organization.	Vision and Mission	Individual Organization
Planning and Targets	This factor is the same as the preliminary factor, which refers to planning, targets, and preparation/preparedness efforts made by the company.		
Credibility and Capability of The Company	This factor is the same as the preliminary factor. This also includes one other preliminary factor: Public Awareness	Organization	
Organizational Culture and Environment	This is the merging of two preliminary factors: decision making and organizational culture. These two factors should be discussed together because the decision-making process is a part of the organizational culture and environment. This factor refers to working culture and environment in the company which relates to management style, decision-making process, rules in the company, communitarianism or groupings, and so on.		
Qualified Personnel	This is the same as the preliminary factor. This refers to the talents working in the company (full-time workers, interns, volunteers, etc.). This relates to their expectation, motivation, working attitude, competences, hiring practices, and so on.	Human Resources	
Benefits for Personnel	This refers to every benefit for the employees of working in the company. The preliminary factor only discusses learning opportunities for workers. However, other benefits are worth considering as well, such as remuneration, networking, self-fulfilment, and so on.		
Role of Company Leaders	This is the same as the preliminary factor. This refers to personal attributes/traits of company leaders (chief, founder, director, etc.), as well as their background, knowledge and skills, networking, image and figure which can affect the company as well. Good leadership skills and other qualities can affect the level of trust of the public and employees towards him/her and the company.		
Products and Services	This is the same factor as in the preliminary framework. This refers to the offerings provided by the company, not only the technological products but also conventional products along with their complementary services. Value propositions of the products/services can increase people's trust and desire to use the technology (e.g. reliability, performance, safety, ease of use, affordability, and so on).	Technology	
Cost Recovery Model	This is the same as the preliminary factor, while also includes two other factors: Affordability of Product or Service and Initial Cost since the two factors are interconnected with the cost recovery model. The affordability of the offerings should be considered in	Financial	

	the cost recovery model. Also, the problem in the initial cost can be solved by utilizing the right cost recovery model. Hence, the cost-related discussions can be covered in the cost recovery model factor.		
Natural Resources	This is the same as the preliminary factor. This refers to local potentials and natural resource constraints. Constraints on natural resources can hamper the operations of technology, for example, obstructed water flow for micro-hydro, the rainy season for solar PV, slow speed of the wind for the wind turbine, and so on.	Internal Business Process	
Standard Procedures and Practices	This is the same as the preliminary factor, which refers to the O&M of the facilities and other operational activities. Standard Operational Procedure (SOP) is applied to be a guide and protocol in carrying out business and operational activities so that it can minimize errors and mistakes during the activities.		
Target Market Readiness	This is a merging of two preliminary factors, such as market demands and technical knowledge of users. This refers to the readiness of the targeted market, which can be shown in the availability of the demands. The readiness can also be seen in the behaviour of the targeted customers themselves, including their knowledge and capacity to manage the technology, their acceptance, feedback loop, etc.	Customers	Civil Society
Benefits for Users or Community	This is the same as the preliminary factor, which also includes one other factor: Local Economic and Entrepreneurship Development. The benefits gained by the community is closely related to the benefits gained by the users since the users are part of the community itself. So, it would be less redundant to merge these two factors to discuss the benefits (financial and non-financial), both for the users and the community. This factor refers to every benefit and positive impact experienced by users such as financial gains, learning opportunity, pride, social status, and so on. This also refers to every benefit that could be gained by the community members, such as community and economic development (especially from the usage of the electricity), learning experiences, and so on. These benefits can maintain users to keep using technology and also encourage more people to use the technology.		
Community Involvement and Participation	This factor is the same as the preliminary factor but also includes a “sense of ownership” factor because of its interrelatedness to community involvement and participation. Discussing community involvement, sense of ownership could not be seen as a disconnected separate entity. This factor then refers to the active involvement and participation of the local community members, which can support the implementation of the technology. This also includes the decision-making process of the local community, the role of local leaderships or champions, a sense of ownership towards the technology, and social support. The involvement and participation of the community members are not only in managing the technology but also for realizing community and economic development goals as well as for improving local livelihood and prosperity. This involvement and participation could be driven by the trust of the community towards the company or its leaders.	Community	
Network and Partnership	This is the merging of two preliminary factors: Social Capital Network and Coordination and Cooperation with Partners. These two factors can be discussed together to give a more comprehensive view regarding the condition of network and partnership in rural RE context. This refers to the availability of social networks that could be beneficial for the company, including suppliers, distributors, consultants, government agencies, and	Network and Support	

	other stakeholders. This includes the involvement of other institutions in establishing collaboration and partnership to provide external support for the company (e.g. facilities, technology, knowledge and skills, learning opportunity, consultancy, etc.).		
Financial Support	This refers to every financial support available for the company to cover initial costs and other existing costs, such as grants or subsidy from the government, funding from donors, and so on. Lack of financial support includes limited access to funding sources (sponsors, donors, and investors), ineffective grants and government subsidy, short-term commitments of investors or donors, and so on. This is the same as the preliminary factor but also includes governmental support. In the initial framework, discussion about governmental support can be redundant with financial support and regulations/permits support, so it would be better to discuss governmental support based on the type of support to make it clearer. So, the government support in terms of financing will be included in this factor, while the support in terms of regulations and policies will be discussed in "regulations and policies" section.		
Competition	This is the same as the preliminary factor. This refers to the existence of competitors and the competitiveness/competitive advantage of the company. The competition can happen with other energy or electricity providers, especially those who can offer lower rates of tariff. For example, the state-owned electricity company can apply unrealistically cheap national electricity tariffs because the massive subsidy from the government supports it. This can affect the purchasing decisions of people and create barriers for social/private sectors to enter the market. The competing products do not necessarily have to reach the community already; sometimes it's just a comparison with the price of the competitors' that decrease willingness to pay of the community.	Competition	
Regulations and Policies	This factor is the same as the preliminary factor, but also in combination with other three preliminary factors: Stability of Formal Institutions, Governmental Support, and National Electricity Tariffs Set by Government. These factors are merged because of their interrelatedness and causality. These factors cannot be discussed separately; otherwise, there will be disconnectedness for the whole context. This factor refers to energy regulations and policies that can influence the implementation of rural renewable energy. This relates to governmental support, government plans and targets, the power of state enterprise, replacement of government officials, and so on.	Bureaucracy and Policy	State
Administrative and Bureaucratic Procedures	This is the same as the preliminary factor. This refers to the difficulties and complexities faced by the company in managing administrative and bureaucratic matters, for example, difficulties in getting permits or licenses, hurdles in fulfilling the legal requirements, complicated coordination within and between government institutions, etc.		
Infrastructure	This is a new factor gained from the case study. In the literature study to determine the initial factors, infrastructure was mentioned as an influencing factor in the development phase, not in the commercialization phase. That is why this factor was not considered in the initial framework of innovation factors. However, when discussing natural constraints in "natural resources" factor, the interviewees mostly would refer to constraints in the infrastructure (e.g. roads, transports, etc.), that can hinder them from going to the sites or visit their rural customers. So,	Infrastructure	

	infrastructure also influences the commercialization phase, especially when the company wants to visit their customers to provide after-sales services.		

6.2 Analysis and Verification

The underlying reasons behind the importance and influence of each factor based on the case study will be explained, by taking into consideration the context of this research: the social innovation ecosystem in rural renewable energy. Expert verification for every factor will also be discussed in this section. This might provide insightful knowledge on innovation within the context.

6.2.1 Individual Organization

6.2.1.1 Vision and Mission

- **Long-Term Goals and Commitment**

  All three companies have a similar vision, which is related to energy and society, especially for rural communities. Each company works towards alleviating poverty and realizing the better livelihood of the rural communities through community development utilizing renewable technology. However, on the lower level, the focus of each company is different. LBN does not only focus on energy but also on food and water sectors by putting importance on research & development (R&D) as well as youth development. IBEKA is more focused on social capital and community empowerment, in which the technology only acts as a tool to realize the community development objectives. RESCO is more focused on operations and maintenance (O&M) services of the RE technology specifically in Sumba Island.

  LBN's vision:

  "Lentera Bumi Nusantara has a vision of mastery technology in energy, food, and water to be used in building society."

  IBEKA's vision:

  "Empower through social capital and energy access."

  RESCO's vision:

  "Renewable energy facilities are difficult to maintain in remote areas. ….. PT RESCO Sumba Terang is established to provide a solution to the challenges."

  The goal of LBN is to light up every dark corner of the country by utilizing the potential renewable energy. This can be done by conducting research and development for technology mastery, implementing technology to solve problems in society, and developing human resources through technology transfer. The main goal of IBEKA is economic development and community empowerment by implementing appropriate technology. So, the success indicator of a project will be the self-sufficiency and self-reliance of the local community. The goal of

RESCO is first to show the benefits of using off-grid RE solutions in a remote area. Then, it wishes to persuade the governments to adjust regulatory framework and electricity tariff setting to promote more private actors' involvement in providing off-grid solutions.

All the three companies have well-defined long-term goals as their focus are not solely on the technology installation, but more on the community development of many unelectrified villages in Indonesia, which will require a long time-investment. This shows that the companies work towards System II regarding their goal setting. For LBN, this long-term focus can be seen from its current state: engaging in research and development to find the right technological formula to implement RE technology for rural people. It also focuses on human resource development, especially the youth, to transfer knowledge related to RE. Ricky Elson, the chairman and founder of LBN, realizes that it will be a long journey to achieve the goals, but LBN does not want to hurry. The long-term focus can also be seen in IBEKA as it has been consistently operated since 1992 with 88 projects, mostly working on RE technology utilization to empower the remote community. According to Jati, the consistency of IBEKA can be seen by becoming a role model in this field. IBEKA provides other actors with reference to successful RE programs that could also be replicated by those who work towards the same goal. RESCO also shows its long-term focus in its goal-setting. As stated in its case description document, it wants to prove the benefits of rural off-grid RE solution, to persuade the government to adjust energy regulation and policy. It is definitely not an easy job which will also take a lot of time, effort, resources, and even require strong negotiation and persuasion skills. It will even be more challenging since the company is still young.

However, the well-defined long-term goals would be difficult to realize without a long-term commitment, both of the internal company and external stakeholders. For example, in LBN, the commitment issue could be seen from high employee turnover. The company focuses on engaging the youth to be a part of its core team members. However, many of them do not stay for long in LBN, which lead to an impression that they see LBN only as a steppingstone. One of the interviewed employees, Robiansyah, said that his motivation to work in LBN is because he wants to pursue a master's degree in a field related to his division in LBN. This also happened to other employees that they left LBN, after working for only a few years, to pursue their other dreams. Hermawati, LBN's core team member, confirmed this turnover issue by stating that *"it would be much better if LBN can find a solution to solve the high turnover rate of the core team members so that the business activities could be more manageable"*. According to Zahra, although the turnover rate in LBN is high, LBN can always find the replacement quickly, and handover should be the last responsibility of the employees before leaving the company. However, although the company leaders said that they can still manage this condition, the high turnover and frequent handovers are not easy homework for any company. IBEKA also faces the same issue related to hiring the youth. Adi Laksono (Program Manager of IBEKA) told that, in the past, it was more challenging to find people who wanted to join

IBEKA. So, the people who eventually joined were the ones having high willingness and dedication. He continued by stating, *"nowadays, although it is easier to find employees, somehow for these youth, self-existence is more important. So, many of them do not stay for long in IBEKA".* For RESCO, it is stated in RESCO's case description document that retaining the employees, mostly young graduates, after providing them with training is a challenge. According to Susanto, the management team is now working pro bono. The Managing Director also works for another company, that is Hivos. This does not necessarily show his lack of commitment, but his focus indeed will be divided between his jobs in different organizations.

Although the implementation of renewable energy is also in line with the Indonesian government's climate goals, the lack of such goals and commitment can be seen from the government. This can be a big hurdle since the companies cannot work alone in achieving their long-term goals. Dedy Haning, Managing Director of RESCO, in his online presentation in Asia Clean Energy Forum 2020, stated that "*rural electrification goal in Indonesia is limited to installation of facilities — short term outputs with an expectation that grid extension will reach the site in no more than three years".* The lack of commitment and long-term goals is also shown by the lack of integrated planning and targets from the government regarding electrification. According to Susanto, co-founder of RESCO, the absence of overall electrification planning from the government is a problem, so nobody could answer how to electrify the unelectrified villages. The goals are not clearly defined, which shows the presence of System I in the government's goal setting. Some companies also have dependencies on their partners or donor institutions regarding the goal setting, which sometimes does not in accordance with the company's own goals. For example, according to Adi, the goals of IBEKA were often defined by its partner institutions or donors. Sometimes, the goals were solely focused on the short-term, that is to electrify the village, meaning that the project would be over once the technology was installed. Although IBEKA wants to go beyond this scope, it is difficult to push the partners due to its dependency. So, the transformation is somewhere in between: the companies have to experience both System I and System II at the same time.

The two experts, Henny Romijn (RE academic expert) and Atiek Fadhilah (RE professional expert) agree that this is an essential factor. According to Romijn, this factor is the most crucial part. So, it needs to be a sustained and long-term operation of the system. While, in many cases, the government focuses solely on short-term targets: nobody really cares about the continuity of the system once it is installed. The commitment of the companies is fundamental, primarily when the companies work towards community development. The attitude of the companies and the inner motives to enter this kind of business will ultimately drive the innovation. The social entrepreneurship projects also need a sustained commitment by considering unrealized costs (e.g. time, patience, stamina, efforts, etc.). According to Fadhilah, this factor is also important and challenging: even if the companies have a long-term vision, often there is a lack of such a vision from external stakeholders. The lack of commitment leads

to lack of coordination between stakeholders, especially within and between governmental institutions. This can also be seen in complicated and contradicting procedures and regulations. Long-term goals and commitment can be an internal driver for the companies, but lack of commitment from other stakeholders can be a challenge that the companies have to deal with.

- **Planning and Targets**

  The way of working in LBN shows that the company puts much importance on planning and target evaluation. According to Al-Rosyadi, usually, the company leaders will give a big picture and direction, then the employees or the interns will develop their own milestones, then the feedback and support will be given. According to Ricky Elson, LBN has daily briefing every morning and daily evaluation every evening. The daily briefing and evaluation are usually applied for the interns in order to train them to keep track of their own working progress as well as to gain suggestions. According to Zahra, the target setting will be stricter for partnership projects because they need to be aligned with the timeline and targets from the clients or partners. The target setting and evaluation for the core team are usually discussed weekly in a team meeting. Zahra explained that LBN uses Trello to manage the tasks of the team members. However, sharing updates in WhatsApp group is usually more effective because the team is small, and the WhatsApp group is much handier for some team members. The updates then will be inputted by one person in Trello to keep track of all the tasks. This indicates that the company is moving towards System II as it starts to use modern management tool within the company, although it is still combined with a more conventional approach. In addition, Robiansyah stated that LBN always tries to prepare for the worst-case scenario and applies preparedness strategy for its sustainability, that is to work with the youth in order to transfer knowledge to them and prepare them to contribute in realizing its goals.

  For IBEKA, the planning and targets will be based on the projects. The projects will be broken down into targets and actionable items/tasks; then the tasks will be distributed over the team members. Jati stated that *"in IBEKA, the targets are made to be shared, so that the targets can be achieved together"*, emphasizing the importance of helping each other as a team. The sequential time management could be seen in the process of running a project that is always applied by the company: identification, mapping, designing the program, looking for funding, and execution of the project by considering social needs and economic development potentials. In building MHP, the planning will consider the worst condition of the year, that is the driest season, to make sure that the technology can still work even in the worst condition. According to Adi, the employees have enough freedom to manage the way they work as long as the targets can be achieved within the deadline.

  For RESCO, the targets will be set based on the current portfolio of projects they are doing. The targets are made to make sure that the employees serve the customers properly. According to Susanto, the top-down grand plan is needed as much as knowing the demand

from the bottom-up approach. There are monthly targets for the employees as they have to collect money from the customers/kiosks in the villages as well as to provide them with O&M. So, once a month, RESCO team will visit the villages to collect money from the kiosk owners while also bringing spare parts and tools to perform O&M. For schools, the visit will be every three months, following government budget disbursement cycle. According to Haning, the company applies bi-weekly catch up for the team to make sure that everything is on track. The company also makes use of software to manage the business activities, such as an accounting system called Accurate, Trello for team planning, and Teamup for mobilization plan, then Haning will monitor these remotely. This indicates that the System II feature is applied in the company that it uses modern management tools.

Based on the information, the three companies apply sequential time management which shows the characteristic of System II for this factor. The three companies have a well-defined (top-down) grand plan, which is reflected in monthly, weekly, or daily targets. This shows that the company leaders can pour out their thoughts and communicate the plan with their subordinates and that the companies work with specific time frames in order to manage the tasks. This will require the initiatives of the employees to set their own targets and the way of working. Moreover, the companies also use some modern management tools to handle activities within the company, such as Trello. According to Romijn and Fadhilah, this is an essential factor because this is the key to realize the goals of the company. If the company can apply it well, this can drive the innovation. According to Romijn, it is crucial that the companies can learn and iterate from the actual condition versus the targets. Flexibility is needed so that the companies can continuously learn, even from failures. According to her, many organizations in this world do not learn because they do not acknowledge failures. If a company has an evaluative culture that it can embrace failures, the company can grow.

6.2.1.2 Organization

- **Credibility and Capability of The Company**

  The knowledge and skills owned by the company are essential to show credibility and capability of the company in running the business. Each company has different competencies as compared to each other: LBN has mastered the core knowledge on generators and electric motors especially for wind turbines, IBEKA has a lot of experience in managing community development projects through MHP, and RESCO is equipped with the know-how for implementing PV-based program. However, for more advanced technical level, the capacity of these companies is still lacking. According to Ricky Elson, LBN is still figuring out (often through experiment or trial and error) the right formula to develop the most appropriate wind turbine to be implemented in a rural area. While IBEKA's expertise is more on the project management, as it does not develop or make the technology by themselves, so the technical capacity on how to build the technology is not necessarily needed as long as it can engage other external stakeholders. The same as IBEKA, RESCO also does not build the technology by themselves

as they can get the technology from the suppliers. The problem on capacity was considered by Global Green Growth Institute (GGGI) which stated that *"capacity limitations in public, private and financial sectors are an overarching barrier to the uptake and mainstreaming of green growth principles, concepts and methodologies".* That is why the partnership is vital for the three companies, so they can always seek external support from their partners or even hire a third-party consultant to help them fulfil the competences that they don't have. For example, LBN had a partnership with IBEKA for wind turbine project in Sumba, in which LBN can learn from IBEKA how to manage the technology in society. However, the companies have to be careful not to be trapped in the high dependency of the support given by the partners.

The three companies under study are all good companies that have good reputation and credibility in public. All of them are recognized through publication in media or seminars/forums, both national and international. For LBN, public awareness and online presence are vital because it sells its conventional products (agriculture and livestock) directly to the general public. For the other two companies, an online presence is more to increase awareness. As stated by Adi, *"the more people aware, the more the support, or at least it will lead to discussions"*. According to Al-Rosyadi, LBN is also well-known due to word of mouth in engineering student communities. The figure of Ricky Elson has a significant influence on this, as he becomes an inspirational role model, especially for young engineers. Nugroho, Managing Director of IBEKA, claimed that there are many of IBEKA's activities being exposed to the public both through online and offline media, including coverage in TV stations. There are many recognitions for IBEKA and especially for Tri Mumpuni, including, as listed in its website, President Barack Obama Mentions in one of his speech, Ramon Magsaysay Awards 2011, Ashden Award 2012, and many others. The company also becomes a role model and runs a knowledge centre on RE. Since RESCO is still a new company, the recognitions are not as many as the other two. However, the image of RESCO is recognized internationally because of Hivos' involvement in establishing the company. According to Susanto, under the name of Hivos, it will be easier for RESCO to gain public trust. This shows the importance of vertical network even in gaining credibility and trust from the public, showing the presence of System I.

According to Romijn, this factor is crucial because if the users, stakeholders, or the general public do not trust the company, the projects could be failed. Credible people running the company and their communication skills are crucial to gain trust. Fadhilah also agreed that the credibility of the company could build trust, both from the stakeholders and the general public. This can be really important, especially for network expansion.

- **Organizational Culture and Environment**

  LBN and IBEKA have a flexible culture, as long as the employees can keep their commitments and stick to the targets. The two companies are mostly dealing with educated university graduates living in big cities as their employees, so the culture is more participatory and

innovative. This shows the existence of egalitarian management style (System II) in the two companies. According to Zahra and Adi, there is no need for the two companies to apply strict control for the employees. However, for LBN, although the employees generally show initiatives, sometimes they still have to be reminded of report making and documentation of their work. In the past, LBN tried to use a stricter approach, but it did not really work out. So, it was more effective for the company leaders to give a big picture that would be processed by the employees to come up with an idea of what to do with that. While for RESCO, since it is dealing with local Sumbanese technicians, who might have a lower educational background, it might be more challenging to apply the same culture as being applied in the other two companies. So, in RESCO, the jobs of the employees are more mundane and well-defined. Although anybody can reach anybody, there is one high gap in the command line because the directors have to coordinate directly with the field team members. This is also of concern of the company as Susanto said that RESCO is currently looking for a manager to act as a bridge between the directors and technicians. However, finding a good manager in Sumba is also a challenge, as stated in RESCO's case description document. In this case, defined jobs and clear direction from the top sometimes are needed to make sure that the company is working well because some employees might not be ready yet to take such initiatives. Also, according to Fadhilah, in the eastern part of Indonesia, including Sumba Island, social strata and hierarchy are still very influential. An aristocrat or nobleman will gain more respect, an ascribed status owned by Managing Director of RESCO.

The management style applied by the companies can be reflected in their decision-making process as well. All three companies tend to maintain an interactive decision-making process at a certain point. Robiansyah, LBN's employee, stated that if a decision is related to a particular division, the person concerned will be involved to give feedback and ideas. Ricky Elson thinks that the involvement of employees in giving ideas is significant because every decision cannot be decided by one person, so others' opinion is needed. While Susanto puts a huge note that this has to be the right kind of participatory decision making. Adi stated that sometimes if the decision-making process is too participatory, it could take longer time and much effort, decreasing effectiveness. So, for small daily operational activities, the three companies allow participation from their employees to decide something related to their jobs. They are often free to decide what they want to do in performing their own jobs by following guidance or merely common sense. However, top-down decision making is also applied whenever needed, especially for critical matters. Dedy Haning stated that *"they are allowed to make their own decision for almost all aspects of the operation, but issues that have cost consequences and reputation will have to be consulted with me".* These show that the three companies work in between the two systems (System I and System II) for their decision-making process.

Ricky Elson stated that, in LBN, initiatives of the employees by utilizing their individual or independent judgment are highly valued. This is confirmed by Al-Rosyadi, that the

responsibilities will be distributed among the employees and the initiatives of the employees are required, while direction and suggestions will still be given by the company leaders along the way. However, every suggestion never becomes an obligation, so there is a lot of freedom and democracy in the company: the freedom of thought that manifests to freedom of action. The same freedom and participatory culture also occur in IBEKA. According to Jati, in IBEKA, the employees are often involved in discussions with the management team to give feedback and ideas for improvement. For every project, the responsibilities will be distributed among the team members through several divisions. In practice, teamwork is highly valued, and every team member can help each other regardless of their own specific role or division. According to Haning, in RESCO, those who joined the company from the beginning show more initiatives, but it takes time for the new ones to catch up on how RESCO works. He also added that the team members could work independently on their defined jobs with minimum supervision. These phenomena of the three companies indicate more System II application.

Regarding the rules, Robiansyah said that there is no strict rule that needs to be complied by the employees working in LBN. Robiansyah added, *"even if there are some rules, they are only for normative matters"*. This statement is also confirmed by Al-Rosyadi and Hermawati. Hermawati added that the rules are only enforced for leave permissions or travelling to other cities, in order to make sure that the number of people left on the site is enough. She also said that there is no rule about working hours and duration; hence the punctuality of the employees is not really needed. During the site visit to LBN's site in Ciheras Village, it could be observed that the working hours in LBN are very flexible. The employees can set their own working time and duration so that the working hours could be changing any day. This indicates that LBN works more on the System I. The internal rules applied in IBEKA are also not very strict. Jati gave an example, *"if an employee wants to take a leave, he/she should apply for permission days before by giving an acceptable reason".* However, IBEKA is more lenient about the duration of the leave. According to Adi, in the past, the working hours were very flexible as he could start working in the evening. However, now, the company is more organized, and the rules regarding working hours are more enforced. This indicates that the company is moving from System I towards System II. Haning stated that RESCO applies a rule to ensure the presence and punctuality of the employees. To enforce the rule, the company implements a fingerprint device in the office; then the office assistant will look after this. Although Haning should monitor this remotely, this kind of rule shows an effort of the company to move towards a more modernized system (System II). However, there are two sides to a coin for these companies. On the one hand, the limited number of rules and lack of punctuality could loosen up professionalism. On the other hand, it could also promote innovation as there would be fewer restrictions to innovate. It would be a challenge for the companies to find out what kind of rules should be implemented and how strict the enforcement should be because they could affect the innovativeness of the company.

For LBN and IBEKA, the ethnic background of the employees is not essential. The two companies use the Indonesian language to communicate with each other instead of using their own tribal language. The companies also employ people from a mixed tribal background. Al-Rosyadi said that sometimes internal turbulences could happen due to the differences in background, but those conflicts are not a big deal. Hermawati stated that, even though the employees come from various ethnical background, they can be respectful and close to each other, just like a family. She also added that the company leaders never give different treatment for the employees, regardless of their background. IBEKA is also very open for people from any background. According to Jati, internal conflicts between the employees due to the differences are usually solved by discussion and sharing. This shows that, in this respect, the two companies already move towards System II. They are different with RESCO because currently it only employs Sumbanese people, showing System I feature. This approach is understandable since the company operates only on Sumba Island. However, it could lead to the tendency of exclusivity and closed in-group ethos. Nevertheless, the company also shows respect for inclusivity. There is a woman who works in RESCO and becomes a senior technician among other male employees, named Jetty. In an article published in RESCO's website in 2018, Jetty stated that she feels her employer gives her an equal treatment and trust without discriminating her gender.

From the discussion, it is clear that the transition between System I and System II is taking place for each of the three companies with respect to their organizational culture. Both experts agree that this is an influencing factor. The high degree of freedom, openness, flexibility, and inclusivity in the company can drive innovation. According to Fadhilah, in addition to the points already mentioned, LBN and IBEKA might have more participatory and innovative culture because their well-educated employees and interns might demand authority to work in their idea. In comparison, RESCO is dealing with local Sumbanese technicians who have a lower educational background and might not really need that kind of self-recognition.

6.2.1.3 Human Resources

- **Qualified Personnel**

  LBN works with a group of youngsters as core team members. The company also hired Hermawati, a local talent from Ciheras Village, to be a part of the core team to manage agriculture products. Although the number of the core team members is limited (± eight employees), LBN utilizes university students who do an internship in the company to help execute RE research, which can reach 500 students every year. The employees, both core team members and interns are required to live and work in LBN's research site in Ciheras Village during their working period. Zahra stated the reason *"because the bonding between the team members is important, and it is easier to coordinate or interact with each other".* IBEKA has a bigger size and a higher number of employees (± 45 collaborators, among them 12 social engineers and 11 technical engineers). This number is considered enough to run business activities, even in the busiest time when running big projects (3). RESCO has started with eight

people and is now working with ± 15 employees. The management team of RESCO is currently working pro bono, leading local talents from Sumba who are mostly working as technicians. Currently, the Managing Director manages the local employees directly, so it needs to look for a middle manager to lead the team in Sumba. However, finding a good manager in Sumba is challenging because the education level is low, and RESCO's budget cannot afford an external manager.

The motivation, working attitude and competences of the employees in each company, might be different. As mentioned earlier, LBN and IBEKA are mostly dealing with young university graduates from big cities. Generally, the reasons for the employees in joining the companies are more driven by intrinsic motivation, that is to give a social impact as well as to gain valuable learning and experiences (8). The employees even think that the reality of working in the company is more than expected because there are many opportunities to learn and grow (5). However, there are still unfulfilled expectations, as mentioned by Al-Rosyadi and Robiansyah, such as to sell products directly from RE technology and to have more explicit guidance. In working with these youngsters, as mentioned earlier, the two companies also have to deal with high turnover. Zahra stated that, usually, the ones who eventually do not have the same vision with LBN would leave the company to pursue other goals. Although IBEKA still has some loyal employees working since the 1990s and 2000's, now it also has a higher turnover than in the past. According to Adi, in the past, only a few people who were willing to work in a social organization like IBEKA, so people who eventually joined were the ones who had a high motivation already. He added that social work is quite a trend among the youth nowadays, resulting in more people having the willingness to join IBEKA but not for a long time. This shows that even though generally the employees are driven by intrinsic motivation (System II feature), their commitment and loyalty are often lacking, leading to the high turnover of the two companies. On the contrary, in RESCO, Fadhilah said that the local talents might be driven more by extrinsic motivation (System I feature), that is economic motives to earn a living. Unlike the employees in LBN and IBEKA who have access to more job opportunities, the choice of working for these local talents might be limited due to limited job opportunities in Sumba. As mentioned earlier, retaining these local talents after training them also has its challenges.

The mindset and working attitude of the employees are also different for each company, which correspond to the organizational culture factor discussed in the previous section. Since LBN and IBEKA work towards more egalitarian culture, initiatives of the employees are highly valued (7). Robiansyah even realizes the importance of a sense of ownership in performing his job, as he stated that, *"I feel that I should have more sense of ownership for my division because how far this division can go will depend on me. If it could go bigger, I am the one who will get the benefits"*. However, he also expects more guidance because sometimes he could be clueless in doing his job, showing that some employees might not be ready to embrace such high freedom. In IBEKA, the employees need to show initiatives because they cannot solely depend

on guidance. According to Jati, sometimes, helping each other is needed because individual goals are made to realize the ultimate shared goals. If the employees are too dependent on strict guidelines, they will not be able to manage this kind of work. Jati stated that, in IBEKA, the employees are often involved in idea generation that could lead to innovations and improvements. Al-Rosyadi even said that sometimes innovations in LBN could come from the interns by improving the modules and developing future research. In RESCO, the employees' jobs are more on operational activities, so clear guidance is needed. Susanto mentioned that the employees would be given targeted outcomes and guidance on how to achieve them. By following the guidance, combined with common sense, the employees are usually able to achieve the outcomes. This shows that the three companies are performing somewhere in between the two systems (System I and System II), meaning that clear guidance from the top and initiatives from the bottom are equally needed. The difference is that LBN and IBEKA are lean more towards the System II, while RESCO is lean more towards the System I.

Regarding hiring practices, each company also has different recruitment approach. In IBEKA, the application system is universal. Occasionally, the company announced its vacancy to the general public through social media, job portals and career development website of some universities. So, it can reach an unlimited pool of candidates (System II). However, referrals and informal ties also play an essential role in the recruitment process, meaning that the existence of a vertical network is beneficial for candidates. For example, Nugroho and Adi knew and eventually joined IBEKA through their network. Ibrahim Ukrin also joined the company by approaching Mumpuni directly since he already knew her beforehand. LBN sometimes open its recruitment to the general public, but not for all positions. Zahra joined LBN (previously LAN: Lentera Angin Nusantara) when the company was still very new. She was offered to join the company by Ricky Elson himself. Robiansyah also stated that *"my position is not open for public, so it was close recruitment".* Although it usually applies close recruitment, LBN still has an unlimited pool of candidates (System II) because it has access to many students through its internship program. In comparison, RESCO has a more limited pool of candidates (System I) because they only hire local people in Sumba through local vacancy placements. So, for IBEKA and LBN, although horizontal network and anonymous trust do exist, the role of the vertical network in the hiring process is still influential, showing the presence of both System I and System II. While, for RESCO, although they only hire local people, the vertical network does not really seem to exist, showing more System II feature. Regarding hiring criteria, Adi said that IBEKA has no proper formula yet. He added, *"the selection committee could only think positively that the new employee really wants to join the project"*. This is also the case in LBN, as Ricky Elson said that what matters is that they have a strong willingness to learn. For RESCO, Susanto stated that *"the potentials and attitude of the talents are more important than their existing skills. What matters the most is their personal motivation and compatibility with the company"*. So, the three companies have no well-defined criteria to recruit a candidate, showing System I feature.

According to Romijn, this factor is vital to drive innovation. High employee turnover could be difficult to manage, so handover policy to transfer knowledge to the new personnel will be very crucial. According to Fadhilah, most of the employees working in social enterprises and NGOs must be highly motivated. They might be driven not solely on the economic factors but also non-economic factors (e.g. learning, experience, pride, self-actualization or fulfilment, and other intangible motives). However, as mentioned earlier, this can be different for each company, depending on the situation and condition which are faced by the company.

- **Benefits for Personnel**

  Regarding financial benefits, all three companies guarantee financial compensation for their employees. However, each company has a different system of remuneration. According to Zahra, in LBN, every team member will get an allowance or "pocket money". The company applies different payment schemes. One of the interviewed employees claimed that the salary is paid monthly with the same amount each month. Usually, this scheme is preferred for them who need to give money to their family every month. In comparison, the other employees are paid once they have important and emergency needs, for example, to go to their hometown. With this scheme, the employees would be paid with an instantly large amount. This scheme is more preferred for some people, so the money will not run out quickly. This difference might not necessarily show unequal treatment between the employees. One employee said that *"actually at the end, the amount will be the same anyway".* So, one could argue that it is just a matter of preference of the payment scheme. Other than that, all the basic needs are provided by LBN, including housing, meals, electricity and internet. This kind of benefits can be categorized as financial benefits but in a more tangible and functional form. Whereas in IBEKA, Adi stated that the employees are paid by basic monthly salary. There will also be an additional allowance for involving in a project. In RESCO, the employees are also paid monthly, which will depend on fee collection from the technology agents, such as kiosk owners and schoolteachers. Jetty admitted, during an interview published in RESCO's website, that since working in the company, she can be financially independent and able to give financial support to her parents.

  Besides financial benefits, non-financial aspects also have an important role in motivating the employees. From the case study, learning opportunities are necessary to motivate employees (9). This is done by giving the opportunity to learn through seminars, training, and workshops, for both internal and external events. Learning is vital for LBN, as Hermawati claimed that it is always willing to devote resources for learning. She told that she had failed in making virgin coconut oil (VCO) for nine trials, in the beginning, hence Ricky Elson should pay for those failed trials. She continued, *"those times, I felt like giving up. But he always motivated me to continue the work, and he told me that failure is a process of learning".* Also, employees often gain knowledge through self-learning or peer-to-peer learning. Moreover, according to Susanto,

knowledge and skills can be gained these days easily through online sources. Even if the company has no capacity to provide training, it can always ask for help from external parties with suitable expertise and resources. For example, RESCO has been partnering with PT Inovasi, Hivos, and GIZ to provide extensive training for the local technicians. According to Adi, IBEKA also often utilizes its existing network to provide training or workshops. It rarely provides internal training unless needed. However, Adi claimed that IBEKA wants internal learning activities to be more regular and structured in the future. According to Al-Rosyadi, in LBN, sometimes learning experience even could come from a bottom-up approach. For example, the interns could help the company improve its modules by giving inputs. Therefore, for this aspect, all the three companies tend to work more towards System II since they always try to accommodate learning or training whenever needed, although it is not held regularly or continuously yet, and the adequacy of the training could be another challenge.

Other intangible benefits include networking, self-fulfilment or actualization, and even pride or status. The three interviewed LBN's employees (Al-Rosyadi, Robiansyah and Hermawati) stated that one of the benefits of working in LBN is that they can establish networking with many people who share the same values or vision, including university students from all over Indonesia. In their opinion, this kind of opportunity is rarely available in other places. Working in LBN also provides more personal benefits for Hermawati. As the only local employee in the core team, she feels that she and her family are being more respected by other locals than in the past. She said that one day after she gave training in a neighbouring village, her mother expressed her proud feeling because Hermawati was known with a good image and able to do something useful to the community. She also feels that her behaviour is changing and that she is becoming a better person after being involved in LBN. For IBEKA, Jati also stated that working in IBEKA provides many opportunities to expand his network, including to local community, partner companies, and even regents and ministers. He also said that he feels like doing something more meaningful than what he did in his previous job in a big multinational company. In RESCO's article, Jetty said that her life is improved since working in RESCO, not only for her economic condition but also physical and psychological condition. She is even able to adopt a little girl now living with her.

Both Fadhilah and Romijn agree that this is an important factor. The remuneration, of course, is significant to motivate the employees. However, merely financial benefits will not be enough for the people who decide to devote their time to work in social organizations. Therefore, non-financial benefits even could be more important for these people. These benefits can be in many forms, such as learning experience, the feeling of fulfilment, networking, pride, status, and so on. These intangible benefits might not be available in other places, especially big corporations.

- **Role of Company Leaders**

  As stated in Kroesen's book (2019), companies which are managed by better-educated leaders have tendency to work more efficiently compared to other companies which are led by less educated leaders (Burki & Terrell, 1998). For the three companies under study, the main leader has an excellent educational background: all of them went to a reputable college. Ricky Elson studied Mechanical Engineering for his bachelor's degree at Andalas University, Indonesia. Tri Mumpuni studied Social Economy for her bachelor's degree in Bogor Agricultural Institute, Indonesia. Dedy Haning pursued his bachelor's degree in Accounting in Universitas Kristen Duta Wacana, Indonesia, followed by Master of Business Advanced, Philanthropy and Non-Profit Studies in the Queensland University of Technology. He also received short course about Renewable Energy Technologies in Eastern Indonesia, held by Murdoch University. They also have credible working experience in the past. Ricky Elson worked as an engineer for many years in Japan before returning to his home country to contribute to developing renewable energy technology and electric cars. Tri Mumpuni has an excellent reputation in managing many successful social works. While, Dedy Haning worked for some reputable companies related to energy, such as Hivos and GIZ.

  Those experiences open their access widely to good social capital networks, both nationally and internationally, which are really crucial for running a company. These leaders can be considered lucky as they have access to such good networking opportunities, even to establish a relationship with "important" people. For example, Ricky Elson has a good relationship with former Indonesia's Minister for State-Owned Enterprises, Dahlan Iskan, who can provide him with access to financial and other supports. He also has a good network to Japanese people, gained from his previous working experience, who also gave support for Ricky Elson to develop RE technology. Dedy Haning also has a good network, gained from his past experiences, including the relationship with international institutions, such as Hivos from Netherlands and GIZ from Germany. All of these phenomena indicate that the companies are three of only a few privileged social organizations. Susanto even stated that *"RESCO has so many advantages because of the financial support from Millennium Challenge Account (MCA) and the guidance from Hivos. Very few social enterprises in this world can be this lucky"*. This shows that the existence of a vertical network, which luckily can be provided by the network of these leaders, is needed to run a company in Indonesia successfully. It would be much more difficult for any company without the same privilege, access, and opportunities to survive in the market. In other words, the network of the advantaged company leaders plays a crucial role to survive and sustain in the market, indicating System I feature.

  These leaders are also recognized by other people, as they are often invited to talk to many seminars and awards events. For example, there are many recognitions for IBEKA and Tri Mumpuni, including being mentioned by President Barack Obama in one of his speeches, Ramon Magsaysay Awards in 2011, Ashden Awards in 2012, and many others. They have the

ability to inspire others by sharing their values and social goals. This is in line with what is stated by Kroesen (2019) in his book: *"A shared social goal serves as the source of inspiration".* Also, they all have the ability to gain trust from partners and the public in general. This statement is confirmed by a story shared by Al-Rosyadi, *"one day, Village Owned Enterprises (BUMDes) approached Ricky Elson to discuss and ask for his opinion regarding their plan to establish tourism beach"*. This shows that even local institution trust Ricky Elson in giving advice regarding the plan of the village. Since he is also a public figure and role model for many people, Hermawati told that *"usually, after Ricky Elson posting the products in his social media account, many orders would come".* So, a personal public figure has an essential role in the specific case of LBN because it sells conventional products directly to the public in general.

The excellent leadership skill and other personal qualities of the leaders are also essential to gain trust from the employees. For his employees, Ricky Elson is considered as a good storyteller who is confident, hardworking, persistent, fair, enthusiastic and inspiring (3). The relationship between him and his employees (or even the farmer partners) is more than professional but also personal. According to Zahra, Ricky Elson has good social skills, manners, and politeness to approach the locals. Ricky Elson also has good execution skills and knowledge transferability that are important to build trust from the locals. For IBEKA, the role of Tri Mumpuni is also essential, not only as a leader but also as a role model who can share her courage, values and vision to her employees and the public in general (3). According to Susanto, for RESCO, good leadership skill is vital to manage the challenging situation in Sumba and to minimize turnover. In addition to its leader, RESCO also depends on Hivos name to gain trust.

According to Romijn, this factor is very important in Indonesia because these figures can inspire leadership to other people, not only the employees but also the wider community. Often, successful companies are led by good people who have an inner desire to do something good and improve others' quality of life. In Fadhilah's opinion, this factor is also essential. When a company enters a village, the locals will see who their guests are. The company must deal with several parties, such as village leaders, cultural leaders, and so on. This can be a challenge since they cannot be approached easily by anybody. So, knowing what to do culturally and whom to approach is vital to gain trust. This might be more significant for RESCO's case. Since the Managing Director came from a noble background, it would probably be easier for him to gain more respect and trust from the locals. Another thing is that the background of the leaders might also affect their approach to solving problems. Ricky Elson has a strong engineering background, so LBN is more focused on technology development. Tri Mumpuni has a background in social economy, so IBEKA's projects are more focused on community development. Dedy Haning has a background in business and accounting, so RESCO pays significant attention to the revenue model of the technology. The social network of these leaders is also crucial to keep the company running and expanding.

6.2.1.4 Technology

- **Products and Services**

  Each company focuses on a different kind of technology. LBN focuses on wind turbines as its research product. According to Ricky Elson, by focusing on wind turbines, LBN can master the core components of RE, such as blade, generator, controller, and data logger. If the company can master those components, it would be easier to develop other kinds of RE technology. He also said that the current focus of the company is on R&D to find the right formula of RE technology by considering all relevant elements in the rural community. The aim of the research is to develop high-quality products that are reliable, affordable, and easy to use or maintain, considering the rural market condition. This shows that the company is working towards market-based innovation (System II feature) because it tries to develop the products which can answer market needs. In addition to wind turbines, it also has solar PV, which is utilized only for internal use in Ciheras site. Currently, the capacity for these two sources combined is still small. They are only able to electrify the site area and not able to electrify the village yet. LBN also works on other products, such as nano cavitation and electric vehicles, but currently, they are not the main focus of the company. In addition to technological products, LBN also has conventional products from agriculture (e.g. virgin coconut oil, moringa, and honey) and livestock (e.g. goat, cow, and sheep). These products were developed through an iterative learning process, even from failures. Zahra stated that *"before deciding to do sheep farming, LBN has tasted failure in catfish farming. Before deciding to produce moringa, LBN has tasted failure in dealing with ginger"*. This shows that the company is working in between the two systems (System I and System II) by implementing product diversification on conventional products as well. For the company, it is essential to consider local resources, capacity and potentials as external support to develop its products. It utilizes simple technological tools to process its agricultural products, such as press machine, sealer, blender and oven. The electricity supplied by RE sources in the site is needed to operate these tools, implying a nice production cycle from the RE technology.

  According to Adi, even though IBEKA's projects focus more on community development, technological products should run well unless the projects would be nothing at all. He added, IBEKA mostly utilizes MHP because it is considered as one of the most effective technologies to be implemented in rural areas, especially for Indonesian context. He added, *"we chose MHP over other technologies because it is simple and easy to use so that the local community can operate it optimally by their own".* IBEKA also utilizes wind turbines and solar PV for some projects. It does not only focus on energy but also on clean water and sanitation in some projects. Nugroho and Adi stated that the aim of the company is to offer appropriate technology for people in a rural area. So, the technology should be able to meet local needs which require the company to do initial market research before implementing the technology. This indicates the presence of System II feature as the innovation is based on market research. Reliability and simplicity of the product are essential to consider since it will be operated by the local community. Adi said that, so far, the technological products are performing well. Some technical

problems might happen, but most are not dangerous. IBEKA also offers services to complement the products, such as local assistance in O&M, small industrial facilities, and a knowledge centre. According to Ukrin, in addition to RE projects and grants, the core business of IBEKA is training provision. So, the company actively gives training for external parties, including the youth. IBEKA also has tried various ways to generate revenue, one of them is through IBEKA Farm. IBEKA Farm is a community-based tourism project which operates in Panaruban Village, West Java. It offers several products and services, such as lodge, food products, fine dining experience, visits to MHP site, visits to natural attractions nearby, butterfly haven, and learning package/classes. This shows that the company also has diversification on its offerings, both technological and traditional/conventional, indicating that the company works in between the two systems (System I and System II).

The value proposition of RESCO is *"providing reliable, safe and affordable clean renewable energy solutions to remote communities, business owners, residents and public facilities".* RESCO's products are mainly photovoltaic (PV) systems because this system is considered as the best solution for Sumba due to its dispersed population and limited infrastructure. The products of RESCO include solar systems to kiosks and school, solar home systems, solar lanterns, small village microgrids, and solar water pump. In addition to technology installation, RESCO offers asset management service (O&M) to maintain the facilities. RESCO runs solar lantern leasing and charging station services applied in PV kiosks and PV schools. These show that the company has quite a diverse set of products and services which are still on the solar RE technology domain, implying that the company is working between System I and System II. According to CNN Indonesia (2018), Margaret, one of the local kiosk owners, stated that the lanterns are beneficial to support household needs. The lanterns are also durable and less risky for people's health. If it is used in economical usage, the people can charge it once every 4-6 days. If technical problems occur, they could be mitigated through warranty service from the manufacturer. The company would be responsible for inspection, troubleshooting and repair of the systems.

Unlike LBN, IBEKA and RESCO do not produce their own RE technological products. The technology is provided by their suppliers. The role of the two companies is more as project implementor. Therefore, to provide technology to their customers, the two companies rely heavily on partnerships with technology suppliers or providers. The two companies prefer to utilize existing resources that are already available in the market instead of making a new one. According to Susanto, one of the advantages of not producing its own products is that it will allow the company to adapt more quickly, *"developing our own products right now is gambling. Why should make one if it is already available?".* On the one hand, this approach is good to minimize costs because doing everything by oneself can be risky. For example, in the case of RESCO, the technical problems could be mitigated through warranty service of the manufacturer so that the risks can be shared. On the other hand, this can be prone to

dependency and discrepancy on the technology because communicating what the company really wants to the suppliers can be challenging. However, as long as the companies can move freely between multiple suppliers, and as long as the cooperation could be maintained, there should be no problem. Also, the RE industry in Indonesia is still far from mature. As mentioned in RESCO's case description document, microgrids powered by RE is a relatively new approach of energy provision, hence problems with design and O&M can cause instability and early component failure. The statement continues, *"there is still a lot to learn and work to do regarding the training of industry and operators in order to improve this"*, indicating the needs to keep on going and continuously learning to increase the reliability and quality of RE products.

Both Romijn and Fadhilah think that this is a crucial factor. The quality of the products and services, as well as the appropriateness with the local context, are paramount. According to Fadhilah, usually, for RE players, the availability of the products will depend on technology suppliers. So, networking and partnership are also crucial in this respect. Networking can expand the "library" of the company into developing new products and services. This can also improve the way of running a business through learning and knowledge exchange opportunities.

6.2.1.5 Financial

- **Cost Recovery Model**

  High initial cost in building RE technology can be a problem for the companies. Usually, the initial cost would be covered by grants. This was stated by Ricky Elson that to cover the initial cost, LBN used external support from outside the company. According to Susanto, RESCO also still depends on grants to cover capital expenditure (CAPEX). This also happens for IBEKA as it depends on external parties to run its projects. Adi stated that the scale of rural RE is small, indicating the presence of System I that it is difficult for the companies to have economies of scale. This economic limitation forces the companies and their innovations to stay small. According to Robiansyah, the limited budget in LBN restricts the company to facilitate advanced technology. It cannot afford the high cost by merely using existing internal financial sources. Hence, by its own, the company can only innovate on small innovations. However, Susanto argued that the initial cost for implementing RE technology does not always have to be high, *"even if it is high, if the returns are also high because the product is highly valued, then this is a moot point. What matters is whether the business model makes sense*". He added that the grants would help the projects in advance, but to make the projects sustained for more than 3-5 years is challenging. So, in addition to the grants, the effort to make RE projects sustainable through cost recovery model is needed. However, despite its importance, not every company is ready to make commercialization effort to sustain their social business, especially for the ones focusing on the rural market. For the three companies under study, the cost recovery model through commercial efforts is present, which is different for each company.

In 2013, LBN implemented RE project to install 100 wind turbines in 4 villages in Sumba Island. This project was done through financial support from CSR of PT Pertamina and in partnership with IBEKA. After installation of the wind turbines, the project was managed by IBEKA using a local cooperative system to manage the collective dues for O&M. Zahra claimed that LBN always gains profits from RE projects (e.g. research, consultancy, installation, etc.) by taking a margin. LBN also runs other business units focusing on agriculture and livestock farming. So, LBN applies diversification in its revenue stream by using several models because depending on RE projects would not be enough. Other than that, agriculture and livestock farming are closed to the lives of the locals so that it can diminish the gap between the company and the community, hence create trust and bonds. Zahra also stated that LBN had explored many things, including fishery and fermentation, which were not successful. She continued, *"the costs involved in that exploration were considered as learning costs".* Since LBN operates with philanthropic values, the hidden costs (e.g. local learning, license, etc.) are not really a problem as long as it can help the community. Elson said that there is no revenue from selling the electricity. The revenue mostly comes from RE partnership projects, agriculture products, and livestock farming. Then, the revenue will be used to fund R&D of the wind turbines and other operational activities. For livestock program, the sales would only be once a year in Eid Adha, so the daily activities are more routine and mundane. Zahra said that some problems in the models sometimes happened. For example, it is difficult to maintain the standardized quality of the products, which can affect customer satisfaction. She added, *"the company sometimes was at a loss because the farmers cannot reach the quality standard, both for agriculture and livestock. While it is also difficult to monitor their production process because they live in other villages".* In Robiansyah's opinion, with the current model and scale, it is enough for the company to survive. However, it would be challenging if the company wants to move to a higher level because it will require more resources and facilities, *"if LBN only depends on agriculture and livestock farming, with the current condition and scale, it would not be enough to leap forward to the more advanced level".*

IBEKA is more focused on community development projects using RE power plants. For every project, IBEKA would encourage the establishment of a local cooperative system for managing the O&M of the technology and the payment of collective dues (3). The payment of the electricity tariff will be managed by the locals to be used for O&M and to promote local economic activities (3). Nugroho said that the source of revenue for IBEKA is mainly from the funds of the project. In addition to that, IBEKA also gains revenue from providing training and speaking engagements. Nugroho added, *"so, IBEKA needs always to run projects, provide training, or be a speaker in events related to IBEKA's expertise".* According to Adi, from experience in running projects, the idea for a new business model could emerge, for example, the idea for PLN to buy electricity from the locals. The most interesting case is a project in Cinta Mekar Village. In this project, IBEKA established Public-Private Partnership (PPP), involving PLN, PT Hidropiranti Inti Bhakti Swadaya (HIBS), UNESCAP, and the local community. PT HIBS

provided US$75,000 for capital expenses and covered the operational costs while providing technical assistance and building infrastructure, in return to 50% of shared revenues (Utomo, 2015). The other 50% of shared revenues were given to the local community through Mekar Sari Cooperatives to cover its loan to UNESCAP, who also contributed the same amount as HIBS. The monthly sales of this scheme amounted to US$2600 and a monthly profit of US$950. The profit was used by the community for several social and economic purposes, including income-generating activities. IBEKA also run IBEKA Farm, arranged to develop IBEKA's existing facilities by involving local community members in Panaruban Village. The core business of IBEKA Farm is on hospitality and tourism. According to Adi, IBEKA Farm is still on the piloting phase. The progress of the design and facilities' construction is slow because of limited resources. IBEKA Farm sold its products to customers in the city of Bandung, mainly through food exhibition. Adi also said that, in the past, IBEKA marketed products of its assisted communities to the German market, in collaboration with a fair-trade organization called "El Puente". However, the activity has stopped, and the local communities are now partnering with local traders instead.

RESCO is one of many contributors in the Sumba Iconic Island (SII) program. According to Susanto, every project under the Millennium Challenge Account (MCA) is always encouraged to have a business model. Since it is one of the projects under MCA, RESCO also applies business model so the project will not depend solely on the grants. Compared to the other two companies, RESCO shows commercialization efforts that utilize the electricity from RE sources. It applies the leasing model of lanterns and charging station, which are powered by solar PV. RESCO rents solar PV along with the charging station and lanterns to local kiosks and schools in the village, then the lanterns are rented by kiosk owners or schoolteachers to the local people. The locals have to pay a service fee for renting and charging the lanterns, or even charging their phone. Then, every month, the kiosk owners will pay the fee to RESCO for the rent of the technology and other provided services. For PV schools, the schoolteachers will pay the fee every three months by using their operational budget or using the commission from providing the services. The schools can utilize the electricity to support learning activities as well as to provide lantern leasing and charging services for the students' family. RESCO team will go to the villages to collect payment manually from the kiosk owners and schoolteachers. According to one article in Jakarta Post published in 2019, RESCO also installed solar-powered rice and corn mills to promote economic development in the villages.

For RE projects of each company, the tariff and payment system of the electricity would be determined by the community members as they know better the local condition of the village, including the willingness to pay and ability to pay of the people. For IBEKA, it would be through a local cooperative system, while for RESCO, the technology agents (kiosk owners or schoolteachers) would have a discussion with community members to determine it. The tariff and payment system can be varied for each village. For example, in one village the tariff would

be the same for every member, but in another village, the tariff would be based on the usage. Margaret, one of the kiosk owners, claimed in one interview with CNN Indonesia in 2018 that the membership and charging fee is affordable for the locals in her village. To get one lantern, the users are required to become a member and pay a membership fee of Rp50,000 (around €3), then the users would be charged Rp2,000 (around €0.12) for a single charging service. Up to 300 times of charging, the users can own the lantern. Every month, she has to pay Rp900,000 to RESCO (around €54) or Rp1,100,000 (around €66) for additional users such as television and phone charging service. She feels that she is benefited from opening the service. Her kiosk has been boosted after many people come to charge their lanterns. However, she never really counts the amount of benefits she gets.

In general, the companies still have to deal with problems in payment in applying their existing cost-recovery model. Adi stated that the problem occurs because the locals are unable to pay for the fee regularly so that they will be in arrears. This is because IBEKA is targeting people in remote and underdeveloped areas, who typically have low purchasing power. He added that the amount of collective dues is often still insufficient to cover ideal O&M, considering the depreciation of the assets. Therefore, for these cases, income-generating activities need to be included as a component in the design of the project. Power plants will function as an initial drive or momentum to realize the economic empowerment of the community. For villages in which most of the people are farmers, their income will depend on harvest time (once every 3-4 months), so the monthly payment system might not be suitable for them. However, in the case of RESCO, Susanto argued that the monthly subscription system applied by RESCO works just fine in many places. In some places, it does not work out, but after the harvest time (3-4 months), the locals are able to pay it off, so it will not be a problem for the annual revenue stream. However, in order to make the business activities more efficient and viable, the adjustment to local context is needed, considering the conditions and variations of the people. The problem regarding the ability to pay is stated in RESCO's case description document: since the people living in Sumba island are relatively poor, not all constituents can afford the payment for energy provision. Moreover, it is stated that *"communities do not always understand the necessity of paying the fees and feel energy provision should be their right provided by the government free of charge"*. According to Haning, people will always compare the tariff of RE with the tariff of PLN because they want to pay the same amount with their fellow relatives all over the country. Susanto said that business expansion is also a challenge, especially when they want to expand to areas that are already electrified with a cheap tariff. He stated that, *"low electricity costs mean that the electricity products and services are valued at a low amount by the users. This limits the possible and viable business model"*. In his online presentation in ACEF 2020, Haning stated that, generally, RE business is challenging to be self-sustained financially, so the funding interventions are needed even if the company has its own business model. He stated that *"Who's to finance the major replacement? Because simply relying on tariff is not enough".*

According to Romijn, this factor is crucial. There is no ideal cost recovery model yet as there are still many obstacles faced by the company to collect money. A good model would consider the variability in the income of the locals. However, this is a difficult problem since this is related to the poverty issue. The ideal business model might not exist because people are poor. Some companies can try to do diversification on their business models. In one type of product, they cannot make any money, but in other types of product, they can make money. Then, the money can be used to compensate for the non-beneficial product. This can help a lot to balance the revenue model while still meeting the social objectives that the non-beneficial product has. Another solution is by selling products to other target groups. Then, some of the profits can be used to subsidize the project. It is also essential to think of how to create value with minimum cost, for example, by involving volunteers. The role of local NGOs is vital to make the system keep running because they know the local condition and how to motivate the locals to keep paying. In Fadhilah's opinion, there is no proper formula yet for developing the model for rural RE context. The good formula can be known by trying to apply a model and continuously iterate. After the trials, the company will know which approach fits better, and the failed trials would be a part of its learning curve.

6.2.1.6 Internal Business Process

- **Natural Resources**

  In rural parts of Indonesia, there are many local potentials that can be developed, not only for RE resources but also for other beneficial usages. For example, LBN tries to utilize the local potentials in agriculture and livestock to become a part of its business model. IBEKA and RESCO also try to develop the local potentials to become a source of income-generating activities for the locals. For RE implementation, Nugroho said that there are many areas in Indonesia that can actually be independent with regards to supplying the electricity for their own community since there are many water sources, the sun shines for the whole year, and so on.

  In the implementation of RE, sometimes natural resource constraints occur, but usually, the constraints are not a big deal, and the three companies know how to deal with them. For LBN, according to Ricky Elson, natural resource constraints do not affect the business, but the constraints affect the research instead. He claimed that to solve natural constraints for wind turbines, LBN applies a hybrid system with solar PV, because usually when the day is not windy, the sky would be clear. According to Adi, sometimes, there are natural obstacles for implementing MHP, such as landslides and floods. To run MHP, the water in the river must flow smoothly. The problem especially would happen during the dry season. However, if the forests are well-protected, the water would still be running although they might be receding in the dry season. So, Adi stated that the challenge is to involve the community to be responsible for maintaining the forest in order to keep the flow of the water. According to Susanto, for RESCO, using solar PV during rainy seasons could be a problem. However, if the sun appears again after 3-4 days, this will allow the battery to be full again. From a technological point of view, these natural constraints can hinder innovation. However, in most cases, the company can

handle these constraints because they are seen as an issue that needs to be addressed. Even these constraints can actually be handled using technology. So, it is more critical for the company to accept the constraints and develop technology by considering these natural conditions.

Romijn claimed that natural conditions are given but what is essential is the ability of the company to manage these problems and how to anticipate them. For example, by adjusting the design to make it easy for repairing the technology. The involvement of the community is also vital to protect their natural environment so that the technology can still run. The natural conditions are there, and the company should be able to work around them. Fadhilah argued that natural resource constraints or disasters could be a barrier; instead, they can be mitigated. There was the case in which a company faced natural disaster in its power plant, forcing it to think about how to solve the problems. The idea was to open crowdfunding and donations from the public.

- **Standard Procedures and Practices**

  All the three companies have manuals and project description, showing the presence of System II feature. They have clear standard operating procedures (SOPs) which are mainly for things related to safety (8). These SOPs act as a guideline to prevent accident and to avoid mistakes in working (8). Until now, each company has not ever experienced any fatal operational mistakes or accidents by following and enforcing these SOPs (5). However, all the SOPs need to be updated regularly to adapt to the latest condition. Also, Ricky Elson argued that *"if the SOPs are too strict, they can hinder innovation".*

  LBN has several SOPs for different purposes, such as for research and design tutorial, installation, inspection, and maintenance (3). Robiansyah also stated that it also concerns about energy usage because it can affect the age of the product. He stated, *"if the capacity of the battery is under 50%, the use of energy needs to be stopped and switched to electricity from PLN instead"*. According to Jati, IBEKA has SOPs for both technical and social aspects. For technical SOP, an example of the procedure is to do maintenance every week. This will require the technology to shut down for 2-3 hours. Adi added that since the operations of RE will involve the local community members, the SOPs need to be very clear and simple so that it can be carried out by the local community easily. Moreover, in the end, the technology will be transferred to the locals to handle the O&M by themselves, and the company can only monitor this remotely. According to Susanto, for RESCO, SOPs are also applied in the company both for technical and non-technical matters, including administrative affairs.

  However, even though the company seems to enforce the manuals and the internal team members seem to follow it, Adi told that there were some cases in IBEKA in which the SOPs were violated by the local operators. The procedure of the payment collection is clear: if

somebody does not pay for the electricity, the service will be cut off. This is the role of the local operators to ask for the payment. However, sometimes the operators cannot collect the payment from particular people because they have personalized or family relations with these people. This personalized relationship or family ethics gives pressure to the operators to be more lenient to certain people, giving unequal treatment to the others. This incident can spread quickly among community members through word of mouth so that the other community members will demand the same treatment. They will be reluctant to pay for the fee if the others can still get the electricity without even paying for the subscription. This shows that the preferential treatment and personalized relationship (System I feature) are still strongly existed within the local community. Adi continued the statement, *"if this kind of issue occurs, the community members usually handle this by arranging a forum for discussion in order to ensure that the procedures are still enforced".* However, the company can also monitor this to make sure that the issue is really solved. Even, if needed, the company can also step in to help solve the problems in order to prevent potential prolonged conflicts among the community members.

Both Romijn and Fadhilah agree that this is important for the companies to follow the standard procedures and practices in implementing the technology to prevent accidents during work. Fadhilah claimed that this is very important, especially when the operations involve the locals. The companies usually will only monitor the implementation of the technology from afar, and the O&M of the technology will be handled by the locals. So, SOPs that are clear, simple, and easy to understand are needed.

6.2.2 Civil Society

6.2.2.1 Customers

- **Target Market Readiness**

  In rural Indonesia, the education level of the people is low since they do not have access to proper education facilities. Adi stated that *"even the elementary school graduates in Sumba are still rare"*. This means that technical knowledge of the local users or operators is also limited. However, in many cases, if the locals are trained well, they can understand how to use and manage the technology independently (4). But still, this is a big challenge. It is even stated in RESCO's case description document that, *"maintaining their knowledge and transferring it to someone else has been proven difficult. Education to customers on how to work with the products can be a challenge*". It is also stated that the customers sometimes use the products wrongly and irresponsibly, which cause errors. Therefore, the companies need always to put the importance of learning for the locals in every project that they run, in order to give an explanation about the technology and how to maintain it. It is also important for the company to use appropriate technology that is simple and easy to use so that the community members can operate it well. Ricky Elson sees this as an essential factor, but this is not something that can hinder innovation. Instead, in his opinion, it can drive innovation for the company to develop a technology that is user-friendly. According to Adi, consideration of local knowledge and capacity

is one of the reasons why IBEKA choose to implement MHP. MHP is considered as a suitable technology for the remote community because of its simplicity and ease of use. The technology is designed to be easily understood by the local community, meaning that the team came up with the technology idea after looking at the local condition.

The three companies target people in a rural area to be the users of their technology. According to Ricky Elson, currently, there are thousands of villages in Indonesia that are still unelectrified, so the opportunities to tap into this market is still big. Other than that, each company has its own preference and targeted market that might be different from each other. Ricky Elson said that LBN's customers for RE division are social coordinators and operators in Sumba, research institutions focusing on RE (e.g. PLN and BJB), universities (both the students and professors), and resorts. For its agriculture products, the customers are general people who mostly live in Jakarta and Bandung. They order the products through LBN's WhatsApp number, Indonesian giant e-commerce named "Tokopedia", an offline store namely "1000 Kebun", and through resellers. To promote its conventional products, LBN utilizes its social media such as Instagram and Facebook for mass marketing (System II feature), so online presence is really important for LBN. Zahra said that sometimes complaints happened due to lack of customers' education and awareness. For example, complaints about forest honey's unstandardized quality and how to deal with the crystallization of the honey. Meanwhile, Adi stated the focus of IBEKA is mainly on rural communities and vulnerable people. By choice, IBEKA targets interior villages that are not ready for commercialization yet, meaning that they have low purchasing power. According to Ukrin, for IBEKA Farm, the customers are IBEKA's guests and the general public. The team used marketing tools through Airbnb, social network, and events in sustainable products or organic farming. For RESCO, as stated in the case description document, it operates only in Sumba Island and the targeted customers are rural villages, business owners, remote schools, local kiosks, residents, and public facilities. RESCO offers solutions for around 50,000 people living in remote parts of the island, who have no access to reliable, safe, affordable, and clean energy. For the three companies, the most effective marketing tools to reach their rural customers for RE products are informal and face-to-face marketing, meaning that they have to work with the more traditional system (System I) since their targeted markets are also traditional.

Since the three companies target unelectrified villages, they never get any rejection from the local community to implement RE technology as the people need electricity to improve their livelihood (5). This also shows that companies have the ability to gain trust from the local community. However, it does not always run smoothly. Adi told that IBEKA sometimes found opposition parties, *"usually they do not oppose IBEKA directly, but rather oppose individuals who support and help the project, because there is a conflict of interests between them"*. Even though there is no direct intervention or threat to the company, this opposition can be an obstacle along the way of the project. According to Zahra, at the beginning of LBN's operations,

trust issues emerged from some people because of their prejudice. Some people, especially the ones who did iron mining in the area, might feel threatened. However, in the end, some people who had a trust issue at first could become friends with Elson when they understand his intention and the benefits that the company offers to the local community. Of course, the local customers will be happy for the existence of electricity in their villages because it can improve their lives, as Margaret said to CNN Indonesia that, *"…. the locals are very happy, not feeling burdened; we are very pleased".* Haning also stated that, so far, RESCO has received minimum complaints from the customers. The complaints are mostly due to delay on visits caused by logistic problems. However, the company never run a survey to really know customers' voice and feedback. Moreover, according to Romijn, rural people, including in Indonesia, generally more passive in their behaviour. So, they might not actively give complaints or feedbacks about technology, even if the technology is not working well anymore. They might feel impolite to challenge or complain, especially for something that is given for free. This behaviour, combined with a lack of initiatives from the company to receive feedback, could lead to a lack of feedback loop, causing unsolved problems and lack of improvement.

According to Romijn, this is important to make sure that local people know about the system and not overuse it. The companies have a lot of work to do before the people are able to receive technology because this is a new thing for them. In most cases, the unreadiness of the local people can be a barrier but not a totally crucial one because the companies can do something about it. Societal condition and culture should be taken into consideration. Some people might be still so conservative that they do not want to adopt the technology. Also, some problems might not be solved without active feedback from the locals. Usually, only a few people can become legitimate spokespersons in the discussion. The companies might not really know what the problems are, because most of the locals might not actively express their opinion nor give complaints. According to Fadhilah, there are still traditional people who are not opened to the culture from outside their village, including electricity. Also, there are many things that they do not consider as problems, leading to a lack of feedback loop. Therefore, education for the locals should become a part of every RE project. The companies are responsible for finding ways to teach and train community members about technology and how to manage it. For other aspects surrounding the technology which are relevant to prepare the market, the companies can work around and collaborate with other organizations.

- **Benefits for Users and Community**

  The benefits for users from using technology is an essential factor in the commercialization phase of the technology (8). According to Elson and Nugroho, usually, the locals will use electricity for lighting and charging the phone. Adi added that, financially, the users could gain benefits from the reduction in monthly expenses, since, in some areas, the people will pay more if they use kerosene lamp. The innovation will be more driven if the company can promote economic and entrepreneurship activities of the local community (4). In Adi's opinion, the most

important thing about technology implementation is the usage of electricity itself. The electricity should be utilized for productive usage so that the local economy could be developed. It can increase the income of the users, hence increase their purchasing power. Also, he stated that the more people gain the benefit from the technology, the bigger their support. The implementation of the technology can develop local economy and entrepreneurship by promoting productive activities and empowering local potentials, which can improve people's livelihood and create more job opportunities (5). The electricity can support productive economic activities as the people can weave, make crafts, process crops, and produce food products in the evening (5). Adi said that they could also utilize refrigerators and other electronic equipment for productive activities by using electricity. Other than financial gains, the users will also get learning opportunities as they will be provided by new knowledge and skills regarding the technology and productive usage of the electricity. Ricky Elson added that the technology could also build a sense of pride and increase the social status of the users.

LBN involves local women in producing moringa powder which will be beneficial not only for the women but also for the ones having the trees. Hermawati said that these women could use LBN's facilities to do the production. According to Ricky Elson, it also involves ±100 local farmers as its partners in agriculture and livestock farming business units. It develops local potentials, such as goats, sheep, honey, moringa and even grass. It can give more values to the grass by buying it from the locals, which then will be used to feed the livestock. From this activity, the farmers can get an extra income of Rp20,000 (around €1.25) per sack by selling the grass to LBN, and usually, they manage to get 2-6 sacks per day. According to Basir, LBN's local farmer partner, since Ricky Elson came to Ciheras, the natural environment surrounding LBN's research site has become greener. Previously, the land was so dry because of mining activities years ago, but it has been successfully greened since LBN arrived at the area. This shows that the impact of the company for the local community is not only on the economic and social aspect but also on the environmental aspect. Zahra stated that *"the impact of RE research is for long-term. While the benefits from agriculture and livestock farming can be felt directly by the locals and the customers who buy the products"*. The product diversification applied by LBN in agriculture and livestock farming will ultimately drive the community empowerment and local entrepreneurship development. This could be a means to solve the issue of trust and create bonds between the company and the local community. Community involvement in the activities other than electricity provision can build trust in a low trust situation.

IBEKA also promotes community development by supporting productive economic activities and entrepreneurship development of the locals (3). For example, by promoting agriculture activities, fish nursery, crafting, home laundry business, and so on. According to Nugroho, the local community can get financial gains through the local cooperative system, including savings and loans, capital investment, and even regular income from selling electricity to PLN. It also conducts training to the locals who will maintain the facility in order to develop their technical and managerial aspect. However, when being asked about whether there is a correlation

between productive use of electricity in a village and sustainability of RE technology, Adi said that it might be difficult to prove because the company has never done any research about it according to academic standards. Logically, he said, *"the greater and more varied the benefits of electricity felt by the community, the greater the interest of the community to keep it operating"*. In his opinion, in most societies, economic motives are indeed the main driver. However, there are other factors that could also affect the sustainability of technology; one of them is community cohesiveness. He said that *"if the community cohesiveness is weak, the economic and political motives of community members can be different, and it could interfere with the management of the technology"*. Adi claimed that the more basic the RE projects (only building power plants and social preparation), the more critical it is to establish relationship and synergy with other parties in order to foster community and economic development, including local entrepreneurship.

RESCO promotes local economy through energy provision, which can facilitate income-generating activities, as the first step towards poverty alleviation. For example, by increasing the efficiency of agricultural activities as well as facilitating better education and healthcare. According to Susanto, RESCO utilizes local kiosks and schools to be its service points. The kiosk owners and schoolteachers act as technology agents in their community. This can create additional income for them by delivering the service while also boosting their entrepreneurial activities. As mentioned earlier, Margaret, one of the kiosk owners, can get more income as there are more people visiting her kiosk and purchase the service. Susanto stated that it is also beneficial for the domestic industry, especially for weaving, as people can extend their productive time to the evening, resulting in increased production. RESCO also installed solar-powered rice and corn mills in order to promote economic activities in the local community. Teaching quality and participation rate in the PV schools are also improved because it can reduce teachers' absenteeism and increase the effectiveness of evening classes to prepare the students for national examinations.

Romijn and Fadhilah agree that both financial and non-financial benefits for the users and the local community, in general, are essential. Fadhilah added that not only the benefits that are important, but also how to communicate those benefits to the customers. It could be challenging to communicate the benefits since the team members, and community members might have a different background, especially in education level and culture. However, knowledge transfer can also happen not only from the companies to the local people but also between the local community members. Local peer-to-peer learning is found to be useful as the people might have a more similar context and language in delivering the message.

6.2.2.2 Community

- **Community Involvement and Participation**

  For the three companies, community involvement is needed from the very beginning to know the preferences of the locals and problems existed in society (4). The community is also

involved in deciding the payment and tariff system as well as managing the money (4). Ricky Elson stated that, for LBN's Sumba project, community participation is essential for O&M of the technology. He claimed that the batteries for wind turbines in Sumba that supposed to survive only for two years could survive for seven years because of the participation of the locals in maintenance. The community was involved in choosing the location, flattening the ground, installing and maintaining the turbines. Other than that, the local community in Ciheras Village is also involved in livestock farming and agriculture production, involving around 100 farmers. According to Hermawati, for producing moringa powder, the women usually get the raw supply from their own garden or buy it from LBN or other people having the trees, then they will process it into powder which will be bought by LBN. This shows that there is open cooperation at the bottom, implying System II feature. The trust towards the company can be shown in the acceptance of the locals (the community of Sundanese people) to Ricky Elson, an outsider who came from the different tribe (Padangnese). Moreover, as mentioned earlier, at the beginning of LBN operations, there was a trust issue for Ricky Elson and LBN. In the end, the company is able to gain trust from the locals by involving them in the diversified business activities familiar to them, different from electricity provision activities which are unfamiliar to them. The transition from low trust to high trust situation shows that the company has experienced the social transformation from System I (previously) towards System II (currently). However, too much trust can also lead to a problem. According to Zahra, the locals put a very high trust for Elson that they can feel comfortable enough to borrow money from Elson or LBN. Elson is considered as a family member and rescuer to them. This kind of an occasion is often unexpected, which can affect the cashflow of LBN, and it would be challenging to maintain standardized bookkeeping. This indicates the existence of System I feature, that is support to the community at the cost of the company. Zahra continued, *"usually, they will pay the loans in instalments or by offering their services, such as providing the grass without being paid until they can pay off the debt".* She also stated that the role of the local champion is vital for a company operating in an area that is new and unfamiliar. The local champions can help give insight, communicate with other community members, and promote the project. The champions usually are the ones without any formal position but being respected and trusted by the locals.

In IBEKA, the locals would be involved from project planning to implementation (3). In an article published in IBEKA's website, in Sumba, the locals' enthusiasm could be seen as they joined hands to lift the heavy equipment of MHP from the main road to the site. They even worked together to open road access of 2.6 km to Kalilang site, consisting of 398 people (132 women and 266 men). According to Jati, IBEKA conducted training since the construction phase so that the operator candidates could be involved from the start. Then, the operators would be chosen by the local community members, consisting of 2-7 people for one site. He also said that, although the incentives for the operators are not high (in Sumba, it is only Rp300,000-600,000 or €18.80-37.60 per month), there are many people who want to become operators. This is because of the pride and respect that they could gain because not everybody can touch

the technology. The community also can do their own decision-making process as they will determine the tariff and payment system for the O&M, also manage the revenue through the cooperative system (3). According to Adi, there are some people who prefer not to take risks and utilize the collective dues only for regular O&M. There are also some people who have the courage to take risks and decide to use part of the collective dues for productive activities, typically by the opening shop or running agriculture/livestock program. IBEKA's projects are inclusive to every member of the community, involving a marginalized group of people (women and low strata group) in order to diminish the gap among the community. Sometimes, as told in one story by Adi, the community can go even further by approaching IBEKA or local government to ask for RE because they realize that their village has potentials. This bottom-up approach shows that the local people even can go beyond community involvement, that is community initiatives. This indicates that it also works towards System II feature as open cooperation at the bottom presents. The open cooperation also could be seen in IBEKA Farm as the locals are involved proactively in making the food products by exploring ingredients and cooking.

According to Susanto, for RESCO, the involvement of the community members is needed to gain knowledge about their needs and benefits experienced by them from using the technology. Susanto said that RESCO conducted workshops from the beginning of the project to make sure that the locals are interested in the technology and willing to pay for it. However, although the company tried to involve them in the discussion, most people in the room tended to stay silent and only a few people who were engaged in the discussion, usually village leaders. So, Susanto added, it is difficult to really know what their needs and wants are. Other than that, the participation of local community members could be seen from the technology agents (kiosks owners and schoolteachers) to socialize the technology in their neighbourhood as well as to open the service. Not everybody can become an agent of the PV kiosk. There are several requirements: the person should already have a kiosk, live in the house that is close to other community members, and have a strong willingness to join the program. For the tariff setting, the technology agents will arrange discussions with community members to agree on a certain amount. Haning, in his ACEF presentation, argued that the involvement of local leaders is crucial for the sustainability of the RE technology in a rural area. Visionary leaders play an important role in this matter. However, creating this sense of leadership is difficult. It will require years of intervention, since finding such figures in a rural context is challenging.

The involvement and participation of the community are significantly related to their sense of ownership. The more they involve, the greater the sense of ownership, and the greater the sense of ownership, the more they want to get involved. Sense of ownership is an essential factor for LBN and IBEKA in order for the technology to survive because the community members will take care of the technology. Basir even emphasized that "*it is important to have a sense of ownership to the land and the things that I work on, so I could treat them well*".

According to Jati, a sense of ownership can be built by increasing the locals' awareness of their problems and solutions. With this sense of belonging, they will be more responsible for maintaining the technology; even they can do the O&M by themselves sincerely (5). But, if there is a problem beyond their capacity that needs to be fixed, they can always ask for assistance from the company (5). However, according to Susanto, a sense of ownership is not that important for RESCO since it only involves technology agents and even has a team to provide maintenance/repair service for these agents. Moreover, according to Susanto, "sense" or "feeling" is something beyond the control of the company. Although it has tried to make people feel that technology is a part of their daily life, it still depends on the individuals.

According to Romijn, this factor is extremely crucial. Participation before the start of the project is needed, not only for laborious activities but also for discussions. It is crucial for the locals to feel that the system is theirs. Local organizations, such as cooperatives and NGOs, can also manage the technology and take care of the maintenance. According to Fadhilah, community involvement is crucial because the community would be the first supporters of the company. The role of local champions is crucial to close the information gap between the two worlds. The seamless communication between the company and the local community can drive innovation.

6.2.2.3 Network and Support

- **Network and Partnership**

  Rural renewable energy needs contribution from many parties, such as governmental institutions, private actors, and non-profit organizations. Since it will require a long time and continuous effort, establishing synergy with relevant parties is needed. The availability of the social network is important to help the companies provide anything beyond their capacity. Since Ricky Elson worked for many years in Japan, he had a network to Japanese stakeholders, who provided LBN with initial support. Ricky Elson also established a good relationship with an important person in the government, that is Dahlan Iskan, a former Indonesia's Minister for State-Owned Enterprises. This relationship has helped the company a lot, especially in getting financial support to install 100 wind turbines in Sumba Island in 2013, in exchange for Elson's contribution in developing electric cars for the minister. This shows the importance of having a vertical network and knowing certain people as it will be easier for the company to get support, including financial, permits, and so on (System I feature). According to Elson, LBN has many partners, such as state-owned institutions, universities, research institutions, and other NGOs. For joint research, its main partners are PLN and BJB, in which, according to Zahra, LBN already has a network inside these partner companies. This shows that established vertical network is also crucial in doing partnership (System I feature). It also has a partnership with multiple local workshops as its suppliers for battery, machines, and other components (System II feature). It also maintains a partnership with around 100 local farmers in agriculture and livestock program. Al-Rosyadi said that there are some criteria to look for a partner, *"not only those who want to improve their image but the ones who share the same values and vision with*

LBN". According to Elson, the coordination with these partners works just fine. LBN even has a closer relationship with some of its partners. The relationship between LBN and some local farmers are not only professional but also personal, which can increase trust. If they need urgent help, LBN will always try to help them with their capacity. This shows the importance of personal relationship for LBN in establishing a partnership, implying the existence of System I feature. This is supported by Zahra's statement, *"in addition to a professional relationship, personal relationship and approach are also very important because it will increase willingness to help each other sincerely and build trust which will require a very long time".*

IBEKA has been operated since 1992, so its social network is very wide. According to Adi, if it has a lack of capacity to do something, it will look for help from outside, especially from the networking circle of Tri Mumpuni. IBEKA has many partners, ranging from government agencies, private companies, NGOs, universities, local organizations, and individuals (3). As stated on its website, the partners include, but not limited to, Ministry of Small Medium Enterprise and Cooperatives that provides local cooperative management training and financial support amounted $2,300,000 for several MHP projects, Japanese Government which provide support on average $100,000 per project per year, local governments in several provinces in Indonesia with the amount contributed worth $250,000-USD 5,000,000, and many others. IBEKA does not produce the technology by itself; it utilizes multiple local workshops to design and manufacture the turbines (3), indicating System II feature. Adi stated that the coordination with these partners is not always smooth, but IBEKA can always handle that. In one project in Sumba, IBEKA even has successfully pushed government agencies to conduct coordination meeting to accelerate the complicated legal process for the project. Adi explained that sometimes donors try to push their will towards IBEKA, enforcing their bargaining power to define the goals, allocated resources, and other stuff. However, some donors are still willing to hear IBEKA's concern so that a win-win agreement can be made.

As stated in RESCO's case description document, the company relies heavily on partnerships. For RESCO, the partners mostly came from Sumba Iconic Island (SII) ecosystem, such as MCA which provides financial support, Hivos which provides advice and networking, PT Inovasi which provides training and business model ideation, universities which provide knowledge and research, and others. Sometimes, RESCO was asked to give assistance in O&M for the system owned by the government by the promotion of Hivos. This shows the importance of having a vertical network in order to gain support and promotion to potential clients, showing an indication of System I characteristic. Even though local governments have seen a lot of their microgrid systems easily broken down, they don't understand that the cause of the breakdown is bad O&M. Hence, to prove how RE should work, RESCO often has to install the first half of the system for free, which causes cash flow issues. This shows that sometimes there is a lack of anonymous trust (System I feature), forcing the company to prove something that could cause the unnecessary cost for the company. RESCO gets equipment and machinery from

technology providers in a solely transactional relationship. Haning claimed that RESCO does not have preferred suppliers, meaning that the company can move freely between multiple stakeholders in a professional way, showing the presence of System II feature. Haning stated that, in order to make sure the partners keep the agreement, *"we draw an MoU signed by local authorities such as local government or village administration"*, showing the critical use of written agreement (System II feature).

Romijn argued that this factor could drive innovation. The companies, of course, need external support, because they will not be able to work alone. Fadhilah also claimed that this could influence the success of an innovation. Especially significant is the role of village leaders. If the village leaders support technology implementation, the technology can be sustained and maintained well, which will be beneficial for the community. Network and partnership can also open the wider arrays of opportunities for the company.

- **Financial Support**

  According to Elson, in the beginning, LBN gained financial support from the Japanese government under the New Energy Development Organization (NEDO) program. Then, the company received other funds with the help of Dahlan Iskan, that is CSR from PT Pertamina. For RE research projects, its partner institutions, such as PLN and BJB, gave financial support and supporting facilities to do the research. Elson claimed that the lack of financial support is not a barrier anymore because LBN is now running other business units by selling products to the general public in order to be self-sufficient and independent from charitable funds. For livestock program, the company would depend on investors. Zahra added, *"now LBN does not ask for grants, but it offers services through a partnership that should be profitable for each party".* For IBEKA, the revenue stream mostly comes from RE projects. IBEKA usually gets financial support from a foreign government, donor institutions, and CSR program of private companies. According to Adi, for RE projects, IBEKA is targeting a very remote community with low purchasing power and no ability to apply commercial scheme, so what is needed is grants. The local government sometimes also contribute its budget to support the project. According to Ukrin, although at the beginning of the project, there is no external support for IBEKA Farm, the company still needs funding from angel investors to expand the project. Ukrin added, *"as a Foundation, the core of IBEKA's activity projects with other institutions. For commercialization to general market or entering the business sector, the company is still on learning phase"*. According to Susanto, RESCO gained a full grant from the Millennium Challenge Account (MCA). The company also received financial support from other donor organizations, such as GIZ and New Nexus Energy. The local government also gave support to PV schools to pay for the O&M of the technology, but not directly to RESCO. According to Susanto, the company still depends on grants to cover its CAPEX. Haning said that the current focus for funding is on CSR and philanthropic approach.

Those phenomena show that the companies still need financial support from outside. Even LBN that is now claimed to be financially independent will still need financial support to run a big RE project like what they did in Sumba. However, in general, access to capital can be limited, especially for social entrepreneurs running a business for people in a rural area who typically have low income. Kroesen (2019) stated that access to capital could be related to access to vertical networks. This would involve important people and relationship to help the company getting closer to the capital. This statement is true, which could be seen in the case of the three companies. All three companies can be considered lucky, as they can get access to such a vertical network in order to gain support. *But, how about the other entrepreneurs?* Repeating Susanto's statement, exceptionally few social entrepreneurs can be that lucky; and the three are part of this fortunate group of entrepreneurs. This indicates that the System I feature, that is a vertical network in getting access to financial sources, is still very strong in the Indonesian system. Lack of investment from private actors could become another issue. According to Adi, it is difficult to find private actors who are willing to invest in rural RE projects because the scale is usually very small, so the projects are not attractive for private actors. This statement is supported by Susanto, as he mentioned that the investment in rural electrification is difficult unless the company have a viable business model. This shows that there is missing middle in the system as the attentiveness of investors is lacking, again implying the presence of System I feature.

According to Haning, in general, RE social entrepreneurs focusing on the rural area still need funding interventions because merely relying on tariff is not enough. The funds can come from both public and private institutions. Adi said that the financial support from the government is more difficult to access since the government applies complex requirements which are difficult for small organizations like IBEKA to fulfil. The three companies mostly received financial support from private entities or foreign donor agencies in the form of grants. Susanto stated that, in advance, the grants would help running the projects, but it would be challenging to sustain after 3 or 5 years. Haning stated that *"there is no financial scheme out there apart from grants; unless we have a proven business model".* He continued, *"hence, we will keep operating at this scale with no intention to expand before we are confident with our business model".* This means that, apart from grants, other forms of support are not impossible to be accessed by the social entrepreneurs as long as they have a viable business model in place.

According to Romijn, this is definitely an essential factor. There are many impact investors, usually wealthy people from developed countries, that the companies can approach. These investors need to ensure the proper social and environmental return. They are willing to invest but not necessarily want to get commercial returns. If the funds are limited, the companies can work on other commercial lines of product that can make more money, although it is labour-intensive and requires a lot of resources. According to Fadhilah, usually, financial support from grants is only enough to cover the initial cost. So, one should think about what to do next and

how to sustain and survive without dependencies on the grants. To get the grants, the credibility and experience of the company are needed to gain trust from donors. In non-profit context or social projects, donors will be willing to give funding by looking at the potential impact of the projects, especially on the social and environmental aspect. So, for these investors, impact monitoring is more important than financial or commercial returns. There are also funding from investors through debts or equity with a longer payment period. This way of funding can only be afforded by a company which has a clear and viable business model.

6.2.2.4 Competition

- **Competition**

  Competitors for the three companies are the ones who also provide the same products and services, including PLN, free government programs, and other companies that want to sell their electricity products. According to RESCO, the market for electricity in Indonesia is highly regulated, and PLN holds a monopoly. The reasons why there is a lack of private sector involvement in this market are because the government regulations do not support private sector involvement, high subsidy for PLN which make the tariff artificially low, and high subsidy for kerosene and diesel. According to Adi, before operating in one village, the company needs to make sure first that there is no PLN grid available in the area. However, the three companies are mostly targeting and operating in un-electrified rural areas without access to PLN grid.

  During the interview, LBN and IBEKA stated that they do not consider PLN as a competitor because they work towards the same goal (4). They even established a partnership with PLN. For example, LBN and PLN did RE research project together, indicating that the company can collab with its competitors for mutual benefits (System II feature). However, the existence of PLN sometimes can be an obstacle for them. For example, according to Adi, the electricity provided by PLN are more trusted by the locals because PLN is owned by the government, creating a false perception in the community that RE is more unreliable a source. Haning also said that price comparison with PLN's tariff could also trigger people to stop paying for RE service because the tariff is more expensive and unregulated. Even if PLN has not reached the area yet, people could still be reluctant to pay because they want to pay the same amount with people in other areas. This was also stated by Susanto, *"if people think that the electricity tariff for the others is cheaper, they could stop using the electricity from RE".* Susanto added, to expand to an area where there is PLN's grid already is another challenge because RE products and services could be undervalued by the community, which then limits a viable business model.

  According to RESCO, the main competitors of RE initiatives in rural areas without stable grid connection are kerosene lamps and diesel generators. Not only PLN, conventional fuels, including diesel and kerosene, are heavily subsidized by the government (Torra, 2019), although they come with health and environmental risks. This creates unfair competition and unequal playing field for RE actors as they do not have access to the same subsidy, indicating

that System I feature is firmly rooted in this industry. Torra (2019), on his research report about RESCO, added that *"in this case, it is mostly due to the lobbying from PLN and Pertamina (the State Oil and Natural Gas Mining Company)".* This implies that vertical network also plays a vital role in the access to the market, which limits the involvement of private sectors. Another competitor, according to RESCO, is solar home systems with low-quality solar panel and battery that can be found in the local market. Free solar home systems program from the government also acts as a competitor for the companies which could influence the expectation of the local community. However, these government projects have a lack of long-term focus. O&M aspects are often overlooked, which results in early system breakdown only after the first few years of installation, resulting in the slow adoption of RET in a rural area.

However, Adi stated that, in some remote areas, the electricity provided by PLN is not that reliable since blackouts often happen. If the people wanted to complain, they must go to the closest big city which is far from the village. So, in some areas, it would be preferable to use RE because people can manage it on their own. For the areas without PLN service, as mentioned earlier, the villagers usually use kerosene lamp and diesel generator. According to Adi, the cost of kerosene is more expensive. It is also difficult to get in some areas. Moreover, the fossil sources have a harmful environmental impact and health risks. It is stated in Torra's 2019 report about RESCO model that, *"the introduction of the solar lanterns in Sumba reduced kerosene consumption from 2 litres a week to just 0.5 litres, saving families between Rp18,000 and Rp24,000 a month (US$1.30 to US$1.70)".* According to Adi, for diesel generators, although the installation costs are lower, this will be followed by high operation costs, since a large amount of fuels will be needed. Thus, RE offers a better solution. The challenge is to educate the community to persuade them to use RE instead of kerosene lamps and diesel generators.

The two experts agree that this is an influencing factor. According to Romijn, this factor may hinder the diffusion of RE technology. The government of Indonesia gives a massive subsidy to PLN while RE projects have to manage without subsidy. This is a big problem for the transition towards RE in Indonesia. There is also no integrated plan from the government, so PLN can just enter any area that they want because they have the power to do that. Fadhilah agrees that the biggest competitor for RE players is PLN. Free electricity government programs can also be a threat to these players. Moreover, those competitors are supported by regulation, which makes the small players in rural RE more powerless. Instead of collaborating with the existing players, government programs often become the most significant threat. The high subsidy from the government for conventional fossil fuels is also a threat. However, some areas are still struggling in using diesel and kerosene because they are more expensive and not always reliable, especially for remote islands.

6.2.3 State

6.2.3.1 Bureaucracy and Policy

- **Regulations and Policies**

  The support from the government (both national and local) is necessary for the implementation of RE. According to RESCO, the main task of government is to ensure the welfare of its people, *"their interest is to speed up electricity access because energy provision is a first step to alleviate poverty which can improve the local economy, education, and heath".* The three companies consider the government as giving support if they do not intervene in activities of the company (6). Even if there is no direct support from the government, it will be helpful if the government allow the company to operate with freedom (6). If the government is too involved and having more intervention, it might be difficult for the companies to innovate (4). Torra argued that government intervention is necessary to several conditions, such as to guarantee the wealth redistribution, to regulate market while stimulating them, to modify the counterproductive consumption patterns, and to remove entry barriers that can hinder healthy competition.

  According to Adi and Susanto, the current regulations regarding energy are not supportive of small-scale players because some regulations are so complicated. Under the Act of 30/2009, private actors can sell the electricity directly to local people by complying with complicated requirements which are difficult for small players to fulfil, especially for regulations regarding the business area. Since RE is still emerging in Indonesia, Elson argued that many of the regulations are not mature enough, which affect the slow development of RE technology. This compels the needs for "ingenuity" and "creativity" of RE players to find a "loophole" in order to survive without breaking any rule. This implies the dysfunctionality of the government support which can be seen in the ineffective regulations and policies, moving towards System I. As mentioned earlier, the regulatory framework also does not stimulate the involvement of private sector because the market is highly regulated, and PLN holds a monopoly. This can hamper entrepreneurial activity, also indicating the existence of System I feature in the regulations.

  According to Torra (2019), the involvement of the public sector in establishing regulations and policies becomes a significant obstacle for off-grid RE development because of the current subsidies and rebates being applied. Indonesia has applied a cross-subsidy, called "One Price Policy" for electricity and fuel. This policy can only be applied since the two state-owned companies (PLN for electricity and Pertamina for fuel) have monopolistic behaviour. This allows them to be compensated for their losses by the government subsidy. The power of PLN to shape the policy can also be seen in MEMR 38/2016, which grants PLN the power to stop an area from being electrified with the claim that PLN has already electrified the area, even if only having an electricity pole (Torra, 2019). This creates an unequal playing field for private actors because they do not have equal access to the same support, then again implying the presence of System I in the market. Instead of encouraging collaboration, the state actors distort the

market with asymmetric competition through imbalanced support. Adi argued that if the subsidy is still that large, RE will be difficult to survive. In Torra's report, it is also stated that *"the Internal Rate of Return (IRR) of such a project (to replace kerosene with solar lanterns) is 0.9%, which is too low for the private sector to be involved in the provision of the service. Whereas, without the subsidy, the IRR could reach 4.7%".*

According to Susanto, the absence of integrated plans for overall electrification in Indonesia is a problem. There is no integrated plan, including on how to electrify the unelectrified villages. Susanto's argument is reinforced by Haning in his ACEF presentation, that there is no clear plan on what to do when the grid arrives in the village since there is no decommissioning plan yet. This creates uncertainty regarding grid extension, as stated in RESCO's case description document that, *"there is no clear roadmap provided by the PLN on which area will be electrified, so investment in off-grid systems can be risky"*. If PLN grid extends to an area where there was an off-grid solution already, this could affect the business severely. Torra (2019) also claimed that the government only focus on short-term political targets without really considering the sustainability of the approach used.

Regulations in Indonesia regarding energy are often conflicting and difficult to apply (3). The instability and inconsistency of formal institutions can be seen in the frequent changes in regulations, policies, and procedures. For example, the replacement of government officials can also replace the existing regulations, policies, and support for RE projects. According to Adi, in 1999, IBEKA could engage the former Minister of Energy and Mineral Resources of Indonesia, Susilo Bambang Yudhoyono, to support the collaboration between PLN and local cooperatives. This effort resulted in the establishment of regulation in 2002, allowing local cooperatives to sell the electricity to PLN as long as the electricity was generated from small-scale RE technology. In an article published in IBEKA's website, the company also executed a program called Patriot Negeri in 2017-2018, that is a community development initiative aimed to improve energy access, environmental health, and food supply in a rural area by engaging the youth. However, the program that initially should be implemented for five years had been cut to only one year due to political contestation. The initiative had been relayed to Empowerment Office because the Energy Office had been shut down. Then, it was merged to the scope of work of the provincial government. This shows the instability of formal institutions and the arbitrary decision-making of the government, adding more presence of System I in this factor.

According to Romijn, this factor is really influencing technology implementation. This factor also includes political aspects, for example, the dynamics during the election year. The frequent changes in policy and regulations create uncertainty among investors. According to Fadhilah, one of the biggest challenges is that there is no integrated planning from the government regarding rural electrification. This can be seen from the different data owned by different

institutions, as each institution uses non-standardized references and indicators in calculating the data. There was a time when the government showed more support for RE, but the support and development scheme will depend on who's in the position. Although hindering regulations and monopoly do exist, Indonesia has started the way towards the transition to RE. PLN and its sub-companies have started several RE initiatives, but not yet on a large scale. This slow transition towards RE is driven by the resistance to change and uncertainty avoidance of the government. This is also one of the STM features regarding attitude over innovation, that is a preference for the status quo instead of innovation, clearly showing the presence of System I. Quoting Indonesian proverbs, "*Tak kenal maka tak sayang*" which means "*do not know, then do not love*", if the government has the willingness to know more about RE and want to try it more, they might love it.

- **Administrative and Bureaucratic Procedures**

  The procedure of doing the administrative and bureaucratic process is often complicated, and time-consuming (4). According to Adi, some regulations can be so complicated and difficult to fulfil, especially for small organizations like IBEKA. He gave an example, *"one of IBEKA's projects in Sumba even took two years only to get the permits".* The company also experienced a 1-year delay for construction due to the complicated and lengthy process to complete legal requirements, causing difficulties to maintain the trust and support of the community. This indicates the pattern of System I in the bureaucratic system. According to Elson, the local government gives its permission for LBN to operate because the government knows that the company is doing community development activities in the area. He stated, as long as the company can fulfil the requirements needed for permits, everything should be alright. Susanto also stated that the key is to understand what the requirements are and make them part of the company's business model. In Susanto's opinion, these difficulties are no more than the typical Indonesian bureaucracy, so the company must understand the requirements and comply with those. Regarding permits, until now RESCO still needs to apply for some permits. Susanto wishes that the legal procedure regarding the business area can be easier for small systems.

  However, the duration and complexities to process the permits are not standardized yet, as they can be different for any case. Zahra told that the licensing process and duration would depend on the readiness of data and money. Sometimes, there are difficulties faced by LBN because it is still unfamiliar with the documents and requirements. The company needs always to adapt and update the license because the regulation is often changing. Zahra also stated that *"it would be easier if a company knows certain people inside the bureaucratic system because the company is more likely to have direct information".* Hence, the vertical network can actually ease the complicated and lengthy process. However, it is not necessarily a bad thing. According to Zahra, the benefit of having this network is to get direct information from the right people. She also told that, on one occasion, the company had to deal with a person asking for a form of "thanks" freely during the licensing process. This was not in the form of money, but

the person asked to get LBN's products instead. Luck is also sometimes needed, as Elson mentioned, *"sometimes, it also depends on the mood of the officers that handle the case".* If the company is lucky enough, particularism and special treatment can be given without a need to have vertical network or relationship within the affiliated institution. For example, Adi told that, in one of IBEKA's projects, even though the permit had not been issued yet, the company could get informal "permission" to do some work while waiting for the permit. This kind of support is really appreciated by Adi because the institution could see the project more than bureaucratic matters. Although Adi claimed that there was no cheating or bribe in the process, this kind of bureaucratic support was risky because it did not comply with the procedure. However, sometimes, leniency is needed in order to deliver greater good, especially in an immature and unsupportive environment. As stated by Kroesen (2019), *"often a timely sin contributes more to change than dauntless political correctness and moral purity".* The story confirms that particularism sometimes happens, showing that System I feature is still firmly entrenched in the bureaucratic system. Sometimes the company can also actively push the government, like in IBEKA's project in Sumba, *"IBEKA has successfully pushed several government institutions to have coordination meeting specially held to accelerate the process of completing legal requirements and support the project".*

Romijn and Fadhilah agree that this factor can be a hurdle for innovation because the typical Indonesian bureaucracy is complicated and time-consuming. The companies usually experience hindrances in permits and take a long time to get them. If they want to apply for the permits, they must comply with the procedures that are not friendly for small actors like them. Therefore, applying for the permits will require a lot of patience and effort.

6.2.3.2 Infrastructure

- **Infrastructure**

  Geographic challenges in remote locations could be a problem to bring innovation to rural people, due to the long-distance, isolated places, and limited infrastructure. Hence, access to the location is limited, and it also requires a long time to reach the area. This creates difficulties to reach the customers and to provide them with the company's products and services. According to Nugroho, this is more difficult for places outside Java island because the people, infrastructure, facilities, and their way of living are different. *"Subsidy will have an important role in this*", he continued. He also added, "*using renewable energy is cheaper, but the initial cost is high because the infrastructure should be built first. But once the infrastructure is available, the locals-only have to pay for the operations and maintenance".* According to Susanto, natural constraints happened a lot when the RESCO team wants to visit a remote village. There are no paved roads, so during rainy seasons, the road will be muddy, while during dry seasons the road will be dusty. He added that the main difficulty in reaching its customers is for travel and logistics to visit the sites where they are providing their services. This is confirmed by Haning that most complaints received by the company are due to delay on visits because of a logistics problem. In some areas, the road even cannot be passed. Sometimes, it requires the

community to work together to open road access. In one of IBEKA's projects in Sumba, to open road access to the construction site, the community had to join hands manually on the rocky and steep hills for almost 4 km, involving men and women from various ages and social strata.

Since LBN deals with local farmers, communication problems sometimes happened, especially for reporting and monitoring. The farmers mostly live in other villages surrounding Ciheras site in which the telecommunication infrastructure is still limited. The difficulty to get signal, combined with limited features of their phone, sometimes make visiting their places the only way to interact with them. However, it would be difficult and time-consuming to visit each of the farmer partners' place. These underdeveloped infrastructure issues show the indication of System I feature in a remote area.

Romijn and Fadhilah agree that this factor could be a barrier for the company because the area is difficult to access. It is essential to define which infrastructures that need to be considered. Sometimes, it requires civil works to build the infrastructure. Fadhilah added that this could be a barrier, not only for the transport system and road access but also for telecommunication. Telecommunication infrastructure is vital for the companies to monitor the performance from afar and manage multiple projects. Lack of infrastructure in telecommunication will lead to a lack of information, which can hamper the business activities.

7 Conclusions

This chapter will conclude the research by answering the research questions articulated in chapter 2 based on the results of the study. The recommendations will be proposed for social entrepreneurs to improve business management. After that, the reflections will also be provided to discuss the limitations of the research, followed by the recommendations for future research.

7.1 Conclusions

This section will present the conclusions of the thesis research by answering the research questions. The sub-research questions will be answered first, followed by the answers to the main question.

7.1.1 The Sub-Research Questions

In section 2.2, there are three sub-research questions that consequently will lead to the answers to the main research question. The findings of the research which are related to the sub-research questions will be discussed below.

- SQ1*: How can critical success factors for the commercialization phase of rural renewable energy which are identified from the basis of the literature, be integrated into a comprehensive research model for the study?*

  From the literature review, 30 social innovation factors relevant to rural renewable energy context were identified. Then, the classification process was done to develop the initial research model. The classification was based on the three levels in Social Transformation Model (STM) developed by Kroesen in 2019, such as individual organization, civil society, and state. This model was chosen because of its comprehensiveness, broadness, and generalizability. This model provided a broader perspective from the organization's standpoint by seeing technology as a resource of the organization; hence inside-out structured insights about the factors were facilitated. The model can also show the transition of the companies between System I (more traditional system) and System II (more modern system) for each factor. Each dimension of the model would be broken down into several categories; then each category would be broken down into several factors. After classification, the initial framework of factors influencing the commercialization phase of social innovation in rural renewable energy context could be derived. This resulted in thirty factors, ten categories, and three dimensions. This preliminary framework of innovation factors would be used as a basis for the empirical study. Then, the factors would be validated through the case study and adapted based on real-life cases.

  Under the "*individual organization*" dimension, there are five categories: vision and mission, human resource, financial, internal business process, and technology. "Vision and mission" category consist of two factors: long-term goals and commitment and planning and targets. "Human resource" category consists of several factors: qualified personnel, learning opportunities for personnel, credibility and capability of the company, decision making,

organizational culture, and role of company leaders. For “financial” category, the factors include initial cost and cost recovery model. For the “internal business process” category, the factors are standard procedures & practices and natural resources. The “technology” category consists of “products and services” factor. For “*civil society*” dimension, the categories are customers, community, network and support, and competition. For “customers” category, the factors are affordability of products/services, technical knowledge of users, benefits for users, and market demands. For the “community” category, the factors are public awareness, community involvement and participation, sense of ownership, and local economic & entrepreneurship development. “Network and support” category consists of several factors: financial support, social capital network, and coordination & cooperation with partners. For the “competition” category, it consists of the “competition” factor. The “*state*” dimension has one category, that is “bureaucracy and policy”. This category has five factors: governmental support, national electricity tariffs set by government, regulations and policies, administrative and bureaucratic procedures, and stability of formal institutions.

- SQ2*: How do the critical success factors for the commercialization phase of rural renewable energy which are explored from the basis of the case study, work in the empirical situation?*

Based on the case study results, the new final adapted framework can be derived. This consists of twenty factors, along with twelve categorizations and three dimensions. This is an iterative process to improve the framework and increase the relevance of a real-life situation. Under “*individual organization*” dimension, the factors are long-term goals and commitment, planning and targets, credibility and capability of the company, organizational culture and environment, qualified personnel, benefits for personnel, the role of company leaders, products and services, cost-recovery model, natural resources and standard procedures and practices. Under the “*civil society*” dimension, the factors are target market readiness, benefits for users/community, community involvement and participation, network and partnership, financial support, and competition. In the “*state*” level, the factors are regulations and policies, administrative and bureaucratic procedures, and infrastructure.

Based on the results of the case study, all the three companies work in between the two systems (System I and System II) which shows that the transition between more traditional approach (System I) and more modern approach (System II) is taking place in the business. For a particular aspect, a company can lean more towards the System I, System II, or somewhere in between. The most important findings of the case study will be presented in more detailed below.

The three companies have a good reputation and credibility, which could influence the trust of other people. The role of company leaders in building a company’s reputation and credibility is crucial. All three companies are led by educated and credible leaders who have access to good

networking opportunities. Although the business focus is different from each other, the three companies have a similar vision, that is community development by utilizing electricity. The three companies have long-term goals as they want to go beyond installing the technology. However, their projects are often restricted by lack of long-term goals and commitment from other stakeholders which usually only have a short-term focus, limited to technology installation. The companies mostly deal with the youth, who are driven more by intrinsic motivation. In general, non-financial benefits (e.g. learning, networking, self-fulfilment) can motivate the employees more than financial benefits. However, the commitment of the employees is often lacking, resulting in high turnover. Top-down grand plan and bottom-up initiatives are equally needed for the companies. The employees can set their own targets which will be discussed in a regular team meeting. The companies, in general, have a flexible and participatory culture, showing the egalitarian approach. However, sometimes, companies might need to give more guidance to their employees. The companies have no well-defined criteria to recruit a candidate and apply a limited number of rules in the company.

Each company runs different kind of RE technology and commercial efforts. Some of them can gain revenue from selling products or services utilizing electricity. Some companies also run diversification of products through agriculture, livestock, speaking engagement, tourism, and so on. Since the companies are targeting people in a rural area, who typically have low purchasing power, they often have to deal with payment issues of the electricity provision. This can impact the community's ability to deliver ideal O&M, as the collective dues amount will be inadequate, reducing the technology's durability. The issues are caused by the lack of ability and willingness of the locals to pay for the fee regularly. There are several causes of this lack of willingness, such as the price comparison with the highly subsidized and considerably cheap electricity tariff of PLN, misperception that the electricity is something that should be given for free by the government, unsuitable payment scheme for the locals, and violation by the operators towards the fee collection SOP due to the family pressure and personal relationships. Hence, income-generating activities need to be included as part of the project by considering local condition variability, so that the ability and willingness to pay of the locals can be boosted.

The locals also have a low educational level, make it challenging to transfer technical knowledge regarding RE. This can lead to a lack of awareness about how to work with the technology, causing incorrect treatment and irresponsible use, which can lead to technical errors and early breakdown of the system. Therefore, the companies have to use appropriate technology that is simple and easy to use, along with clear SOPs. Also, learning of the locals should be a part of the project. Trust issues emerged in the beginning, but the companies managed to gain the trust of the locals by giving positive impact to the community, including involving them in the diversification of its business. The innovation could be more driven if the companies can promote local economic and entrepreneurship development from productive usage of electricity. The locals can get many benefits from using electricity from RE, such as

savings in monthly expenses, learning opportunities, economic development, better education and healthcare, and so on. Community involvement and sense of ownership towards the technology are crucial because the locals will maintain and manage the technology by themselves. The community members will be involved in managing the O&M, determining the tariff and payment system, and managing the revenue from the payment. Sometimes, geographic challenges in remote locations could be a problem in reaching the rural customers due to the distance and underdeveloped infrastructure, be it for road, transport system, and telecommunication.

The companies established a partnership with many parties because rural RE requires joint efforts. It is inevitable that the existence of a vertical network will make it easier for companies to get support and promotion. Personal relationship, in addition to a professional relationship, can also help to build trust and increase willingness to help each other. The companies still need external charitable support because solely relying on tariff payment will not be enough, especially for a major replacement. Unless the companies have a proven viable business model, they will not be able to access external financial sources apart from charitable ones. The scale of rural RE project is small, making it less attractive for the private sector to invest. The absence of an integrated plan for overall electrification also creates uncertainties in off-grid investment and makes the investment riskier. The regulations are not supportive to private RE players due to subsidy and rebates being held for the state-owned institutions (PLN for electricity and Pertamina for fuels) as well as free government programs, creating asymmetric competition through imbalanced support. Even though in some areas the cost of kerosene and diesel can be more expensive, it is still a challenge to educate the customers and persuade them to use RE instead. In processing the permits, the procedures are often complicated and time-consuming, especially for small players. Moreover, the duration and complexities are not standardized. Particularism and special treatment could also present in the process.

- SQ3: *How can the barriers in rural renewable energy be overcome to improve the commercialization phase of the innovation?*

  There are many barriers and challenges faced by RE actors operating in a rural area. In this part, the discussion will focus on the most critical problems in the commercialization phase, particularly in terms of impact on the costs and cost recovery model. Based on the findings of this research, several recommendations can be derived to overcome the main barriers and challenges in managing the implementation or commercialization phase of rural RE innovation. These suggestions aim to be applicable to rural RE actors in general.

Table 9 Overview of barriers and proposed recommendations

Barriers	Details	Proposed Recommendations
The lack of long-term goals, plans, and commitments from other parties (e.g. government, partners)	Many rural electrification projects have a lack of long-term focus, be it from the government, partners, and donors. Usually, the goal is only to install the technology. This can affect the commercialization phase and cost recovery model because there is no clear plan on how to manage the technology after the installation. O&M is overlooked, which can lead to early system breakdown and slow adoption of RE in a rural area.	- For every rural RE project, the goal should be beyond installing the facilities. After-the-launch of technology is actually the most crucial part because technology cannot operate sustainably without good O&M. So, every stakeholder needs to pay more attention to this phase by considering how to manage the technology to prevent early component failures.
	There is no integrated plan from the government for overall electrification. This can affect the commercialization phase as it will create uncertainty in rural RE projects. If PLN unexpectedly enters the area of the project, this will affect the business severely. So, no viable cost recovery model anymore.	- The government should make a clear plan regarding electrification (e.g. how to electrify remote villages, which area will remain off-grid, etc.). This could be done by also involving other forces, for example, by promoting Community-NGO-Public-Private Partnerships (CNPPP). Clear communication on the plan is no less important so that every stakeholder can really understand and play their roles well.
Lack of commitment and compatibility of the employees	High employee turnover can affect the commercialization phase because it will be difficult to manage people that come and go frequently. At least, the learning costs (e.g. training, handover) will present.	- The company needs to find a way to motivate its employees, but that could be another challenge. So, what is more important is to prepare handover policy so that it would be easier and more effective to transfer the knowledge to new people.
	No well-defined hiring criteria can affect the commercialization phase because it will prevent the company from acknowledging the incompatibility of the candidate from the start. Consequently, the company will face high turnover and pay for the costs of hiring a new person which can be a time-consuming process, so it would be better if the companies can prevent this issue from the start.	- The company should consider making well-defined hiring criteria based on its needs. So, it could be known from the start whether the candidates will fit with their jobs or not, which will then save the effort, time, and money to hire a replacement.
Problems in electricity payment by the locals	Even if the locals determine the tariff and payment system by themselves, some people are still unable to pay the subscription regularly. This can affect the ability of the community to provide ideal O&M as the amount will be insufficient, which will affect the durability of the technology.	- Develop the payment scheme that really considers the conditions of the locals, such as harvest time. In this case, the initial research will play an important role. Then, the company can consult the scheme with the locals to make sure that they are willing and able to pay. - Income-generating activities for the locals should be promoted in every RE project so that it will increase the ability to pay of the people in the community. - Since not everybody can afford the payment due to low purchasing power, the local community members can apply cross-subsidy system among them so that those who have lack of ability to pay can pay a lower fee (or even for free) because they will

		be subsidized by other members who have higher purchasing power. This will need financial capacity categorization that can be discussed and decided in a forum.
	Even if they have the ability to pay, some people can still avoid or refuse to pay for the fee. This can affect the ability of the community to provide ideal O&M, which will affect the durability of the technology.	- More enforcement of the rules is needed. If the company is only able to monitor from afar, the company can also involve more local people to help the operators (or even to monitor the operators) in collecting the payment. Local leaders or champions will play an important role in this.
	There is a violation in the fee collection procedure by the operators due to family pressure and personal relations. Sometimes the operators cannot collect the payment to particular people due to personal or family relations. This leads to partial treatment among the community members, which can make the others reluctant to pay for the fee and even can lead to conflict.	- Encourage the community to pay more attention to this by monitoring the operators together. If needed, they can also arrange a meeting/forum to discuss this to make sure that the procedures are really enforced. - The company can also monitor this or even step in, if needed, to help solve the problem that cannot be solved by the community.
	The local people do not always understand the necessity of paying their fees because they feel energy provision is their right and should be given for free by the government. This can decrease their willingness to use the technology or pay for the fee.	- Education and socialization are needed to make people aware so that the misperception can be solved. Local peer-to-peer learning could be a solution to communicate better with the locals, as the people might have a more similar context and language.
The limited capacity, awareness, and responsiveness of the local community	There is a capacity limitation of the locals to understand technology advancement due to the low level of education and technical knowledge. This can lead to a lack of awareness of the locals on how to work with the technology, causing wrong treatment and irresponsible usage, which can cause errors in the technology and early system breakdown.	- Local learning should be a compulsory part of every project. The company (and other stakeholders) is responsible for transferring the knowledge and making sure that the locals really understand. - The company should also use appropriate technology that is simple and easy to use so the community members can operate it by themselves. - The SOPs for the locals need to be very clear and simple because the technology will be handed over to the locals to manage the O&M, and the company can only monitor this remotely. - After the training, the capacity of the locals should be monitored, so other training can be held whenever needed (not only a one-time thing). Local peer-to-peer learning can be applied to increase better understanding as the people will have more similar context, language, and way to communicate with each other. - Learning is also needed for increasing awareness of the locals about the benefits of RE in order to persuade them to use RE instead of other alternatives that might be more expensive
	Lack of feedback loop because local people tend to be passive, and the company might have a lack of initiatives to gain feedback. This can cause problems unsolved which will	- Initiatives from the company to receive feedback from the customers are needed, for example, by a regular visit and to conduct a survey to gain inputs.

	affect the commercialization phase because it will hinder the company from solving the problems and improving its products or services.	- Community involvement from the start of the project is needed to increase their sense of ownership; hence, their willingness to be responsive and proactive. The company should also involve them in a two-way discussion and promote local decision-making.
Dependency on financial support	Difficult for RE projects to self-sustain financially, so there is a dependency on charitable funding, especially for a major replacement.	- In order to be self-sustained, the company can also consider diversifying its business models with other lines of business, which do not necessarily have to be related to RE. This will decrease dependency on external support. The company can involve the locals in this strategy so that it can strengthen the trust, which may solve other issues as well.
	There is a need for a vertical network in getting access to financial sources and other support. This can create a preferential treatment and unequal playing field to sustain in the market.	- This needs to be solved at a higher level. The government and other stakeholders should provide small players with equal opportunities so that there is no need for a vertical network to gain support.
Ineffective and imbalanced support from the government	The imbalanced support to private actors can hinder RE to flourish because it will be difficult for RE actors to survive as they have no access to the same support (e.g. subsidy, regulations) as the state-owned institutions. Because of the subsidy, PLN can apply unrealistically cheap tariff, which creates asymmetric competition for the private sectors. This can make people reluctant to pay for RE tariffs because of the price comparison with PLN's.	- The government should consider giving subsidies to RE as well, considering the impacts and benefits that RE offers. Subsidy to RE can even give much savings for the government compared to fuel subsidy. - The government should promote collaborations between the private and public sectors, instead of distorting the market with unfair competition.
Bureaucratic hurdles in obtaining permits	There are complicated and time-consuming bureaucratic procedures, especially for small actors. This requires expensive costs, not only in terms of money but also in terms of time, patience, effort, paperwork, etc.	- The company needs to understand what the requirements are in obtaining permits to prevent unnecessary rejection. Then, it should follow all the process proactively. - The government should re-consider the existing procedures, realize the hurdles, and improve them so that the process will be more effective and efficient.

7.1.2 The Main Research Question

Social entrepreneurship operating in a rural area is difficult and challenging, especially for the case of rural renewable energy, because the companies are targeting people in a remote community who typically have low purchasing power. They might be not ready to apply commercial scheme in their community. That is why the companies have a high dependency on charitable funding or grants, even after the launch of the technology. The funds or grants will support the projects in advance; however, after 3 or 5 years, it would be another challenge to make the projects sustained. Therefore, companies need to have a cost-recovery model. The cost recovery model of replacing kerosene by RE sources should be possible. In some areas, people have to pay more for kerosene or diesel, so the local community members can save money from replacing kerosene with RE sources. However, it is cancelled out by the obstacles present in the RE business operations, leading to extra costs that the

companies should pay. These extra costs are not necessarily in the form of money, but also in terms of extra paperwork, extra time, lack of cooperation, local learning responsibility, and so on. From the results of this research, it can be seen that the business obstacles present at every level. These obstacles, and extra costs incurred, make the cost recovery model still problematic. The main obstacles affecting the cost recovery model will be discussed below:

- *Individual organization level:*
    - The lack of long-term goals, plans, and commitment can be seen as many projects only have a short-term focus, that is to install the technology, not considering the sustainability
- *Civil society level*:
    - Some people have a lack of ability (or willingness) to pay the regular tariff of the electricity
    - The limited capacity and awareness of the locals could lead to difficult knowledge transfer and incorrect treatment of the technology
    - The dependency on external financial support which is also difficult to access unless the companies have a good vertical network
- *State level*:
    - The ineffective regulations and imbalanced support from the government which are not supportive to private actors
    - The high subsidy to two state-owned institutions (PLN for electricity and Pertamina for fuels) allows them to apply cheap tariff, creating unfair competition for private actors
    - The bureaucratic procedures are complicated and time consuming for small players

Referring to the main research question:

"How can social entrepreneurs successfully manage
the commercialization phase of renewable energy technology in a rural area?"

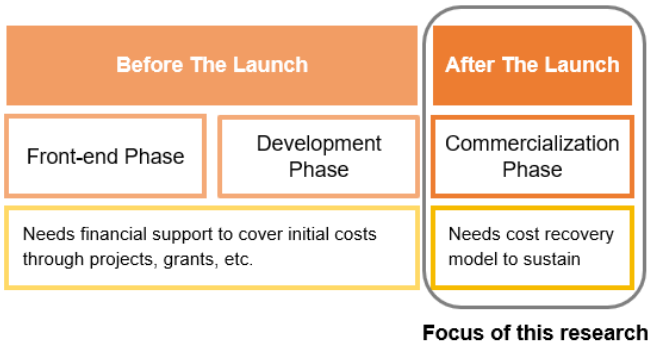

Figure 16 Review of innovation phase

In order to be able to manage the commercialization phase successfully, the business should be self-sustaining. This means that the companies have to apply a viable cost recovery model to eliminate dependency on charitable funding. However, the self-sustaining cost recovery model cannot be applied

immediately, and it will need intervention from many parties. So, establishing collaboration and synergy with other parties are needed. In order to be self-sustaining, the following points can be considered:

- To develop income-generating activities of the locals in the cost recovery model
  The companies can drive the economic and entrepreneurship activities in the village by promoting productive usage of the electricity and empowering local potentials. This community-building approach can also be a strategy to build trust between the local community and the company. This way, their purchasing power and livelihood can be boosted. This can be applied by exploring product diversification through other commercial lines of business.
- To promote community involvement from the very beginning of the project
  It is needed to build a sense of ownership so that the locals will have initiatives to take care of the technology by performing a good O&M; hence the technology can be sustained. Local leaders or local champion will play an important role to promote the projects and to act as a bridge to communicate with the locals, especially about the benefits that the technology offers. So, the companies need to have the ability to gain trust from these “local heroes”.
- Capacity building and learning activities should also be a compulsory part of the project
  The companies are responsible for developing both technical and managerial knowledge of the local community members. This is done to develop their knowledge about technology and how to manage it. Entrepreneurial capacity is also needed to be developed in order to be able to manage the income-generating activities. This needs to be a continuous effort and not only a one-time thing. The companies can also promote peer-to-peer learning to pass one’s knowledge to other members within the same community for better understanding.
- To promote collaboration and joint effort with other parties
  Rural villages, especially the ones without commercial ability, will need more assistance from many parties to run the projects and develop their potentials. Involvement from many parties is needed, so these parties can join hands by giving contributions based on their capacity. Public-Private Partnership (PPP) or even Community-NGO-Public-Private Partnerships (CNPPP) can be promoted. Clear coordination and communication are really crucial in the partnership.
- To apply subsidy for RE sources so that the business can be flourished
  The government could also consider giving subsidy to RE to allow the social entrepreneurs to electrifying the remote villages which have low purchasing power and commercial capacity. This should be attractive since the government can gain savings by shifting (part of) its fuel subsidies to RE. Although, nowadays, the Indonesian government shows more attention towards RE by running and supporting a number of RE initiatives, the transition towards RE is still slow. Hence, the government needs to have a more open attitude towards RE and give more support.

7.2 Reflections and Limitations

This research has enriched the body of knowledge on social innovation within the rural renewable energy domain, especially on critical success factors influencing the commercialization phase. However, this research has limitations.

7.2.1 Reflections on Data Collection

During the data collection period of this study, there are several restrictions to do field visit, which are mainly caused by COVID-19 pandemic. Due to the lockdown situation in Indonesia, the field survey to RESCO and IBEKA were not possible to conduct. However, the field survey to visit LBN site was still manageable because the site was placed in West Java, so it was still reachable by private car (7-8 hours ride from Jakarta) as the only type of vehicle allowed to use. To do this, the health certificate and letter of the assignment should be prepared in order to be allowed to go out of town. Initially, the representatives of local community members were targeted to be interviewed as well. However, because it was not feasible to visit the site, interviewing the local community members were not possible for IBEKA and RESCO. So, the interviews with community members were done only in LBN during the field survey in Ciheras Village.

Additionally, the interview approach is not the same for all interviews. Due to the physical distancing rules, most of the interviews were held online, mainly via WhatsApp or Skype. However, three interviews with LBN participants were conducted face-to-face during the field visit, an interview with the founder of LBN is a combination of online and offline approach, an interview with Managing Director of IBEKA was done offline, and a verification interview with Henny Romijn was also held offline.

Those situations make the data collection approach different for each company. Moreover, each company gave a different response and showed different interest in the research. The Managing Director of RESCO, for instance, suggested to dig deeper on secondary data sources first, and the written answers to the questions were given to fill any unanswered gaps. So, there was no interview with the Managing Director. Since an interview with RESCO's co-founder was already done, the data gained from this interview and the data gained from the exploration of secondary data sources, as well as the written answers from the Managing Director, were combined to get a more thorough understanding. For the other two companies, utilization of secondary data sources was also done to fill any gap if necessary.

7.2.2 Reflections on Data Analysis

Since this research is a qualitative study using interview and multiple case analysis, some limitations are unavoidable. Generalizability was limited because the information is gathered through a relatively small sample. Subjectivity might also be in place. However, the case study provides a vast amount of information and useful insights to draw a valid conclusion.

This research has experienced several improvements, especially in the analysis part. The improvements were based on the integration of the feedback during the meetings with my supervisors. The initial plan was to look for drivers and barriers to social innovation. However, during the journey, the term “drivers” and “barriers” make the framework more confusing, because there will be two different types of factors: one sounds more positive, and the other one sounds more negative. So, in the end, I decided to use a neutral term instead, so it is not “driving factors” or “hindering factors”, but just “factors”, to allow more flexible and general explanation.

Previously, I analyzed each factor based on my own points of analysis, so it is less structured and not supported by a theoretical explanation. I also received feedback that I only show the bright side of the companies. Then, I read Kroesen’s book to dig deeper into the things that can be integrated with my research model. Then, I learned many things from the book, and I found more-structured points of analysis to be a guideline in doing the analysis. I also included the transition theory between System I and System II and tried to apply it at each point of analysis. Then I tried to dig deeper once again in the existing data, while combining it with new points of analysis, and the more extensive analysis could present, along with the new (previously unrecognized) identified problems.

7.2.3 Recommendations for Future Research

For future research, this study could be replicated for various cases of social innovations in order to increase generalizability. The framework derived from this research can also be useful to study other social innovation domains, not only limited to rural renewable energy context. The modification of the framework is also possible to increase the relevance with the context of the study.

One of the limitations of this research is that the companies under study are all good and reputable companies. They are three of the few lucky ones operating in rural renewable energy in Indonesia. It will be interesting to see the findings from the companies that are not that privileged to really know the struggles for these companies, which have more limited resources and network, to survive in the unsupportive market. This can also provide a comparison between different kinds of a company focusing on one sector. The cross-sector analysis will also be interesting to know more about the social innovation factors for different industries. The future researcher might also do a comparative study between the rural and urban area in one specific sector. For example, the future researcher can focus on the renewable energy sector but comparing it between the system in the rural area and urban area to see the differences between the two worlds. This can also be replicated for various cases in other developing countries, such as Vietnam, Bangladesh, or even African countries.

References

ACEF (2017). https://pronto-core-cdn.prontomarketing.com/581/wp-content/uploads/sites/2/2017/01/ACEF-Program-2017_31-May2017_WEB.pdf

Agus, F. (2020). *Kios Energi dan Lentera Penerang Warga Sumba*. https://www.cnnindonesia.com/nasional/20180130040306-20-272496/kios-energi-dan-lentera-penerang-warga-sumba

Alam Hossain Mondal, M., Kamp, L., & Pachova, N. (2010). Drivers, barriers, and strategies for implementation of renewable energy technologies in rural areas in Bangladesh—An innovation system analysis. *Energy Policy*, 38(8), 4626-4634.

Avisena, M. (2020). BPS: Angka Kemiskinan Indonesia Turun Jadi 9,22 Persen. https://mediaindonesia.com/read/detail/283554-bps-angka-kemiskinan-indonesia-turun-jadi-922-persen

Baporikar, N. (2014). Drivers of Innovation, (January 2014), 250–270. https://doi.org/10.4018/978-1-4666-6457-9.ch014

Balachandra, P., Kristle Nathan, H., & Reddy, B. (2010). Commercialization of sustainable energy technologies. Renewable Energy, 35(8), 1842-1851.

Bekkers, V.J.J.M., Tummers, L.G., Stuijfzand, B.G.; Voorberg, W. (2013). Social Innovation in the Public Sector: An integrative framework. LIPSE Working papers (no. 1). Rotterdam: Erasmus University Rotterdam. https://pdfs.semanticscholar.org/e941/41a318649481d4f783aef5dc826f31aa7b9a.pdf

BEPA. (2011). Empowering people, driving change: Social Innovation in the European Union, p. 34. http://ec.europa.eu/bepa/pdf/publications_pdf/social_innovation.pdf

Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. Research Policy 37, 407-429.

Bijker, W. (1995). Of Bicycles, Bakelites and Bulbs. Toward a Theory of Sociotechnical Change. MIT Press, Cambridge, MA.

Blum, N. U., Sryantoro Wakeling, R., & Schmidt, T. S. (2013). Rural electrification through village grids—Assessing the cost competitiveness of isolated renewable energy technologies in Indonesia. Renewable and Sustainable Energy Reviews, 22, 482–496. https://doi.org/10.1016/j.rser.2013.01.049

Bröring, S., Cloutier, L.M., Leker, J. (2006). The front end of innovation in an era of industry convergence – the case of nutraceuticals and functional foods. *R&D Management Journal*, 36 (5): 487-498.

Burki, A. A. & Terrell, D. (1998). *Measuring production efficiency of small firms in Pakistan*. Word Development, 26 (1), 155-169.

Cooper, R. G. (2008). Perspective: The Stage-Gate® Idea-to-Launch Process. *Journal of Product Innovation Management*, *25*(3), 213–232. Retrieved from www.stage-gate.com

DAGI Consulting (2018). *Monitoring & Evaluasi Program Sumba Iconic Island 2018.* https://sumbaiconicisland.org/wp-content/uploads/2015/09/Laporan-Akhir-Monev-SII-2018-Bahasa-Indonesia.pdf

du Preez, N. D., Louw, L., & Essmann, H. (2009). An Innovation Process Model for Improving Innovation Capability. *Journal of High Technology Management Research*, (November 2014), 1–24.

D'Este, P., Iammarino, S., Savona, M., & Von Tunzelmann, N. (2012). What hampers innovation? Revealed barriers versus deterring barriers. Research Policy, 41(2), 482–488. https://doi.org/10.1016/j.respol.2011.09.008

European Commission (2013a). Guide to Social Innovation, p. 6. http://s3platform.jrc.ec.europa.eu/documents/10157/47822/Guide%20to%20Social%20Innovation.pdf

Elmustapha, H., Hoppe, T., & Bressers, H. (2018). Understanding Stakeholders' Views and the Influence of the Socio-Cultural Dimension on the Adoption of Solar Energy Technology in Lebanon. *Sustainability*, *10*(2), 364.

Feron, S. (2016). Sustainability of Off-Grid Photovoltaic Systems for Rural Electrification in Developing Countries: A Review. *Sustainability*, *8*(12), 1326.

Geels, F. W., Sovacool, B. K., Schwanen, T., & Sorrell, S. (2017). Sociotechnical transitions for deep decarbonization. Science, 357(6357), 1242–1244. https://doi.org/10.1126/science.aao3760

Global Energy World Institute. (2009). Wind energy potential in Indonesia. Available from: http://www.geni.org/globalenergy/library/renewableenergy-resources/world/asia/wind-asia/wind-indonesia.shtml as cited from http://www.rsvp.nrel.gov/wind resources.html

Hasan, M. H., Mahlia, T. M. I., & Nur, H. (2012). A review on energy scenario and sustainable energy in Indonesia. Renewable and Sustainable Energy Reviews, 16(4), 2316–2328. https://doi.org/10.1016/j.rser.2011.12.007

Hekkert, M., Negro, S., Heimeriks, G., Harmsen, R. (2011). Technological Innovation System Analysis: A manual for analysts. Utrecht University.

Hekkert, M.P., Suurs, R.A.A., Negro, S.O., Kuhlmann, S., Smits, R.E.H.M., 2007. Functions of innovation systems: a new approach for analysing technological change. Technological Forecasting and Social Change 74, 413-432.

Herstatt, C., & Verworn, B. (2001). *The "Fuzzy Front End" of Innovation*. *Bringing Technology and Innovation into the Boardroom: Strategy, Innovation and Competences for Business Value*. https://doi.org/10.1057/9780230512771

Haxeltine, A., Pel B., Dumitru, A., Avelino, F., Kemp, R., Bauler, T., Kunze, I., Dorland, J., Wittmayer, J., Søgaard Jørgensen, M. (2017). Towards a TSI theory: a relational framework and 12 propositions.

Hirmer, S., & Cruickshank, H. (2014). The user-value of rural electrification: An analysis and adoption of existing models and theories. *Renewable And Sustainable Energy Reviews*, *34*, 145-154.

Hivos. (2012). *Sumba: An Iconic Island to Demonstrate the Potential of Renewable Energy*. Retrieved from http://www.hivos.nl/Campagnes/Energie/Sumba-Iconic-Island/Geen-sprookje

Hivos. (2014). *Stakeholders Report 2013-2014*. Jakarta, Indonesia.

Holttinentt. (2006). Design and operation of power system with large amounts of wind power, global wind power conference, Adelaide, Australia.

Home – IBEKA. (2020). http://3.ibeka.or.id/wp/index.php/en/home/

Indonesia energy outlook & statistic. (2006). Depok, Indonesia: Energy Reviewer, University of Indonesia.

Kaletka, C., Markmann, M., & Pelka, B. (2016). Peeling the Onion. An Exploration of the Layers of Social Innovation Ecosystems. Modelling a context sensitive perspective on driving and hindering factors for social innovation. European Public & Social Innovation Review, 1(2). https://doi.org/10.31637/epsir.16-2.3

Kompas. (2007). Allows development of wind energy. Jakarta: Kompas Cyber Media. Available from: http://www.energi.lipi.go.id/utama.cgi?artikel&1177294977&1

Konda, I., Starc, J., Rodica, B. (2015). Development of Social Innovations And Their Marketing: A Slovenian Case Study. Informatol. 48, 2015., 3-4, 154-168.

Kroesen, J. O., Darson, R., Ndegwah D. J. (2019). Cross-cultural Entrepreneurship and Social Transformation: Innovative Capacity in the Global South. Lambert Academic Publishing.

Kroesen, J. O., Ndegwah D. J. (2016). Economically feasible, but not financially sound? Charity and/or business in rural development. 14th Rural Entrepreneurship Conference, Lincoln Business School.

Lasma Dobele, DR. (2015). Factors which influence the development of social innovation in Latvia. Proceedings of the 2015 International Conference Economic Science For Rural Development, 40, 226-238. https://llufb.llu.lv/conference/economic_science_rural/2015/Latvia_ESRD_40_2015-226-238.pdf

Lentera Bumi Nusantara (2020). http://www.lenterabumi.com/

Luoma, T., Paasi, J., & Nordlund, H. (2008). Managing commercialisation risks in innovation development: linking front end and commercialisation. *In Proceedings of the XIX ISPIM Annual Conference.*

Mair, J., Battilana, J., & Cardenas, J. (2012). Organizing for Society: A Typology of Social Entrepreneuring Models. Journal of Business Ethics, 111(3), 353–373. https://doi.org/10.1007/s10551-012-1414-3

Mulgan, G. (2006). The Process of Social Innovation. Innovations: Technology, Governance, Globalization, 1(2), 145-162. doi: 10.1162/itgg.2006.1.2.145

Murni, S., Whale, J., Urmee, T., Davis, J., & Harries, D. (2012). The Role of Micro Hydro Power Systems in Remote Rural Electrification: A Case Study in The Bawan Valley, Borneo. Procedia Engineering, 49, 189–196. https://doi.org/10.1016/j.proeng.2012.10.127

Murray, R., Caulier-Grice, J., Mulgan, G. (2010). The Open Book on Social Innovation.

MYOK, S., Yatim, B., Daud, W. R. W. (2005). Future directions in Malaysian environment friendly renewable energy technologies research and development. ISESCO, Science and Technology Vision;1:30–6.

Oeij, P., van der Torre, W., Vaas, F., & Dhondt, S. (2019). Understanding social innovation as an innovation process: Applying the innovation journey model. Journal of Business Research, 101, 243-254. doi: 10.1016/j.jbusres.2019.04.028

Osburg, T., Schmidpeter, R. (2013). Social Innovation: Solutions for a Sustainable New York: Springer Heidelberg.

Peranginangin, G. (2019). Frugal Business Model in Energy Sector for Base of Pyramid. Delft University of Technology.

Primadhyta, S. (2020). *Terjerat di Lingkaran Setan Proyek Energi Terbarukan*. https://www.cnnindonesia.com/ekonomi/20180125115623-85-271472/terjerat-di-lingkaran-setan-proyek-energi-terbarukan

Projects Running – IBEKA. (2020). http://3.ibeka.or.id/wp/index.php/en/projects-running/

Purwanto, W. W., & Afifah, N. (2016). Assessing the impact of techno socioeconomic factors on sustainability indicators of microhydro power projects in Indonesia: A comparative study. Renewable Energy, 93, 312–322. https://doi.org/10.1016/j.renene.2016.02.071

Rahman, M., Paatero, J., Poudyal, A., & Lahdelma, R. (2013). Driving and hindering factors for rural electrification in developing countries: Lessons from Bangladesh. *Energy Policy*, *61*, 840-851.

RESCO. (2018). *PT . Renewable Energy Service Company (RESCO) Sumba Terang About Us – Our Vision*.

Resco | Renewable Energy Service Company SUMBA. (2020). http://rescosumba.com/

Resco. (2020). *Lahir untuk Memimpin: Perempuan Teknisi Mendefinisi Ulang Batasan-Batasan*. http://rescosumba.com/lahir-untuk-memimpin-perempuan-teknisi-mendefinisi-ulang-batasan-batasan/

Ritter, R. (2011). *Sumba Iconic Island Project: Scoping Mission on Off-Grid Electrification 02/2011*.

Ryan, F., Coughlan, M., & Cronin, P. (2009). Interviewing in qualitative research: The one-to-one interview. International Journal of Therapy and Rehabilitation, 16(6), 309–314. https://doi.org/10.12968/ijtr.2009.16.6.42433

Safii. (2018). Jonan: Tahun 2019, Rasio Elektrifikasi 99,99%. Kementerian Energi dan Sumber Daya Mineral Republik Indonesia. https://www.esdm.go.id/id/media-center/arsip-berita/jonan-tahun-2019-rasio-elektrifikasi-9999

Sasetyaningtyas, D. (2017). Sustainable business model for off-grid PV electrification in developing country: In the case of Sumba Island, Indonesia. Delft University of Technology.

Schumpeter, J. A. (1981). *The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle*.

Seetharaman, Moorthy, K., Patwa, N., Saravanan, & Gupta, Y. (2019). Breaking barriers in deployment of renewable energy. *Heliyon*, *5*(1), e01166.

Sengupta, S., Sahay, A., & Croce, F. (2017). Conceptualizing social entrepreneurship in the context of emerging economies: an integrative review of past research from BRIICS. International Entrepreneurship and Management Journal, 14(4), 771–803. https://doi.org/10.1007/s11365-017-0483-2

Septania, I. (2020). Indonesia sees growing opportunities in green jobs. https://www.thejakartapost.com/news/2019/07/15/indonesia-sees-growing-opportunities-green-jobs.html

Sijabat, R. (2015). The Role of Social Entrepreneurship in Enabling Economic Opportunities for the Poor: A Synthesis of the Literature and Empirical Works. International Journal of Business and Social Science, 6(11). https://ijbssnet.com/journals/Vol_6_No_11_November_2015/5.pdf

Tim Komunikasi Kementerian ESDM. (2018). Menuju Rasio Elektrifikasi 99 Persen pada 2019. Humas EBTKE. http://ebtke.esdm.go.id/post/2018/04/27/1945/menuju.rasio.elektrifikasi.99.persen.pada.2019

TNP2K - Tim Nasional Percepatan Penanggulangan Kemiskinan. (2016). Meningkatkan Akses Listrik Penting Untuk Kurangi Kemiskinan dan Ketimpangan. http://www.tnp2k.go.id/articles/meningkatkan-akses-listrik-penting-untuk-kurangi-kemiskinan-dan-ketimpangan

Torra, M. (2019). *Sustainable Decentralized Renewable Energy through the RESCO Model in Indonesia*. HIVOS SEA, Jakarta, Indonesia pp. 1-64. https://sumbaiconicisland.org/wp-content/uploads/2019/10/Report_Sustainable-Decentralised-Renewable-Energy-through-the-RESCO-Model-in-Indonesia_final.pdf

Tracey, Paul & Stott, Neil. (2016). Social innovation: a window on alternative ways of organizing and innovating. 10.17863/CAM.7990. https://www.researchgate.net/publication/315877166

Utomo, S. B. (2015). Improving Rural Electrification in Eastern Indonesia through Institutional Capacity Development. International Institute of Social Studies Erasmus.

Yin, R. K. (2003). Case study research: Design and methods (3rd ed.). Thousand Oaks, CA: Sage.

Yin, R. K. (2013). Case study research : design and methods (4th edition). New York: SAGE Publications

Appendix I

Interview Questions

Company Leader – Batch 1

1. What are your goals and dreams for the company that you want to achieve in the future?
   Follow-up questions:
   - *Have you ever have any change regarding direction along the journey of the company? What is it?*
2. Do you prefer to focus on short-term goals (0-1 years from now) or long-term goals (3-5 years from now)? Why?
3. Does your company work with targets? How often do you set and evaluate targets (for example: weekly, monthly, yearly)?
   Follow-up questions:
   - *Is there a planning? What is it? Who makes the planning? Who is in charge to make sure employees follow the planning?*
   - *Do you have to remind your employees oftenly to keep the targets and stick to the plans, or do they do that by themselves?*
4. How many employees did you have when the company was first founded? At present, how many employees (full-time, part-time, and volunteers) work for the company? In your opinion, does the company have enough human resources?
   Follow-up questions:
   - *According to you, what are the most important skills needed for the employees to run the business? Do your employees are sufficient in these skills?*
5. What is your strategy for finding new employees? What are the selection criteria?
   Follow-up questions:
   - *Do you hire local talents? Which positions? How are they performing?*
6. How do you support the personal and technical development of your employees? What trainings do your employees attend? Is it held regularly or once in a while?
   Follow-up questions:
   - *Do you have in-house training sessions and/or external training sessions? Do you work with other NGOs/NPOs/government institutions for personnel development? What are their contributions?*
7. What difficulties have the company faced regarding knowledge and skills for developing technology and running a business? How do you handle it?
   Follow-up questions:
   - *How did you develop your managerial and technical ability? Do you have external support?*
8. What is the company's organizational structure?
   Follow-up questions:

- *Does the company apply any rules (formal and informal)? What are they and why are they needed?*

9. In what ways are your employees or subordinates allowed to make decisions? Can you give an example?

   Follow-up questions:

   - *Do the employees usually show initiatives, or they tend to wait for instruction from their supervisors?*

10. What purchasing scheme (business model) that you apply to your customers? What problems are being faced in relation to the scheme that you are using (example: customers do not pay regularly, etc.)? How do you and the team handle it?
11. Does your company have a standard procedure (SOP) that explains how things should be done? Can you give an example?

    Follow-up questions:

    - *Have these protocols reduce operational mistakes and improve the business?*

12. Have you ever experienced problems with natural resources (for example: obstruction of water flow, gloomy and rainy weather, slow speed of the wind, etc.)? Can you give an example? How does this affect your business?

    Follow-up questions:

    - *If you ever experience it, how do you handle that?*

13. Have you ever experienced interference or technical problems related to the performance and reliability of your technology products? How do you and the team handle it?

    Follow-up questions:

    - *Do you ever have complaint(s) regarding the reliability and performance of the technology? What kind of complaints did you receive? How do you handle that?*

14. Have you ever had a complaint from a customer regarding the affordability of the technology and service offered? What complaints did you receive?

    Follow-up questions:

    - *How much is the tariff? How did you set the tariff? Do you also consider the purchasing power of your customers? Do you think that the tariff is affordable for your customers?*

15. Who are your customers? What difficulties have you experienced in obtaining and retaining customers?

    Follow-up questions:

    - *How do you market your product? What channels do you use to reach and interact with your customers? Are they effective? Why (not)?*
    - *Do you think trust is important in selling your product? How do you gain customer trust?*

16. Have the users of your technological products ever had difficulty in operating the product that you made? How do you provide technical knowledges to users?
17. What are the financial benefits felt by users or community members of the technology products that you make (example: savings from reducing electricity costs, income from productive activities, etc.)? Besides financial, what other benefits do they get?

18. What are the value propositions of the product or service offered (for example: low tariffs, ease of use, etc.)?
19. In your opinion, does the public have sufficient awareness about renewable energy? What do you do to make people aware about renewable energy and especially about the product that you offer?

    Follow-up questions:

    - *Do you think public awareness is important? What is the effect of public awareness to your business?*
20. Are local community members involved in the renewable energy project that you run? In what ways are they involved?

    Follow-up questions:

    - *How important is the linkage to the community for company's success? What are the effects of community involvement and participation to the company?*
21. Do community members have a sense of ownership of the technology that you offer? In what ways do they have that sense of ownership? Are there strategies in place to form the sense of ownership of the community?

    Follow-up questions:

    - *Do the community perform the maintenance and operations by themselves? If so, what sort of maintenance and operations can be done by them? In what circumstances do they call the engineers from the company?*
22. What kind of contribution does the company make in supporting economic activities of the community? Is there an entrepreneurial development supported by the company or the technology?
23. What institutions provide financial support for the company? How is the process of getting financial support?

    Follow-up questions:

    - *Is the financial support enough to support your business and innovation? Is it consistent and sustainable?*
    - *What are the other financial sources of the company, apart from the external support?*
24. In your opinion, is the initial cost to develop the technology high? How long does it take for you to pay off the initial cost?

    Follow-up questions:

    - *How did you get the financial resource to cover this initial cost? Can you explain the process?*
25. What institutions are the key partners for the company? What is their role?

    Follow-up questions:

    - *Do these partners function well? Could you explain how your relations with them work (work on networks, dependencies, loyalties, etc.)? What could be improved?*
26. How does the company maintain coordination and communication with these key partners? What challenges are faced?

Follow-up questions:

- *How did you get in contact with them for the first time? Is it important to know certain people to get in contact with them?*

27. Who are the main competitors of the company? What are the company's competitive advantages compared to these competitors? What is the company's strategy to stay competitive in the market?

    Follow-up questions:

    - *Do you collaborate with your competitors? Do you also work towards a common goal? Would this collaboration be beneficial for the market? Why?*

28. Do government agencies provide support? What kind of support do they provide?

    Follow-up questions:

    - *Could you give some examples how the government is influencing the business practises? What are the effects?*

29. What do you think about the national electricity tariff (state-owned national electricity company's rate) set by the central government? What is the effect of these rates to your business?
30. What do you think of the existing government regulations and policies regarding renewable energy or energy in general? Are the regulations and policies effective? Do you think they are important?

    Follow-up questions:

    - *How strict are the rules?*

31. Have you ever encountered difficulties and complexities related to administrative and bureaucratic matters? Can you give an example (e.g. permits, business license, etc.)?

    Follow-up questions:

    - *How did you obtain your business license and permits? How long does it take?*

32. Since the establishment of your business, how has the replacement of government officials (formal institutions) affected your business? Does the formal institution still run the policy/regulations and provide the same support to your business?

Company Leader – Batch 2

1. How do you start/join the company? What is the story behind it?
2. What are your short-term and long-term goals for the company?
3. How does the company manage the bookkeeping and time management?
   Follow-up questions:
   - *How often do you set and evaluate planning/targets?*
   - *How to make sure the employees follow planning and targets? Are the employees aware of the targets? Do you have to make them constantly aware of that?*
4. How do you gain credibility and trust towards your company?
   Follow-up questions:
   - *Does the company receive positive feedback from the community? Are there sometimes complaints? Are they to the point or misconceived?*
   - *How do you develop your capacity and capability? Do you have external support?*
5. How is the working environment and culture in the company? How do you manage/treat your employees?
   Follow-up questions:
   - *Is it necessary to keep the employees under strict control?*
   - *Does the company apply any internal rules (including working hours, leave permission, etc.)? How do you enforce those rules or give commands?*
   - *In what ways are your employees or subordinates allowed to make decisions?*
   - *Do the employees usually show initiatives (and innovations), or they tend to wait for instructions?*
6. In your opinion, does the company have enough human resources?
   Follow-up questions:
   - *According to you, what are the most important skills that the employees need to have? Do your employees are sufficient in these skills?*
   - *What are the benefits that you offer to your employees, both financial and non-financial?*
   - *How to keep the commitments and motivation of the employees?*
   - *How do you distribute responsibilities among the employees?*
7. What is your strategy for finding new employees? What are the selection criteria?
   Follow-up questions:
   - *Do you face any difficulty to get people to join the company?*
   - *Do you hire employees from mixed background (e.g. tribes, origins, other biographical characteristics)? How to make sure that they can cooperate well with each other (teamwork)?*
8. How do you support personal and technical development of your employees? What trainings do your employees attend? Is it held regularly?
   Follow-up questions:

- *Do you have in-house training sessions? Or do you work with other organizations to provide your employees with training?*

9. What are the products/services (both technological and conventional) that you offer? What are the value propositions of the product or service offered?
10. What is the cost recovery model that you apply? How does it work?

    Follow-up questions:

    - *What are the problems in relation to the cost recovery model that you are using? How do you and the team handle those issues?*
    - *Have you ever experienced these issues below? Is there any other issue?*
        - *Nonpayment issues*
        - *Infrastructure problems*
        - *Suppliers problems*
        - *Governance and regulations*
        - *Internal management culture*
        - *Others: ……..*
11. Who are your customers? Did the company experience difficulties in relation with customers' relationship? What are the difficulties that you ever experienced in obtaining and retaining customers?

    Follow-up questions:

    - *How to introduce your products to these people? What channels do you use to reach and interact with your customers?*
12. What are the benefits (financial and non-financial) felt by users or community members of the products that you provide?

    Follow-up questions:

    - *How to transfer the knowledge to the users? Are these people ready to be trained? Is there any reluctance at first?*
    - *How does the company contribute to local economic and entrepreneurship development?*
13. Are local community members involved in the project? In what ways are they involved?

    Follow-up questions:

    - *What are the effects of community involvement and participation to the company?*
    - *Do community members have a sense of ownership of the project or the technology? Do the community perform the maintenance and operations by themselves?*
14. What institutions are the key partners for the company? What is their role?

    Follow-up questions:

    - *How does the company maintain coordination and communication with these partners? What challenges are faced?*
    - *How do you gain their trust? How do they gain your trust? How important is the personalized relationship with your partners?*

- *How did you get the link to these partners? How did you approach them at first? Is it important to know certain people to get in contact with them?*
- *How many suppliers do you have? Why do you choose them?*
- *How do you make sure your partners keep the agreements? What do you do when your partners make a mistake? How can conflicts be solved?*

15. What institutions provide financial support for the company? How is the process of getting the financial support?

    Follow-up questions:

    - *Is the financial support enough to support your business and innovation? Is it consistent and sustainable?*
    - *Is the financial support easy to access for the company? Do you face any problem?*

16. Who are the main competitors of the company?

    Follow-up questions:

    - *What are the company's competitive advantages compared to these competitors? What is the company's strategy to stay competitive in the market?*
    - *Do you collaborate with your competitors? Do you also work towards a common goal?*
    - *How does this competition? Is it (un)fair? Why? Do competitors take advantage of particularistic relationships and personalized contacts?*
    - *What do you think about the government subsidy to PLN and national electricity tariff set by the government? How does this affect your business?*

17. Do government agencies provide support? What kind of support do they provide?

    Follow-up questions:

    - *Could you give some examples how the government is influencing the business practices? What are the effects?*
    - *How do you gain support from the government?*

18. What do you think of the existing government regulations and policies regarding renewable energy or energy in general?

    Follow-up questions:

    - *Are the regulations and policies effective and consistent?*
    - *How strict are the rules/regulations?*

19. Have you ever encountered difficulties and complexities related to administrative and bureaucratic matters? What are they?

    Follow-up questions:

    - *How did you obtain your business license and permits? How long does it take? How long are they valid? How expensive are they?*

20. How is the infrastructure? Do you face any difficulty with regards to the infrastructure?

Employee

1. Can you introduce yourself?
    - What is your background?
    - What is your position and role in the company or the project?
    - For how long have you been working in the company or the project? Until when do you plan to work here?
    - Can you explain about the project?
2. Why do you join the company or the project? What is your motivation and expectation? Does working in the company meets your expectation?
3. Do you work with targets? How often do you and your supervisor set and evaluate the targets (daily, weekly, monthly, etc.)?

    Follow-up questions:
    - *Do you work with a clear planning? Who makes the planning? Who is in charge to make sure you follow the planning?*
    - *Do you have to be reminded oftenly by your supervisors to keep the targets, planning, and deadlines, or do you do that by yourselves?*
4. What do you think about your workload? Is it worth the benefits provided by the company? Do you think the company have enough human resource?

    Follow-up questions:
    - *What are the (financial and non-financial) benefits provided by the company?*
5. What are the difficulties in doing your job, especially in terms of knowledge and skills?
6. How about the hiring process? What is the requirement and the criteria?

    Follow-up questions:
    - *Do you have specific job descriptions and responsibilities for your function?*
    - *How are the tasks assigned to you? Do you think the tasks assigned to you are suitable with your skills and expertise? Have you ever been assigned a task that you cannot handle because of lacking skills? What do you (or the company) do about that?*
    - *Do you cooperate well with other employees? Do you face any difficulty? Is there any difficulty to cooperate with other employees from different backgrounds (gender, age, ethnical background)?*
7. What kind of learning experience that you get (e.g. trainings, workshops, etc.)? Which trainings have you followed?

    Follow-up questions:
    - *How many trainings do you get? Are they held regularly or occasionally?*
    - *Do you get in-house training sessions and/or external training sessions? Who provides them?*
8. How did the company develop its managerial and technical ability? Does the company have external support?

9. What is the decision-making approach that is implemented by the company? Does the company involve you in making decision? Do you actively give suggestions?

   Follow-up questions:

   - *Is showing initiatives and discussion valued by your supervisors/managers? How do they respond to these initiatives and discussions?*
   - *To what extent are you allowed to make your own decisions? Could you give some examples?*

10. What does the structure of the organization look like? Where is your position in the structure?

    Follow-up questions:

    - *How do you communicate with your supervisors? How do you communicate with other employees?*

11. Does the company apply any rules and regulations? What are they? Do you think they are important and sufficient? Why?

    Follow-up questions:

    - *How strictly are these rules applied? What will happen if you don't follow the rules?*

12. What do you think about the company leaders? Do you think you can look up to him/her? How does he/she gain your trust?
13. What is the business model that is applied by the company? Do you ever see any problem regarding the scheme applied (e.g. customers do not pay regularly, etc.)?
14. Does the company have standardized procedures and practices to do operational activities? What are they?

    Follow-up questions:

    - *Do you work based on these protocols? Do you think these protocols are important and sufficient? Why?*
    - *Have these protocols reduce operational mistakes and improve the business?*

15. Do you ever experience natural resource constraints? If you ever experience it, how do you (or the company) handle that?
16. Do you ever have any technical problem on the technological product that you run (regarding performance, reliability, etc.)? How do you handle that?

    Follow-up questions:

    - *Do you ever have complaint(s) regarding the reliability and performance of the technology? What kind of complaints did you receive? How do you handle that?*

17. Do you ever have complaint(s) from customers regarding the affordability of the technology? What kind of complaints did you receive?

    Follow-up questions:

    - *How much is the tariff? How did you set the tariff? Do you also consider the purchasing power of your customers? Do you think that the tariff is affordable for your customers?*

18. Do the users experience any difficulties to operate the technology? How does the company transfer the technical knowledge to users?

19. What are the (financial and non-financial) benefits experienced by the customers from using the technology (e.g. savings from energy cost reduction, income from productive activities)?
20. Who are the costumers of the company? Which groups are targeted? Is there any problem to get the customers?

    Follow-up questions:

    - *How do you market your product? What channels do you use to reach and interact with your customers? Are they effective? Why (not)?*
21. Is the community involved in the project? To what kind of involvement?
22. Does the community have sense of ownership for the technology? In terms of what?

    Follow-up questions:

    - *Is there any strategy implemented to create sense of ownership of the technology to the users? How can you improve this?*
    - *Do the community perform the maintenance and operations by themselves? If so, what sort of maintenance and operations can be done by them? In what circumstances do they call the engineers from the company?*
23. What kind of contribution of the technology or the company in supporting economic activity of the community? Is there any entrepreneurship development supported by the technology or the company?
24. Who are the key partners of the company? What are their roles?
25. How is the coordination and cooperation with these partners? How does the company communicate with them? Is there any problem with the coordination?
26. Who are the (main) competitors of the company? How is the competition?
27. Does the government give support? What kind of support that they give?

    Follow-up questions:

    - *Could you give some examples how the government is influencing the business practises? What are the effects?*

Local Community Member (Farmer Partner)

1. Can you introduce yourself?
    a. What is your background? (name, occupation, age, etc.)
    b. For how long have you been in the community?
2. Can you explain about your job(s)?
3. Why did you join this job? What is your motivation and expectation? Does the reality meet your expectation?
4. How long have you been working for this job? Until when do you plan to do this?
5. What kind of contribution of the company in supporting your job?
6. What are the roles of the company in improving social and economic condition in the village?
7. What do you think about this job? Is it profitable?
8. How much revenue that you could get from this job?
9. Who are your costumers? Do you have any problem to get the customers?
10. Do you ever experience any problem or difficulty in doing your jobs? What are they and how do you handle them?
11. Does the company (LBN) provides you with learning activities? What are they?
12. Is there any agreement made between you and the company? What is it and what do you think about it?
13. Do you have any idea or solution to improve current situation?
14. Is there any driving or hindering factor that influence your job? What is it and why do you think it is an influencing factor?

Verificator

1. Can you introduce yourself? What is your background and expertise?
2. What do you think about each of these factors? (explaining the main takeaways for each factor first, based on the case study results)

Factors	Category	Dimension
Long-Term Goals and Commitment	Vision and Mission	Individual Organization
Planning and Targets		
Credibility and Capability of The Company	Organization	
Organizational Culture and Environment		
Qualified Personnel	Human Resources	
Benefits for Personnel		
Role of Company Leaders		
Products and Services	Technology	
Cost Recovery Model	Financial	
Natural Resources	Internal Business Process	
Standard Procedures and Practices		
Target Market Readiness	Customers	Civil Society
Benefits for Users or Community		
Community Involvement and Participation	Community	
Network and Partnership	Network and Support	
Financial Support		
Competition	Competition	
Regulations and Policies	Bureaucracy and Policy	State
Administrative and Bureaucratic Procedures		
Infrastructure	Infrastructure	

3. Do you have any recommendation to overcome the challenges or barriers?
4. Do you have any ideas or suggestions to improve this research?


TU Delft