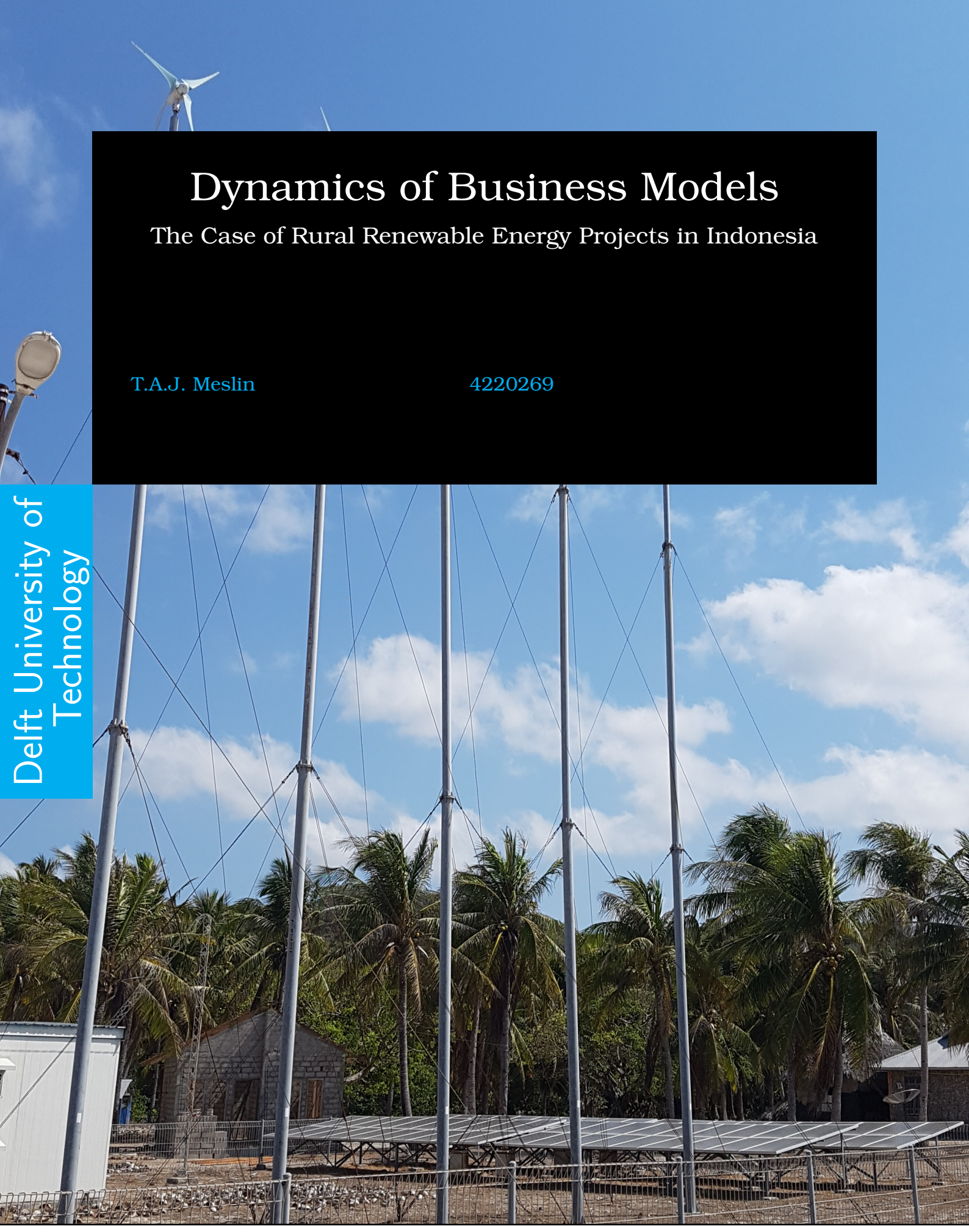

Dynamics of Business Models

The Case of Rural Renewable Energy Projects in Indonesia

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Delft University of Technology

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Dynamics of Business Models

The Case of Rural Renewable Energy Projects in Indonesia

November 25, 2019

by

T.A.J. Meslin

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Master of Science
in Sustainable Energy Technology

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Preface and Acknowledgments

Having been raised on the island of Bali in Indonesia for the first 18 years of my life, I have always been aware of the country's vast and abundant natural resources. Yet it is only after starting my Master's in Sustainable Energy Technology that I truly realized Indonesia's potential, specifically regarding sustainable energy. There is therefore special significance in the fact that I chose Indonesia as a country for my case study, as I truly believe that with its amazing potential, sustainable energy can be used to bring benefits to a great amount of people and to the country as a whole, but also hold the country dearly in my heart and thus hope to use what I have learnt throughout my studies to help in its betterment.

This work is the result of several months of arduous conceptualization and research followed by several more months of writing down and refining thoughts and concepts. The whole process was something completely new to me, as I had of course written a great amount of reports before, but never of this scope or size. It was one of the most valuable learning experiences of my life, especially considering that the meat of the topic was one I was quite new to at first. Needless to say it was a journey I was only able to embark on thanks to the endless support of my friends and family. In particular, I would like to thank my parents for always believing in me and encouraging me every time they knew I needed it, and my two sisters for always being there when I needed someone to talk to.

I would also like to thank all of my thesis committee, for their priceless feedback and constant kindness and support. Talking to them was always a pleasure, getting to go over ideas and concepts with people so well versed in the topic at hand. Fisrtly, I would like to thank Roland Ortt for agreeing to chair the thesis committee. His great insights into the topics of our conversations were always enlightening, and his passion for the topic was contagious. Secondly, I would like to thank my secondary supervisor, Linda Kamp, for being there to give me her opinion and advice when I started conceptualizing the topic of my thesis, pointing me in the right direction and then continuing to give me her feedback throughout the whole process. And finally, I would like to thank my primary supervisor Hanieh Khodaei, for guiding me the rest of the way with such energy and positivity. I would always come out of our meetings with more enthusiasm and joy towards the topic of my thesis. I could not have asked for a better thesis committee.

Next, I would like to thank Leonie Boortman, for being there to help me when I faced with hard times, and for inviting me in her graduation group, where I got to meet and talk to other students that were struggling with their thesis. My conversations with Leonie and with the members of the graduation group were my best source of self improvement and really helped in me tackling the issues I was dealing with.

I would like to thank all of the interviewees for agreeing to meet with me and answer my questions. Their answers and insights were invaluable in shaping this thesis and I could not be more grateful to them for their willingness to help me on this journey.

I would also like to thank Leon Pulles, for giving me some advice on how I should perform my interviews and for his interest in the topic of renewable energy in Indonesia, on which we have spoken several times. His experience, coming from someone who has long worked in the field, is a great source of information, and I am grateful to have been able to talk to him about such topics.

Finally, I would like to thank all of my friends, here in Delft and all around the world, for walking with me, for at least part of the road, on this long journey we call life. Our paths may diverge but I faith that they will cross again. In particular, I would like to thank Julien, for giving me an office to work in during the time I was in Indonesia for my interview, and always pushing me to do my best, and my roommate Andrei, for being there to bounce ideas with and for having someone to talk to when I just needed to discuss a certain aspect of my thesis.

Delft, November 2019

Theo Meslin

Abbreviations

AC	Alternating Current
BM	Business Model
BMC	Business Model Canvas
BMF	Business Model Framework
BoP	Bottom of the Pyramid
CC	Choice-Choice
CF	Choice-Forced
COD	Commercial Operating Date
CRS	Cost & Revenue Structure
DC	Direct Current
EPC	Engineering, Procurement and Construction
FC	Forced-Choice
FF	Forced-Forced
GoI	Government of Indonesia
IDO	International aid and Development Organizations
IPP	Independent Power Producer
IR	Interrelationship
MoU	Memorandum of Understanding
PLN	Perusahaan Listrik Negara
PV	Photovoltaic
RE	Renewable Energy
REC	Renewable Energy Company
Ref	Reference
SET	Sustainable Energy Technology
VN	Value Network
VP	Value Proposition

Glossary

Hedonic	Relating to, characterized by, or considered in terms of pleasant (or unpleasant) sensations.
Utilitarian	Designed to be useful or practical rather than attractive.

Executive Summary

Indonesia is a country that boasts a great wealth in renewable energy resources and that has been recently motivated to reach 100% electrification as well as increase its share of renewable energy. Despite this fact, it is also one of the main consumers of fossil fuels in the region as well as the biggest energy user amongst countries in the Association of South East Asian Nations. in order to address electrification and the deployment of renewable energy, the rural market in particular needs to be addressed. This market, especially in Indonesia, has several challenges, such as isolation from highly populated areas, and low income in these regions, which makes financial viability difficult. To address these problems, the rural renewable energy market is looked at from the perspective of Business Models, specifically in terms of their dynamics. From the literature, Business Models offer the best representation of business elements and business logic, while the dynamics of Business Models offer the best understanding of how these elements interact and how they change over time. While Business Models have been widely accepted as a framework to be used by managers and entrepreneurs, dynamics are rarely included in these frameworks. The problem also lies in the lack of research on Business Models for this specific application as well as on Business Model dynamics in general.

Considering this lack of research and the importance of the Business Model framework as a tool for analysis, the study focuses on developing the research on Business Model dynamics, specifically for the case of rural renewable energy projects and looking at Indonesia in particular. This leads to two main research questions: "What are the dynamics of Business Models for renewable energy systems in rural communities?" and "What are these dynamics for the case of Indonesia?". To answer these research questions, the dynamics of Business Models are separated into their different aspects, each reflected in its own sub-question. These components include internal and external elements, interrelationships between elements and changes over time. Beyond these aspects of Business Model dynamics, the objective is also to develop a framework of Business Model dynamics that can be used both for analysis and Business Model creation and development. To do so, the research is separated into four main parts: the literature study, the development of the conceptual model, the case studies and the comparison of the conceptual model and case study.

To start with, the literature study covers information on the Indonesian renewable energy scene, Business Model components, Business Model dynamics and its various aspects. It is found in this literature study that the three main components of Business Models that can be seen as universal are the Value Proposition, the Value Network and the Cost & Revenue Structure. The subsequent Business Model dynamics are given based on these three main components. The literature study then looks specifically at the case of renewable energy companies. It gives the main components of this type of Business Model, the main external factors affecting these components, the main interrelationships between these components and the main changes occurring to this type of Business Model over time. Some underlying relationships are also uncovered between elements of the Business Model that affect the tendencies of the elements to influence one another, such as the Value Network being necessary for the provision of the Value Proposition, which results in the Value Network often being forced to change as a result of a change in the Value Proposition.

The literature study is then used as a basis for the development of the Business Model dynamics framework. This framework gives components of Business Models for rural renewable energy projects, causes for their change, their interrelationships and a graphical representation of Business Models over time. The interrelationships between Business Model components are classified based on if the changes are forced or strategic changes. Through this classification, it is found that the Value Proposition tends to force a change in both the Value Network and the Cost & Revenue Structure but that changes in the Value Network will usually lead to a choice to change the Value Proposition. On the other hand, a change in the Cost & Revenue Structure usually forces a change in the Value Proposition. The framework is also operationalized to enable managers or entrepreneurs to better account for dynamics when setting up or modifying an existing Business Model. This operationalization consists of a set of questions that the user of the framework can ask himself about the selection of certain Business Model components and their relationship to other Business Model components. Relating back to the objective of uncovering the Business Model dynamics of rural renewable energy projects, the development of this framework not only provides a tool for analysis to be used in better understanding these dynamics, it can

also be used as a tool to convey and share this information more concisely. This is used to focus the answering of the research question to a specific formulation of Business Model dynamics and do so in an effective manner. Overall, the framework provides a guideline for the classification of components, a graphical representation of changes to Business Models over time that can be used to both convey and analyze information, and a tool that can be used by researchers to compare data or for managers to develop their own Business Model.

The development of the framework is followed by a case study of Indonesian renewable energy companies involved in the rural sector. It is found in this section that there are trends not only in the components of Business Models for rural renewable energy projects, but also in their dynamics. In the case of Business Model components, it is found that they tend to have similar Customer Segments, such as NGOs, commercial entities, government organizations, local communities and individuals. They also mainly offer the same types of Value Offerings, with variations mainly in the different applications they offer for the renewable energy systems (water pumping, reverse osmosis or cold storage). For the case of trends in the dynamics of their Business Models, an example is the fact that all of the companies changed their Value Proposition at least once. In one company, by improving the battery technology being used, but in all three of the other companies, by applying renewable energy technology to a specific application. Other trends were found, such as the fact that all but one company improved their collaboration with local communities, or in the fact that all of the companies mainly changed their Value Proposition or Value Network but never changed their Cost & Revenue Structure if not as a response to a change in another component. Changes that started in the Value Network mostly had to do with partnerships being formed with other companies or organizations. In the cases, two of the examples were suppliers, one was a financial company and one was local developers. It was also found that all interviewees considered policy to be the main potential external influencing factor to the Business Model of their company. This was seen in the cases with most of the companies moving to the private on-grid market when policy allowed for it.

Finally, the framework is improved based on the comparison between the data obtained in literature and the data obtained from the case studies. It is found that although there is a large overlap between the results of the literature study and the results of the case studies, some additions can be made to the framework based on the case studies. This indicates the importance of case studies in providing additional data that may not be found in literature. This comparison and further analysis of the framework also resulted in an improvement of the representation of changes over time. This new representation makes use of a single time axis to represent changes in all of the three components of the Business Model over time, allowing for a clearer representation of change in the different components relative to one another.

The applications that this work can have for researcher is in the different perspective it brings regarding the analysis of Business Model dynamics. To start with, the framework proposes a unifying division of Business Model components that is heavily based on past literature and offers three broadly applicable components. The benefits of this unifying division are also use on the classification of the interrelationships between Business Model components. Having these unifying classifications allows researchers to more easily compare results with other people using the same framework. Another benefit of the framework lies in its use of past data to get a clearer image of common and uncommon elements by quantifying their rate of occurrence within data sets. This allows researchers to more easily find trends within certain markets, which is also helped by the framework identifying the types of markets that certain data sets belong to. More broadly speaking, the implication of this work for researchers in the field is that the development of more accurate representations of Business Model dynamics and a deeper understanding of these dynamics in the context of their initial causes requires more research on the developments of actual companies over time. This work can then be used as a basis for how such an analysis of companies and their development over time could be performed.

For managers and entrepreneurs, the benefits of the work can be seen from two perspectives. In the first case, the framework developed in this work offers a tool that can be used for the development or improvement of Business Models to account for their dynamics. On the other hand, it can be said that the benefits this framework would give to researchers will also be beneficial for managers and entrepreneurs. Indeed, if the tools and frameworks used for the analysis of Business Model dynamics become more standardized, the data obtained from these becomes easier to analyze as a whole and individual cases become easier to compare. On another level, it could even be argued that just through the developing of literature on Business Model dynamics and the analysis of companies and how they change over time, managers and entrepreneurs can learn more from such studies about how these dynamics work. In particular, this work brings up certain areas of the Business Model that deserve special attention on the part of managers, namely the types and effects of initial causes for changes in the Business Model, and the intrinsic relationships between components that will lead one change to cause another.

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Chapter 1

Introduction

In this Introduction, some background information on relevant topics will be given, from which the research problem will be derived. The research gap that relates to this problem will then be identified as well as the research objective to fill the research gap and resolve the research problem. The scope of the research will then be more clearly outlined, as well as its relevance for different applications. Finally, the methodology that will be used to perform the research will be given, followed by an outline of the whole Thesis.

1.1 Background

To have a better understanding of the reason for this research, and the reason for its particular focus, different topics must be looked at. First, about the context of renewable energy in Indonesia, as that is the industry this paper focuses on. Then, some information about the BoP (Bottom of the Pyramid) market, as that is the most common market for rural projects. And finally, information about Business Models, as they are the framework through the lens of which these types of projects will be analyzed.

1.1.1 Indonesia's renewable energy scene

First of all, Indonesia is the most important energy producer of the Association of South East Asian Nations (ASEAN), representing about 40% of their combined energy production (IRENA, 2017). This energy consumption is also continuously growing, it has increased an impressive 44% between 2002 and 2012 and has continued increasing by about 5-6% per year in the past decade (Reber, Burman, & Hirsch, 2016). Also, despite having the seventh lowest share of fossil fuels in its Total Primary Energy Supply (TPES) among member countries of the International Energy Agency, it is conversely the sixth biggest CO2 producer in the world and its share of renewable energy in TPES has actually reduced from 37.5% to 33.5% between 2002 and 2012 (Florian Kitt, et al., 2015).

This is especially concerning when considering the fact that Indonesia has long been a proponent of renewable energy development. This started from the mid 1980s until the end of the 1990s with the first foreign grants and technical assistance in renewable energy projects, leading up to a collaboration between the GoI (Government of Indonesia), the World Bank and the Global Environmental Fund (GEF) on a solar home system project just before the Asian financial crisis of 1997 (Tumiwa & Rambitan, n.d.). Some laws were then put in place such as the Presidential Regulation on National Energy Policy in 2006, which stipulated a goal of about 15% renewable energy by 2025 (IEA, 2006), or the Energy Law No. 30/2007, which one year later gave more information on the regulations related to setting up a renewable energy system, including the more important role of local governments in granting licenses and supervising energy generating projects in their region (IEA, 2007). In 2010, the GoI established the Directorate-General of New, Renewable Energy and Energy Conservation (DGNREEC) within the Ministry of Energy and Mineral resources (MEMR) (Florian Kitt, et al., 2015) to facilitate the implementation of energy efficient projects.

This increased interest on the policy side of renewable energy in Indonesia has been a primary focus of many research papers and reports on Indonesia's renewable energy scene, including IRENA's REMap 2017 (IRENA, 2017) and has been reflected in the increased number of renewable energy policies that have surfaced in recent years (Tumiwa & Rambitan, n.d.). Apart from policy, most of these reports on the current state of renewable energies in Indonesia focus on the fact that financing is lacking dues to this lack of policy. Although this might be true to some extent, some other factors have been highlighted, for example, a report on renewable energy in remote Indonesian grids concludes about such projects that: "site- and community-specific project sustainability strategies will be required for long-term success of these projects. This includes a business plan, an ownership

structure, payment mechanism, an identified "project champion" and viable business entity to conduct ongoing operations, maintenance, troubleshooting, bill collection, and community education and outreach." (Hirsch et al., 2015, p.46). This goes to show that although there is a lot of focus on financing, there is some awareness that sound Business Models are key to the sustainability of such projects. But beyond the general methods to be used for the diffusion of Renewable Energy in Indonesia, there is the more pressing problem that when looking specifically at rural communities, these will usually be part of the BoP.

1.1.2 Bottom of the Pyramid

The term Bottom of the pyramid refers to the largest but poorest socio-economic group and was popularised by C. K. Prahalad in his 2004 book "The Fortune at the Bottom of the Pyramid" (Prahalad, 2004). The idea behind the book was that there could be a win-win situation established between companies and consumers in low-income communities which would yield profits for the companies while helping reduce poverty and providing goods and services at an affordable price. Although this may be true, there is also the case that BoP communities can be exploited by companies focusing on monetary profits (Bharti, Sharma, Agrawal, & Sengar, 2014).

This is where a distinction can be made between a utilitarian product or service and a hedonic one. The simple difference between these two types is that a utilitarian product or service will have a productive purpose, whereas a hedonic product or service will cater to the emotional side of consumers. The case of Renewable Energy for example is mainly utilitarian, as it is mostly used to power lights, machines, computers or other devices that can benefit the individuals or communities using them. One could argue the case that using it for things such as televisions or other entertainment devices would be mainly hedonic, but some arguments can still be made for their utilitarian purpose (emergency warnings, educational documentaries, language developments, etc). The disadvantage of hedonic products is that in poor communities, any disposable income that goes to such products would otherwise have gone to buy more essential goods such as food and water (Agnihotri, 2013).

Such drawbacks have to be considered by businesses looking to cater to this market. They are what you would call "social costs", the negative effects on the serviced community. On the other side of the coin, businesses can also investigate the potential "social revenues". For example, employing members of the community and offering schooling for their children would lead to positive developments in the community. Aiming at generating both monetary and social revenue goes a long way towards attaining the win-win situation between company and costumer that Prahalad predicted.

There are several points to be made about this "social value" to be added by projects in BoP markets. The first thing is that a deeper understanding of communities in such markets is necessary to uncover what value can be created and added to the society (whether it be monetary or social). This is partially due to these communities usually being more diverse and fragmented, as was observed in the case of India: "By virtue of lower levels of integration with the national economy, lower literacy levels, and lower levels of physical and digital connectivity" (Lakshman, 2015, p.114). Added to this is the fact that customers in BoP markets are usually more "value conscious" due to the necessity for them to spend their income wisely (Beninger & Robson, 2015). This brings us to the second point, the fact that social value can either be created as a conscious objective or as an organic part of the business model (Sinkovics, Sinkovics, & Yamin, 2014). According to Sinkovics et al, the organic integration of social value into the business model has the advantage of having spill-over effects on younger generations through access to education, health-care and other benefits.

Now that it is more clear why BoP markets require special considerations, and how businesses can go about better catering to them, this leads to the question of the importance of Business Models in this role.

1.1.3 Business Model

The term Business Model was not well defined until the last decade or so (Morrisa, Schindehutte, & Allen, 2005; Zott, Amit, & Massa, 2011), in which some attempt was made to develop some form of coherent framework that could be used by companies to better capture value (Teece, 2010) through their product or service. It was formally defined by two experts in the field, Christoph Zott and Raphael Amit, as: "The content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities" (Zott & Amit, 2001, p.511). This is a rather broad explanation but explains quite well the purpose of a Business Model: to map out the inner workings and external actions a business must undertake to create value in a way that generates revenue. As this concept was further developed, tools were created to aid in the creation of a sound Business Model, such as the now well known Business Model Canvas (Osterwalder, Pigneur, & Clark, 2010). This canvas gives the 9 main elements that must be taken into considerations when creating a business. These are:

- **The Value Proposition:** This is the unique value of the service or product the company provides. It is the main selling point of the company and usually what sets it apart from other companies. For example, Mcdonald's Value Proposition would be "affordable quick food with consistent quality."
- **The Key Activities:** These are the main activities the company will need to perform to produce, distribute and maintain their product or service. For example, Facebook's Key Activities would be to maintain and update their website and data centers as well as marketing their services.
- **The Key Resources:** These are the main resources the company will need to create the product or service they provide. For example, a car manufacturing company would need materials, manufacturing machines, warehouses, vehicles for distribution, personnel, etc.
- **The Key Partnerships:** These are the main partnerships that will be required to produce or distribute their product or service. For example, a company such as Airbus will have partnerships with other companies building smaller components of airplanes, but also with universities and Research/Engineering organizations.
- **Customer relationships:** These are the types of relationship that are developed with the customer depending on the product or service provided. Is the only relationship with the costumer the selling of the product? Or is there some form of community building (i.e: constant communication between the company and users of the product/service) or other interactions with the customer afterwards? For example, banks need to be able to keep customers updated with the current status of their account as well as enable them to arrange meetings with them in case of fraudulent use of their account or if they would like to make any changes to it.
- **Customer Segment:** This is the market demographic that is targeted by the product or service. This segmentation can be done on various different criteria such as age, income, hobbies and interests, etc. Doing so allows for a more effective marketing campaign and definition of the product/service. For example, in the case of Barbie dolls, the Customer Segment would be young girls.
- **Channels:** These are the methods and services used to get in touch with the customer. This can be be for informing them of the product/service provided (marketing) or actually distributing this product or service to them. For example, the Channels for 7/11 would be its distribution infrastructure and network of mini markets.
- **Cost Structure:** This is an overview of all the costs that will be incurred by the company for the creation of the product or service and its maintenance after sale. For example, a company like Apple needs to cover the costs of production for its devices (materials, labor, location, machinery) but also for the distribution of the product from the manufacturing site to their stores, for the maintenance of their servers and for the costs of their advertising.
- **Revenue Streams:** This is the way in which the company actually makes a profit. It looks into the different aspects of revenue, such as what value the customers are willing to pay for (relates back to the value proposition). It asks how much they are currently paying for this value (pricing). Finally it determines how many potential sources of revenue there are and how much they will provide all-together. For example, a product like coca-cola will obtain most if not all of its revenue from the sale of its product alone while a web services such as Youtube will obtain most of its revenue from advertisement on the site.

From all these elements, we can see how starting with a Business Model prior to launching a big project or company can significantly reduce the risks involved. For example, knowing exactly what Revenue Streams are available in a certain Customer Segment allows to choose an appropriate Value Proposition. Or vice versa, knowing the Value Proposition helps in establishing what revenue streams are available from it. There is much less chance of a mismatch between the different components crucial to the functioning of a company when the bigger picture is established beforehand. For example, consider a fishing village which does not have the means to refrigerate their fish and so have to throw what they cannot sell. The wasted fish becomes a potential source of revenue that can be exploited with a value proposition such as providing solar powered fridges. Here a guaranteed interest in the product would be created by its immediate applicability in generating its own revenue. This goes back to the advantages of utilitarian products over hedonic ones.

Interestingly enough, although this seems to be one of the more obvious characteristics of a Business Model, it is only recently that there has been an attempt to empirically determine the effect of such models on firm performance (Pucci, Nosi, & Zanni, 2017). Up to this day, literature on the subject either focused on better defining Business Models (Teece, 2010) or on analyzing their development in the context of continuous innovation (Amit & Zott, 2012).

A particular paper (Gerdoçi, Bortoluzzi, & Dibra, 2018) analyzed this causality with respect to two main types of Business Models: Efficiency centered and novelty centered (Zott & Amit, 2007). This makes sense when considering that those are the two main elements relating to the relationship between a firm and the market it's in. Mainly, that in order to be competitive, and thus sustainable, a firm either has to offer the same product or service in a more efficient manner, or offer a novel product or service than its competition. The main takeaways from this paper are: firstly, that Business Model novelty has a positive effect on firm performance and secondly, that the combination of the two Business Model themes can also have a positive effect on performance. This is relevant to the purpose of this study because it verifies the assumption that a sound model for value creation has a positive impact on future performance. Also, for the case of combined efficiency and novelty centered Business Models, it is interesting to note that renewable energy projects, specifically for rural applications, are both more economically efficient and novel compared to their fossil fuel based counterparts. This being the case, a recent paper on Business Model design and performance of SMEs subdivided the novelty centered Business Model into Business Models focused on innovations and new products, Business Models focused on the search for operational efficiency and Business Models focused on the creation or innovation of markets(Pucci et al., 2017).

Though when looking at Business Model types for renewable energy specifically, a different distinction is made, based on the Pricing Strategy employed. In the past Master's thesis on the creation of a Business Model for the island of Sumba (Sasetyaningtyas, 2017), the distinction is made between ownership and service Business Models. Ownership Business Models imply that the system is sold as a whole and ownership is transferred to the community using it. Service Business Models imply that the use of the system is the paid service and ownership remains with the company that provides the system. Being aware of this distinction will help focus the research to develop the most accurate framework for the chosen case. In a past Master's thesis by Pratheek Reddy on drivers for Revenue Models, he puts forward that when analyzing Revenue Models for BoP applications, it is more appropriate to use the terms Business Model and Revenue Model synonymously. Although this may seem strange, it was found in a detailed review of the definition of Business Models that they are usually characterized as one of three concepts, one of them being: "Business Model as cost/revenue architecture." (Zott et al., 2011, p. 1038). This is where some confusion exists as to the relationship between the Business Model and the Revenue Model, seeing as a Business Model focused on the Cost/Revenue structure is not dissimilar to the Revenue Model itself. Therefore, to also make the Revenue Model term more clear, we will again rely on a definition by Christoph Zott and Raphael Amit: "The Revenue Model refers to the specific ways a Business Model enables revenue generation for the business and its partners. It is the way in which the organization appropriates some of the value that is created by the Business Model for all its stakeholders." (Amit & Zott, 2012, p.42)

This definition of the Revenue Model makes it more clear as to why this is a crucial aspect for improving the success of rural renewable energy projects. As we have seen, one of the main problems with such projects is the lack of financing from such communities. This is the main risk that dissuades most private companies from investing in these regions. For the purpose of this manuscript, an interpretation of the Business Model focusing on three main elements will be used. These elements are: the Value Proposition, the value network and the revenue/cost structure (see Figure 1.1 (Bohnsack et al., 2014)). It looks at determining the value of a product for which people, with what means and at what price/cost. The main difference between these elements of this simplified Business Model and the components of the Business Model Canvas that they compare to is in their categorization. Yet this categorization of elements is arbitrary even within the context of Business Models. An example of this was shown in the St. Gallen Business Model Navigator where more than 55 types of Business Models were identified, all with slightly different elements, depending on their focus (Gassmann et al., 2014). It is because of this broadness in the definition of the term that it can be used to analyze businesses from different perspectives.

The importance of the three components of the Business Model outlined here, lies in what they each bring towards understanding a business' potential revenue. The Value Proposition, as in this framework it represents both the value of the product and the customer it is for. This is well represented by the Value Proposition Canvas, developed by Alexander Osterwalder et al E:18, where the left side represents the product/service and its value while the right side represents the main activity of the customer as well as the pains your product or service would prevent and/or gains it could provide (see Figure 1.2). The Value Network because this is the way in which the product is produced and how sales and after sales services are performed. And finally, The Cost and Revenue Structure, because it is crucial for a revenue stream to be stable that the Pricing is adapted to both the product and the customer and that the costs incurred are not too high. One of the assumptions that this paper puts forward, from the previously mentioned information, is that the Business Model itself is a crucial starting point to the establishment of renewable energy projects for rural communities.

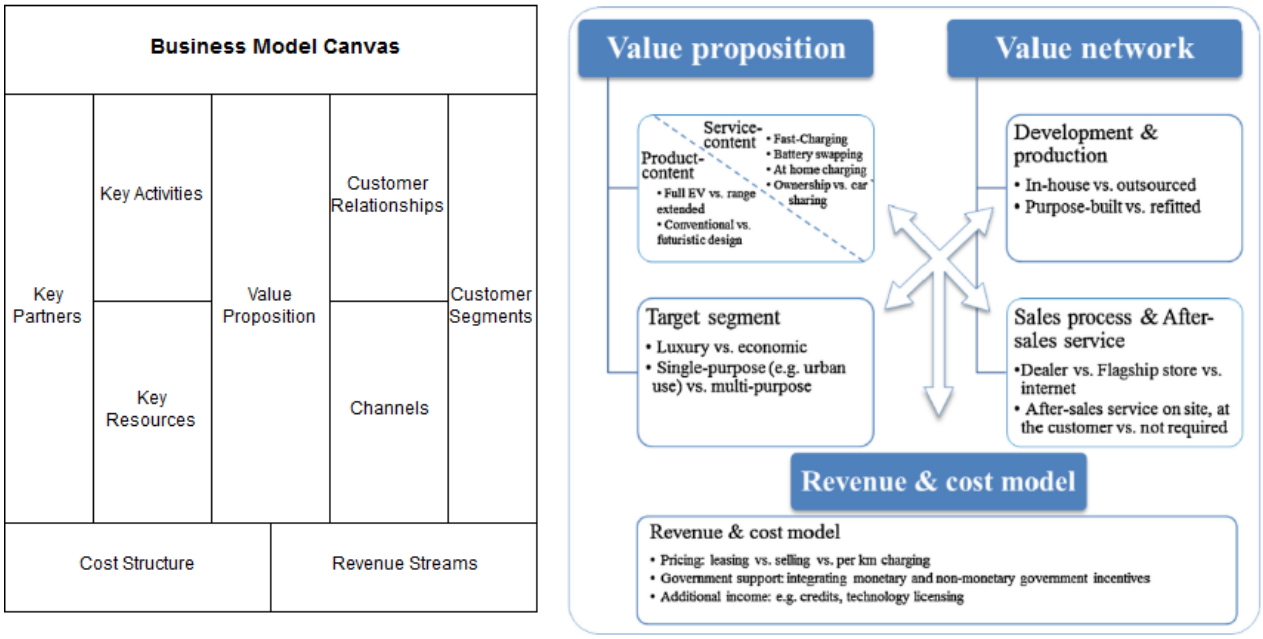

Figure 1.1: Business Model Canvas and Simplified Business Model from Bohnsack et al. (2014)

1.1.4 Business Model Dynamics

But beyond the classifications of Business Models and their components, there is a more general point to be made that is a key aspect of this research paper: the fact that the dynamic capabilities of Business Models are vital to ensuring profits for the business in the long term (Teece, 2018). Business models cannot be static (Achtenhagen, Melin, & Naldi, 2013). This has been well known for some time, even by senior managers, as in a survey done in 2012, a majority (54%) of senior managers preferred new business models over new products or services (Amit & Zott, 2012). And especially in the context of BoP markets, the adaptability of businesses to their environment as well as awareness of their impact on their environment is even more so crucial (Ausrød, Sinha, & Øystein Widding, 2017).

These dynamics can be evaluated on different levels, all of which are important to Business Model theory as a whole. These different levels are completeness, interrelationships, interrelationships over time and framework changes (Khoadaei & Ortt, 2019). In this work, the last two levels are combined into 'changes over time' as they both quite literally look at how the Business Model changes over time, either within individual components or as changes to the Business Model as a whole.

The first level, completeness, can be seen as the foundation for the analysis of Business Model dynamics in general. It looks at what are the internal components of the Business Model and what external factors influence these components. This is important to know how the business shapes its environment and is shaped by it (Teece, 2010). The second level, looks at the interrelationships between these internal components and external factors. Again these interrelationships are not necessarily dynamic, as they can be taken into account even in a static Business Model, but are necessary for the analysis of the final level.

This final level is what is usually considered to be Business Model dynamics: the changes to the Business Model over time. This is the culmination of the two previous levels and is impossible to properly assess without them. Indeed, without a proper understanding of what internal components the Business Model consists of, what external factors affect them and how all of these are interrelated, it would be impossible to give a good analysis and explanation of the causality of changes to the Business Model over time. This is to say that without 'completeness' and 'interrelationships', one would be hard pressed to explain what caused a change in one of the Business Model components, what the change to the component was, and how this change affected the rest of the Business Model.

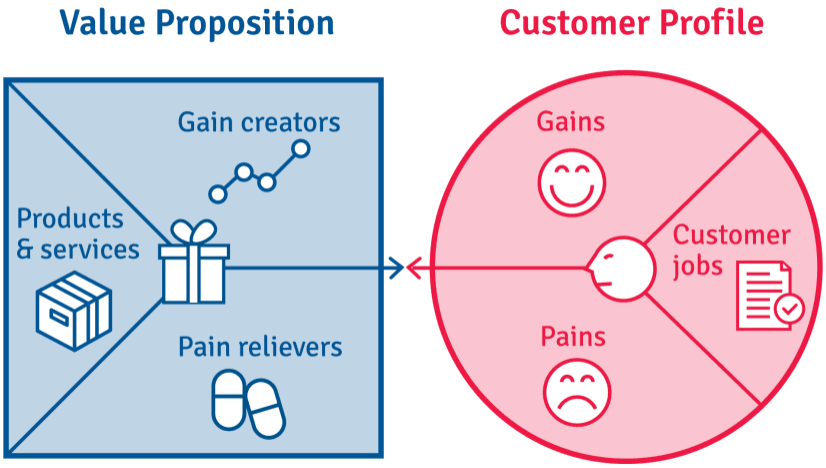

Figure 1.2: Value Proposition Canvas (image obtained from B2B International (n.d.))

1.2 Research Problem

Having obtained this information on Indonesia's renewable energy scene, we can see that the first problem is that despite ambitious goals for rural electrification and the diffusion of renewable energy technology, the challenges faced by projects trying to cater to these communities can be daunting.

For starters, we come back to the point that companies aiming to cater to rural communities have to make up for the fact that these communities are usually quite poor. This makes it complicated to approach one of the main elements of the Business Model: the Revenue/Cost Model. This is not to say that there are no sources of revenue available but that these sources are not as self-evident as with products that only need to sell to make a profit.

Indeed, the revenue stream from poor communities must be created by the product instead of resulting from the product's sale alone. This is to say that the most effective way for such products to provide a revenue is to be its very source. Productive use is a very good example of this, as it entails the use of energy for a specific revenue generating process. This can be in many shapes and forms but is done on the basis of generating wealth for the community to repay their investment and further develop and grow.

This leads to another element of the Business Model: the Value Proposition. Indeed, even within renewable energy systems, there are various applications that these can be used for and therefore various different value propositions that can be offered. For example, the system could be designed to specifically power certain productive machines, to serve as backup lighting, refrigeration, or simply to power households. At this point, the choice of an appropriate Value Proposition that yields a viable Revenue/Cost Model becomes of primary importance in the success of the project. Failing to do so can result in an unsustainable project based only on initial investments and not on potential returns. This has been observed in the shift from a donor based approach for renewable energies to a market based approach due to the unsustainability of the former (Utomo, 2015).

As for the other element of the Value Proposition, the Customer Segment, it should be taken into account along with the Product/Service Content. This is self evident in the fact that a specific product is not applicable to all customer segments and just as well, a specific customer segment will not be open to any type of product. Again this relates back to the Value Proposition Canvas (Osterwalder, Pigneur, Bernarda, & Smith, 2014) where the content of the product/service has to fit with the related customer job and pains/gains.

Going back to the Cost & Revenue Model, it must be noted that it is also heavily intertwined with the Customer Segment, as different jobs will have different regularities of payment and so impact the customer's ability to pay for the product. This is obviously a more important aspect due to this paper's focus on rural and thus usually BoP markets. Just the same, the Value Network has considerable influence on the Cost & Revenue Model, as the choice between in-house development/production and outsourcing or the type of sales and after sales services provided will directly influence the costs incurred by the company.

From a societal point of view, increasing the incentive for investment in rural renewable energy systems, as well as ensuring a higher sustainability of the project in the long term through a dynamic Business Model framework would be incredibly beneficial to the communities in question. This could lead to increased capacity building, economic growth, improved welfare and education and a reduction of poverty. Of course, this is not to say that these will directly result from electrification projects, but they are a necessary enabler to those improvements (Asian Development Bank, 2016).

From an academic point of view, as there is a certain lack of agreement on the scope and contents of a Business Model (Gerdoçi et al., 2018), and that these can be quite different for different applications, companies with little to no experience with such concepts will have a hard time determining how much information is required about what topics. This is true not only about the inter relationship between the three main components of the Business Model as explained above, but also in knowing what main external company aspects affect the Business Model. Some external company aspects have been identified in previous literature but cover a broad scope of businesses, and so offer some aspects that might not be applicable to all types of companies (Shields & Shields, 2015). Although the previously mentioned research paper identified some of these drivers for rural renewable energy projects (Reddy, 2015), this was in a different country (India), so the author mentions the possibility of additional drivers being left out due to the limitations of his paper. A different country, even one in the same region, like Indonesia, might have some different drivers. Also, regarding the core elements of a Business Model, the paper focused on the effect of the value proposition on these drivers and not the inverse effect the drivers might have on the choice of the value proposition itself. In summary, it can be said that although Business Models would be an extremely beneficial starting point for establishing rural renewable energy projects, where determining potential revenues is one of the most challenging tasks, the lack of information about their content and structure in a dynamic context makes it a hard task.

1.3 Research Gap

There may be an increasing number of research papers in the past decade focused on developing Business Model theory in general, many of which look at better defining ways in which Business Models can be developed or modified over time (Achtenhagen et al., 2013), it is also the case that such papers will usually focus on the application of Business Model theory to a specific industry (e.g: the automotive industry (Guerriero & Olivito, 2013)). And the ones that do look at the renewable energy industry usually don't focus on rural communities.

This was verified by performing a quick search of articles with different degrees of focus on the topic of this research. The results of this classification are given in Table 1.1. Science Direct, Emerald Insight and JSTOR were used as search engines to ensure that results would be verified academic articles. For starters, a single search term was used to focus on the "Business Model Dynamics", also using synonyms such as "Business Model Innovation" and "Dynamic Business Model". This returned 1674 articles on the topic, which is less than the number of articles on Business Models in general (about 30000) that can be found on these databases, but is still a considerable amount of research. Another term was then added to represent either the "Rural" or the "Renewable Energy" aspect. "Bottom of the Pyramid" was also used instead of "Rural" and "Renewable Electricity", "Sustainable Energy" and "Sustainable Electricity" instead of "Renewable Energy". This returned 247 articles related to Business Model dynamics and rural communities and 396 articles related to Business Model dynamics and Renewable Energy. Finally, combining all three search terms with their different synonyms yielded a total of 84 articles mentioning Business Model dynamics, Renewable Energy and rural applications. This is by no means a negligible amount, yet it must also be said that these papers will not necessarily focus on Business Model dynamics of Renewable Energy projects in a rural context but often look at one or two of these three elements in great detail while briefly mentioning the other.

Search Terms	**Number of Articles**
"Business Model dynamics"	1674
"Business Model dynamics" and "rural"	247
"Business Model dynamics" and "Renewable Energy"	396
"Business Model dynamics", "Renewable Energy" and "rural"	84

Table 1.1: Search results by search terms

Looking at past Master's theses that have tried to fill this gap, two in particular help in better defining where the current gap in literature stands. The first one is the previously mentioned thesis paper by Pratheek Reddy (Reddy, 2015), which looks at the topic of Business Models for rural renewable energy systems from the point of view of Revenue Models, where he identifies revenue generation as the main barrier to the development of

such systems. He focuses in his paper on the so called "revenue drivers" that affect the Revenue Model, and how their importance differs based on the Revenue Model itself.

The other paper, "Sustainable Business Model for Off-Grid PV (Photovoltaic) Electrification in Developing Countries: In the Case of Sumba Island, Indonesia" by Dwi Sasetyaningtyas (Sasetyaningtyas, 2017) looks at developing a Business Model for a PV project on the Indonesian island of Sumba based on information gathered from various PV companies working in the rural market. This paper focuses on the barriers to the implementation of rural PV projects and looks at Business Model theory as a way to overcome these barriers.

It can be said that the picture that is obtained from these two papers that explore a very similar topic using two different approaches is static, a list of elements and their application in different scenarios. Much is given about what the elements are, and not much on how they behave. What is missing is the dynamic relationship between such elements, how one affects another if it changes. This research gap is brought up in both papers for the case of choosing a value proposition, but it can be said that information is also lacking about other components such as the pricing strategy or customer segment. This is the case because both papers focus mostly on the effects of external factors, not so much on the internal effects that these have on each other.

This interest in developing Business Model dynamics is reflected in several research papers on the topic. For starters, the point was made that Business Model research would be more useful from a dynamic perspective (Chesbrough, 2010). A call for research was also made in the case of understanding the relationship between internal components of the Business Model when undergoing big changes (Amit & Zott, 2012). Another call for research was made regarding the importance of gathering real data from case studies to better understand dynamics of Business Models for both new and established firms in different markets (Cosenz & Noto, 2018). It was also brought up that Business Model innovation is necessary to bring sustainable technologies to the market (Bohnsack et al., 2014; Chesbrough, 2007) and that there needs to be more research of different types of businesses on Business Model innovation (Hockerts & Wüstenhagen, 2010).

Finally, a call for research was made regarding the state of Business Models specifically for rural renewable energy projects in Indonesia (Blum, Wakeling, & Schmidt, 2013). In this paper, the potential of renewable energy for rural electrification is emphasized, but the lack of knowledge on the working principles of such businesses is found to be a notable barrier for their diffusion.

1.4 Research Objective

So from the fact Business Models can be a very beneficial starting point for the establishment of a rural renewable energy project (especially in Indonesia), and now knowing what information is missing about Business Models for such an application as well as what research has been called for by experts in the field, the aim of this research is then:

- Provide a framework explaining the dynamics of Business Models for renewable energy systems in rural communities.
- Apply the findings of the previous objective to the case of Indonesia.

This first research objective can be further broken down into the following sub-objectives:

- Uncover the main components of Business Models for rural renewable energy projects.
- Uncover the main internal and external factors influencing the components of Business Models for rural renewable energy projects.
- Uncover the interrelationship between these Business Model components and their influencing factors for rural renewable energy projects.
- Uncover how Business Models for rural renewable energy projects change over time.
- Lay-out these relationships in a comprehensive framework.

1.5 Scope of the Research

The scope of the research is important in delimiting the limits of the research itself. Just as a gap is identified that must be filled, the scope outlines exactly how much of that gap will be addressed.

In terms of the actual topic of the research, some additional information of the Indonesian renewable energy landscape will be given in order to obtain a better outline of the conditions surrounding renewable energy businesses there. Some more information will then be gathered about the Business Model concept, including its history, definitions and components. This will serve as a basis to better interpret the fundamental elements and purpose of the Business Model. Subsequently, this also yields a better understanding of the importance of Business Model dynamics, as well as how these can best be analyzed and applied. In terms of these dynamics, this can be assessed according to the three levels mentioned before: completeness, interrelationships and changes over time (Khoadaei & Ortt, 2019).

As such, after having found more information about Business Model dynamics in general, the focus will be on these different levels. Starting with completeness, the goal will be two-fold, first to use the information obtained from the literature review on Business Model components and definitions to obtain and justify a certain combination of components to be used in this work. The second step of this research on 'completeness' will look at what these components are in the case of renewable energy projects. The scope of the research then changes as the application of the framework gets more refined. Indeed, while the first aspects of Business Models and Business Model dynamics are developed from general business & management literature and so are more broadly applicable, the scope is then refined for the different levels of dynamics to focus on renewable energy in particular.

Regarding the next levels, 'interrelationships' and 'changes over time', the research will therefore focus on finding interrelationships between Business Model components and changes over time for renewable energy in particular. Although another focus of this work is specifically rural projects, having too many restrictions on the information to be gathered would considerably reduce the amount of results. There is also something to be said about the applicability of renewable energy Business Models to rural based projects which is not the case if the focus had been on rural Business Models first and then trying to apply them to renewable energy projects.

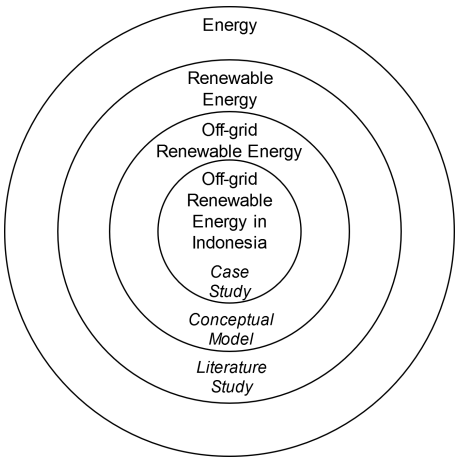

Figure 1.3: Levels of Research

After the literature study, the framework will be developed by combining the information obtained on Business Models and their dynamics, and the information about the Indonesian renewable energy context. By doing so, a framework can be developed that is adapted to Indonesia as country. This is therefore where the scope is once more refined from rural renewable energy projects in general to the case of Indonesia in particular. As such, the case study companies will be renewable energy companies based in Indonesia with experience in rural projects.

It should also be mentioned, regarding the scope of this work, that different parts have different levels of applicability regarding their findings. In the literature study (see Figure 1.3), the results on the Business Model framework can are broadly applicable and not constrained to any particular market type. Further in the literature study, the research becomes focused on elements of Business Model dynamics for renewable energy projects in particular. This is further refined in the development of the conceptual model, where the results are looked at specifically for rural applications of renewable energy projects. Finally, in the case studies, the research becomes focused on the case of Indonesia in particular.

1.6 Relevance of the Research

While the looking at the research problem and research objective, the benefits of performing such research is implicitly given. To be more clear on these advantages, they can be looked at from two points of view:

1.6.1 Academic Relevance

From an academic perspective, the outlined research would be helpful in developing the current research on Revenue and Business Models in general. Mainly because it addresses a certain gap in this field of research that has been shown to be a source of interest by other papers on similar topics (see Chapter 1.3).

Another reason is that this study can serve as a foothold to develop understanding of Business Model dynamics for other types of applications. Indeed, although these internal relationships may be determined for the case of renewable energy in rural communities, some may be more broadly applicable. This can lead to more research topics looking at the differences in results for different countries and applications and trying to find out why those differences exist.

1.6.2 Practical Applications

From a practical point of view on the other hand, this research would be beneficial to any company working in the business of Renewable Energy, especially in Indonesia. Rural communities being widely seen as the hardest to cater to with such systems, mainly due to financial considerations, having a better understanding of the inter-relationships between elements that are crucial to establishing revenue can help these companies expand to rural communities more reliably. This is important because the use of renewable energy in rural communities is one of the most socially beneficial applications of the technology as it brings much more than simple returns and reduction of CO2 emissions than an equivalent system in an urban setting. Indeed these rural applications can be used to electrify regions previously unelectrified. This allows the people living in these communities to not only have access to light at night, which in and of itself is proved to increase overall productivity in many sectors, but also allows for the use of previously out of reach technology (Khandker, Barnes, & Samad, 2013). This can be computers in schools, machinery in hospitals to improve local standards of living, or simply manufacturing machines to boost the local economy. In this sense, the context surrounding such projects evolves as the project progresses, more so than in cities and urban contexts.

One could also argue that if a current rural renewable energy project isn't performing as well as expected due to these inter-relationships between Business Model elements, this information would be very useful in finding a potential solution to the problem. This could be on a higher level regarding a misalignment between elements like the customer segment and the pricing strategy or on a lower level with the influence of individual external company aspects, such as customer trust on other aspects like the willingness to pay.

1.7 Methodology

The creation of a comprehensive framework mapping out the interrelationships of Business Model components for rural renewable energy projects starts with an extensive literature study on the topic. The methodology used for the specific literature research approach is explained in more detail in Section 2. Of course, it must be mentioned that there is some merit in basing our theories on cases and not just past literature (Cunningham, 1997), and so no definitive answer to the research questions will be given until after having been verified by case studies. The reason case studies are of such importance for this type of research is that the conditions for, and results of Business Model dynamics may be extrapolated from literature, but due to their dependence on the context of the business in question, literature based results may not all be applicable. By performing case studies on companies that are precisely in the region, business and market of choice, new factors may be uncovered that are not in the literature. This can also serve to confirm the elements that are present in both the literature and the case studies. It can also be said that beyond the fact that not all literature based information will be applicable, there is little information to begin with. Specifically, looking at individual companies and how their Business Model change over time is not a very common approach to current literature on Business Model dynamics, where focus is given to specific innovations at certain points in time. In this case, the best information is obtained from real companies in the field.

What can be said though, is that the approach of the literature study will be focused on completing the previously outlined Research Objectives. To frame these objectives in a way that is more easily useable for the literature study and subsequent framework building and case studies, they can be expressed in the form of the following Research Questions:

- **RQ1** What are the dynamics of Business Models for renewable energy systems in rural communities?
- **RQ2** What are these dynamics in the case of Indonesia?

The first Research Question can then be further broken down into the following sub-questions:

- **RQ1.1** What are the main components of Business Models for rural renewable energy projects?
- **RQ1.2** What are the main internal and external factors influencing the components of Business Models for rural renewable energy projects?
- **RQ1.3** What are the interrelationship between these Business Model components and their influencing factors for rural renewable energy projects?
- **RQ1.4** How do Business Models for rural renewable energy projects change over time?
- **RQ1.5** How can these interrelationships and changes over time be expressed in a comprehensive framework?

It can then be said that the literature study itself will focus on RQs (Research Questions) 1.1 to 1.4 (see Figure 1.4), as the answer to RQ 1.5 will be given in Chapter 3. As for RQ 2, this will be answered through the case studies, which are also used to further refine the findings relating to RQs 1.1 to 1.4. These case studies are performed with the rural RECs as a unit of analysis, but a distinction must be made between projects that deal with integrating communities to the national electric grid and off grid projects. These have fundamentally different opportunities and constraints and so different Business Models. In the case of this research paper, the focus is on companies that have performed off-grid projects. Within those two categories, a distinction can also be made between ownership, service and other types of Business Models. Most renewable energy companies in Indonesia run both service based Business Models and ownership based Business Models as the two actually have a large (if not complete) overlap in their Value Network. These two types will therefore be considered in the case studies as they are both relevant Value Offerings to the case of rural renewable energy projects in Indonesia. Another important consideration is the information obtained from organizations such as the ASEAN center for energy, as they have considerable insight into the current renewable energy scene in Indonesia.

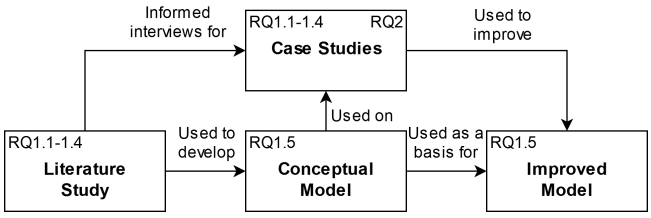

Figure 1.4: Methodology

To be able to use the case studies to improve on the conceptual model, the interview questions are based on the model itself. These questions therefore either ask about the components, external factors, interrelationships and changes over time of Business Models for rural renewable energy projects in Indonesia. The gathered information is then used to adapt and improve the previous conceptual model to be more representative of real circumstances for renewable energy in rural Indonesia.

As such, the case studies will allow for a better understanding of how these different types of Business Models will be reflected in their components, and how these changes are implemented over time. A literature study on its own would only have been enough to offer conjectures and not actual conclusions on the real situation of renewable energy in Indonesia.

1.8 Organization of the Thesis

The subsequent chapters of this thesis will cover the following topics: First, an in-depth literature study on the different main topics of the thesis and on the relationships between the internal and external components of the Business Model. This will be followed by the creation of the conceptual model from the data obtained in the literature study. A case study will then be performed on Indonesian RECs involved in the rural market to test the applicability of the model. Then a comparison is made between the results of the case study and the previous conceptual model to see what the similarities and differences between them and how the conceptual model can be improved to better reflect real life circumstances. Finally the conclusions, discussions and recommendations on the research will be given in the final chapter.

Chapter 2

Literature Study

Having gone through the important background information for this topic, and having established the research problem, objective and methodology, it is now necessary to go more in-depth into the literature on the topic. This chapter will first cover the general topics of relevance in more detail, starting with more information on the Indonesian renewable energy scene followed with an explanation of the differences between the Business Model concept and other similar terms, an in-depth look at the evolution of the Business Model concept and its different interpretations over the years, a look at the emergence of dynamics as a crucial element of the Business Model and finally, some research on the interrelationships of Business Model components from which the framework will be derived.

To ensure the reliability of the information gathered in this literature study, articles will be gathered from trusted scientific databases. These are: Emerald Insight, Science Direct, Scopus, Scientific.net and Web of Knowledge. Furthermore, for every search term used, synonyms will also be used to make sure all relevant information is found. The exact search terms and their synonyms will be given for each topic.

2.1 Indonesian Renewable Energy Sector

The information that has been given on the topic in the introduction covers Indonesia's current rate of electrification, its renewable energy capacity as well as its goals for rural and renewable energy development. What is missing but necessary to set up a framework for Revenue Model dynamics is the exact context of renewable energy companies in this sector.

To begin with, it is important to better understand the relationship between RECs and the national energy company PLN. Since its creation PLN been in charge of everything from generation to transmission and distribution, all the way to the end user (Schmidt et al., 2013). As such, it was also responsible for grid development, maintenance and expansion. There have been several attempts by the GoI to loosen this monopoly that PLN is in charge of, by allowing IPPs (Independent Power Producers) to sell directly to consumers. This was attempted all the way back in 2002 (through Act No 20 of 2002 ()) but annulled in 2004 by Indonesia's Constitutional court. Again, a bill was passed in 2009 (Act No 30 of 2009) ()) to try and legislate an end to PLN's monopoly, but this was controversial too. More recently, in 2016, a bill was once again passed to try and open the sector to more private companies, and yet, in a report by the Institute for Energy Economics and Financial Analysis in 2018, the company was described as "Indonesia's monopoly coal-dependent state-owned power company, Perusahaan Listrik Negara (PLN)" (Brown, 2018). This is not a flattering description but highlight's how past attempts to move PLN away from a monopoly position in the market, has not been entirely succesful, expecially in the eyes of foreign investors.

As for the actual stakeholders in the Indonesian energy sector, on a National level, several key players are central to different aspects (see Figure 2.1). The Ministry of Energy and Mineral Resources, is probably one of the central figures as it is in charge of policies and regulations; the Ministry of State Owned Enterprises has a shareholder function for the national energy company PLN; the Ministry of Finance is in charge of subsidies and loans; the National Development Planning Body has planning function Indonesia's development as a whole; Regional governments are in charge of regional planning; and the Ministry of Economy helps in coordinating these different stakeholders (Marquardt, 2014; Schmidt et al., 2013). In addition to these general roles, the Ministry of Energy and Mineral Resources, along with regional governments in some cases, set the price of the electricity to be sold by the IPP (MEMR, 2016).

So what are the actual options for RECs in Indonesia and how do they relate back to PLN? Basically, there

are currently two main choices for such companies, either work with PLN as an IPP, or cater to the private market as an EPC (Engineering, Procurement and Construction) company (Marquardt, 2014). Now there is one other market that was opened to RECs through the previously mentioned bills aiming at involving more private companies in the electricity market: working as an IPP selling directly to consumers. The catch here, is on several levels: firstly, such companies may only cater to off-grid areas, and under a certain capacity (50 megawatts) (MEMR, 2016); secondly, PLN has to have no interest in developing those regions, as if they do they then have priority over private companies; and the private company needs to get approval from the local government as well to actually start on such projects.

Finally, while the bureaucracy of setting up a renewable energy project in Indonesia might be complicated, there is also the issue of the acquisition of land for such projects. This is partially because of the complexity of land rights in Indonesia, as all land rights were required to be registered in 1960 but with no time limit given and that in the past four decades, the National Land agency has only managed to register one third of all privately owned plots of land. Added to this is the requirement for IPPs to obtain a so called Business Area license, which is imparted by the Ministry of Energy and Mineral Resources in coordination with PLN and the regional government involved (MEMR, 2016).

There are several consequences of this particular context for renewable energy in Indonesia. For example, the fact that companies can only work as IPPs in regions where PLN does not already have an interest means that renewable energy companies will only have access to the most secluded and distant regions, for which the transportation of materials and components will be the most costly. Add this to the fact that even then, especially if the companies want access to some form of government subsidy, they would have to leave the decisions on the pricing of the electricity to be sold to the regional governments and the Ministry of Energy and Natural Resources (MEMR, 2016). This makes it very hard for these companies to envision a return on their investment for such projects and so instead they will tend to go either for tender projects offered by PLN or the Ministry of Energy and Mineral resources, or on the direct sale of systems for off-grid applications.

In the case of tender projects, the costs incurred by the renewable energy company are reduced due to the fact that such projects will specify precise system requirements, which bypasses the need for the company to perform field surveys to arrive at an appropriate system design(). This reduces the costs incurred by the renewable energy company but also means they are not guaranteed the project as they have to compete with other companies on the affordability of the system they offer.

On the other hand, when companies focus on the direct sale of renewable energy systems, the problem is once again a financial one: because the local rural communities do not usually have the means to afford such systems, the target customer is therefore either NGOs, national or regional governments and villas/eco lodges. Now of course, in the case of NGOs and governmental organizations, the beneficiaries of the systems will usually be the rural communities in question, but as they are not directly paying for the systems, they are not the customer. This is in line with the other way renewable energy companies manage to cater to rural communities, by collaborating with other companies on CSR (Corporate Social Responsibility) projects (Mezher, Tabbara, & Al-Hosany, 2010), whereby all of the funds are put forward by the renewable energy company in question and other partners looking to improve their image through such projects. Once again, the locals will not be required to pay for the system and be beneficiaries, not customers, of the renewable energy company.

This may not seem like an issue in and of itself, as goodwill projects are certainly beneficial and can help empower communities and alleviate some of the problems they may be facing, but due to the financial nature of such projects, they are impossible to apply on a large scale or with broad applications. Some villages may benefit from them, but only up to a certain size, and only a certain amount of such villages. Again, this does not discount the importance or value of such projects, but it must be understood that to expand the amount of people that benefit from them, profitability needs to be established in a more sustainable manner.

In the case of Indonesia, this could be done through new pricing strategies, price sharing schemes, or as mentioned in the introduction, through systems that focus on productive use. Such systems allow for value creation by the end user which in turn allows them to more easily repay the system in question. On the other hand, it should not be the responsibility of the renewable energy companies alone to solve the financial problems that prevent the diffusion of renewable energy systems in the poorest regions of Indonesia. On the contrary, it could be said that the combination of new pricing strategies, price sharing schemes and productive use with increased government support for renewable energy projects would be most effective.

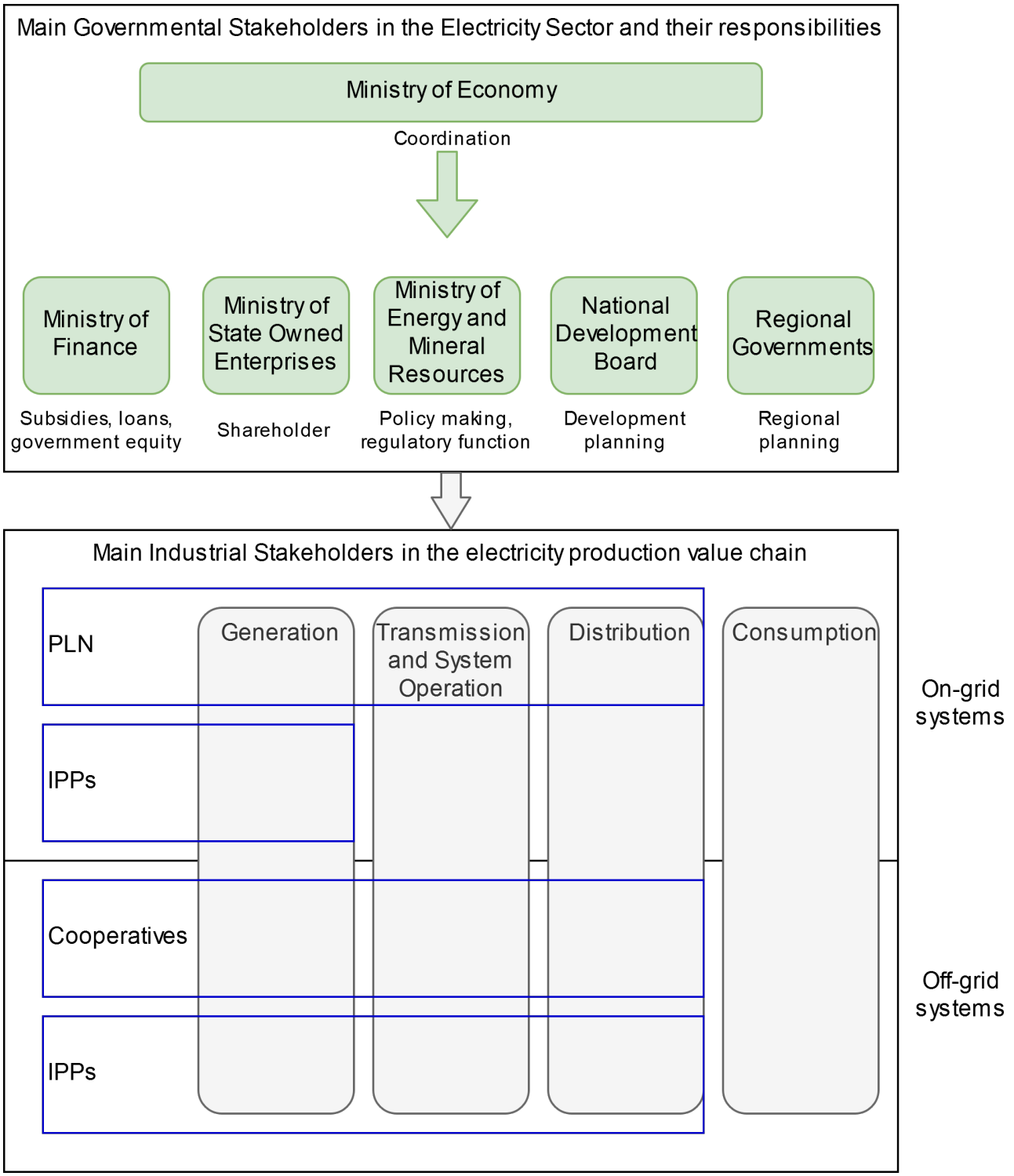

Figure 2.1: "Governmental and industrial stakeholders in the Indonesian Electricity Sector" Adapted from Schmidt et al. (2013)

2.2 Disambiguation of the Business Model Concept

There is much to be said about ambiguity of terms such as the Business Model. In the earlier days of Business Model theory this was mainly due to the emergence of the term and it's lack of a concrete definition. This was because it was often employed but rarely defined (Chesbrough & Rosenbloom, 2002), but also because there wasn't an agreed upon definition for the term yet (Morrisa et al., 2005). Despite this fact, the Business Model was already becoming an integral part of managerial vocabulary (Tikkanen et al., 2005). This led to more research into a unified definition for the term (DaSilva & Trkman, 2014; Morrisa et al., 2005; Shafera et al., 2005). Despite this fact, there can still be some confusion regarding the differences between the Business Model and similar terms. As such, this section will look at differentiating these concept so as to have a good basis on what the Business Model is not.

2.2.1 Business Model and Business Strategy

Firstly, some people mistake the Business Model for a Business Strategy. This can make sense when looking at the internal logic that is dictated by the Business Model and the information it lays out. This information can very much seem like some form of strategy, especially when the Business Model is defined as "a representation of a firm's underlying core logic and strategic choices for creating and capturing value within a value network" (Shafera et al., 2005, p. 202). Indeed it can even be said that although a Business Model is not a Business Strategy, it definitely contains strategy elements (Morrisa et al., 2005). Although these two terms are quite closely related, they are very much distinct from one another.

To begin with, the two terms were already explicitly differentiated in an article by Henry Chesbrough and Richard Rosenbloom back in 2002. In this article, the authors outline three differences between a Business Model and a Business Strategy (Chesbrough & Rosenbloom, 2002, p. 535):

1. There is more emphasis on value creation for the customer and less on capturing value for itself in the Business Model than in the Business Strategy. This also means that competitive threats, which are central to the Business Strategy, are considered but not as important within the Business Model.

2. There is less emphasis in the Business Model on capturing value for stakeholders, often assuming financing is internal and not from external sources.

3. Finally, the Business Model assumes that knowledge held by the business and stakeholders is cognitively limited whereas the Business Strategy assumes that there is a great deal of reliable information.

Such distinctions help better understand the differences between these two concepts. Another distinction can be found in the scope of the concept in time, as Business Strategies can look at long periods of time while the Business Model looks at the business at one point in time (DaSilva & Trkman, 2014).

As for how they actually relate to each other, this depends on perspective, but they can generally be used to better define one another. For example, strategy has been defined as "the comprehensive pattern of a company's actions and intents, binding together all the components of the business model" (Tikkanen et al., 2005, p. 793) but has also been described as the choice of the Business Model through which a firm will compete in the market (Casadesus-Masanell & Ricart, 2010). Finally, Alexander Osterwalder saw the Business Model as "the strategy's implementation into a conceptual blueprint of the company's money earning logic. In other words the vision of the company and its strategy are translated into value propositions, customer relations and value networks" (Osterwalder, 2004, p. 17). All in all, a Business Model can be derived from the Business Strategies, can be used to test a set of Business Strategies (Zott et al., 2011), or looking at various Business Models, each with their own set of Business Strategies, can be used to select a competitive Business Model (Shafera et al., 2005). Indeed "Coupling strategy and business model analysis is needed to protect competitive advantage." (Teece, 2010, p. 179).

2.2.2 Business Model and Revenue Model

The second misconception to be addressed before delving deeper into the Business Model framework is its relationship with the Revenue Model. This was already mentioned in Section 1.1.3, but to further clarify, there has been misconception regarding the two terms and they were sometimes used interchangeably (DaSilva & Trkman, 2014; George & Bock, 2009; Gerdoçi et al., 2018). Sometimes, the Revenue Model is seen as encompassing some elements of the Business Model, such as the Value Proposition and the Customer Segment (Afuah, 2004). Sometimes it is seen as a type of Business Model (Zott et al., 2011). Despite this fact, the Revenue Model is also seen as a subset of the Business Model (Mullins & Komisar, 2009) or a tool to analyze the ways in which

the Business Model enables Value Capture (Amit & Zott, 2012).

In this final description, the Revenue Model is not dissimilar to the Cost & Revenue Structure of our framework, as it also describes "the way in which the organization appropriates some of the value that is created by the business model for all its stakeholders." (Amit & Zott, 2012, p. 41). But in this sense, this also means that along this interpretation of the term, it is one aspect of the Business Model but not an equivalent to the Business Model.

2.3 Business Model Components

To begin with, it can be quite insightful to look at the chosen framework for the Business Model with its three components (Value Proposition, Value Network and Revenue/Cost Structure) in relation to past frameworks of the Business Model. This will help give more context to each element and what aspects it covers, as well as give more insight into the very role the Business Model plays. For this purpose, a research was performed on the Business Model, the abstract of the most popular papers were read to determine their relevance to the topic. Those papers chosen to be of relevance were read and their sources analyzed for additional relevant content. From these papers, 14 were chosen on the basis of their analysis of the Business Model concept, dating from 1998 to 2015 to get some insight into its evolution over time. Some of these papers were also chosen based on them performing their own literature study on the Business Model concept (Morrisa et al., 2005; Saebi & Foss, 2015; Zott et al., 2011). The definitions and Business Model components of these papers can be found on Tables 2.1 and 2.2.

To begin with, two of the oldest papers on the topic of Business Models in 1998 come to considerably different conclusions as to what this model is. In the first paper, the Business Model is defined as a plan to design strategy along three vectors: customer interactions, asset configurations, and knowledge leverage (Venkatraman & Henderson, 1998). This definition sees the Business Model as a tool for strategy design. As has been seen in Section 2.2.1, the Business Model can indeed be used in that way, but in this case there are three vectors (or components) along which this design happens. Although this can make sense when looking at the goal of the Business Strategy being to gain an edge over competition, and interactions with customers, configuration of assets or leveraging knowledge are some of the best ways to do so, this is not the only purpose of a Business Model and only a portion of its scope.

Article	Definition	Components
Venkatraman and Henderson (1998)	"The Business Model is a coordinated plan to design strategy along all three vectors rather than leading in any one vector. Strategies should recognize the interdependencies among the three vectors." (p. 46)	Customer Interaction Asset Configuration Knowledge Leverage
Timmers (1998)	"an architecture of the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues" (p. 2)	Value Proposition Value Network Revenues
Zott and Amit (2001)	"the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities" (p. 511)	Content of Transactions Structure of Transactions Governance of Transactions Value Creation Design
Chesbrough and Rosenbloom (2002)	"The business model provides a coherent framework that takes technological characteristics and potentials as inputs, and converts them through customers and markets into economic outputs." (p. 532)	Value Proposition Market Segment Value Chain Cost Structure and Profit Potential Value Network Competitive Strategy
Magretta (2002)	"A good business model answers Peter Drucker's age-old questions: Who is the customer? And what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?" (p. 4)	Customer Segment Value Proposition Cost & Revenue Structure Value Chain
Shafera et al. (2005)	"we define a business model as a representation of a firm's underlying core logic and strategic choices for creating and capturing value within a value network." (p. 202)	Strategic Choices Value Creation Value Capture Value Network
Tikkanen et al. (2005)	"We define the business model of a firm as a system manifested in the components and related material and cognitive aspects. Key components of the business model include the company's network of relationships, operations embodied in the company's business processes and resource base, and the finance and accounting concepts of the company" (p. 792)	Strategy and Structure Network Operations Finance and Accounting
Morrisa et al. (2005)	"A business model is a concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets." (p. 727)	Offering Market Internal Capabilities Competitive Strategy Economics Investors
Osterwalder, Pigneur, and Tucci (2005)	"A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams." (p. 10)	Value Proposition Target Customer Distribution Channel Customer Relationship Value Configuration Capability Partnership Cost Structure Revenue Model

Table 2.1: Business Model Definitions and Components

Article	Definition	Components
Zott and Amit (2010)	"Building on existing literature, we conceptualize a firm's business model as a system of interdependent activities that transcends the focal firm and spans its boundaries. The activity system enables the firm, in concert with its partners, to create value and also to appropriate a share of that value" (p. 216)	Activity system content Activity system structure Activity system governance
Teece (2010)	"A business model articulates the logic, the data, and other evidence that support a value proposition for the customer, and viable structure of revenues and costs for the enterprise delivering that value. In short, it's about the benefit the enterprise will deliver to customers, how it will organize to do so, and how it will capture a portion of the value that it delivers." (p. 179)	Value Proposition Customer Segment Cost and Revenue Structure Value Network
Zott et al. (2011)	"four important themes are forming, primarily around the notions of the business model as a new unit of analysis, offering a systemic perspective on how to "do business," encompassing boundary-spanning activities (performed by a focal firm or others), and focusing on value creation as well as on value capture." (p. 1038)	Value Proposition Revenue Structure Network of Relationships
Gassmann et al. (2014)	"business models describe how the magic of a business works based on its individual bits and pieces."	Value Proposition Customer Segment Value Chain Cost & Revenue Structure
Saebi and Foss (2015)	"Thus, in line with recent literature, we define business models as the content, structure, and governance of transactions within the company and between the company and its external partners that support the company in the creation, delivery and capture of value." (p. 204)	Content of Transactions Structure of Transactions Governance of Transactions

Table 2.2: Business Model Definitions and Components (continued)

It is interesting to note that even back in 1998, there was already a need for the differentiation of the terms "Business Model" and "Business Strategy". This is something that would keep occurring in literature on the topic for years to come (Chesbrough & Rosenbloom, 2002; Shafera et al., 2005; Teece, 2010; Venkatraman & Henderson, 1998; Zott et al., 2011).

In the second paper, the Business Model is defined as "an architecture of the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues" (Timmers, 1998, p. 2). This definition includes elements such as the Value Proposition, Value Network and Revenues. Interesting to note that one of the oldest definitions of the Business Model fits so well with the presently proposed framework. This is most likely due to these three elements being critical success factors for businesses. It can also be said that each represents one of the three "values" necessary for businesses to strive: Value Creation, Value Delivery and Value Capture. At the most fundamental level, these three actions can be seen as the three lenses through which the effectiveness of the Business Model is measured (Saebi & Foss, 2015). That is to say that every element of the Business Model, as well as any consequences derived from these elements, should reflect positively on the creation, delivery or capture of value.

Three years later, one of the most popular papers on the topic and the first one to come up with a definition of the Business Model that has had such a long term effect on the Business Model literature was written: "Value Creation in E-business" (Zott & Amit, 2001). In this paper, Raphael Amit and Christoph Zott define the Business Model as "the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities". This was explained to be a fitting definition in Chapter 1.1, but can now serve as a basis for the interpretation of future versions of the Business Model.

Another well referenced work by Henry Chesbrough and Richard S. Rosenbloom was written on the topic of Business Models for capturing value looking at evidence from spin-off technologies of the Xerox corporation (Chesbrough & Rosenbloom, 2002). In this paper, the authors argue that the roles of the Business Model can be separated into 6 functions: articulating the Value Proposition, identifying the Market Segment, defining the structure of the Value Chain within the firm, estimating the Cost Structure and Profit Potential, describing the position of the firm in the Value Network and finally, formulating the Competitive Strategy. This article also

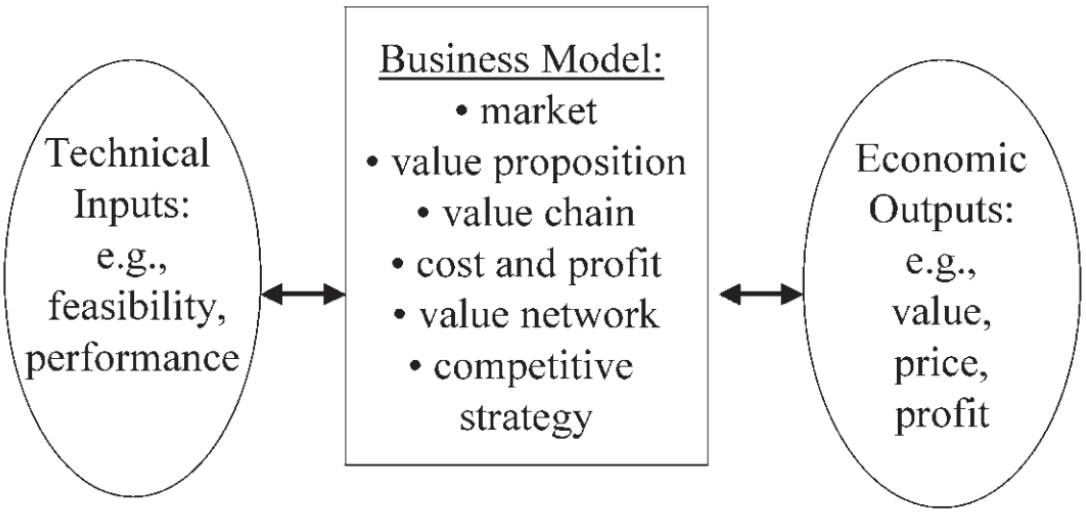

Figure 2.2: "Business Model Components and Purpose" from (Chesbrough & Rosenbloom, 2002, p. 536)

summarizes the Business Model as a tool to be used for the purpose of creating value, delivering it and then capturing some of it for itself.

In this paper, a certain order is also given to the elements of the Business Model to ease the design of it. To begin with, a market focus is needed to constrain the range of possible products/services to be delivered and to start looking at possible "architectures of revenue". From the definition of the Value Proposition and an analysis of the resulting Value Network and Value Chain, a Cost Structure can be estimated. One note to be made here is that in this description of the order of Business Model elements, the Competitive Strategy is not explicitly mentioned. This is specifically because this strategy isn't a stand alone element but rather a result of strategic choices made regarding other elements to enable the business to have an advantage over other competitors. For example, in the case of this paper, the different Competitive Strategies are found to be in different elements of the Business Model, such as having improved product quality and capability (Value Proposition), exploiting new channels (Value Network) or high switching costs (Revenue Structure). These findings also reinforce the previous conclusion that Business Models are very different from Business Strategies but are still related to one another.

A final note on this interpretation of the Business Model is that in relation to its context, the paper looks at the Business Model as a mediator between technical and economical domains (see Figure 2.2). Here, the Business Model uses technical inputs regarding the feasibility and performance of the offered product/service to derive the economic outputs such as the value being delivered, at what price and for how much profit.

Next is a paper titled "Why Business Models Matter" (Magretta, 2002) written in the same year as the previous article. In this paper, the Business Model is not explicitly defined and so does not have a list of clear components such as the other article, but it is defined in a somewhat roundabout manner. Indeed the author states that the Business Model answers the following questions: "Who is the customer? And what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?" (Magretta, 2002, p. 4). From these questions we can derive the expected elements of the Business Model as required. Firstly, a clear Customer Segment from which a Value Proposition is derived, then a clear Cost and Revenue Structure to estimate potential profits and finally a clear Value Chain to deliver the value to the customer at a reasonable price.

This emphasis on the Value Chain rather than the Value Network as a whole is also clear in the description of how new Business Models come about, specifically that all new Business Models are variations of the basic Value Chain underlying all businesses. This Value Chain is described as having two sides, one being the product development side: designing, material purchasing and manufacturing. The other side deals with the customer interactions: Finding and convincing customers and distributing the product or delivering the service. We can see how this somewhat resembles the view of the Business Model as seen in the previous paper, where the

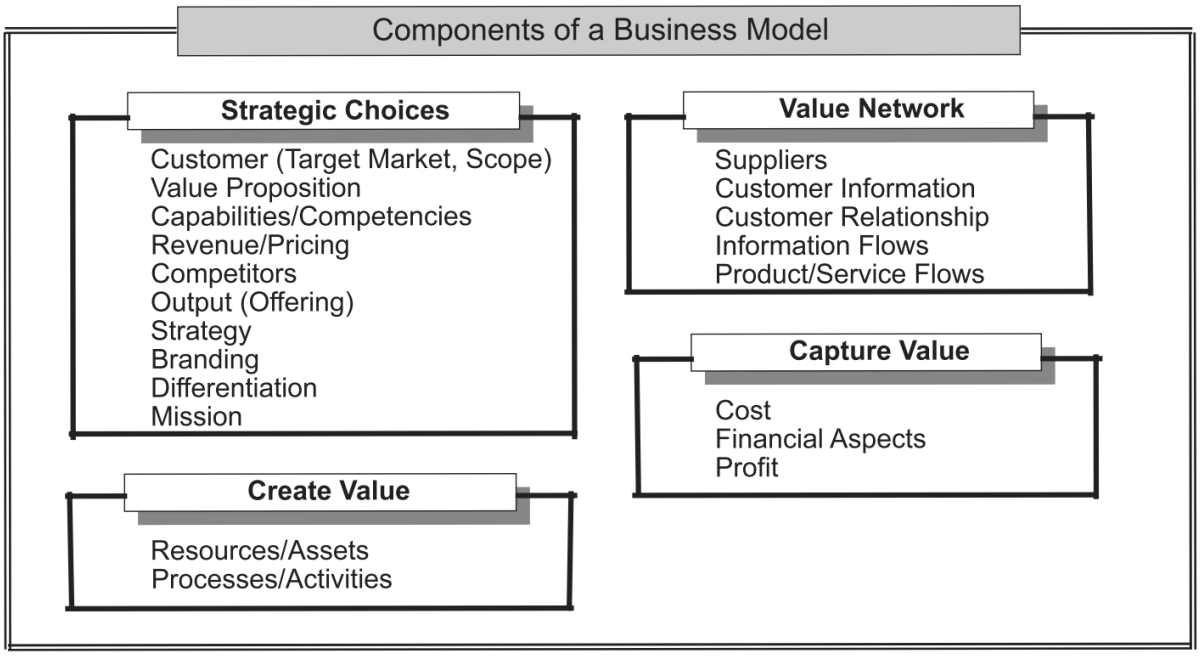

Figure 2.3: "Business Model Components" from (Shafera et al., 2005, p. 202)

Business Model is seen as an intermediary between a certain input and output, though in this case, instead of a technical input to an economical output (Chesbrough & Rosenbloom, 2002), the Business Model is seen as an intermediary between the two opposite ends of the Value Chain (Magretta, 2002). One could say that along the Business Model Canvas (Osterwalder et al., 2010), the previous paper views the Business Model as an intermediary between top and bottom elements (Value Proposition to Cost & Revenue Structure), whereas this paper views it as an intermediary between left and right elements (Production and Key Partners to Customer Segment and Channels). This view gives credence to the Business Model Canvas concept, as it looks at the coherence of the links between different elements along both of the previously described directions (top to bottom and left to right). As such it respects the conceptualization of the Business Model as described in a combination of some of the earliest works on the topic.

One final word about this paper is its insistence on the importance of a coherent definition for the Business Model. It is in part thanks to such papers that research on that very topic accelerated in the years following. One such paper, titled "The Power of Business Models" (Shafera et al., 2005), acknowledges the lack of coherence in the term through a literature study of the use of it between the years 1998 and 2002. It finds that in total, 42 different components were found in all. This disparity in the layout of the components of the Business Model perfectly exemplified the need for a more concise and united definition. By aggregating the 42 different components into overarching themes, the Business Model concept was refined into 4 main components, each containing certain sub-components. This can be seen on Figure 2.3.

On this figure, the four components are: Strategic Choices, Create Value, Capture Value and Value Network. Now it is interesting that once again, Business Strategy, or Strategic Choices, is included as a component in and of itself, when in fact its components can also be associated to one of the three other categories. For example, Profit is part of Value Capture whereas Revenue and Pricing are part of Strategic Choices. This is simply because, in this perspective, Revenue and Pricing are the variables that can be adapted to obtain an advantage in the market and lead to Profits in the Value Capture aspect. So in reality, this view of the Business Model sees three main components: Value Creation, the Value Network and Value Capture. The strategic choices are more of the way in which these three elements are addressed so as to give the firm an edge. This is expressed in the definition they come to for the term: "we define a business model as a representation of a firm's underlying core logic and strategic choices for creating and capturing value within a value network" (Shafera et al., 2005, p. 202).

The next paper, titled "Managerial cognition, action and the business model of the firm" (Tikkanen et al., 2005), was written in the same year and also expressed concern regarding the lack of cohesion in the definition of the Business Model. In this case, the Business Model is analyzed in the context of managerial cognition and action. The components of the Business Model identified in this case are shown in Figure 2.4.

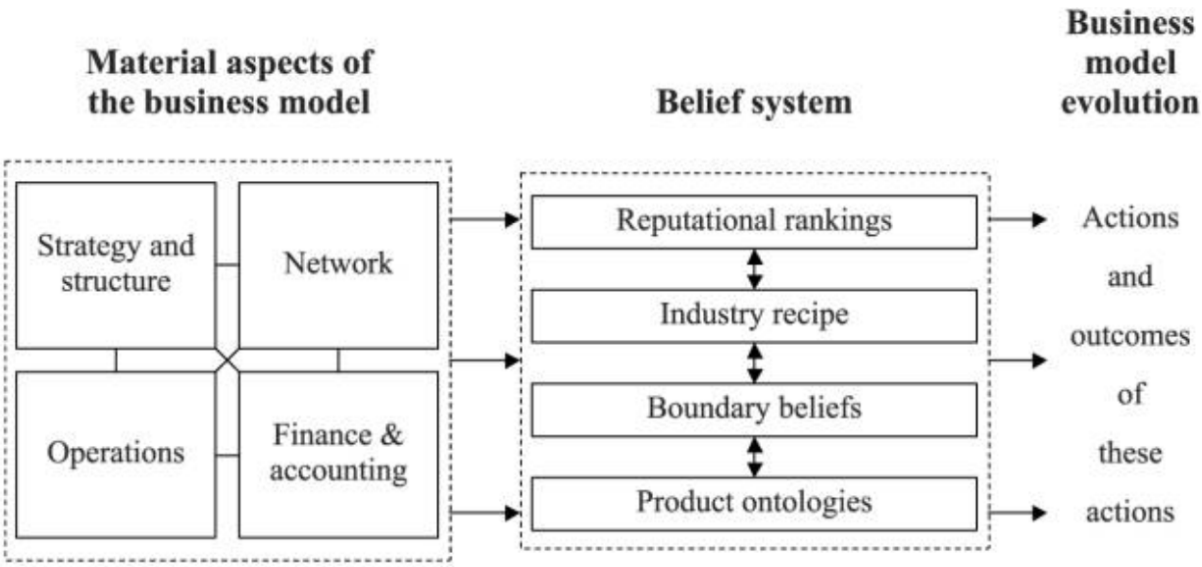

Figure 2.4: "The Business Model of the Firm" from (Tikkanen et al., 2005, p. 793)

On this figure, one can also see the different levels of cognition that affect managerial action within the given components. Of course, in the context of Business Model components, that is the part of the model that is of real interest. In this case, four components are identified: Strategy and Structure, Network, Operations and Finance and Accounting (Tikkanen et al., 2005). Once again, although there are some considerable differences in the definitions of the components, a parallel can be drawn between this model and previous ones, where Strategy and Structure mirrors Strategic Choices, Network mirrors the Value Network, Operations mirrors Value Creation and Finance and Accounting mirror Value Capture. Where these models differ is in the actual sub-categories of each component. For example, in this paper, potential revenues from costumers are not looked at in the "Finance and Accounting" component but in the "Network" component under the "Customer Portfolio" sub-component. This is also where the Customer Segment is determined, instead of having it combined with the selection of the Value Proposition.

Apart from the different components, a different order is given to the components, where Strategy and Structure is the starting point, followed by the determination of the Network and then Operations to finish of with the Finance and Accounting. Although the last step being the financial aspect, seems coherent with previously seen versions of the Business Model, the fact that the Value Proposition, expressed through the "Product and Service Offering" sub-component of the "Operations" component, comes after the "Process Architecture" and "Resource, Capability and Competence Base" sub-components (Tikkanen et al., 2005). This makes more sense when considering that the Business Model framework can be used to both generate new business ideas and analyze currently existing ones. From this perspective, it makes sense that a paper focusing on managerial cognition and action would look at the Business Model from the perspective of an already established business. In this case, it would therefore make more sense to arrive at an appropriate Value Proposition based on existing networks, processes, capabilities and competences.

This paper thus demonstrates that beyond the disparity of applications of the Business Model framework within different business contexts, there is also the disparity regarding the actual use of the Business Model. On the other hand, this paper also demonstrates that despite this fact, there is still some cohesion regarding the primary elements of the Business Model, namely that it looks at the creation and appropriation of value within a network through the careful application of strategic decisions.

Another paper written in the same year was titled "The entrepreneur's business model: toward a unified perspective" (Morrisa et al., 2005) and again brought up the lack of a definition for the Business Model. This paper used a literature review method to analyze past trends regarding Business Model components and again found quite some disparity among the literature. Between four and eight components were identified in each paper, with a total of 24 different components mentioned overall. These components were classified based on the amount of times they were used in different papers, and the top six were selected to form the basis for a

Business Model.

These six components were labelled as factors, or questions that underlie the Business Model (Morrisa et al., 2005):

1. factors related to the offering: How do we create value?
2. market factors: Who do we create value for?
3. internal capability factors: What is our source of competence?
4. competitive strategy factors: How do we competitively position ourselves?
5. economic factors: How do we make money?
6. personal/investor factors: What are our time, scope, and size ambitions?

The first component is related to Value Creation, as seen by its related question, and mirrors what would be the Value Proposition in a modern Business Model. The second component, which was bundled with different components in the previous Business Models, mirrors the Customer Segment. As for the third component, it mirrors the "Process" and "Resource, Capability and Competence Base" sub-components of the previous paper, whilst also looking at the Value Network and Value Chain. The fourth component relates to Strategic Choices and how the firm can gain a strategic advantage. The fifth component is the financial element, looking at pricing and revenues. Finally, the sixth component is quite a unique one so far and looks at the firm's relationship with investors and the planned use for those investments through different predictive models (subsistence model, income model, growth model and speculative model). Indeed, the first five components were found in one form or another in the other Business Model frameworks, but not but these types of predictive models. This can be explained by the fact that at the time, Business Models more often assumed financing was internal and didn't look at creating value for stakeholders but more so for the customer (Chesbrough & Rosenbloom, 2002).

Looking at the last paper from this selection that was published in 2005, "Clarifying Business Models: Origins, Present and Future of the Concept" (Osterwalder et al., 2005), we can see the same pattern of criticizing the lack of understanding of the Business Model concept within literature, as quite eloquently expressed in its introduction: "despite all the ink spilt and words spoken, business models are still relatively poorly understood." (Osterwalder et al., 2005, p. 1). In this paper, the Business Model is defined as "a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams." (Osterwalder et al., 2005, p. 10). This definition, although different than the previous definitions of the Business Model released in the same year, nicely ties some of their components together. Namely, that the Business Model expresses the underlying logic of the firm (Shafera et al., 2005), describes the firm's capabilities and offering, its Network structure and financial considerations (Tikkanen et al., 2005), as well as its target market (Morrisa et al., 2005).

This seems to yield quite an inclusive definition, and when looking at the actual components that were determined to constitute the Business Model, the resemblance to the Business Model Canvas is obvious. This makes sense when considering that the authors of this paper are the ones to have proposed the Business Model Canvas to begin with (Osterwalder et al., 2010). These components are separated into four pillars and then further subdivided into nine blocks. The first pillar is the "Product", or the Value Proposition block. The second pillar is the "Customer Interface" and is made up of three blocks: the "Target Customer", the "Distribution Channel" and the "Relationship" blocks. These three blocks perfectly correlate with the three top-right blocks of the Business Model Canvas relating to the customer. The next pillar, "Infrastructure Management" contains three blocks: the "Value Configuration", the "Core Competency" and the "Partner Network" blocks. These three blocks also correlate to three corresponding blocks on the Business Model Canvas, although "Value Configuration" and "Core Competency" become "Key Resources" and "Key Activities". Although there isn't a direct equivalence from one term to the next, the combination of these two terms cover the same aspects. Finally, the last pillar, "Financial Aspects" is formed of two blocks: the "Cost Structure" and "Revenue Model" blocks. These once again directly correlate to the the two final blocks of the Business Model Canvas, although it is interesting to note that at this point, what is now the "Revenue Streams" block was termed the "Revenue Model". This gives credence to the use of the Revenue Model term as a sub-component of the Business Model but also raises the question as to why the authors felt the need to change it. Namely, this seems to indicate that the Revenue Model as a self-contained Model would consist of more than just Revenue Streams but also look at costs to establish profitability.

It must be noted that despite considerable developments in the Business Model literature over the years, such core concepts as expressed in this paper have remained central to the Business Model concept to this day. Indeed, as has been seen, the blocks forming the Business Model as determined in 2005 are close to exactly the same as the ones still used in the Business Model Canvas today (Osterwalder et al., 2010).

The next paper, titled "Business Model Design: An Activity System Perspective" (Zott & Amit, 2010), as its title implies, focuses on activity systems, seeing the Business Model as "a system of interdependent activities that transcends the focal firm and spans its boundaries. The activity system enables the firm, in concert with its partners, to create value and also to appropriate a share of that value" (Zott & Amit, 2010, p. 216). This perspective is considerably different from other perspectives of the Business Model, as it looks at all aspects from the lens of the business' activities. This is not to say, the other Business Model frameworks do not look at activities at all but more implicitly than in this case. Indeed, compared to their previous paper in which they look at three components of the Business Model as being "Content of Transactions", "Structure of Transactions" and "Governance of Transactions" (Zott & Amit, 2001), in this one they look at "Activity system content", "Activity system structure" and "Activity system governance". The main difference between these two approaches is again just as the name implies: while the first looks at the content, structure and governance of "transactions", the other looks at the content (what activities?), structure (how are they linked and sequenced?) and governance (where and by who should they be performed?) of "activities".

This perspective brings a few advantages, as the authors bring up. Firstly, focusing on activities is natural for entrepreneurs and managers. Secondly, it encourages more systemic and holistic thinking about the firm, which can be more advantageous than getting too caught up in the details of small and isolated individual components. Thirdly, this perspective offers more focus on the focal firm regarding transactions with other firms. Finally, the activity system perspective allows for more improvements in the theoretical basis of the Business Model, as it "encourages managers, researchers to consider what happens in the 'black-box' of activities" (Zott & Amit, 2010, p. 224) leading them to pry deeper into the micro-mechanisms that govern the Business Model.

A last note on this paper and its definition of the Business Model is the interesting wording regarding its scope, namely that it "transcends the focal firm and spans its boundaries." (Zott & Amit, 2010, p. 216). This is interesting because it quite eloquently describes the actual scope of the Business Model and puts in focus the fact that it must include not just the focal firm, but also the other actors in its network that form its boundary. This is the first of the reviewed definitions that explicitly mentions this scope.

Moving on, the next paper, titled "Business Models, Business Strategy and Innovation" (Teece, 2010), defines the Business Model as something that "articulates the logic, the data, and other evidence that support a value proposition for the customer, and viable structure of revenues and costs for the enterprise delivering that value. In short, it's about the benefit the enterprise will deliver to customers, how it will organize to do so, and how it will capture a portion of the value that it delivers." (Teece, 2010, p. 179). This is a familiar take on the Business Model as the Value Proposition, Customer Segment, Cost & Revenue Structure and Value Network are all common components in the Business Model literature so far. Another familiar take is that the article concludes by defining the Business Model as a description of "the design or architecture of the value creation, delivery and capture mechanisms employed." (Teece, 2010, p. 191). This seems to reinforce the idea that some of the earliest Business Model concepts have been able to stay applicable over time.

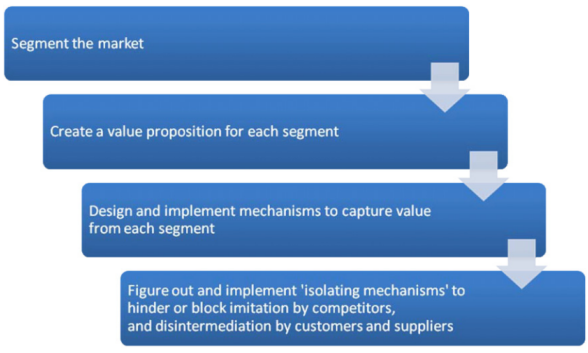

Figure 2.5: "Steps to achieve sustainable business models" from (Teece, 2010, p. 182)

This paper also presents an order to the creation of a sustainable Business Model (Figure 2.5). This starts with the identification of market segments, followed by the creation of value propositions for the different segments, designing and implementing value capture mechanisms and finally, implementing 'isolating mechanisms' to maintain a competitive advantage. This specific order of components is not a new one (Chesbrough & Rosenbloom, 2002) but the final element somewhat is. This 'isolating mechanisms' element is similar in purpose to the 'Competitive Strategy' mentioned in the article by Chesbrough and Rosenbloom in the sense that it aims at providing a competitive advantage to the focal firm in order to secure its revenues. Where it differs is that it focuses

specifically on hindering/blocking imitation and disintermediation by customers and suppliers. Another way to put it is that while the previous article looks at establishing a competitive advantage, this article looks at how to maintain it.

In the next paper, titled "The Business Model: Recent Developments and Future Research" (Zott et al., 2011), the authors show through a literature review how fragmented the Business Model concept is, showing that a general level, it was described in 10 different ways: as a statement (Stewart & Zhao, 2000), a description (Applegate, 2001), a representation (Morrisa et al., 2005; Shafera et al., 2005), an architecture (Dubosson-Torbay, Osterwalder, & Pigneur, 2001; Timmers, 1998), a conceptual tool (George & Bock, 2009; Osterwalder, 2004; Osterwalder et al., 2005), a structural template (Zott & Amit, 2001), a method (Afuah & Tucci, 2001), a framework (Afuah, 2004), a pattern (Brousseau & Penard, 2007), and a set (Seelos & Mair, 2007). One could argue that some of these descriptions are either synonymous or simply not mutually exclusive, but the authors also state that of the 103 articles they reviewed, over a third (37%) did not explicitly define the Business Model.

This disparity in the description of the Business Model led the authors to search for some common themes among these articles. Their result was four themes recurrent in past literature on the Business Model, namely, that it is "a *new unit of analysis*, offering a *systemic perspective* on how to "do business," encompassing *boundary-spanning activities* (performed by a focal firm or others), and focusing on *value creation* as well as on value capture." (Zott et al., 2011, p. 1038). This definition brings together different perspectives of the Business Model, seeing it as a 'unit of analysis' (Zott & Amit, 2001), with a systemic perspective (Tikkanen et al., 2005), encompassing boundary-spanning activities (Zott & Amit, 2010), as well as offering value creation and value capture (Magretta, 2002; Shafera et al., 2005; Teece, 2010).

The next paper, titled "The St. Gallen Business Model Navigator" (Gassmann et al., 2014), sees how the literature on the Business Model as not yet reached an agreement on the exact components that form it. It thus relies on its own framework to analyze the Business Model, which is represented in Figure 2.6. This image represents the four cores of the Business Model, namely the Who (Customer Segment), the What (Value Proposition), the How (Processes, Resources, capabilities and Value Chain) and the Value (Cost & Revenue Structure). These are common elements of the Business Model, as seen in the previous articles, but by phrasing them as questions simplifies the application of the Business Model concept by defining the way in which the elements should be determined (by asking the right questions) (Morrisa et al., 2005).

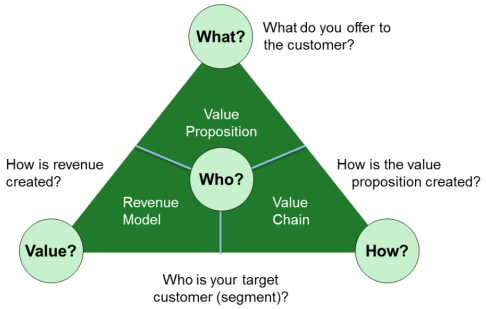

Figure 2.6: "Business Model Definition - The Magic Triangle" from (Gassmann et al., 2014, p. 2)

Finally, the last paper is titled "Business models for open innovation: Matching heterogeneous open innovation strategies with business model dimensions" (Saebi & Foss, 2015), and is of particular interest due to the result of its own literature review of 15 articles defining the Business Model. It must be noted that of these papers, eight of them were included in our own selection of literature. Of these, only one of the sources was added after consulting this list (Venkatraman & Henderson, 1998). The rest were chosen based on a combination of them being relevant sources, often referenced in other works, and the fact that five of these were present in two different literature reviews (Saebi & Foss, 2015; Zott et al., 2011).

The definition this paper arrives at is a familiar one, as it defines the Business Model as "the content, structure, and governance of transactions within the company and between the company and its external partners that support the company in the creation, delivery and capture of value." (Saebi & Foss, 2015, p. 204). Now this does not mean this should be the final definition of the Business Model, but it does seem that some consensus has been achieved in the Business Model literature as to what aspects are indeed central to the concept. Although, there will always be new Business Models with different components and perspectives, it will still be the case that for a vast majority of these, the components will have to do with Value Creation, Value Delivery or Value Capture, in the form of the content, structure and governance of the business' transactions.

Relating the results of this literature study to our own framework of three components for the Business Model. We can comment on several aspects. Firstly, the main components of our own framework are the most common components, namely, the Value Proposition, the Value Network and the Cost & Revenue Structure. These are expressed in different ways among different articles but their core principle is undoubtedly a common one. Also, the three components mirror the three goals of the Business Model as expressed in the previous articles

(Magretta, 2002; Saebi & Foss, 2015; Shafera et al., 2005; Teece, 2010), namely "Value Creation" in the Value Proposition, "Value Delivery" in the Value Network and "Value Capture" in the Cost and Revenue Structure.

The last thing to be noted is that although the Customer Segment, which has been seen to be a component in and of itself in several of the reviewed Business Models (Chesbrough & Rosenbloom, 2002; Gassmann et al., 2014; Magretta, 2002; Morrisa et al., 2005; Osterwalder et al., 2005; Teece, 2010), this is also a component that has been addressed implicitly in the majority of the works reviewed. This goes along with the fact there is clearly a strong link between the two components in all the articles that they are looked at. This validates the use of a Customer Value Proposition that looks in tandem at the value that is created as well as who it is created for.

	Venkatraman and Henderson (1998)	Timmers (1998)	Zott and Amit (2001)	Chesbrough and Rosenbloom (2002)	Magretta (2002)	Shafera et al. (2005)	Tikkanen et al. (2005)
Value Proposition	Knowledge Leverage	Value Proposition	Content of Transactions	Value Proposition	Value Proposition	Strategic Choices	Operations
Revenues		Revenue	Content of Transactions	Cost Structure & Profit Potential	Cost & Revenue Structure	Strategic Choices	Finance & Accounting
Costs			Content of Transactions	Cost Structure & Profit Potential	Cost & Revenue Structure	Value Capture	Finance & Accounting
Customer Segment			Structure of Transactions	Market Segment	Customer Segment	Strategic Choices	Network
Activities				Value Chain	Value Chain	Value Creation	Operations
Capabilities	Knowledge Leverage		Content of Transactions	Value Chain	Value Chain	Strategic Choices	Operations
Resources	Asset Configuration					Value creation	Operations
Customer Relationship	Customer Interaction					Value Network	Network
Channels	Asset Configuration	Value Network	Structure & Governance of Transactions	Value Network	Value Chain	Value Network	Network
Partners	Asset Configuration	Value Network	Structure & Governance of Transactions	Value network	Value Chain	Value Network	Network
Strategy				Competitive Strategy	Strategic Choices	Strategic Choices	Strategy & Structure
Governance		Value Network	Governance of Transactions	Value Network		Value network	Strategy & Structure
Competitors				Value Network		Strategic Choices	Network
Investors			Structure & Governance of Transactions			Strategic Choices	Finance & Accounting

Table 2.3: Business Model components

	Morrisa et al. (2005)	Osterwalder et al. (2005)	Zott and Amit (2010)	Teece (2010)	Zott et al. (2011)	Gassmann et al. (2014)	Saebi and Foss (2015)
Value Proposition	Offerings	Value Proposition	Content of Activities	Value Proposition	Value Proposition	Value Proposition	Content of Transactions
Revenues	Economics	Revenue Model	Content of Activities	Cost & Revenue Structure	Revenue Model	Cost & Revenue Structure	Content of Transactions
Costs	Economics	Cost Structure	Content of Activities	Cost & Revenue Structure	Revenue Model	Cost & Revenue Structure	Content of Transactions
Customer Segment	Market	Target Customer	Structure of Activities	Customer Segment	Value Proposition	Customer Segment	Structure of Transactions
Activities	Offerings	Value Configuration	Content of Activities			Value Chain	
Capabilities	Internal Capabilities	Capabilities	Content of Activities				Content of Transactions
Resources		Value Configuration				Value Chain	
Customer Relationship	Customer Interaction	Customer Relationships			Network of Relationships		
Channels	Offerings & Market	Distribution Channels	Structure & Governance of Activities		Network of Relationships	Value Chain	Structure & Governance of Transactions
Partners	Offerings & Market	Partnerships	Structure & Governance of Activities		Network of Relationships	Value Chain	Structure & Governance of Transactions
Strategy	Competitive Strategy			Competitive Strategy			
Governance			Governance of Activities	Value Network	Network of Relationships		Governance of Transactions
Competitors	Competitive Strategy			Competitors			
Investors	Investors		Structure & Governance of Activities		Network of Relationships		Structure & Governance of Transactions

Table 2.4: Business Model components (continued)

There are several conclusions that can be drawn from Tables 2.3 and 2.4, the main one being that Business Model components are not a uniform framework. Depending on focus, interpretation and grouping of components, various versions of the tool can be created, but the core purpose remains: to represent the underlying business logic used to create, deliver and capture value, with the focal firm as the unit of analysis and spanning its boundaries.

All components of the Business Model are subject to the ambiguity of grouping that can be seen on Tables 2.3 and 2.4. For example, although Costs and Revenue can be looked at separately (Osterwalder et al., 2005), they can also be combined into one overarching component (Chesbrough & Rosenbloom, 2002; Magretta, 2002; Teece, 2010; Tikkanen et al., 2005). This is a common trend for most of these components, as the broadness of each component can be adapted to the focus of the research that the framework is used for. In this sense, what is important is not necessarily if the components are isolated or accounted for in an overarching component, but if they are accounted for at all.

This brings us to the second point to be made about the compilation of components from different papers: they do not all account for all components. This is usually a matter of not explicitly mentioning a component, as is the case, for example, with strategy not being a stand alone component but being necessary to the underlying logic of the Business Model (Osterwalder et al., 2005; Zott & Amit, 2001). Or it can be a case of the specific component not being accounted for in a particular version of the Business Model.

In the case of our own framework, it is the goal to either explicitly or implicitly covering all of the mentioned elements. Again, to simplify the analysis of the Business Model dynamics, it is best to focus on as few main components as possible. In that case, a framework similar to the one proposed by Zott and Amit (2001) seems to be the most appropriate due to its small number of components. Of course, some adaptions can be made to this type of framework for the purpose of this work, as a focus on content, structure and governance results would result in a considerably different analysis of dynamics than is desired. Indeed, as the purpose is to ascertain the effect of components of the Business Model on one another, it would be more beneficial to separate components as they pertain to different aspects of the Business Model altogether. These aspects are also mentioned in the paper by Zott and Amit (2001) as the creation, delivery and capture of value and can be reinterpreted to better reflect the elements in Tables 2.3 and 2.4.

For starters, Value Creation can be reinterpreted as the Value Proposition, as it is the core logic for the role of the focal firm. This interpretation would also mean that internal firm Capabilities, Activities and Resources would be implicitly accounted for in this component, as a given Value Proposition is only possible given the focal firm possesses the Capabilities to perform the necessary Activities with the given Resources. As was explained, this Value Proposition component can also include the Customer Segment as a part of it due to the strong causality between the two elements. This is especially true in a framework where the Customer Segment is used as a starting point for the creation of the Business Model, as it needs to be accounted for in concert with the Value Proposition to prevent a misfit between the two.

The Value Delivery aspect can be extended to all actors within the broader Value Network, as it not just about how value is delivered from the focal firm to the customer, but how each actor contributes to this delivery process on all levels. As such, the Value Network can be said to look at the content, structure and governance of activities related to the focal firm, within the firm's boundaries. By doing so, partners, channels, investors and to a certain extent, competitors are all taken into account in the Value Network. Also, to clarify what is meant by the firm's boundaries, within these boundaries are contained all of the actors that affect or are affected by the focal firm in any way, shape or form. It can also be noted that Capabilities and Activities that do not directly relate to the creation of the Value Proposition can be accounted for in the Value Network. These can be activities such as organizing networking events with partners, developing additional relationships with customers, planning educational seminars or other such activities.

Finally, the Value Capture aspect, reflected in the Cost & Revenue Structure, can then be seen as a very similar component to the Value Network but concerned solely on the financial side of things. Indeed, this Cost & Revenue Structure can be defined as the content, structure and governance of financial transactions with the focal firm.

The next important point to be made about the framework to be used is its inclusion of strategy. The difference here with a traditional Business Model framework is that due to the dynamic aspect being looked at, strategy is thus included in a much more explicit way. Indeed, instead of considering strategy as a separate yet interrelated tool than the Business Model, strategy is considered when looking at the actual dynamics of these Business Models. In this case, changes to the Business Model will more often than not be direct reflections of the strategy used by the focal firm to differentiate itself from other companies. This also were resources and capabilities are taken into account, as they constrain the possible strategies that can be employed. This is also where competitors are actually taken into account, as they will be relevant to the degree of differentiation that

is obtained from a given strategy.

So to summarize and refer back to the components of Tables 2.3 and 2.4: The Value Offering and Customer Segment are both taken into account in the Value Proposition, and internal Capabilities, Activities and Resources are also implicitly accounted for. To specify why these last components are only accounted for implicitly, this is because showing changes in these components in the overarching Value Proposition component would yield too much information on the framework, and so they are accounted for insofar as they relate to a change either one of the two main sub-components (Value Offering and Customer Segment). The Channels, Partners, Investors and Competitors as well as the Governance of activities relating to these different actors are taken into account in the Value Network, as well as the external firm Capabilities and Activities (which contain the Customer Relationships). Costs and Revenues are taken into account in the Cost & Revenue Structure, and finally, Strategy is taken into account in dynamic aspect of the framework, but can also be said to be applicable in the generation of a starting Business Model as well. This is also where the Competitor aspect takes more importance, as when looking at this element in the Value Network, it is more on the basis of collaboration or activities with said competitors.

2.4 Business Model Dynamics

One trend that was noticeable in the articles from the previous section, is the increased focus on Business Model innovation as demonstrated by the use of the term in the titles of two of the more recent articles (Saebi & Foss, 2015; Teece, 2010), but the trend of mentioning Business Model innovation and dynamics within the article goes back earlier than that, and at a higher frequency (Chesbrough & Rosenbloom, 2002; Magretta, 2002; Morrisa et al., 2005; Osterwalder et al., 2005; Tikkanen et al., 2005; Zott & Amit, 2001, 2010; Zott et al., 2011), accounting for a total of 9 of the 14 articles that were looked at.

For starters, what is business model innovation exactly? different sources have arrived at different conclusions on the topic, but consistent themes still remain. Looking at some of the more recent definitions for the concept (Table 2.5), we can see that on a micro level, it either relates to changes in individual components of the firm, such as "core elements" (Bucherer, Eisert, & Gassmann, 2012) and "value dimensions" (Abdelkafi, Makhotin, & Posselt, 2013), or to changes in the core logic of the firm (Aspara, Lamberg, Laukia, & Tikkanen, 2013). Of course, by pursuing changes in the value creation logic, this will reflect in changes in Business Model components (Berglund & Sandström, 2013). One can even say that the Business Model is a representation of the core logic of the firm (Shafera et al., 2005). On the other hand, Business Model innovation can also be under the form of a change in the Business Model as a whole (Berglund & Sandström, 2013; Khanagha, Volberda, & Oshri, 2014). The last article, from which this selection was obtained (Foss & Saebi, 2017), looks at both of these by defining Business Model innovation as the change to both the elements and architecture of the Business Model. The authors describe the architecture of the Business Model as the interdependencies between Business Model elements and explain that with higher interdependencies between elements, Business Model innovation will result in more changes to the architecture of the BM as a whole.

To summarize, Business Model innovation can be in the form of changes to key elements of the Business Model, changes in the value creation logic of the firm, changes in the structure of the Business Model elements, and as such, changes to the Business Model as a whole. Then another clarification needs to be made regarding the relationships between Business Model dynamics, Business Model innovation and Business Strategies, as these are quite intertwined.

For starters, regarding the difference between Business Model dynamics and Business Model innovation, the difference can be seen as innovation being a subset of a firm's Dynamic Capabilities (Cavalcante, Kesting, & Ulhøi, 2011), and thus as a subset of Business Model dynamics. This is simply because while innovation is seen as a decision made by managers to willingly and strategically improve their Business Model (Foss & Saebi, 2017), Business Model dynamics looks at all changes, regardless of these changes being planned or expected. As such, a Business Model innovation in one component could lead to a change in another component, which would therefore be due to Business Model dynamics rather than directly resulting from a planned innovation.

In this sense, the act of innovating the Business Model can be seen as a strategic process, seeing as "such capabilities can be seen as high-level strategic routines" (Cavalcante et al., 2011, p. 1337). This makes sense considering the previous differentiation between the Business Model and Business Strategies (Section 2.2.1) in which it was shown that Business Strategies can be used as tools to help in the development of a coherent Business Model based on concise objectives (Osterwalder, 2004). It was also mentioned that the coupling of Business Strategy and Business Model analysis is necessary to maintain a competitive advantage (Teece, 2010), but this can be extrapolated to the fact that by coupling Business Strategy and Business Model innovation, a competitive advantage can be created. As such, Business Model innovation can be seen as a subset of Business

Model dynamics, which can benefit from a coupling with Business Strategies to create and maintain a competitive advantage. Understanding what is classified as Business Model innovation, the question is now, what are drivers of Business Model innovation?

Article	Definition
Amit and Zott (2012)	"An innovative business model can either create a new market or allow a company to create and exploit new opportunities in existing markets. " (p. 39)
Bucherer et al. (2012)	"We define business model innovation as a process that deliberately changes the core elements of a firm and its business logic." (p. 184)
Abdelkafi et al. (2013)	"A business model innovation happens when the company modifies or improves at least one of the value dimensions." (p. 13)
Aspara et al. (2013)	Corporate business model transformation is defined as "a change in the perceived logic of how value is created by the corporation, when it comes to the value-creating links among the corporation's portfolio of businesses, from one point of time to another." (p. 460)
Berglund and Sandström (2013)	"A BMI can thus be thought of as the introduction of a new business model aimed to create commercial value." (p. 276)
Casadesus-Masanell and Zhu (2013)	"At root, business model innovation refers to the search for new logics of the firm and new ways to create and capture value for its stakeholders; it focuses primarily on finding new ways to generate revenues and define value propositions for customers, suppliers, and partners." (p. 464)
Khanagha et al. (2014)	"Business model innovation activities can range from incremental changes in individual components of business models, extension of the existing business model, introduction of parallel business models, right through to disruption of the business model, which may potentially entail replacing the existing model with a fundamentally different one." (p. 324)
Foss and Saebi (2017)	"Accordingly, we define a BMI as "designed, novel, and nontrivial changes to the key elements of a firm's BM and/or the architecture linking these elements." (p. 216)

Table 2.5: Business Model Innovation Definitions (adapted from Foss and Saebi (2017))

Although the literature on the drivers of Business Model innovation does not always agree or have a final answer on the topic (Foss & Saebi, 2017), some common themes do emerge. For starters, there are two types of drivers: internal or external (Foss & Saebi, 2017; Khoadaei & Ortt, 2019), and these can further be divided into threats or opportunities (Bucherer et al., 2012). Although, the article that made that distinction, from its results of categorizing Business Model innovations by their type, found that out of 11 different case studies, not a single one was of the 'internal opportunity' type. This is partially because businesses will usually respond to threats (Saebi, Lien, & Foss, 2017), but also because in terms of opportunities, these will usually be in the external environment and not within the firm itself. This makes sense when considering that the Value Proposition, as defined in this work, caters to a certain Customer Segment. New opportunities will therefore be more likely to appear in the form of better ways to serve these customers, or new markets appearing (Foss & Saebi, 2017).

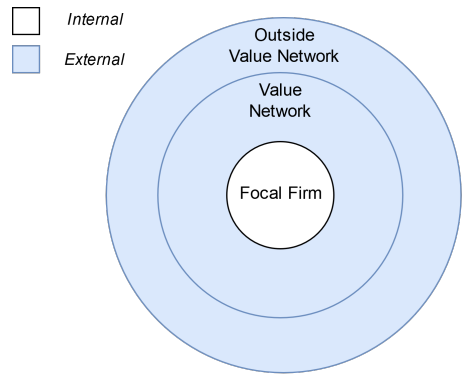

Figure 2.7: Definition of Internal and External

This is apparent in literature on Dynamic Capabilities, which is an essential quality for companies to innovate and stay competitive (Teece, 2018). Originally, these Dynamic Capabilities were defined as an approach to identify firm-specific capabilities that can be a source of advantage, as well as what configurations of competences and resources can be developed and protected (Teece, Pisano, & Shuen, 1997). The name 'Dynamic Capabilities' was used to stress the focus on "exploiting existing internal and external firm-specific competences to address changing environments." (Teece et al., 1997, p. 510).

It must be noted when talking about internal and external effects, that external refers specifically to anything outside of the focal firm (see Figure 2.7). This is important to clarify because as defined in this work, the Business Model also includes the Value Network, which itself extends outside of the focal firm, so external in this sense, could have meant outside of the Value Network.

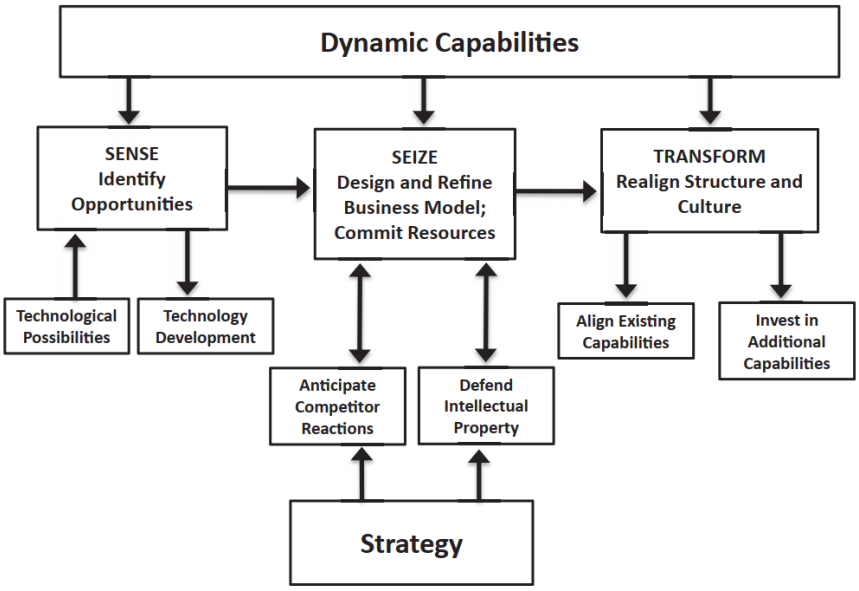

Figure 2.8: "Simplified schema of dynamic capabilities, business models, and strategy" from (Teece, 2018, p. 44)

Later on, this initial framework was further developed to look at three different steps of the innovation process: Sensing, Seizing and Managing Threats/Transforming (Teece, 2007) and then later again, including strategy in the framework as well as changing the last elements to only 'Transform' (Teece, 2018). These components and their relationships can be found on Figure 2.8. The first capability looks at the ability to discern opportunities, which sounds simple but is a considerably complicated process, as some technological changes leading to these opportunities are unpredictable and can be hard to contextualize into a product or service (Teece, 2018). The second capability looks at seizing that opportunity by designing its Business Model and refining it through two strategic paths: 'anticipating competitor reactions' and 'defending intellectual property'. The first path looks at predicting how likely competitors are to adapt to this new Business Model while the other looks at what can be done internally to isolate this new intellectual property. Finally, the last capability looks at realigning the structure and culture of the firm to adapt to the new Business Model, which includes aligning existing capabilities or investing in new ones (Teece, 2018).

Another area that is relevant to Business Model Dynamics is Open Innovation. In this field of literature, it is argued that businesses can no longer rely on closed innovation (Chesbrough, 2003), and that they need to depend more on "accessing external sources of knowledge and collaborating with individuals, companies and other organizations that possess relevant knowledge that may be deployed in the context of the company's innovation process." (Saebi & Foss, 2015, p. 204). The principle here is that the firm needs to be open to more collaboration with other members outside of the firm and sometimes outside of the Business Model, to improve its chances of capturing value from new opportunities. It sees the expansion of the firm's boundaries, with a strong focus on costumer needs and wants, as the best way of generating innovation (Trimi & Berbegal-Mirabent, 2012).

Apart from Dynamic Capabilities and Open Innovation which look at their own methods of innovating the Business Model, some different papers also have their own classification of types of innovations (see Table 2.6):

Article	Types of Business Model Innovations
Mitchell and Coles (2003)	"Most companies use one of four strategies to outperform the competition: 1. Lower prices based on cost advantage (Wal-mart); 2. More desirable products and services (Tiffany); 3. More choices and information (Amazon.com); and 4. Close personal relationships (Avon)." (p. 16)
Sheehan and Stabell (2007)	"managers can craft profitable business models by altering one of their four key positioning characteristics. 1. Key value creating activity strategies [...] 2. New fees/asset ownership strategies [...] 3. New reputational capital strategies [...] 4. New governance strategies" (p. 27-28)
Cavalcante et al. (2011)	"we distinguish between four different types of business model change: 1. business model creation; 2. business model extension; 3. business model revision; and 4. business model termination." (p. 1328)
Amit and Zott (2012)	"Business model innovation can occur in a number of ways: 1. By adding novel activities, for example, through forward or backward integration; we refer to this form of business model innovation as new activity system "content." 2. By linking activities in novel ways; we refer to this form of business model innovation as new activity system "structure." 3. By changing one or more parties that perform any of the activities; we refer to this form of business model innovation as new activity system "governance."" (p. 39)

Table 2.6: Business Model Innovation Definitions (adapted from Foss and Saebi (2017))

The first thing to be noticed is the difference in categorization of Business Model Innovation types. The first article classifies types based on the most common examples of Business Model Innovations (Mitchell & Coles, 2003); the second based on which 'positioning characteristic' of the firm is changed (Sheehan & Stabell, 2007); the third based on how the elements of the Business Model are affected and if the Business Model is created or terminated (Cavalcante et al., 2011); and the fourth based on what element of the Business Model is changed (content, structure or governance) (Amit & Zott, 2012). This shows how innovations in the Business Model can be looked at from different perspectives based on the focus of the specific paper. This also implies that these changes can occur in all aspects of the Business Model and that it is important to be aware of that and not focus only on improving the Value Proposition (Amit & Zott, 2012).

A last comment to be made on the topic of Business Model Innovation is about the importance of key individuals in the actual process. Indeed, it has been pointed out that if no predefined individual has the authority to force innovations in the Business Model, this would become considerably more difficult to achieve (Chesbrough, 2007). It was also pointed out that it is thus important for managers to be aware of the interrelationships of the Business Model component to be able to predict the consequences of changing one component on another component (Demil & Lecocq, 2010). In light of this, Raphael Amit and Christoph Zott proposed "that managers

ask themselves the following six key questions as they consider business model innovation:

1. What perceived needs can be satisfied through the new model design?
2. What novel activities are needed to satisfy these perceived needs? (business model content innovation)
3. How could the required activities be linked to each other in novel ways? (business model structure innovation)
4. Who should perform each of the activities that are part of the business model? Should it be the company? A partner? The customer? What novel governance arrangements could enable this structure? (business model governance innovation)
5. How is value created through the novel business model for each of the participants?
6. What revenue model fits with the company's business model to appropriate part of the total value it helps create?" (Amit & Zott, 2012, p. 42)

These questions clearly reflect the Business Model perspective of the authors that should be taken into account when looking at innovation. Another paper concludes that there are three critical capabilities for Value Creation: "Identifying, experimenting with and exploiting business opportunities; Using resources and capabilities in a balanced way; Achieving active and clear leadership, a strong corporate culture and employee commitment" (Achtenhagen et al., 2013, p. 435). This definition fits well with the concept of Dynamic Capabilities as it looks at the identification and exploitation of business opportunities. What is interesting is the focus on a "strong corporate culture and employee commitment". The paper outlines the positive effects of involving employees in certain strategic decisions allowing them to have a stronger sense of purpose towards their role in the company (Achtenhagen et al., 2013).

To summarize, it can be noted that although there are various perspectives and approaches to the topic, there is consistence in the considered importance of the topic. Indeed, with increasingly complex and changing markets, more than ever firms have to be aware of external and internal threats or opportunities and adapt their Business Models in kind. And while Business Model dynamics as a whole is definitely moving towards this goal, the focus on Business Model innovation is a sensible one, as it can be argued that a firm with a high level of Dynamic Capabilities will have most of its Business Model dynamics in the form of willing innovations. In other words, by advancing research in Business Model dynamics and making firms more aware of the causes and effects of Business Model changes, they can prepare in advance to turn more of the changes they would "have" to do (dynamics) into changes that they would "want" to do (innovation).

As to how best approach the analysis of Business Model dynamics, their separation into different levels, as presented by Khodaei and Ortt (2019), would be most useful. This would cover the variety of components and influencing factors (drivers) in the 'completeness' level; the causal relationships between these components and influencing factors in the 'interrelationships' level; and the changes affecting the Business Model over time in the 'interrelationships over time' and 'framework changes' levels. The last two levels are combined they both relate to changes to the Business Model over time, simply at a different scale.

2.4.1 Completeness

To begin with, looking at the completeness of elements in Business Model dynamics, this is limited by the amount of interrelationships over time that need to be analyzed (Khoadaei & Ortt, 2019). Indeed, when looking at a large list of internal and external elements to the Business Model, analyzing their interrelationships becomes exponentially more complicated the more elements are added. This was one of the reasons why a Business Model representation with three main elements was chosen, so as to more easily convey their interrelationships, both statically and over time. In that sense, the proposed framework scores lowest on the aspect of completeness, but this does not mean its completeness is inadequate.

Once again, it must be mentioned how important establishing the completeness of Business Model elements and external factors is to the Business Model dynamics as a whole. As was mentioned in the Introduction, this is not only to better understand what the causes of these dynamics are, but also to know what exactly they affect within the Business Model. Without a complete list of these factors and components, some of the interrelationships as well as their consequences on the Business Model as a whole cannot be properly explained.

First of all, the Value Proposition can be separated into its two main subcategories: the Customer Segment, describing for whom this value is created, and the Value Offering, describing what Value the company is creating. Similarly, the Value Network can be divided into three subcategories: Partners, Sales Process, and After

Sales Services. Finally, the Cost & Revenue Structure can be separated into Costs and Revenues respectively. Regarding the completeness of this framework, relating it back to the Business Model Canvas for example (Osterwalder et al., 2010), all of its components are at least partially included in one of the three main elements apart from 'Key Activities' and 'Key resources'. Regarding these two components, one could say that they are indirectly accounted for either in the Value Proposition or the Value Network. In the case of Key Activities, this is because any new Value Proposition would require a set of basic capabilities and resources to create, and given that those activities can not be accomplished by the focal firm, will require the collaboration of partners in the Value Network that can. A good example would be the transportation of goods to the customer, a Key Activity that if it cannot be accomplished by the focal firm will require a distributor in the Value Network. On the other hand, one advantage of the framework to be used regarding the completeness aspect is that it takes into account external threats (such as competition), which is missing in the Business Model Canvas (Khoadaei & Ortt, 2019).

The most common elements for each of these categories in the case of RE projects were gathered from literature and can be found in Tables 2.7 and 2.8.

Elements	Sub-components	Typical examples
VP	Customer Segment	• International aid and development organizations (IDOs) & Non-governmental organizations (NGOs) • BoP communities • Governments • Individuals • community leadership • commercial entities
VP	Value Offering	• Knowledge/advice • Product delivery & sales • Technology & system design • Large scale supply of energy services
VN	Partners	• Network • Local installers & technicians • Other entrepreneurs: knowledge & skills • Manufacturers & suppliers • Government/community leaders • IDOs, NGOs, etc. • Local business/utilities
VN	Sales Process	• Word of mouth marketing • Company website • Web & print advertising • Tender process
VN	After Sales Services	• Maintenance • Customer Support

Table 2.7: Business Model elements for renewable energy projects (Adapted from Gabriel and Kirkwood (2016))

Elements	Sub-components	Typical examples
CRS	Costs	• Materials and components • Logistics & operations • Hiring and retaining human capital • Subcontracted human capital • Import duties and taxes
CRS	Revenues	• Advice/knowledge transfer • IDO project tenders • System design and sizing (& overseeing installation) • Product sales (& installation) • System sales & infrastructural integration • Feed-in tariff (Richter, 2012)

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure

Table 2.8: Business Model elements for renewable energy projects continued (Adapted from Gabriel and Kirkwood (2016))

Apart from these internal elements of the Business Model, completeness also looks at factors, internal and external, that can influence these Business Model elements, as the first step to a deeper understanding of Business Model dynamics requires a good understanding of the very factors that affect it. Relating back to the literature on Business Model dynamics and their drivers, it was mentioned that these can either be opportunities or threats. In Table 2.9, some of the most common types of factors are listed, along with what type of factors they are (E.T for External Threat, I.T for Internal Threat and E.O for External Opportunity). These are also coded as they will be referred to later in Section 3.1.

Effect	Type of Factor	Code
E.T→CRS	Constraining Financial System (Hamwia & Lizarralde, 2017).	E1
E.O→CRS	Supportive Financial System (Hamwia & Lizarralde, 2017).	E2
E.T→VP/CRS	Constraining Policy and Regulatory Framework (Emrah Karakaya & Hidalgo, 2016; Leisen, Steffen, & Weber, 2019).	E3
E.O→VP/CRS	Supportive Policy and Regulatory Framework (Huijben, Verbong, & Podoynitsyna, 2016; Sawhney et al., 2014; Shakeel, Takala, & Zhu, 2017).	E4
E.O→VP/CRS	Technology (Hall & Roelich, 2016).	E5
E.T→VP/VN/CRS	Competition (Horváth & Szabó, 2018).	E6
E.T→VP/VN	Lack of Social Acceptance (Stigka, Paravantis, & Mihalakakou, 2014).	E7
E.O→VP/VN	Social Acceptance (Stigka et al., 2014).	E8
E.T/O→VP/VN	Landscape Changes (Budzianowski et al., 2018).	E9
I.T→VP/VN/CRS	Production Issues (Horváth & Szabó, 2018).	I1

E: External | I: Internal | O: Opportunity | T: Threat | VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure

Table 2.9: Factors affecting Business Model elements

2.4.2 Interrelationships of Business Model Components

Having obtained more information on the main topics of this thesis, and with a better understanding of what elements the Business Model is composed of and why these elements are relevant to its dynamics, the individual relationships between components can be explored.

For this purpose, a systematic research approach was used, looking at all related articles and then filtering out the ones that are not directly relevant to the topic at hand. To do so, the research was focused on the actual research question "What are the interrelationships between elements of the Revenue Model for rural renewable energy" and so we can adapt it for each relationship to look specifically at two elements. This focus also gives us a rejection criteria, as any paper that does not look specifically at the relationship between components but just at each component individually, then it is not relevant to the development of the framework. Looking at these search terms in particular, apart from the two components that are looked at for each relationship, the term "renewable energy" is also used to try and limit results to articles pertaining to this specific topic. The reason "rural" was not used to further refine the search is that results would then have been too scarce to build any form of framework from it. It can also be said that between "renewable energy" and "rural", the first term will help us get closer to the Revenue Model framework we need than the second one. Indeed, although there is a difference between Revenue Model elements from a rural to a non-rural setting, going from one business type (renewable energy) to another will usually require a completely different Business Model and Revenue Model. This is to say that although not using the term "renewable energy" would have yielded more results, most papers would then relate to other types of businesses who's dynamics might not reflect those of renewable energy companies. Again, synonyms were used for each search term and are listed under Table 2.10.

Search term	**Synonyms**
"Renewable Energy"	"Sustainable Energy"; "Sustainable Electricity"; "Renewable Electricity"
"Value Proposition"	"Value Offering"; Offering; "Value Creation"
"Value Network"	"Value Chain"; Partner; Supplier; "Value Distribution"
"Cost and Revenue Structure"	"Cost Structure"; "Revenue Structure"; Revenue; "Value Capture"

Table 2.10: Search terms and their synonyms

Therefor, three terms were used for each interrelationship, the first one being "renewable energy" or a synonym, and the two others being either the terms for the components being looked or one of their synonyms. In order to guarantee that all results would be scholarly articles, published in peer reviewed journals, or books, the following search engines were used: Sciencedirect, Emerald Insight, JSTOR and the TU Delft library database.

In order to only look at appropriate papers, a first selection was made based on the Abstracts of the papers. If the topic was not related to renewable energy (only mentioned it somewhere), then it would be removed. The second selection was done by looking for the search terms related to the Business Model elements within the paper. If these elements were only mentioned separately and not in correlation to one another, the paper wouldn't be removed just yet but further checked for external effects on said elements. If none was present, then the paper would be removed. The final selection process looked at if these interrelationships applied to an off-grid scenario. Indeed, as mentioned before, the research did not restrict articles based on this criteria and so the selection had to be done manually. The interrelationships between components were then analyzed from the remaining papers.

Value Proposition and Value Network

All in all, 14 papers were found explicitly mentioning a relationship between the Value Proposition and Value Network. Of these 14 papers, some trends were found regarding recurring relationships between these components and grouped into 11 different relationships (see Table 2.11). Additionally, four types of relationships were identified based on the reason for the changes in each component. In this case, the types of changes were separated into 'forced changes' and 'strategic decisions'. One could argue that any change to any component of the Business Model is a result of a strategic decision made by the managers of the firm, but the differentiation here is made between changes that were made necessary for the firm's survival by external/internal circumstances or changes that were made necessary due to the relationship between components; and changes that were not necessary but implemented due to a strategic choice on the part of managers to improve their Business Model.

From this perspective, it becomes easier to see how four types of interrelationship types would arise, as there are two possible types of changes in the initial component (necessary or not) and just the same, there are two possible types of changes in the correlated component. These different interrelationship types can be found in Figure 2.9. On this figure, a relationship of type CC implies that both the initial change and the resulting change in the correlated component were not necessary but the result of a strategic "Choice" (thus the two Cs). A relationship of type FC is one where the initial change in the first component is a "Forced" (thus the F) or necessary one, which then allows for a strategic decision to change the correlated component. A relationship of type CF is one where the first component is changed due to a strategic choice but that then results in a forced or necessary change in the correlated component. Finally a relationship of type FF is one where both the initial

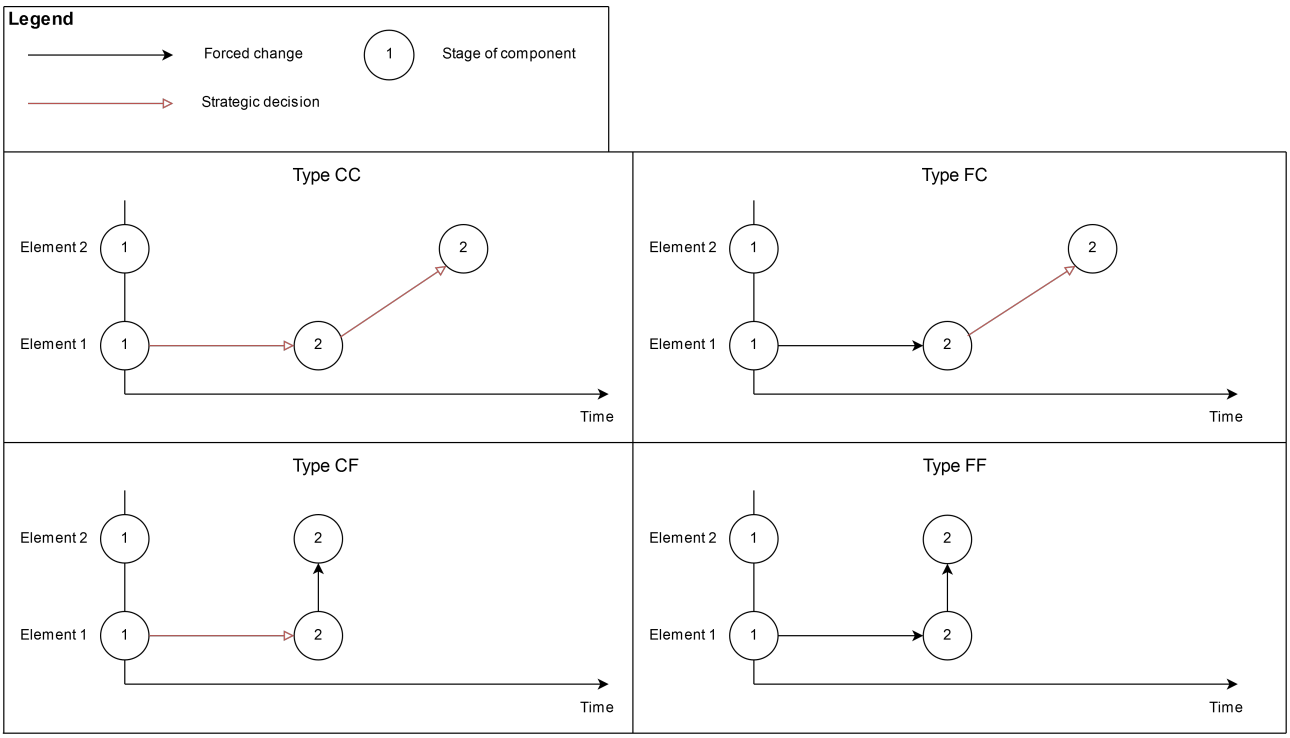

Figure 2.9: Types of relationships between Business Model elements

change and the resulting change in the correlated component are forced or necessary.

The first interrelationship that was found is a dynamic one, namely that by implementing bilateral interactions between producers and installers of PV components, a feedback loop is created that leads to product innovation that meets the needs of the customer (Strupeit, 2017). This is a relationship of type CC, as the choice of implementing bilateral interactions is a strategic choice and not an obligation. Similarly, the advantages obtained from such a relationship do not have to be applied to the Value Proposition, but can be in order to gain an strategic advantage.

On the other hand, a relationship was found regarding the nature of PV projects becoming increasingly technically demanding (increasingly complex Value Proposition). This leads to increased collaboration between network actors to meet those demands (Strupeit, 2017). This can be seen as a relationship of type FF, as the initial change in the required Value Proposition is caused by changes in customer needs, which need to be met by the product/service the focal firm is offering and is therefore not out of choice but necessity. On the Value Network side, the strengthening of relationships with other network actors is also a necessary change that results from the necessity of improving the Value Proposition.

Another similar relationship was found regarding the quality of the product rather than its technical complexity. In this case, the author posits that in order to guarantee quality, different actors in the network can band together under umbrella organizations to ensure certain quality standards (Huijben & Verbong, 2013). This relationship can be bundled with the previous relationship, implying that the network configuration needs to be such that the level of quality and technical complexity that the customer expects can be delivered.

Now it can be said that beyond the effect of increasing requirements from costumers, leading to a change in the Value Network, changes in the Value Network will also lead to changes in the Value Proposition. For example, while the focal firm has the ability to innovate their product (Amit & Zott, 2012), this is also the case for all the other companies in the Value Chain (Hall & Roelich, 2016). This can be in the form of improved storage, improved energy production components or even in new applications for energy use. Whatever the case, these innovations in the Value Chain can lead to improved Value Proposition. This is a type FC relationship, as the initial change in the Value Network is outside of the control of the focal firm, but results in the ability of the focal firm to strategically innovate their Value Offering.

Similarly, as it was mentioned that companies can band together due to certain quality requirements (Huijben & Verbong, 2013), they can also band together of their own volition to acquire new customers and respond

more rapidly to changing demands (Camarinha-Matos, Oliveira, Ferrada, & Thamburaj, 2016). This can be seen as a relationship of type CC, as both the changes to the Value Network and the ensuing opportunities for improving the Value Offering are strategic decisions on the part of the focal firm.

The next relationship mirrors the previous one in the sense of improved collaboration in the Value Network, but looks mainly at the customer side. In this case, the relationship is that by improving collaboration with customers and including them in an open Business Model, the firm can explore new markets and provide revenues for their customers, thus complementing their Value Proposition (Engelken, Römer, Drescher, Welpe, & Picot, 2016). Again, due to this not being a requirement, we classify it as a type CC relationship.

Another relationship looks at how some innovative services will require the inclusion of companies outside of the traditional Value Network (Pereira, da Silva, & Soule, 2019). Here the idea is that by involving data analytics, marketing and other firms outside of the traditional renewable energy Value Network, innovative Value Propositions can be attained. This is in line with the concept of dynamic capabilities, where managers have to sense opportunities for innovation (Zollo & Winter, 2002). On the other hand, this is not a type CC relationship like the previous ones, but a type CF relationship, as the initial change to the Value Proposition is the strategic choice on the part of the focal firm, and the subsequent changes to the Value Network are necessary changes to accomplish this strategic choice.

Another relationship is offered between suppliers and the Value Proposition of the renewable energy company, namely that collaboration between the firm and its suppliers can allow them to more rapidly respond to customers and ensure smooth project developments (Pätäri & Sinkkonen, 2014). This can be added to the relationship where increased collaboration of actors in the Value Network leads to a faster response to changing demands (IR1.4). This was also echoed in two other articles where it was explained that different forms of interactions between Business Model actors would have a significant impact on the value being created (Klimanov & Tretyak, 2019; Rossignoli & Lionzo, 2018).

In the next case, the relationship involves the effect of involving new network actors on the Value Proposition. Specifically, this looks at how involving a third party in the ownership of a system might make it more suited for smaller scale distributed generation and not for larger buildings (Lam & YU, 2016). This would effectively change who the Value Offering is best suited for, and as such can affect the Value Proposition. One could argue that this is rather a change in the Cost Structure, yet for the focal firm, the payment may well be the same. Third party ownership would mainly create an intermediary between the focal firm and the end user through this third party. As such, it can be more broadly representative of how a change in the transactions between network actors within the Value Network can also affect what the appropriate Value Proposition should be.

The next relationship is interesting in the sense that it looks at an external effect causing an interrelationship. Namely, that when energy markets get increasingly decentralized, the more the customer becomes a part of the value chain as a producer or a storage provider, which consequently changes the appropriate Value Proposition for such costumers (Löbbe & Hackbarth, 2017). This is a relationship of either type FC or 4, seeing as the initial change in the Value Network is beyond the focal firm's control, but the subsequent changes to the Value Proposition can either be necessary or a strategic choice based on how strongly the appropriate Value Proposition changed. In other words, such a case can only be seen as a type FF relationship if the Value Network changed to the extent that the old Value Proposition is no longer viable at all.

This is similar to the next interrelationship, that looks at how small companies in fragmented Value Networks do not have the means to innovate and so cannot move into new markets (Shum & Watanabe, 2008), especially in the sense that it can be seen as two types of relationships depending on the circumstances. In the first case, it can be seen as a relationship of type FF, as a fragmented Value Network would not be a strategic choice but rather a lack of a strategic choice and the resulting constraints on the possible Value Propositions to be offered are also outside of the focal firm's control. On the other hand, this relationship can be seen in another light as a relationship of type CC, positing that if a strategic choice is made to mend the segmented Value Network, new innovations may become available to focal firm to choose from.

In the next case, the relationship is somewhat convoluted, but basically implies that by targeting a certain Customer Segment for off-grid projects, ties can then be formed with relevant local communities to ensure a competitive advantage over other firms (Heynen, Lant, Sridharan, Smart, & Greig, 2019). This can be seen as a relationship of type CC, as the initial choice of the Customer Segment to be targeted is exactly that, a choice, not a forced decision made out of necessity. Also, the subsequent changes that can be made to the Value Network to strengthen the ties with the targeted community are also a strategic choice on the part of the focal firm.

Finally, the last relationship looks at how the electrification of rural communities can help in the development

of value added products, such as grinding and packaging for turmeric cultivation. This changes the position of such people in the Value Chain and so effectively affects the Value Network (Narula & Bhattacharyya, 2017). Also, this could lead to a feedback effect when looking at the fact that costumers changing position in the Value Chain can lead to new Value Propositions (Löbbe & Hackbarth, 2017). This is a relationship of type CF, as the initial change to the Value Proposition to develop value added products is a strategic choice on the part of the focal firm, but the resulting changes in the Value Network are simply a necessary result of this new Value Proposition.

Direction	**Type**	**Relationship**	Code
VN→VP	CC	Implementing bilateral interactions between installers and producers can lead to product innovation that meets the needs of the customer (Strupeit, 2017).	IR1.1
VP→VN	FF	The increasing technical complexity and quality of required products leads to higher collaboration between network actors (Huijben & Verbong, 2013; Strupeit, 2017).	IR1.2
VN→VP	FC	Developments and innovations within the Value Network can lead to new products and services (Hall & Roelich, 2016).	IR1.3
VN→VP	CC	Companies within a Value Network can band together to obtain new customers and respond more rapidly, smoothly and efficiently to their needs (Camarinha-Matos et al., 2016; Pätäri & Sinkkonen, 2014) and to other yet unknown effects (Klimanov & Tretyak, 2019; Rossignoli & Lionzo, 2018).	IR1.4
VN→VP	CC	Companies can collaborate with customers in Open Business Models and use this reconfiguration to adapt the Value Proposition to better fit their needs (Engelken et al., 2016).	IR1.5
VP→VN	CF	For a company to provide new products and services, it will sometimes require the inclusion of new actors outside the current Value Network (Pereira et al., 2019).	IR1.6
VN→VP	CF	The involvement of new actors within the Value Network can change who the Value Proposition is best suited for (Lam & YU, 2016).	IR1.7
VN→VP	FC or FF	When customers become more integrated in the Value Chain, their respective Value Proposition changes as well (Löbbe & Hackbarth, 2017).	IR1.8
VN→VP	CC or FF	A fragmented Value Network where small companies do not have the means to innovate their product will be unable to move into new markets (Shum & Watanabe, 2008).	IR1.9
VP→VN	CC	By choosing a Customer Segment as a key-element to its off-grid energy business, a firm can build its competitive advantage by creating business ties with the local community (Heynen et al., 2019).	IR1.10
VP→VN	CF	The development of value added products based on the regional activities will change the position of locals in the Value Network (Narula & Bhattacharyya, 2017).	IR1.11

VN: Value Network | VP: Value Proposition | C: Choice | F: Forced

Table 2.11: Interrelationships between Value Proposition and Value Network

Value Proposition and Cost & Revenue Structure

Regarding the interrelationships between the Value Proposition and the Cost & Revenue Structure, 10 articles were found explicitly mentioning a relationship. These were grouped together when applicable into 8 different interrelationships which can be found in Table 2.12. The first relationship was found between the Cost and Revenue Structure and the Value Proposition, wherein certain Value Propositions will shift to service due to different circumstances, one of which is the nature of the financial system (Hamwia & Lizarralde, 2017). This is a relationship of type FF as both the changes in the Cost & Revenue structure resulting from a change in the financial system and the subsequent restriction of the Value Proposition to a service type offering is out of the control of the focal firm.

The second relationship is given in the context of an external effect resulting in a strategic choice. In this case, it is the case of a PV company in a setting where feed-in tariffs are diminishing, adoption rate is declining and the company gets less turnover per PV system installed. As a result, the company makes less and less profit, so the authors suggest that they could expand their market to the national/international level or come up with incremental/disruptive innovations as potential solutions (Emrah Karakaya & Hidalgo, 2016). As has been seen before, this is another example of a strategic choice for the company rather than a causality between

the elements, but one could argues that if this is an effective solution, then it is based on a causality in the other direction. This would be of the form: "Expanding your market to the national/international level or coming up with incremental/disruptive innovations, can allow for new and improved sources of revenue". In the first case, it is a relationship of type FC, as a change i feed-in tariffs leading up to less and less profits is an uncontrollable effect on the Cost & Revenue structure, but the subsequent changes to the Value Proposition are completely up to strategic choice. In the second case, it is a relationship of type CC, as if it is the case of expanding the target market and Value Proposition to obtain new sources of revenues, the type of expansion and type of revenues to be obtained from it are up to the strategic choice of the focal firm.

The next article, where a relationship was found, looks at the fact that the cleantech industry in Finland is dominated by small to medium enterprises and argues that due to resource constraints, theses companies are not able to turn their great ideas into innovations (Shakeel et al., 2017). This is an interesting case, as in a straightforward manner it is simply a type FF relationship, with resource constraints not being a strategic choice on the part of the focal firm and the subsequent inability to innovate also being out of their control. This is interesting because at a first glance, it appears to contradict IR2.3, but one could look at it as a cautionary tale, warning that although moving to other markets and innovating may bring new sources of revenue, if revenues do get too low, there is a point where such actions will no longer be a possibility.

The same article also looks at the relationship between Value Proposition and Cost & Revenue Structure from the point of view of a technology that does not fit the customer's expectations, implying that such a mistake can lead not just to low returns, but also to an inability to attract investors (Shakeel et al., 2017). Interestingly, this particular example looks at the offering not matching the customer's willingness to pay and so could be said to look at the negative effect on the Cost & Revenue Structure of not basing the Revenue Structure on the particular Customer Segment. We can thus see it as a strategic choice to design the Pricing Strategy based on the Customer Segment's willingness to pay because the coherence between these two will causally affect the whole Cost & Revenue Structure. This can be seen as a relationship of type CC, as both the choice of the Customer segment and the choice of the Pricing Strategy are up to strategic choice. Where it becomes restrictive is that pricing strategy should be derived from the Customer Segment in question, as not everyone will have the same abilities to pay for given products or services. In this sense, this relationship can also be seen as a type CF relationship in cases where a change in the Customer Segment requires a change in the pricing strategy.

An example that was given in an article of the simplest relationship between these two components is that the Revenues are directly correlated to the Value Proposition (Helms, 2016). This is especially true when adding the consideration of the Customer Segment in the Value Proposition, where the customer's willingness to pay for the offered value is even more of a determinant of revenue. This is a relationship of type CF, as even though the Value Proposition itself is the product of a strategic choice, its related costs are not up to choice but a necessity of its creation.

In the next case, the article looks at how different types of Value Propositions can improve financial returns. The example being looked at is a comparison between a traditional PV system and a PV system with a solar water pump for farming purposes (Zhang & Yan, 2014). They find that by combining returns from the solar energy being produced and revenue from farming thanks to the solar water pump, the overall financial projections of the case are better than the standard case. Here, this is again a relationship of type CF, as the choice of how the Value Proposition should be improved is a strategic choice on the part of the focal firm, whereas the resulting added revenues are results of the Value Proposition being applied.

The next relationship echoes the relationship between a certain pricing strategy and the customer's willingness to pay as it looks at the case of a solar company deciding to opt out of a certain pricing strategy based on feedback from customers (Ode & Wadin, 2019). Due to this, it was included in IR2.5.

The following relationship is also one that was combined with another relationship, namely IR2.6. This was the fact that, some changes in the Value Proposition can lead to drastic changes in the Revenue Structure (Parka & Yong, 2017). This is not just in terms of the amount being payed by customers but even in the structure of who is paying for what. This relationship was added to the relationship about Revenue being a function of the Value Proposition.

Moving on, the next relationship looks at how there are different ways to set-up PPAs (Power Purchasing Agreements) with end users (Kulatilaka, Santiago, & Vakili, 2014). Depending on the chosen configuration, costs and revenues will be allocated differently, which leads to differences in the Value Proposition for the end user. This is once again of type three, as the choice of how a certain pricing strategy should be implemented is a strategic choice on the part of the company, but the resulting changes to the perceived Value Proposition would be a consequence of it.

Another paper looks at how western hydro companies can move into the Indian market to provide consultancy services and even operate some small hydro projects. They argue that doing so would allow these companies to secure stable long term revenue if they prefer that over quick returns (Khan, 2015). This relationship thus looks at how moving into new markets with the addition of new services can be used to obtain a desirable Revenue Structure. This was added to IR2.3 in Table 2.12. This can also be complimented with the next relationship, which looks at how complimenting your initial offering with additional services can offset the volatility of electricity prices (Bryant, Straker, & Wrigley, 2019).

Finally, the last relationship that was found had to do with the choice of an adequate Value Proposition. This is another common sense relationship, just as the fact that revenues are a function of the Value Proposition, but looks at how an unsuccessful Value Proposition that does not provide a unique value, will not attract customers and thus lead to low returns (Preston, 2010). This is also a type CF relationship, as the choice of the Value Proposition is a strategic choice, but in the case of mistaken choice, the resulting low returns would not be part of this choice.

Direction	**Type**	**Relationship**	Code
CRS→VP	FF	Given the nature of a certain financial system, the service Value Proposition for procurement of energy might be the only choice for RECs (Hamwia & Lizarralde, 2017).	IR2.1
CRS→VP	FC	in the case of diminishing returns, companies can expand their market or innovate as a response (Emrah Karakaya & Hidalgo, 2016).	IR2.2
VP→CRS	CC	Moving to new markets and developing new services for this market allows the firm to pursue new avenues of revenue and to offset volatile electricity prices (Bryant et al., 2019; Emrah Karakaya & Hidalgo, 2016; Khan, 2015).	IR2.3
CRS→VP	FF	An inadequate Cost & Revenue Structure will prevent the development of new innovations (Shakeel et al., 2017).	IR2.4
VP→CRS	CC or CF	Pricing should be based on customers as an improper fit between cost of the technology being offered and the customer's willingness to pay will lead to diminishing returns and low investments (Ode & Wadin, 2019; Shakeel et al., 2017).	IR2.5
VP→CRS	CF	Revenues are a function of the Value Proposition and so certain unique Value Propositions can require some considerably different Revenue Structures (Helms, 2016; Parka & Yong, 2017).	IR2.6
VP→CRS	CF	Combining different but related Value Propositions can lead to higher financial returns (Zhang & Yan, 2014).	IR2.7
CRS→VP	CF	Different distributions of costs and revenues among the focal firm and end user will lead to different Value Propositions for the customer (Kulatilaka et al., 2014).	IR2.8
VP→CRS	CF	An inadequate Value Proposition will lead to unsustainable Revenues (Preston, 2010).	IR2.9

CRS: Cost & Revenue Structure | VP: Value Proposition | C: Choice | F: Forced

Table 2.12: Interrelationships between Value Proposition and Cost & Revenue Structure

Value Network and Cost & Revenue Structure

Finally, looking at the interrelationships between the Value Network and the Cost & Revenue Structure, 11 articles were found explicitly mentioning a relationship. These were grouped together when applicable into 6 different interrelationships which can be found in Table 2.13. The first relationship looked at how different ownership configurations for village micro-grids usually resulted in specific forms of payment (Knuckles, 2016). For example, micro-grid developers who operated and maintained the grid were likely to include pre-payments in their Revenue Structure whereas micro-grid developers that did not operate or maintain the grid would usually include post-payments as part of their Revenue Structure.'This is also true about the initial cost burden for the system and the subsequent payment schemes when looking at the effect of ownership vs service Business Models (Chaurey & Kandpal, 2009). This relationship is somewhat complicated to classify because while the initial setup of the ownership network is up to the strategic choice of the focal firm, the resulting change in the pricing strategy also is. In this case, it is more a matter of tendencies, with one pricing strategy being more appropriate for a certain ownership model than another, but not a necessity, and therefore not a type CF relationship but a type CC relationship.

Another paper looks at a case study of four companies and finds that they usually have ties with (non-)governmental organizations, with one of the main purposes being to secure subsidies or other forms of support (Kolk & van den Buuse, 2012). This interrelationship can be classified as a relationship of type CC, as both the companies that are being added to the Value Network and the sources of revenue that are being sought after are strategic choices on the part of the focal firm.

The next paper looks at a similar relationship but with the collaboration aspect being with other private companies in its network. It proposes that by building ties with other companies and developing standard metrics for all companies to follow, confidence in those companies would improve and lead to more prospects from commercial banks and other financial institutions (Yadav, Heynen, & Palit, 2019). This was grouped with the previous relationship in Table 2.13.

Looking at the next relationship, it mentions that some firms in their case study list the presence of a supportive bank as one of the most important factors for moving into a new region (Harish, Iychettira, Raghavan, & Kandlikar, 2013). This indicates that the presence of such a bank in the firm's Value Network can have a considerable impact on revenues. This could be seen as a type CF relationship, as the choice to obtain financing from a supportive bank is a strategic choice that requires the presence of such a bank in the Value Network.

A familiar relationship that was found is that due to the fragmented nature of industrial Value Chains, small companies need to collaborate with their partners or even competitors to ensure they obtain the maximum benefits from the production network (Lee, Chen, & Kang, 2011). This is an interesting one because in this paper, this causality is mainly explored from the perspective of these changes in the Value Network first leading to an improved Value Proposition and then to more profit and growth. Indeed, looking at previous relationships between the Value Network and the Value Proposition, as well as the Value Proposition with the Cost and Revenue Structure, we can obtain the same result (Camarinha-Matos et al., 2016; Emrah Karakaya & Hidalgo, 2016; Pätäri & Sinkkonen, 2014). This can be seen as a type CC relationship, as the increased collaboration in the Value Network is a need in this case, that results in higher profits or lower costs.

The next article points out how there is a great potential for reduction in costs of renewable energy through the development of local learning (Huenteler, Niebuhr, & Schmidt, 2016). This, in and of itself does not necessarily lead to a relationship between the Value Network and the Cost and Revenue Structure, but when considering that some of the greatest opportunities for learning come from collaboration within the network (Huijben & Verbong, 2013; Strupeit, 2017), then we can see how increased collaboration within the production network can lead to reductions in costs. As this is the same overall relationship as the previous one, they will be grouped together, although this shows how this relationship can also be a type CF relationship, with the initial change in the Value Network being a strategic choice rather than a forced decision.

Just how one of the previous relationships went from the Value Network to the Value Proposition and then to the Cost and Revenue Structure, this next relationship is not a simple direct one. It looks at how, when expanding the Value Network to include new actors in the Value Chain (in this case, ICT experts) to improve the Value Proposition, there will consequently be changes in the distribution of costs and payments (Dehdarian, 2018). As this was expressed in the first relationship that was found, these will be grouped together.

In the following case, the article demonstrates how in the case of Germany, renewable energy companies are heavily vertically integrated and that by doing so, they control upstream manufacturing processes with high value added (Marinova & Balaguer, 2009). By being in control of these processes, they are much more likely to have a willing influence on the overall Cost Structure. This relationship can be classified as type CC, as the initial change to the Value Network and the subsequent changes in the pricing of the product/service that are now available by having control of new high value added manufacturing processes are all strategic choices on the part of the focal firm.

Surprisingly enough, the next relationship is again a familiar one, but will actually be grouped with the second relationship in Table 2.13. This is that multi-stakeholder partnerships are vital for several things, one of which being the access to finance (Heuër, 2017). Considering the recurrence of this theme, this seems to be an important consideration when looking at the interrelationship between the Value Network and the Cost & Revenue Structure.

The final article looks at how the building of community networks can help motivate locals to engage in the company's social and financial value creation (Guia & MacGill, 2018). This is an important consideration in addition to the first relationship in Table 2.13, as it looks not only at the fact that the Cost & Revenue Structure will change, but also that the Revenue potential will improve from the involvement of common minded actors in the local community. This is a relationship of type CC, as the initial changes to the customer sided Value Network is a strategic choice, and although the additional revenues that can be taken up by the company are simply a

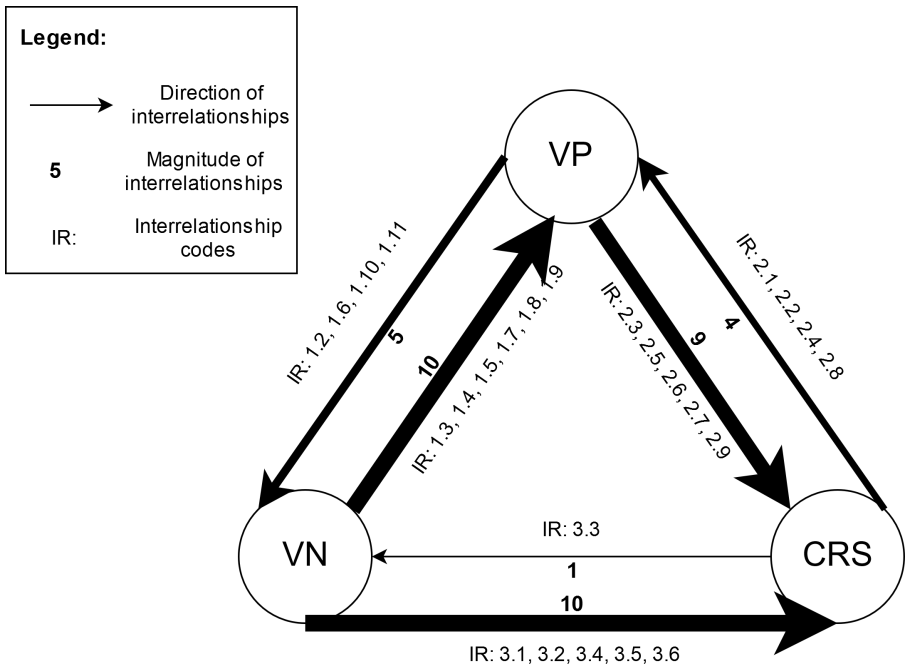

Figure 2.10: Summary of interrelationships between Business Model components

result of this, how the focal firm takes advantage of these to secure revenues for itself is a strategic choice as well.

Direction	Type	Relationship	Code
VN→CRS	CC	Different configurations of the Value Network on the customer side (including the addition of new actors) will result in a different Cost and Revenue Structure (Chaurey & Kandpal, 2009; Dehdarian, 2018; Knuckles, 2016).	IR3.1
VN→CRS	CC	Building strong ties with (non-)governmental organizations and other companies in the network can help secure additional sources of funding (Heuër, 2017; Kolk & van den Buuse, 2012; Yadav et al., 2019).	IR3.2
CRS→VN	CF	The presence of a supportive bank can be an important consideration for the choice of a target market region (Harish et al., 2013).	IR3.3
VN→CRS	CF or FF	Building strong ties within the production network can yield lower production costs (Huenteler et al., 2016; Lee et al., 2011).	IR3.4
VN→CRS	CC	By vertically integrating all upstream processes, the focal firm can control high value added steps in the manufacturing process which can impact the whole Cost Structure (Marinova & Balaguer, 2009).	IR3.5
VN→CRS	CC	The involvement of locals in the Value Network can lead to increased social and financial value generation (Guia & MacGill, 2018).	IR3.6

VN: Value Network | CRS: Cost & Revenue Structure | C: Choice | F: Forced

Table 2.13: Interrelationships between Value Network and Cost & Revenue Structure

One thing to be noted about these interrelationships is that the ones given in this work in no way represent an exhaustive list of interrelationships. It is the opinion of the author of this paper that these relationships are dependent on the specific type of Business Model that is addressed and that as such, as Business Models evolve over time, so will these interrelationships. The goal would then be to better understand the underlying principles dictating these interrelationships to better predict how they will change as the Business Models they relate to change as well.

2.4.3 Changes Over Time

Regarding the changes to renewable energy Business Models over time, these can be uncovered from the literature that was used for the two previous sections on completeness and interrelationships. These can be found in

Table 2.14.

Starting with changes that tend to occur to the Value Proposition, these are either related to the Value Offering in the form of new products and services caused by new technology (Hall & Roelich, 2016), competition (Horváth & Szabó, 2018) or in order to take advantage of some opportunity in the market. The other change is due to the acquisition of new customers from different Customer Segments (Emrah Karakaya & Hidalgo, 2016), which may or may not require different Value Offerings. This can be done in order to reach new Value Offerings (Engelken et al., 2016) or in order to find new sources of revenue in case of diminishing returns (Emrah Karakaya & Hidalgo, 2016).

Regarding the Value Network, changes to this component usually involve the inclusion of new Network Actors in the hope of developing new products (Strupeit, 2017) or because of increasing requirements from customers regarding the complexity and quality of systems (Huijben & Verbong, 2013). Including locals in the Value Chain or simply developing relationships with communities to involve them more in the process is another incentive for changing the customer side of the Value Network (Heynen et al., 2019).

Finally, looking at the Cost & Revenue Structure, it can be noted that changes to this component will rarely be the starting point for changes in the Business Model. Although this can occur due to external effects such as changes in the financial system (Hamwia & Lizarralde, 2017; Sawhney et al., 2014) or due to an incompatibility between the chosen pricing strategy and the customer's willingness to pay (Shakeel et al., 2017). Usually, this will result from changes to the other two components, as one could argue that revenues are a direct result of the Value Proposition and Costs are a direct result of the Value Network (Demil & Lecocq, 2010).

Component	Change
VP	• Change to Value Offering due to new technology (Hall & Roelich, 2016) • Change to Value Offering due to competition (Horváth & Szabó, 2018) • Change to Customer Segment due to new opportunities (Engelken et al., 2016) • Change to Customer Segment due to diminishing return (Emrah Karakaya & Hidalgo, 2016)
VN	• Addition of Network Actors in the hope of developing new products (Strupeit, 2017) • Addition of Network Actors because of increasing requirements from customers (Huijben & Verbong, 2013) • Adding customers to the Value Network in search of new revenues or Value Offerings (Heynen et al., 2019)
CRS	• Changes due to financial system (Hamwia & Lizarralde, 2017; Sawhney et al., 2014) • Change to the pricing strategy due to incompatibility with customer's willingness to pay (Shakeel et al., 2017)

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure

Table 2.14: Main changes over time of renewable energy Business Models

2.5 Chapter Summary

In this chapter, information was found on the context of renewable energy in Indonesia, whereby a better understanding of the external factors influencing renewable energy companies in Indonesia was obtained. This can serve as a basis to answer RQ 2, but only in conjunction with the information that will be obtained from the case studies. Indeed, although the context is necessary to better understand the local conditions in Indonesia that would restrict or incite certain types of Business Models, it is then necessary to look at actual companies to see of this context actually influenced these companies. For example, although it is clear that policy in Indonesia, from PLN's priority on electrification projects, to the complexity of obtaining land rights, is not condusive to renewable energy development on the part of private companies, the answer as to how these companies overcome

these obstacles has to be obtained from the companies themselves. As such, this first part of the literature study serves as a stepping stone for the answering of RQ 2.

Moving on, the next part focused on obtaining more information about the Business Model concept itself, from its origins, definition to its actual components. By looking at this evolution and at the main components found in literature, a Business Model framework can be developed that both suits the purpose of the research and stays in line with the interpretations of the Business Model found in literature. In this case, it was found that the Business Model will always contain some form of Value Proposition; that it needs to specify a Customer Segment; that it must also look at all of the Partners within the Value Network and specify what their role is in the creation, delivery or capture of value; that it needs to look at how value is captured by the focal firm; and that it needs to define what relationships the focal firm will maintain with their customers over time, apart from the delivery of the Value Proposition.

It was also found that some elements that are sometimes explicitly expressed in certain Business Model frameworks, such as 'Key resources','Key Activities' or 'Strategy', can be implicitly expressed within a Business Model framework so as to include them in the conceptualization and development of the other components. All in all, this part also acted as a stepping stone to answer a Research Question and not as an answer in and of itself. Indeed, RQ 1.1 focuses on finding what these components are for the case of rural renewable energy in particular, but to do so, the choice of the Business Model framework (and therefore the type of components it would contain) had to be made.

Thanks to this section on the history of Business Models and their components, the next sections can then focus on actually answering the Research Questions. Starting with the completeness section, the goal was to answer RQ 1.1 and 1.2 by finding the most common components, as well as the most common internal and external factors affecting them, for renewable energy companies and then filtering them for the application to a rural market. The reason 'most common' is used to define these components and factors is because due to the nature of business development, an exhaustive list of components and factors is impossible. This is simply due to the fact that an infinite amount of new ideas can be applied to Business Models with varied results, giving new and uncommon components and factors that are not necessarily important to the study of the field as a whole. The very nature of Business Model dynamics is based on this principle that the Business Model construct is not a static one. As such, it is impossible to predict components and factors that have not been invented yet, just like it isn't appropriate to include all components and factors that have just been invented and have not proved their viability in the market yet.

The next chapter on interrelationships looked at answering RQ 1.3 by once again outlining the 'most common' interrelationships between the components of the Business Model that were found. Because the Business Model framework being used consists of three main elements: the Value Proposition, the Value Network and the Cost & Revenue Structure, these interrelationships could be broken down into three categories, looking at the interrelationships between two components at a time. What was found was that these interrelationships can sometimes be stronger in one direction than the other, such as the case of the Cost & Revenue structure that usually derives from the Value Proposition and the Value Network and rarely the other way around. This is coherent with the part of the literature study on the Business Model framework, as the costs and revenues are never the starting point of a Business Model and always a result of it.

Finally, to answer RQ 1.4, the most common changes over time of Business Models for renewable energy projects were found from literature. These were mainly obtained from a combination of the two previous sections, as common changes will occur within certain 'components' due to certain 'factors', which were outlined in Section 2.4.1. Section 2.4.2 was also used as some of these interrelationships were given in the context of an actual change occurring to the Business Model over time. This was then complimented with additional literature to get a more complete picture of these changes over time.

As such, this literature study chapter looked at answering RQ 1.1 to 1.4 as well as being a stepping stone to answer both RQ 1.5 and RQ 2.

Chapter 3

Conceptual Model

Having gone deeper into the background of renewable energy in Indonesia, as well as Business Model elements and their dynamics, this chapter will now delve into the creation of the conceptual model to be used for the analysis of rural renewable energy Business Models. To begin this process, the first aspect to be looked at is the completeness of elements. Following this, the interrelationships of components are analyzed to ascertain the coherence of the model as a whole as well as to prepare for the analysis of the Business Model over time. Indeed, the next step is to look at the inclusion of changes in the Business Model over time, mainly based on the interrelationships of components, but also due to internal and external stimuli. Finally, the framework needs to be able to account for changes in the Business Model as a whole.

3.1 Completeness

Regarding the completeness of elements for the framework, these are based on the results of the literature review on the topic and adapted for the case of rural communities. This is because the focus for now is on RQs 1.1 to 1.5, as the previous chapter served the purpose of gathering data on these different aspect of Business Model dynamics in the case of renewable energy in general. In this chapter, the information will be further refined to focus on the case of off-grid projects in particular, and will look to answer RQ 1.5 by also presenting this information in a way that may be useful for future research. The way this can be done is through a process of elimination, by removing elements in particular that cannot adapt to an off-grid setting. This is because excluding elements based on them not being common or frequent in a particular sub-market would constrain the perception of how that market truly can operate. In order to prevent this while also conserving information about the likelihood of a certain element existing, statistical data about the frequency of a certain element being included can be represented in the framework when used for data gathering and data analysis.

In this case, the basis for the expected elements of the Business Model can be obtained by looking at each component from the literature study and asking the question: is there any reason this element is not be applicable to an off-grid context? This process of elimination may seem to let through many components that may not be relevant or common, but once again, the more information is gathered, the more this will become apparent in the framework and thus better inform people using it on how the sub-market itself is divided into mainstream and niche applications. The internal components as found using this method are listed in Tables 3.1 and 3.2.

What can be immediately noticed is that this table is nearly identical to the one from the literature study, in fact, only one element was removed based on the previous criteria. One can make sense of this when going through elements one at a time while thinking about how they may not be applicable to an off-grid context.

Starting with the Customer Segment, we can see how the six first given types are easily envisioned as an off-grid customer. IDOs and NGOs can both be said to be heavily involved in such types of rural community developments that might require renewable energy. On the same basis, governments and community leaders also have it in their best interest to develop and electrify these off-grid regions. As for BoP communities, being the major market in off-grid areas makes it a likely candidate for such projects. Finally, individuals with the means to purchase such system can exist in any region, and so it is to be expected that there will also be some in off-grid regions that would still have the desire to be self-sufficient in terms of energy and have the means to do so. Where some level of contention can be brought up regarding the customer segment is when it comes to commercial entities, as one would not expect much of a commercial entity in an off-grid region. The counter argument to this is that a commercial entity is a rather broad concept and can include any entity whose purpose is some form of financial transaction for a service or a good. In that sense, private eco-lodges can be seen as a commercial entity, and are likely to be found in off-grid areas, making them just as likely

a customer as individuals. Moving on to the Value Offering, all of the four options are once again activities that can be performed in an off-grid market and have no particular reason to be removed from the table as such.

Elements	Sub-components	Typical examples
VP	Customer Segment	• IDOs & NGOs • BoP communities • Governments • Individuals • community leadership • commercial entities
VP	Value Offering	• Knowledge/advice • Product delivery & sales • Technology & system design • Large scale supply of energy services
VN	Partners	• Network • Local installers & technicians • Other entrepreneurs: knowledge & skills • Manufacturers & suppliers • Government/community leaders • IDOs, NGOs, etc. • Local business/utilities
VN	Sales Process	• Word of mouth marketing • Company website • Web & print advertising • Tender process
VN	After Sales Services	• Maintenance • Customer Support

Table 3.1: Business Model elements for rural renewable energy projects (Adapted from Gabriel and Kirkwood (2016))

Elements	Sub-components	Typical examples
CRS	Costs	• Materials and components • Logistics and operations • Hiring and retaining human capital • Subcontracted human capital • Import duties and taxes
CRS	Revenues	• Advice/knowledge transfer • IDO project tenders • System design and sizing (& overseeing installation) • Product sales (& installation) • System sales & infrastructural integration

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure

Table 3.2: Business Model elements for rural renewable energy projects continued (Adapted from Gabriel and Kirkwood (2016))

As for the Value Network, once again we can see the applicability of different components to an off-grid setting. In the case of partners, we can see how a renewable energy company would still have a need for manufacturers & suppliers regardless of the market it is catering to. As for partnerships with networks of companies, the benefits of such collaborations are once again not limited to an on-grid market and are more broadly applicable. Local installers and technicians would be even more so important in an off-grid setting than an on-grid one, where longer distances means higher costs for sending your own installation team and so a higher likelihood of relying on local labor. There is also no reason for such companies not to work with other entrepreneurs and sharing knowledge and skills to better serve their target market. Regarding governments and community leaders, just as they can be a customer segment in and of itself, they can also be important partners in the development of off-grid projects, as they mostly oversee the rules and regulations that would otherwise constrain a company from delivering its services in a certain region. The same can be said of IDOs and NGOs, which would have as much incentive to partner with renewable energy companies to develop certain projects as to hire them to perform a certain project. Finally, local businesses would also be potential partners in developing certain products or services, as they would have the best knowledge of the local context. As for local utilities, this is not out of the question for off-grid markets either, as the procurement of electricity for off-grid regions can very well be assigned to private companies in partnership with the local utility company.

Regarding the sales process, we once again find that all of the given components from the literature study could also fit with an off-grid setting. One could argue that methods such as word of mouth advertising and company websites would not be effective for the off-grid market, as most people in such regions would not be accessible by word of mouth and would not necessarily have access to the internet. But as was seen in the Customer Segment, the customer is not necessarily the community living in these off-grid regions, it can be IDOs or NGOs, local or national government bodies, individuals, commercial entities, all of which can have access to those previously mentioned marketing methods. This is also true of web & print advertising, which may be less effective for isolated communities but will still work for any customer applying the technology to off-grid markets but not being in the market themselves. Finally, the tender process of getting a project assigned to the company is one that is not limited to the on-grid market and is thus included as well.

Regarding the after sales services, one can see how not only would these components be valid in an off-grid setting, but would actually hold more importance. Indeed, the ability to get support from the company when encountering an issue with the system is something that becomes more critical in a situation where there is no alternative. If an off-grid house encounters a problem with their renewable energy system, they can just use the grid energy in the meantime. This is not possible in an off-grid setting and makes maintenance and customer support that much more important.

Finally, when it comes to the Cost & Revenue Structure, starting with the costs associated with off-grid renewable energy projects, we once again get the case that all of the costs are applicable. From materials and

components, logistics and operation, hiring and retaining human capital, subcontracting human capital, or paying import duties and taxes, these are all costs that can be seen as irrespective of if the renewable energy system in question is on-grid or off-grid. It is only when it comes to the revenues that a difference can be made. This difference is in the feed-in tariff, as it obviously has to do with a grid connected system by definition. This gives a good example of how some elements can indeed be excluded when their application is tied to a specific market. As for the case of other components, it is not the case of if they are usable in an off-grid context, but how likely, or useful they are in such contexts.

Of course, apart from the internal elements of the Business Model, the completeness element also looks at the external factors that may influence the Business Model. The elements that were obtained from the literature can once again be filtered through the lens of off-grid applications. In this case though, it can be found that none of the given causes for changes in the Business Model can be excluded from an off-grid application. Looking once again at these results, that can be found on Table 3.3, we can see why that is the case. Starting with a constraining or supportive financial system (E1 and E2), one can see that such effects are not constrained to an on-grid renewable energy company. The same with constraining or supportive policy, which will affect any company within the market that the policy is targeting. Indeed, beyond the on-grid or off-grid distinction, one could argue how such effects are more generally applicable to any target market that has any financial systems or policies affecting them.

Effect	**Type of Factor**	**Code**
E.T→CRS	Constraining Financial System (Hamwia & Lizarralde, 2017).	E1
E.O→CRS	Supportive Financial System (Hamwia & Lizarralde, 2017).	E2
E.T→VP/CRS	Constraining Policy and Regulatory Framework (Emrah Karakaya & Hidalgo, 2016; Leisen et al., 2019).	E3
E.O→VP/CRS	Supportive Policy and Regulatory Framework (Huijben et al., 2016; Sawhney et al., 2014; Shakeel et al., 2017).	E4
E.O→VP/CRS	Technology (Hall & Roelich, 2016).	E5
E.T→VP/VN/CRS	Competition (Horváth & Szabó, 2018).	E6
E.T→VP/VN	Lack of Social Acceptance (Stigka et al., 2014).	E7
E.O→VP/VN	Social Acceptance (Stigka et al., 2014).	E8
E.T/O→VP/VN	Landscape Changes (Budzianowski et al., 2018).	E9
I.T→VP/VN/CRS	Production Issues (Horváth & Szabó, 2018).	I1

E: External | I: Internal | O: Opportunity | T: Threat

Table 3.3: Factors affecting Business Model elements

As for the next effect, technology, this could be said to affect any company who's product or service is based on technology. Again, a very broadly applicable effect that is not constrained to the on-grid renewable energy sector, or the renewable energy sector as whole for that matter. Which leads us to our next effect: competition. This is arguably the most broadly applicable effect, as some companies may not be affected by technology, financial systems, and in rare cases, policy and regulations, but any product or service, especially if successful, is liable to replication and thus competition.

Regarding social acceptance, or lack thereof, this can be said to be even more important with off-grid projects than on-grid ones, as it was seen that the off-grid local communities may be the end user of the system but not necessarily the customer, which means that they are even less likely to be invested or accepting of the technology than if it was their own choice to make use of the system. This makes this external factors a more contentious one than in on-grid projects, as the lack of guarantee that the users of the system are accepting or understanding of the system could lead to problems over time.

Looking at the last two external effects, namely landscape changes and production issues, these are also more broadly applicable than simply in an on-grid setting. Landscape changes can occur on any level and in any region, which doesn't exclude off-grid rural communities, and production issues are more general to any business that produces something, which is just as much the case for an on-grid project as it is for an off-grid project. Actually, one could even argue that production can be even more of an issue in off-grid systems than on-grid ones as isolation makes reliability a more critical factor, leading to higher requirements on the reliability and thus adequate production of such systems.

3.2 Interrelationships

For the representation of interrelationships in the framework we again have to rely on this elimination process of the results from the literature study. This is because the broadness of applicability of each interrelationship cannot be bounded to an exact context. The only way to do so would be to have considerable data on past changes of Business Models for each type of context. The best that can be done is to discard only interrelationships that would have a good reason not to be applicable to the rural market. Interestingly enough, when going through the interrelationships found in the literature study, it was found that not a single one could be eliminated on this basis. In other words, all of the interrelationships that were found relating to renewable energy in general can be seen as having applicability in a rural off-grid setting as well. This partly comes from the fact that both markets have a strong overlap in the type of technologies being used, and so the production side Value Networks are mostly identical. This does bring into question how these interrelationships can be generalized. Indeed, one can see the complexity of trying to determine to what extent each interrelationship can stay applicable. On the other hand, it is important to take into consideration interrelationships that might seem specific to a certain sub-market, but end up being applicable to other sub-markets. This is why it is thought to be best to only discount interrelationships for which a good reason can be given for its exclusion.

As such, looking at the interrelationships found in the literature study, the question is now how to use this information as the basis of a framework. This can be done by classifying each interrelationship based on its direction and its type. This allows for a better representation of which types are more common between different components. By looking at these trends, one can then look at the interrelationships that are at the root of each type and better understand why such a type is common or rare. The result of this classification can be found on Table 3.4. To better explain what can be found on this table, first the direction of each relationship is given, followed by the type of relationship, a statement is then given representing the relationship type. These generic statements give an idea of what type of interrelationships these encompass. The interrelationships from the literature that these correspond to are then given, followed by an accounting of the number of interrelationships of that type in that direction, and the number of references that refer to those interrelationships. What can be noted about this last column is that the total of interrelationships and references do not amount to the total of each row. This is simply because some interrelationships were found to be of different types depending on their interpretation.

Several things can be noted when looking at these interrelationships from this perspective. To begin with, there seems to be some preference in different directions regarding the common types of relationships. For example, while the effect from Value Proposition to Value Network is only slightly in favor of a relationship of type CF, in the direction from the Value Network to the Value Proposition, most relationships are of type CC. This may seem obscure at first but when looking at the associated statement to this relationship, this makes more sense. Indeed, while the Value Network can be changed by necessity and thus cause a change to the Value Proposition, and it is possible for a strategic change to the Value Network to lead to a forced change in the Value Proposition, one can see how it would be much more common for a company to strategically change their Value Network, allowing them to strategically improve their Value Proposition.

Another interesting thing that can be noted is how the VP is very rarely changed by an initial forced change. The only case of this in these interrelationships is IR1.2, of type FF. This is also something that makes sense when thinking about the typical causes for changes in the Value Proposition. Indeed, most changes to the Value Proposition will be designed to take advantage of some opportunity, it is rare for a Value Proposition to be forced to change. Of course there are considerable internal effects that can constrict a Value Proposition, as can be seen through the relationships of types CF and FF from the Value Network and Cost & Revenue Structure to the Value Proposition.

Finally, one can see from the results of the effect of the Value Network on the Cost & Revenue Structure that the two most common types are CC and CF. This implies that externally, the Value Network is more likely to change from a strategic choice than by necessity. This is corroborated by the previously mentioned relationship between the Value Network and Value Proposition, where the most common type is CC, another type starting with a strategic change to the Value Network. This is especially interesting when comparing this to the type of change as a result of another component's change, where the Value Network tends to change more by necessity than strategy.

Relationship	Type	Statement	Interrelationships	IRs (Refs)
VP→VN	CC	A strategic change to the VP can lead to a strategic change in the VN	IR1.10	1(1)
	CF	A strategic change to the VP can lead to a forced change in the VN	IR1.6, IR1.11	2(2)
	FF	A forced change to the VP can lead to a forced change in the VN	IR1.2	1(2)
				Total: 4(5)
VN→VP	CC	A strategic change to the VN can lead to a strategic change in the VP	IR1.1, IR1.4, IR1.5, IR1.9	4(7)
	FC	A forced change to the VN can lead to a strategic change in the VP	IR1.3, IR1.8	2(2)
	CF	A strategic change to the VN can lead to a forced change in the VP	IR1.7	1(1)
	FF	A forced change to the VN can lead to a forced change in the VP	IR1.8, IR1.9	2(2)
				Total: 7(10)
VP→CRS	CC	A strategic change to the VP can lead to a strategic change in the CRS	IR2.3, IR2.5	2(5)
	CF	A strategic change to the VP can lead to a forced change in the CRS	IR2.5, IR2.6, IR2.7, IR2.9	4(6)
				Total: 5(9)
CRS→VP	FC	A forced change to the CRS can lead to a strategic change in the VP	IR2.2	1(1)
	CF	A strategic change to the CRS can lead to a forced change in the VP	IR2.8	1(1)
	FF	A forced change to the CRS can lead to a forced change in the VP	IR2.1, IR2.4	2(2)
				Total: 4(4)
VN→CRS	CC	A strategic change to the VN can lead to a strategic change in the CRS	IR3.1, IR3.2	2(6)
	CF	A strategic change to the VN can lead to a forced change in the CRS	IR3.4, IR3.5, IR3.6	3(4)
	FF	A forced change to the VN can lead to a forced change in the CRS	IR3.4	1(2)
				Total: 5(10)
CRS→VN	CF	A strategic change to the CRS can lead to a forced change in the VN	IR3.3	1(1)

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure | IR: Interrelationship | C: Choice | F: Forced | Refs: References

Table 3.4: Interrelationships between Business Model components by type

One thing that can be noted about the usefulness of this classification, apart from how it helps in deriving theories on the interrelationships of components, is how it is a representation that plays well into the concept of Dynamic Capabilities. This is because the differentiation of relationships based on if a change is necessary or the result of strategy, specifically defines where strategies are used. In this sense, this classification allows for a representation of the use of these dynamics capabilities both to initially change a component, as well as use this as an opportunity to strategically change other components. Additionally, with relationships of type FC for example, one can specifically focus on relationships where a forced change led to a strategic opportunity. This would allow for a better under of opportunities in necessary changes. Or relationships of type FF would help in determining the types of changes that have inevitable consequences on different Business Model components, and thus help in possibly avoiding such changes in the case where they are detrimental to the focal firm.

3.3 Changes Over Time

Apart from the framework indicating what the components of the Business Model are, and what factors influence them, it also aims at giving an informative graphical representation of how such Business Models evolve over time. To do so, a framework was conceptualized where each of the three main elements would be represented as the tip of a triangle. Each of these components can go up in levels, which represents a change in the specific Business Model component, due to internal or external threats or opportunities. This is represented by an arrow pointing at the initial component that underwent a change. To represent the type of driver that caused the innovation, the arrow is either pointing from inside the triangle outwards for internal drivers or pointing from outside the triangle inwards for external drivers, and either originates from an X when it is a threat, or an O when it is an opportunity. These innovation drivers are numerated so as to keep track of the order of innovations. If a component that was changed due to an innovation driver affects another component, this one goes up a level as well and the causality is represented by an arrow between the components. Finally, the sign next to the arrow showing changes in the components (+, - or R), represent if an element was added (+), removed (-), replaced (R) or if no sign is there, an existing element was modified. An example of this framework can be found on Figure 3.1.

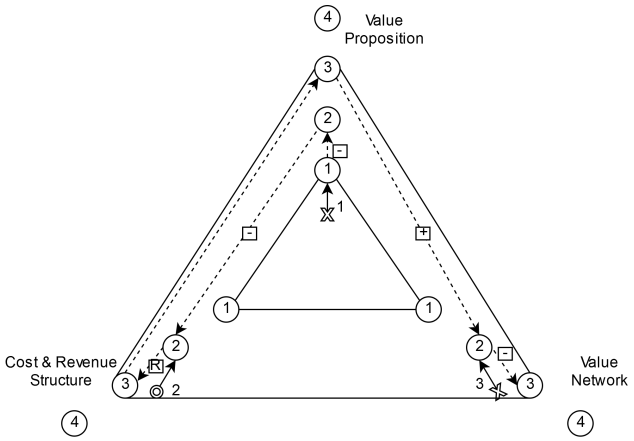

Figure 3.1: Example of the Dynamic Business Model Triangle

So to quickly summarize what the given example represents. The Business Model starts with all components at level 1, here one of the Value Offerings from the Value Proposition gets removed due to an internal threat, which leads to the removal of its related costs and revenue in the Cost & Revenue Structure. The Cost & Revenue Structure is changed a second time, but this time due to an external opportunity that leads to the replacement of one of its elements, which leads to a change in the Value Proposition and subsequently, an addition to the Value Network. Finally, an external threat causes the removal of an element of the Value Network. In this example, one of the driver leads to a change in all of the Business Model elements, but this is a case where this happens due to the causality between elements over time and not from a decision to innovate the Business Model as a whole. For this last case, this will be explored in the next Section on Framework Changes. The last element of the given example, is a change in the Value Network due to an external threat.

Some of the advantages of such a framework is the vast amount of information contained in such a simple framework, as one can at a glance determine the amount of innovation that has been performed, due to what type of drivers and what type of correlations between elements led to the current Business Model. Of course, the information as to exactly what the drivers were, what the components changed to, and what the reasons were for the changes in other components (or what were the interrelationship that caused these changes) would have to be given in a table accompanying the framework, which is not unusual for such frameworks (Cosenz & Noto, 2018).

So we can see that the framework can serve two purposes: first, to help managers set up and innovate their Business Model, and second, to ease the analysis of Business Model Dynamics in a more simplified and holistic way. These two purposes can be said to be mutually beneficial, as the more people use this framework as a tool for the analysis of past trends in Business Model Dynamics, the more drivers and interrelationships will be discovered, especially for very specific markets, which in turn, will make it easier for managers to use this tool to help them in the development of their own Business Models in these markets.

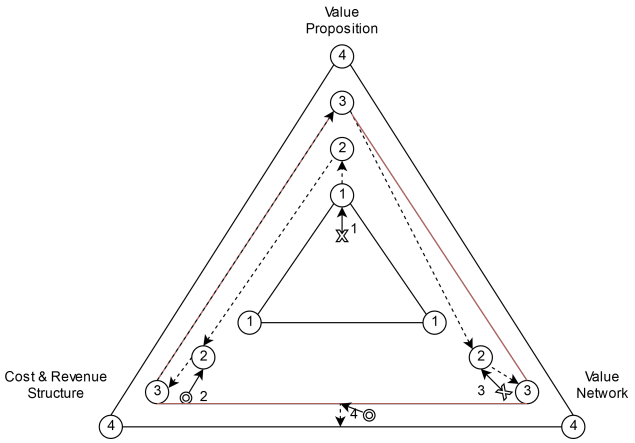

Figure 3.2: Dynamic Business Model Triangle with changing framework

Finally, looking at changes in the overall framework, this can be represented by a complete change in all three elements simultaneously, but with the arrow representing the driver somewhere else. For example, on Figure 3.2, this represents a change in all elements of the Business Model due to an external opportunity. The color of the old Business Model can be used to indicate if the Business Model is still active, as in red for inactive and green for active.

3.4 Operationalization of the Framework

The aim for the framework is not just to be a useful tool for researchers to more easily display their findings on Business Model dynamics, or for them to compile such information more easily from other researchers using the framework, but also for it to be useful to manager in developing and improving their Business Model.

To turn the interrelationships between components for off-grid renewable energy projects that were looked at in Section 2.4.2 into a usable framework, the easiest way is to phrase them as questions (see Table 3.5) to help the user of the framework to verify if his choice of components fit with the questions on their interrelationships. In order to ease the use of the concept for Business Model generation the 'Completeness' and 'Interrelationships' are combined in the framework, by making the user start from the Value Proposition component by setting his chosen customer segment and product/service offering, then determining the necessary Value Network through the interrelationships between the two components and finally, moving on to the Cost & Revenue Structure, determined by its relationship with both the Value Network and the Value Proposition. The list of questions actually goes in the order that should be followed, and one will notice that it also includes feedback questions regarding how changes might have impacted previous components. If when closing the loop, the Value Proposition is considerably changed by the Cost & Revenue Structure, then the whole process should be continued from there until the selected Business Model components are stable.

These questions also make managers more aware of certain opportunities that they can take advantage of in their Business Model, but to make this even more clear, another list of questions can be derived specifically based on the typical factors affecting Business Models in order to prepare managers for such opportunities and threats and guiding them on the path of adapting their Business Model to them.

Direction	Questions
VP	• What Customer Segment is being targeted? • What unique value are you offering to these costumers? • Can value added products be offered based on the types of activities in the Customer Segment? (IR1.11)
VP→VN	• Can the chosen partners, suppliers and other relevant actors in the Value Network be collaborated with to produce the level of technical complexity and quality required by the customers targeted by the Value Proposition? (IR1.2) • Can business and social relationships be built with members of the targeted Customer Segment to get a competitive advantage? (IR1.10) • Can companies be collaborated with from outside the traditional renewable energy Value Network to offer unique products/services? (IR1.6)
VN	• Can ties be built with other (non)-governmental organizations in the network in order to help secure sources of funding? (IR3.2) • Can locals be included in the Value Chain to increase social and financial value generation? (IR3.6)
VN→VP	• If relationships are considered with local communities, does this affect the original Value Proposition? (IR1.8, IR1.5) • If companies are involved from outside the traditional Value Network to offer unique products/services, is this reflected in the Value Proposition? (IR1.6)
VN→CRS	• Does the configuration of the costumer network imply a certain Revenue Structure? (IR3.1) • Does the Value Network contain a supportive bank, and is this accounted for in the Cost and Revenue Structure? (IR3.3)
VP→CRS	• Does the Revenue Structure derive from the Value Proposition? (IR2.6) • Does the Pricing Strategy fit the customer demographic that the Value Proposition is for? (IR2.5)
CRS	• Does the Cost & Revenue Structure allow for expenses in innovation? (IR2.2, IR2.4)
CRS→VN	• If there is an implied Revenue Structure, is there a better configuration of the Value Network that would yield more profit? (IR3.4, IR3.5)
CRS→VP	• Does the nature of the financial system favor a certain Value Proposition? (IR2.1)

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure | IR: Interrelationship

Table 3.5: Questions on interrelationships of Business Model elements

Chapter 4

Case Study

As mentioned in the introduction, the case study companies were chosen to be renewable energy companies based in Indonesia with some experience with rural renewable energy projects. Based on a web-search and some recommendations from people with knowledge of the Indonesian Renewable Energy scene, 11 companies were chosen. Some did not explicitly mention any rural projects on their websites but were contacted to make sure this was the case. Out of all these companies, either because they did not have any direct involvement in rural projects or due to a lack of response from them, 4 companies remained. A list of the initial and final companies can be found in Table 4.1.

Company name	**Applicable/Responsive**
Akuo Energy Indonesia	Yes
Contained Energy	Yes
Daun Energy	No
Hita Dakara	No
Selaras Daya Utama	Yes
Solarig	No
Solar Power Indonesia	Yes
Surya Utama Nuansa	No
Sun Power Technology	No
Sinergi Energi Baru	No
UPC Renewables	No

Table 4.1: List of Companies

4.1 Interview and Design

To begin with, some information regarding the interview process with the different companies can be found in Table 4.2.

Company name	**Active since**	**Interview process**	Position of interviewee
Akuo Energy Indonesia	2012	Conference call	Project manager
Contained Energy	2004	Face to face	Solar project engineer & Solutions engineer
Selaras Daya Utama	2009	Conference call	Solar sales engineer
Solar Power Indonesia	2007	Face to face	Business development manager

Table 4.2: Interview details

Regarding the actual interview process, based on discussions with Leon Pulles, a senior investment manager, Project Manager and Managing Partner at Energy Investment Management BV, that has often worked with renewable energy projects, including some in Indonesia, and with Hanieh Khodaei, the main supervisor of the thesis, that the best way to get some information would be through semi-structured interviews. In this case, this would mean sending the company in question a summary of the research of this work and the point of interview. The interview would then take place around some basic points that would need to be addressed. This is also why the interviews needed to be either over a conference call or face to face for allow some flexibility.

In order to make sure to cover all of the relevant topics though, a list of questions was written out as a basis for the interviews. But by not depending on a strict question answer basis, depending on the interviewees responses, the conversation could be directed so as to obtain as much relevant information as possible.

The main questions to be covered, or guideline for the interviews consisted of the following:

General Information:

- - What position do you hold in the company?
- - How many rural off-grid projects has your company been involved with?
- - Could you give me an example of a project in particular that you would think is a good example of successful integration of renewable energy in off-grid communities?

Value Proposition:

- - What kind of solution did you bring to the community?
- - Is this different to previous solutions you might have brought to similar communities in the past?
- - Do you think it would be worthwhile to modify, expand, improve or build on this current solution as time goes on?
- - Was this solution catered to the community in a particular way?
- - What was your beach head market?
- - Have you changed your target market since?

Value Network & Costs:

- - Did you provide any after sales services to the community in question?
- - If so, did you always plan on providing after-sales services?
- - Is this something you plan on continuing to provide?
- - If not, do you plan on doing so in future projects?
- - Did these incur considerable costs?
- - Did you manufacture any of your components or dealt mainly with assembly?
- - Do you believe renewable energy companies should move more towards vertical integration or that it is more convenient for them to focus on assembly and procurement?
- - Were any of the components you used imported from other countries?
- - Do you believe this incurred considerable costs compared to if these components were manufactured locally?
- - What would be the condition for you to use local products (equal costs, equal quality or both)?
- - What would you say are the two biggest costs with such projects (development, assembly, transportation, maintenance, marketing)?

Revenue Structure:

- - At who's request were you commissioned to work on this project (NGO, government agency, the community itself)?
- - Did you use marketing strategies to make these communities/organizations aware of you or did you approach them directly to offer your services?
- - If it was through marketing, have you tried or considered a direct contact approach or other alternatives (showroom, community ambassadors)?
- - Were they the main source of financing for the project or were there other sources (Bank loans, grants, venture capital)?

- - Were the community themselves required to pay?
- - If not, do you plan on changing that if the community in question gains sufficient purchasing power in the future?
- - If so, what payment plan was used (one time, weekly, monthly)?
- - Was this payment plan always in use?
- - Do you plan on eventually moving towards a different payment plan?

Completeness:

- - What were in your opinion the biggest external factors that affected how the project was carried out (education, policy, infrastructure)?

Interrelationships over time:

- - Considering this was a good example of integration of renewable energy in an off-grid community, do you also have an example of such a project that did not go as well or that you at least learnt from to improve your approach?
- - What were the biggest lessons/improvements you obtained from it?
- - In your history with rural communities, have there been any significant changes in your method of operating (system design, marketing, after sales services, partners, etc..)?

These questions were deemed to cover all of the relevant aspects and were adapted on the basis of the companies that were interviewed and how each conversation went.

4.2 Overview

To begin with, from the interviews with the renewable energy companies in Indonesia as well as Nadhilah Shani, a research analyst from the ASEAN center for energy, a better picture can be obtained of the current situation with rural projects in the country.

The first thing to be said is that one of the main barrier to the successful diffusion of renewable energy in general (and this applies to rural communities as well), is the established policy regarding the use of such systems. Although on paper Indonesia has made quite a few policy decisions meant at improve the situation, in practice this is not quite the case.

For starters, the certification for renewable energy projects can be quite expensive and cumbersome. The first thing that was often mentioned is the Business Area License (or BAL), which is a certificate entitling a company to produce energy at a utility scale within a region. By default, this certificate is owned by PLN, the state energy company, in charge of both energy production and the expansion and maintenance of the national electric grid. In the case where the region of interest is one where PLN is looking to expand, this BAL would therefore not be obtainable by other parties.

Another certificate that is required, specifically for production above 25kW peak, is called Sertifikat Laik Operasi (or SLO), which translates to operational worthiness certificate. Now again, on paper this seems to be a normal and even necessary procedure to ensure the quality of such systems. The problem is that there is apparently between 5 to 10 companies in Indonesia that are capable of delivering such certificates. This apparently led to these companies over-charging for these certificates making the whole process more expensive still.

Quite a few of these companies are also what are called PT PMA, Perseroan Terbatas Penanaman Modal Asing, which translates to Foreign Investment Limited Liability Company. These companies don't always have the right to participate in government tenders and are sometimes restricted from certain government projects.

There is also the case that the price of electricity to be bought by PLN, although up to debate to a certain extent, still has to be cleared by the Ministry of Energy and Mineral Resources and is capped to a certain percentage of the expenditure for electrification in the region. According to the renewable energy companies interviewed, this is usually 65% percent of the national electricity price, making it hard for renewable energy companies to recuperate their costs.

Finally, although Indonesia used to allow renewable energy companies to operate under a Build, Own, Operate (BOO) scheme, the only legal option is now a Build, Own, Operate, Transfer (BOOT) scheme. This, on top of the low electricity prices stipulated in Power Purchase Agreements (PPA) with PLN, somewhat explains the low interest on the part of bank institutions and private investors to get into this sector in Indonesia.

On a case by case basis, it can be said that each company had their own obstacles to deal with, although some similarities can be easily distinguished, showing a trend amongst renewable energy companies involved with rural markets.

4.3 Solar Power Indonesia

To start with, SPI (Solar Power Indonesia) is one of the oldest renewable energy companies in Indonesia and has worked on a good amount of rural projects. They offer the simple value proposition of providing affordable, reliable and clean energy. Despite being affordable relative to other energy alternatives in remote areas, this is not necessarily the case for poorer rural communities, and so SPI usually caters to NGOs and eco lodges in the rural market.

On the value network side, they work mainly as an EPC (as most renewable energy companies in Indonesia) and do not manufacture their own components. The more complicated ones (inverters, batteries, solar panels) they import, while they get most of their other components and materials locally. As for their partners on the distribution side, especially for rural and isolated projects, they need to coordinate transportation of the materials and workers on to the project site. They may also require local manpower in which case coordinating with local workers is also key.

Regarding the sales process, SPI mainly depends on direct marketing to get to their clients, but also make use of their website and other internet based marketing methods. As for After Sales Services, SPI provides monitoring and maintenance but also offers the opportunity for their clients to sell their old solar panels back to them so as to be able to purchase newer ones at a reduced cost.

As for the cost and revenue side, being focused on the sale of complete systems and not on the procurement of energy, SPI gets payed up-front by their customers. The main costs they incur, specifically for remote areas, are transportation costs, but just as other companies they of course have to cover the costs of material and components and their own internal costs (salaries, office spaces, etc). One could also say they incur installation and certification costs but due to the small scale of their projects, these are negligible compared to the other costs. Regarding their warranty and the costs it might cause for the company, even though it covers the first five years of operation, the high reliability of the installed systems means things rarely go wrong, and if they do, transportation is once again one of the main costs.

The main changes to their method of operating are not so evident on the larger scale of their business model, as most of their value proposition, value network and cost/revenue structure have stayed the same, but there were minor changes to certain aspects of the business, the summary of which can be found on Figure 4.1 and Table. These minor changes come in three forms: improvements due to technological advances, small lessons learned from unique circumstances in certain projects and adaptations to national regulations.

An example of a change that was related to their own personal experience was their decision to focus on solar panels and not wind turbines due to a project where they realized the complexity of shipping wind turbines to remote locations, requiring extra space and thus adding to their carbon footprint (change 1 on Figure 4.1). If we had to look at the cause of this change, we could see it as an external opportunity that the delivery of clean renewable energy was not being done in the most efficient way possible. Why specifically this cause would be classed as external rather than internal would be in the position of the cause (packing efficiency) relative to the focal firm. In this case, considering that the effects of changing the Product Offering are mainly considered in terms of how they affect the transportation of the system, such as its cost and the amount of pollution generated, and considering that the delivery itself is not performed by the focal firm but by hired companies on a per project basis, the cause can be seen as external, as it did not originate from within the focal firm.

This change initially impacted their Value Proposition, as despite their similarities, solar and wind energy have some significant differences in terms of the value they entail. The best example being how solar power will only operate during the day and thus require some form of energy storage to be able to provide electricity at night or during particularly cloudy weather. As for wind, it will obviously depend on how windy it is, specifically at the velocities that the turbines are designed for. Also, one could look at the very difference in the power they generate, seeing as PV provides DC (Direct Current) power which then needs to be converted by an inverter for AC (Alternating Current) applications, while a wind turbine provides AC power directly, but can require

AC/AC conversion to match the necessary frequency and phase.

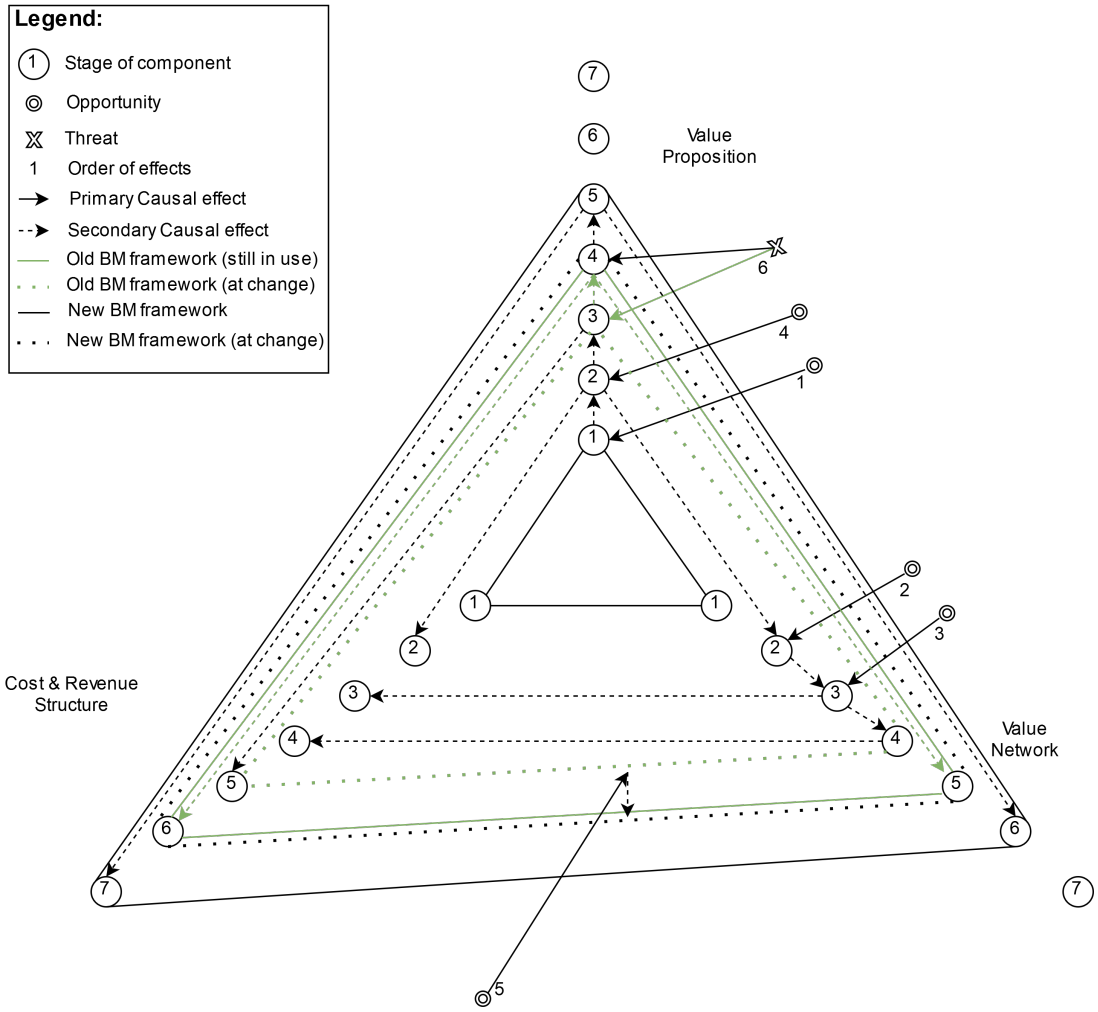

Figure 4.1: Framework representation of changes to SPI's Business Model

So as can be seen, removing wind energy as a product offering does indeed affect the Value Proposition, but in this case, it is clear that SPI considered such effects when removing wind energy from their Product Offering. This is because of the nature of most of their projects, which when all factors are taken into consideration, including availability of energy sources, system sizing, transportation and installation, will result in PV being more advantageous. Especially considering projects that are isolated and long distances away, this results in a bigger relative importance of how easily packaged the system is. As was seen in the literature study on the context of Indonesia's renewable energy scene, PLN, the national energy company, has a decisive role in any grid connection and grid extension project, and the amount of locations available to private companies depends on PLN expansion plans. As such, most areas that are serviceable within these constraints will be highly isolated. This explains why such a consideration would yield a considerable advantage to solar over wind energy.

Looking at the other elements of the Business Model, one can see how removing such a product offering would also change the Value Network as well as the Cost & Revenue Structure of the company. On the Value Network side, this is simply because the company would no longer need to collaborate with wind turbine manufacturers, while on the Cost & Revenue side, different considerations need to be taken into account. on the cost side, this is not as straightforward as a simple removal of wind from the Cost Structure, but on a deeper level, all of the previously mentioned differences between solar and wind will result in different costs of the overall system when designed for the same capacity. As for the Revenue Structure, it does not necessarily have to change as a result, but a change to the pricing strategy for example, can be implemented based on the changes in the Cost Structure.

N.	Cause	Primary effect	Follow-up effect
1	More efficient packaging of PV panels compared to wind turbines	VP 1→2: Change from PV and wind combination to only PV	VN & CRS 1→2: Removal of wind turbine manufacturers from Value Network, and removal of wind turbine associated costs from Cost & Revenue Structure
2	Advantages of partnerships	VN 2→3: Partnership with PV companies	CRS 2→3: Different costs and pricing of PV
3	Advantages of partnerships	VN 3→4: Partnership with battery companies	CRS 3→4: Different costs and pricing of batteries
4	Value Network / technological opportunity	VP 2→3: Change from lead-acid to lead-carbon batteries	CRS 4→5: Different costs and pricing due to new battery
5	Implementation of net metering policy	VP 3→4; VN 4→5; CRS 5→6 (black dotted line): New on-grid Business Model	
6	Customer's fearing PV obsolescence	VP 3→4 (green line): Implementation of buyback scheme for old panels VP 4→5 (black line)	VN 4→5; CRS 5→6 (green line): New company-customer relationship and interactions and new costs and revenues from the buyback scheme VN 5→6; CRS 6→7 (black line)

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure

Table 4.3: Cause and effect of changes to SPI's Business Model

The next change to occur to SPI's Business Model was the formation of partnerships with PV companies (change 2 on Figure 4.1). This change can be seen as being caused by an external opportunity, namely, the opportunity of improving reliability, quality and affordability of their system by having partnerships with relevant manufacturers. Of course, the results of such a partnerships are not necessarily direct, but one can see how this change in the Value Network can have a positive effect on both the Value Proposition (improving reliability and quality) and on the Cost & Revenue Structure by changing pricing agreements between the focal firm and the manufacturer.

The third change in the company's Business Model is once again the formation of partnerships with relevant companies, but this time with battery manufacturers. Just as in the previous example, this type of change is caused by an external opportunity, results in an initial change in the Value Network and can have an effect on both the Value Proposition and the Cost & Revenue Structure. What is interesting in this case, is that there is actually an example of this, as around 2 years after the formation of this partnership, SPI changed its energy storage from lead-acid to lead carbon batteries (change 4 on Figure 4.1). How this affected the Value Proposition can be seen in the advantages of a lead-carbon battery over a lead-acid battery or even a lithium battery, which can be used as additional selling points for the system being offered. For example, lead-carbon batteries have been advertised as having higher energy densities, cheaper price per capacity, longer life, simpler system designs, and most importantly for the customer, not producing any harmful and toxic gases as byproducts of their use.

An important note to be made here about the dynamics of SPI's Business Model, is that before the change to the type of battery to be used by SPI (2016-2017), the company had previously formed partnerships with battery manufacturers in 2014-2015. This can raise an interesting question about the extent to which this partnership influenced the later choice of the battery, but it is clear that however much it did, the final decision laid in the hands of SPI themselves. As such, this can be seen as an interrelationship of type CC, as defined in the literature study. Namely, an initial strategic choice to change the Value Network to form partnerships with battery manufacturers, leading to an opportunity to strategically improve their Value Proposition by changing their type of battery. An interesting point that can be made here is how analogous a change in the Value Network is to what we would call an external opportunity or threat, as a cause for change. This is because by definition, any company, organization or entity within the Value Network, is outside of the focal firm itself. How this analogy plays out can be exemplified by this very change in SPI's Business Model, as the change to the energy storage used can both be seen as a result of the previous change in the Value Network creating an opportunity to improve the Value Proposition, or simply as an external opportunity for the focal firm to seize.

An interesting change in SPI's Business Model that could be considered a complete framework change is SPI's expansion into the grid-connected private market. This was not always an option as there didn't use to be a feed in tariff or net metering scheme for renewable energy, but with the implementation of a 1 to 1 net metering scheme, SPI started catering to this market. The cause for this change, namely the change in policy, can clearly be seen as an external opportunity, seeing as SPI had no obligation to do so, but with this new market becoming more accessible, it was an opportunity to expand their potential sources of revenue. The reason we

could classify this as a Business Model Framework change is that the approach to the on-grid market will be different to its off-grid counterpart in all three main elements. To begin with, the Value Proposition will differ to an off-grid offering by the very presence of the net metering scheme. In this sense, net metering addresses some of PV's most important shortcomings, the its low or nonexistent energy production during cloudy weather and night time. An off-grid system would either have to make due with this drawback, use alternate energy sources (wind, hydro) or some form of energy storage. So here, net metering allows to improve the intrinsic value of the PV system, without relying on alternate technologies. From this, we can easily see how the Cost & Revenue Structure would also be affected, seeing as the net metering scheme allows for a different creation and appropriation of value for both the focal firm and the customer. On the customer side, willingness to pay would increase due to the ability to recuperate any excess energy produced by the system in the form of an energy credit with a one-to-one equivalence. On the side of the focal firm, this means pricing can be adapted to account for this added value, but also that costs can be reduced to account for the effect of this net metering on energy storage requirements. Finally, the Value Network can be seen to be affected, mainly in the context of distribution. As previously mentioned, most off-grid projects will be long distances away from major cities and quite isolated, this is much less the case with the type of on-grid sales that are made. This proximity considerably simplifies the amount of people that need to be involved in this distribution from the focal firm to the end customer.

The final change to SPI's Business Model is one that affects the Value Proposition: the addition of a buyback scheme for their old solar panels. This allowed customers to sell back their older panels to more easily purchase the newer versions. This is an interesting example of the interrelationships between the three main components of the Business Model, as depending on the interpretation of different aspects of this change, all components can be seen to be affected. In the Value Proposition, the ability to sell back old panels to more easily upgrade the system is definitely a new selling point and a unique value of the product. In the Cost & Revenue Structure, this will naturally result in new costs and revenues from the purchase of old solar panels and sale of new ones to their customers. Finally, in the Value Network, this would result in changes regarding the relationship the company has with the customer. Apart from the actual transaction of reselling and purchasing new panels, this could improve the overall company-client relationships after the sale of the original system to keep the customers informed and interested about the technology they are purchasing and engaged with the company regarding how they can improve their system over time. This can be seen as a method of increasing the lock-in of customers engaged with the company, which as has been seen in literature, is certainly an effective way of gaining a competitive advantage (Zott & Amit, 2001), but interestingly, can also be seen as creating a complementary service to the original product.

A final comment on this change in SPI's Business Model is that its cause can be seen as being of the external threat type. What is meant here is that we could describe the change as being a response to obsolescence, as it directly addresses the controversy of PV systems in relation to their continuously increasing efficiencies: A PV system from 10 years ago will now be using outdated panels and would be more financially viable with current technology. As the obsolescence has to do with how the product's value changes after the sale, we are therefore not talking about the focal firm itself becoming obsolete and so this is more external than say the case of a given company becoming obsolete as a whole, due to their product not being as viable over time (think of the cassette tape industry). Although it can be noted that even in the example of cassette tapes becoming obsolete, a company moving from cassettes to DVDs (Digital Versatile Discs) would be moved not necessarily by this internal obsolescence but by the external changes in the landscape that caused this obsolescence in the first place. This would leave only one possibility for obsolescence to be considered as an internal threat, which would be for a company to decide themselves to go in such a direction, with no external factors affecting this decision, which would require a considerable disregard for the Value Proposition associated with such a direction.

4.4 Contained Energy

Contained Energy is the oldest renewable energy company in Indonesia, having been active since 2004. Their value proposition is to procure high reliability, clean energy for a variety of uses. It could be said that the variety of products they offer is one of their selling points as a company. Having offered products such as solar-powered water pumps, solar reverse osmosis systems, full scale off-grid systems, PV/diesel hybrid systems, solar driers and cold storage systems, the diversification of their product offering is clear. They started out in the rural market as their company was created after the founders wanted to help with relief efforts for the 2004 tsunami in Aceh by using renewable energy. In this market, their main customers are either private villas and eco lodges or donor/NGO based projects. An example of such a project was one they performed for the Danish government as part of a goodwill collaboration project between them and the Indonesian government.

In this project, Contained Energy had to work with local communities to train local operators for the plants they were building. This demonstrates their flexibility both within their value proposition (in the services they offer) and in their value network (in their ability to turn local people into partners). As for Contained Energy's supply

side, they also perform as an EPC and do not produce their own components. Just as SPI, they obtain most of their components form other countries, namely their inverters from Germany, and their batteries and solar panels from China. But just as SPI, they use locally sourced products for mostly all other components and materials.

As for some of their other relationships, it is interesting to note, regarding the dynamics of the company, that they mention on the "about us" page of their website that they are looking to accelerate their expansion through a partnership with and investment from Impiro, a full-service investment firm from Singapore (Contained Energy, n.d.). This in and of itself is a great example of how expanding the Value Network by involving financial firms can affect not only the Cost & Revenue Structure but the direction of the focal firm as a whole through guidance and advice from expert partners.

Regarding their cost and revenue structure, Contained Energy get their payments up-front but specified that they get it in three instalments. The first as a down-payment, the second before material sending and the third after commissioning. As for their costs, just like SPI, they mentioned that their highest cost for rural projects was transportation and material delivery, but also mentioned that another considerable cost was licensing. This is consistent with the overall picture that licensing can be considerably costly.

The main changes in CE's Business Model are the evolution of their Value Proposition through the addition of new product offerings, thus involving new suppliers in their Value Network, and minor changes caused by either experience, or policy. To begin with, the first change on Figure 4.2 is for the adding of reverse osmosis as a possible project type. Such a change to the possible Value Propositions to be offered by the company will usually come from an external opportunity regarding the technological readiness of the relevant technology in combination with the market opportunity to make use of this technology to create some relevant value. In the case of reverse osmosis, this market opportunity was the purification of water, which is very beneficial to remote regions with little to no access to clean water. Regarding how this change in the Value Proposition led to a change in the other components, this again has to do with the addition of new companies related to the relevant technology (reverse osmosis) to the Value Network, and the addition of the costs associated to the acquisition of this technology to the Cost & Revenue Structure.

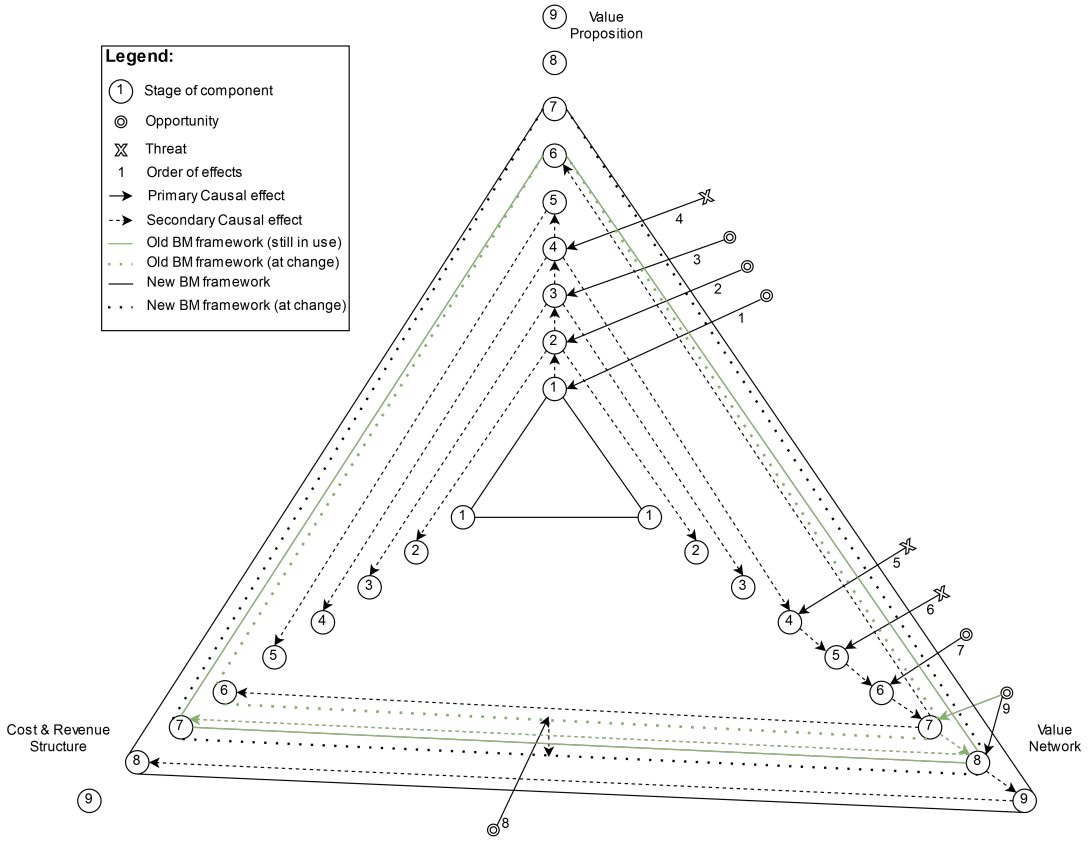

Figure 4.2: Framework representation of changes to Contained Energy's Business Model

The next two changes to CE's Business Model are analogous to this first one, as they both also relate to an

addition to the Value Proposition. In one case, this was the addition of cold storage as a possible application for the offered renewable energy system, and in the next case, was the addition of hybrid systems as a possible system design. Both of these changes, just like the previous one, originate from an external opportunity, which leads to a change in the Value Proposition and subsequently affecting both the Value Network and Cost & Revenue Structure.

N.	**Cause**	**Primary effect**	Follow-up effect
1	Need for clean water in certain rural regions	VP 1→2: Added reverse osmosis to Value Offering	VN 1→2; CRS 1→2: New suppliers for reverse osmosis systems and added costs of these systems
2	Need for refrigeration in fishing communities	VP 2→3: Added cold storage to Value Offering	VN 2→3; CRS 2→3: New suppliers for refrigeration systems and added costs of these systems
3	Large amount of generator use in rural areas	VP 3→4: Added PV hybrid to Value Offering	VN 3→4; CRS 3→4: New suppliers for diesel generators and added costs of these systems
4	Danger of lightning damage	VP 4→5: Added measures for added protection of subsystems from lightning strikes	CRS 4→5: Added costs of these measures
5	Danger of causing social unrest	VN 4→5: Changed hiring practices for boat transportation to project sites	
6	Danger of damaging components during travel on rough terrain	VN 5→6: Improved packaging of components to prevent damage	
7	Opportunity of improving long term sustainability of project	VN 6→7: Training local operators from the community	VP 5→6; CRS 5→6: New Service Offering of training operators and added costs associated to this training
8	Implementation of net metering policy	VP 6→7; VN 7→8; CRS 6→7 (black dotted line): New on-grid Business Model	
9	Opportunity for financing and consulting from third party companies	VN 7→8 (green line): Partnership with financing company VN 8→9 (black line)	CRS 6→7 (green line): New opportunity for financing and new insight into financial considerations of projects CRS 7→8 (black line)

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure

Table 4.4: Cause and effect of changes to Contained Energy's Business Model

The next few changes are interesting in the sense that they originate from an external threat rather than an opportunity. The first of these (change 4 in Figure 4.2) had to do with an experience CE had with an inverter getting damaged by lightning. This led the company to implement additional protective measures to their system to account for worst case scenario lightning storms. The way this can be seen to have affected the Value Proposition is with respect to the reliability of the system. This can be seen as an added value to the system that is only achievable through the focal firm's personal experience with such extreme conditions. This can also be seen as affecting the Cost & revenue Structure through the additional costs associated with this change.

Another change originating from an external threat was CE's change in how they handled the distribution of components and materials to project sites (change 5 in Figure 4.2). While they would not necessarily pay attention to which boat driver they would hire when transporting components and materials to remote islands, they quickly realised that this could cause local tensions amongst different boat drivers if certain people were seen as monopolizing this source of income. This led them to change how they hired these boat drivers to make sure they would minimize the chance for conflict within these communities. This mainly affected the Value Network of the company, as it changed how they would handle the distribution of their systems. An interesting thing to comment about this change is how it was essentially based in social considerations, namely the minimization of the social costs that their operation might have on local communities.

The final change related to an external threat was a change that was implemented to the way materials and components would be packaged for transportation. This was the result of a particular experience where road conditions were so bad during the trip to the project site that some components were slightly damaged. This caused CE to rethink the way they packaged their components and materials to make sure no damage could occur during transportation. Just as in the lightning strike example, this can be seen as a change towards a

higher reliability based on actual experience, but contrary to that example, this will result in a primary change to the Value Network and not the Value Proposition. This is because the example of the lightning strike had to do with the operation of the system, whereas here, it has to do with its distribution.

The next change (change 7 on Figure 4.2) has to do with a new type of service that was developed by CE. This was the training of local operators, as exemplified in the project they had for the Danish government. This change can be seen as having been caused by an external opportunity, namely the opportunity of improving the long term viability of a project by involving local communities. This can be seen as resulting in a change to the Value Proposition, as the training of local operators is clearly an added service to the original Value Offering. This also results in a change in both the Value Network and Cost & Revenue Structure through the inclusion of locals in the operation and management process of the renewable energy system.

Finally, the last change to be looked at is the change in the Business Model Framework by CE's move to the private on-grid market. Just as most other renewable energy companies in Indonesia, the change in policies regarding such projects was the main driver for the company getting involved in this market. This can therefore be seen as being caused by an external opportunity. Also, this once again results in changes to each of the three elements of the Business Model and so results in a distinct Business Model Framework. Of course, just as in the previous example of this type of change, the new on-grid Business Model will be applied in parallel to the off-grid Business Model of the company.

4.5 Selaras Daya Utama

Sedayu is one of the largest renewable energy companies in Indonesia, having often been commissioned by the Indonesian government for utility scale renewable energy projects. Their value proposition, for tender projects, is to provide the required capacity at the most affordable price, whereas for private customers, it is to provide high quality, reliable, clean energy. Its main customers for off-grid projects are the government, private villas and donor/NGO based projects.

Apart from the emphasis on cost when looking at their value proposition for tenders, there were also other differences in their method of operating. For example, given their own discretion on the timing of a project, they would select the best months for installation so as to avoid the worst weather. Unfortunately, with tender projects, PLN dictates the timeline, which doesn't allow for the renewable energy company to weigh in on the adequate periods for construction. Another difference is in the sizing of the system for the community in question. Given their own discretion, Sedayu would monitor the environmental conditions in the area and work with the local community on determining the adequate sizing of the system when again, for tender projects, this decision is taken out of their hands and made entirely by PLN.

As for the value network, on the distribution side, Sedayu also works with local transportation services but are also required for tender based projects to higher local contractors. On the supply side, Sedayu also doesn't deal in manufacturing its components and imports their main components (inverters from Germany, solar panels from China and batteries from Europe). They also use locally sourced products for the rest of the components.

Looking at the cost/revenue structure, Sedayu spends most of its money on transportation and installation. Apparently, the high installation costs are in part due to the use of local contractors, which usually have a monopoly on their region and thus dictate their prices. As for the payment they get for their services, it is either in the form of a direct payment if from a private customer, or if for a tender project, dictated under a PPA. As for if the community themselves are required to pay, this seemingly depends on which government body the project was commissioned by. If it was by PLN, then a monthly payment will be required, whereas if it was the ministry of energy, then the only cost is for the maintenance of the system.

As for changes to the company over time, their methods of operating have been the same for a long time. What can be seen as having evolved or developed is their range of Value Offering. For example, several solutions are offered on their website (Selaras Daya Utama, n.d.), including hybrid solar systems, solar water pumps and solar water production from ambient humidity. These can all be seen as a response to an external opportunity, affecting the Value Proposition, and through it, the Cost & Revenue Structure and the Value Network.

What is interesting to look at is the addition of "Zero Mass Water" as a possible product (change 6 on Figure 4.3), which integrates solar panels into a device for the production of clean drinking water from ambient humidity. How this stands out from hybrid systems or solar water pumps is that it is applicable both to the off-grid and on-grid market. Indeed, when looking at grid connected regions, the application of hybrid systems is much less common due to the existing availability of electricity and therefore the reduced use of diesel generators. As for solar water pumps, their very specific application means that they are best suited for rural farming regions

with little to no access to electricity, as grid-connected regions will usually already have access to running water. Zero Mass Water on the other hand, can both be used to produce clean drinking water in under-developed regions with little to no access to clean water, and be sold to private consumers in the grid connected market for them to reduce their carbon footprint. All of these will have an effect on the Value Network, by requiring the focal firm to acquire the necessary parts from relevant companies. They will also affect the Cost & Revenue Structure through the added costs of these parts, and through the effect they have on the overall system design and therefore cost.

The next change to be looked at, N. 3 on Figure 4.3, was a change that was caused by their own experience in the field. This had to do with the that they initially shipped the materials for a project in different parcels and would sometimes cause the workers to have to wait for the next parcel to arrive before being able to continue construction on the site. This made them change to sending all of the materials at once. This can be seen as being caused by an external threat, namely, the threat of inadequate distribution leading to wasted time. This change can be seen as having mainly changed the Value Network, in how materials and components would be distributed, and having a slight effect on the Cost & Revenue Structure insofar as the changes to the logistics of distribution would result in some different associated costs. One could also argue that however much the construction team would be paid while a shipment is delayed would be removed from the costs, but this would have been a rare occurrence to begin with.

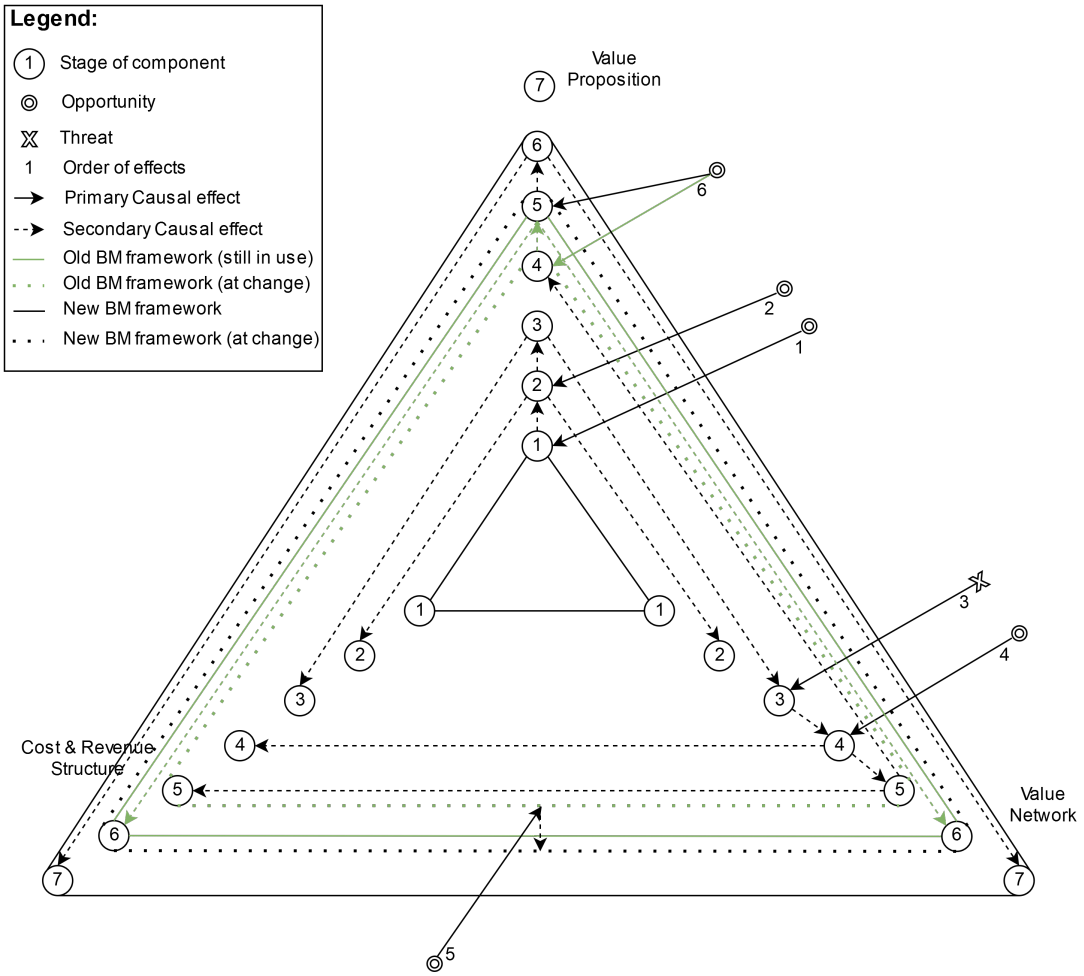

Figure 4.3: Framework representation of changes to Sedayu's Business Model

N.	Cause	Primary effect	Follow-up effect
1	Large amount of generator use in rural areas	VP 1→2: Added PV hybrid to Value Offering	VN 1→2; CRS 1→2: New suppliers for diesel generator systems and added costs of these systems
2	Need for running water in some rural communities	VP 2→3: Added solar water pumps to Value Offering	VN 2→3; CRS 2→3: New suppliers for pump systems and added costs of these systems
3	Inefficiency of having installers wait if shipment is delayed	VN 3→4: Change shipping method from several shipment to all at once	CRS 3→4: Change in costs due to change in shipping method
4	Opportunity of improving long term sustainability of project	VN 4→5: Increased collaboration with local community, including education and training	VP 3→4; CRS 4→5: New Service Offering of educating and training locals and added costs associated to this training
5	Implementation of net metering policy	VP 4→5; VN 5→6; CRS 5→6 (black dotted line): New on-grid Business Model	
6	Need for clean drinking water (off-grid) or need to lower carbon footprint (on-grid)	VP 4→5 (green line): Added Zero Mass Water to Value Offering VP 5→6 (black line)	VN 5→6; CRS 5→6 (green line): New suppliers for Zero Mass Water system and added costs of these systems VN 6→7; CRS 6→7 (black line)

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure

Table 4.5: Cause and effect of changes to Sedayu's Business Model

Another change to the Value Network by Sedayu was the added collaboration with locals to include them more in the projects in their region. A similar case was seen with Contained Energy, where such a change to the Value Network is caused by the external opportunity to increase the long term sustainability and effectiveness of a project by involving local communities. This change in the Value Network, regarding the role and responsibility of the end user in taking care of the system also results in changes in the Value Proposition and Cost & Revenue Structure. For the Value Proposition, as previously seen, this is due to the added Value of training locals to become operators or maintenance engineers, which can be seen as an added service to the procurement of a renewable energy system. On the Cost & Revenue side, this would be reflected in the added costs associated with organizing classes and demonstrations to teach the locals about the system and how it works.

Finally, just as both previous companies, Sedayu also expanded into the private on-grid market when regulations finally allowed for it. As was explained in those cases, this results in a new Business Model Framework, with a different Value Proposition, Value Network and Cost & Revenue Structure. These are very similar to their original components but have their own differences. This Business Model Framework, once again, does not replace the original but is used in concert with the off-grid Business Model.

4.6 Akuo Energy

Akuo Energy is an interesting company to look at for several reasons. First of all, it is the only company of the sample that was founded and based abroad (France, in 2007) and later expanded into the Indonesian market through a subsidiary in 2013. This is interesting because this means the company starts with a fundamentally broader network than the others, and that it has more experience with diversifying their Value Offering based on different markets from their experiences abroad. Indeed, apart from Indonesia, Akuo Energy has subsidiaries in 18 other countries around the world. the other interesting thing is how the company quite quickly entered into an MoU (Memorandum of Understanding) with PT. Pertamina (Persero), the national oil and natural gas company. This is interesting because it is not as common as working with the national energy company PT. PLN, but does have its own potential in accelerating the energy transition by proving its viability to the body in charge of the incumbent source of energy in Indonesia: fossil fuels.

As for the Value Proposition of Akuo Energy and the Customer Segment it targets, we again find a similar trend than the other companies. Namely, that although Akuo Energy does have a lot of awareness regarding the potential of deploying renewable energy in rural communities to create social value, due to the lack of a supportive financial framework and the inability of the end users to pay for such systems on their own, their rural projects will usually be payed for by the GoI, donors or NGOs. This is also due to the fact that Akuo

focuses on medium to large scale systems, which will have considerably higher up-front costs than small installations. On the other hand, although there are less projects to speak of as a result, these are also implemented in interesting ways. At the time of the interview, Akuo Energy had one completed project in East Kalimantan and around five ongoing projects in off-grid areas. What was unique about this project in East Kalimantan is the insistence of the donor that the community eventually be in charge of the system. In order to do so, Akuo Energy spent the whole development and construction phase teaching the locals about solar energy and the features of the system they were installing. Their contract stipulated that they had to give the reigns to the locals to manage and maintain the system 2 years after the COD (Commercial Operating Date) of the power plant. During those two years, Akuo Energy trained technicians to be able to perform basic maintenance of the system, as well as teaching the members of the community that would be in charge of the power plant, how to manage and finance the continued operation of the plant.

According to Komang, from Akuo Energy, this was a great advantage of this project as it helped involve the community in the ownership of the system and for them to be invested in its continued operation. He stated that in Akuo Energy's experience with rural renewable energy projects, it is not rare to see those that fail after only a year due to the lack of accountability of upkeep and maintenance. This is especially the case if problems occur after the warranty offered by the project developer expires, as the costs are then incurred by the owner of the system. In consequence, Akuo Energy teach the community how to act as a mini-PLN and sell the electricity to the rest of the community with a price per kWh based on the costs of maintenance of the system.

Regarding Akuo Energy's Value Network, as mentioned, it is quite expansive, but at the same time, also more integrated within the company. For example, their "our strategy" section of their website states: "Akuo Energy has also sought operational independence by bringing in-house all the required expertise in development, contracts, financial engineering, construction and operation of its projects" (Akuo Energy, n.d.). By doing so, Akuo Energy is able to better control the costs required for services they might have required from other companies. They have also created specific projects around certain innovations that they have developed, such as Agrinergie® and Aquanergie®, which focus on the application of renewable energy for agriculture and fish farming respectively. This allows them to create connections with both suppliers and their customers based on very specific Value Propositions and Customer Segments, in order to better suit their needs. For example, in Réunion, Akuo Energy partnered with Agriterra to bring back into production crops that the country was famous for. Regarding Indonesia specifically, it is mentioned on their website that they will look towards developing such projects in Indonesia based on their previous experience with Agrinergie® and Aquanergie®.

Looking at the Cost & Revenue Structure, we find that again, the company either gets payed for the development and construction of a renewable energy system, as the case with the project they had in East Kalimantan, or if they are working as an IPP, they get payed based on the terms of the PPA with their customers. As for costs, they also cover materials, components, internal costs, transportation, construction and maintenance. The maintenance costs do depend on the terms of the contract and on whether the warranty is still valid, but even then, the costs will mainly be due to the transportation of the replacement components and technicians (if necessary), as the critical components themselves will usually be under the warranty of the suppliers.

Regarding changes to Akuo Energy's Business Model, there aren't any many to be mentioned for the case of its Indonesian subsidiary, as it was based on well developed principles acquired through years of experience from the main company. What could be mentioned is their increased willingness and dedication to collaborate with local communities for the betterment of their project. This was seen in other companies as being primarily a change in the Value Network, but that can in and of itself provide multiple benefits. Starting with the Value Proposition, it was seen to give the opportunity for more refined Value Offerings being more adapted to the community in question. It also provides social benefits in improving the acceptance of the technology and increasing the involvement of the local community to help in maintaining the system in the long run. Of course there would be some effects on the costs of such projects, as resources would have to be spent on training and educating locals, but the benefits are more than worth it.

The next change to the Business Model is in partnering with local developers to improve their competitiveness and market acceptance. One can see this as a change in the Value Network caused by an external opportunity to improve the viability of their projects. This change can be seen as mainly affecting the Value Proposition, as working with local developers can be a considerable selling point and unique value Akuo can offer when looking at projects in tightly knit communities where importance is given to contributing to local labor.

The last two changes are changes that have not yet been implemented but are in the process of it. They concern Akuo's plan to make use of their innovations regarding the combination of renewable energy and agriculture or fish farming. This change can be seen as originating from an external opportunity to increase the sustainability and integration of energy in farming and fish farming. This results in a change in the Value Proposition, as the Value Offering in these cases are quite different to a traditional renewable energy system, and this change

in the Value Proposition leads to changes in both the Value Network and the Cost & Revenue Structure. On the Value Network side, the company would have to work with farming cooperatives or communities and fish farming companies to implement their systems and on the Cost & Revenue side, one can see how these applications, entailing very specific system designs with different components to a traditional system, would result in different pricings and costs.

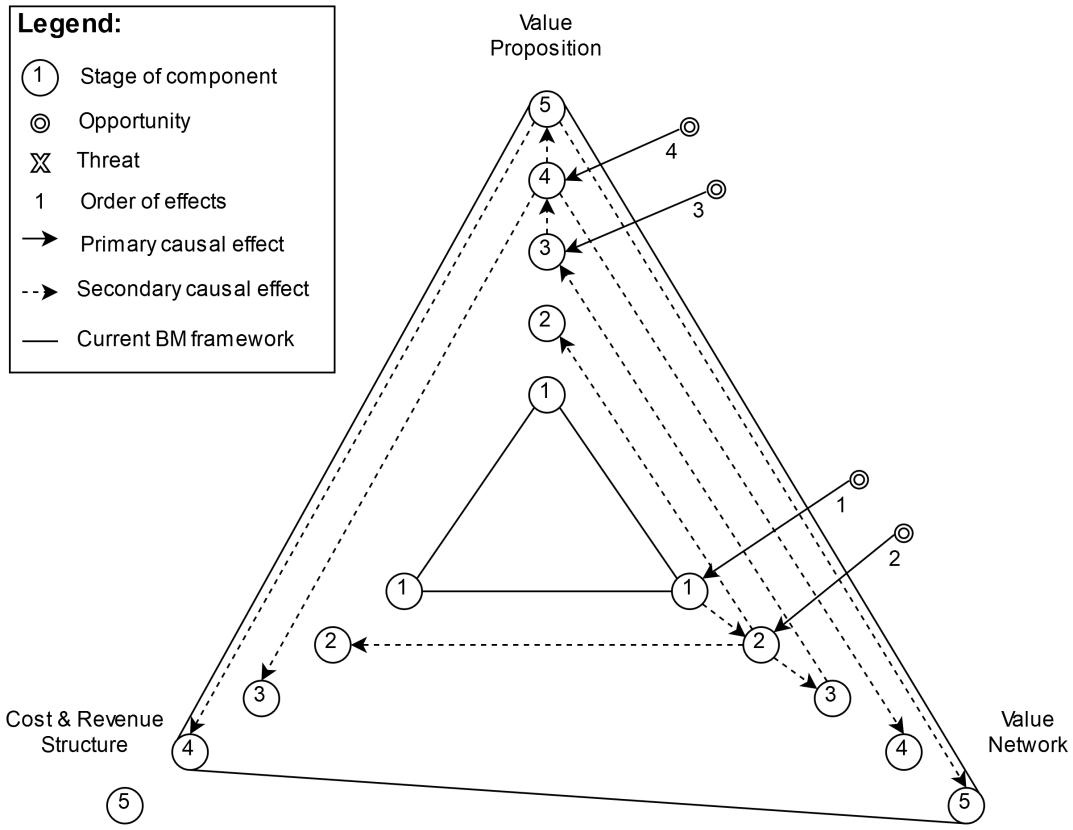

Figure 4.4: Framework representation of changes to Akuo's Business Model

N.	Cause	Primary effect	Follow-up effect
1	Opportunity of improving long term sustainability of project	VN 1→2: Increased collaboration with local community, including education and training	VP 1→2; CRS 1→2: New Service Offering of educating and training locals and added costs associated to this training
2	Opportunity of improving competitiveness and market acceptance	VN 2→3: Partnerships with local developers	VP 2→3: Added value of contributing to local economy
3	Opportunity of improving sustainability of farming applications	VP 3→4: Adding Agrinergie® to Value Offering	VN 3→4; CRS 2→3: New suppliers for farming related components and new cost considerations for the system
4	Opportunity of improving sustainability of fish farming applications	VP 4→5: Adding Aquanergie® to Value Offering	VN 4→5; CRS 3→4: New suppliers for fish farming components and new cost considerations for the system

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure

Table 4.6: Cause and effect of changes to Akuo's Business Model

4.7 Cross-case Analysis

Having gone through each company one at a time, we can now combine these different archetypes of Business Models into one to cover all the current approaches to rural renewable energy projects in Indonesia (see Figure

4.5). Starting with the Value Proposition, the Value Offering can be under the form of a service offering by offering consultancy services or through the procurement of electricity as an IPP/mini-utility, and under the form of a Product Offering by procuring the system as a whole as an EPC, or by selling individual components as a wholesaler. We have also seen that in the case of Contained Energy, Sedayu and Akuo Energy, the diversification in the Product Offering by the creation of value added products in combination with other technologies and for specific markets is also used as a competitive advantage over other companies.

Also to be noted about the Value Propositions of such companies is that their applicability to off-grid and on-grid markets is often interchangeable but not always. A good example is the Value Offering of reducing energy bills through net metering or feed-in tariffs, as these are exclusive to grid-connected installations, or the sale of electricity to end users as a mini-utility, as this only allowed in off-grid areas in Indonesia. Regardless, these companies have made use of the broad application of Value Propositions such as the sale of renewable energy systems (with or without an application for the power produced), to target both on and off-grid markets.

Regarding markets, there is no single unifying market for rural areas but much overlap between companies. For example, Solar Power Indonesia does not participate much in tender projects and contracts with PLN but focuses more on the private market of villas/eco lodges as well as NGOs. On the other hand, Akuo Energy does not participate much in the private villas/eco lodges market as it is more focused on larger scale projects in collaboration with government agencies. But despite these differences, the other companies have common elements, namely, that they cater to the private villas/eco lodges and NGOs market and, that given the opportunity, they would participate in tender projects for PLN. Sedayu is the only one of the interviewed companies that is registered simply a PT. and not a PT. PMA. This means that they have more freedom to participate in government tenders and projects for PLN as well the Ministry of Energy and Mineral Resources. Also, as mentioned in the case of Akuo, Pertamina can be a good customer to further the energy transition from the side of the incumbent energy producer.

Regarding partners, it was clear from the interviews that the Indonesian production scene for renewable energy components is not on par with its foreign competitors. In order for Indonesia to compete, products such as batteries, inverters, solar panels, would have to be at least as cheap and of equal or higher quality. This is far from being the case at the moment, but there have been mentions by renewable energy entrepreneurs in Indonesia that importing these components could become more complicated in the future due to new regulations. Currently, as expressed by interviewees, the requirements is that at least 20% of the system be sourced locally. If regulations do indeed become more stringent, it will become critical for these renewable energy companies to form ties with promising local manufacturers to accelerate the development of quality products at an agreeable price.

As for the Sales process, it seems most companies rely mainly on one avenue for marketing their services, depending on the context of their experience and network, whether it be mainly direct marketing for SPI, mainly through their reputation for Contained Energy, or mainly through partnerships with relevant costumers for Akuo. Regardless, all of these methods can be combined to obtain the best result.

Looking at the After-Sales Services, there is a strong commonality between all the companies that they provide monitoring and maintenance for the systems they install. The period of warranty determines for how long said company is responsible for the monetary repercussions of maintenance. Once this warranty is over, it is up to the user of the system to pay for the maintenance (usually an hourly or daily rate). Solar Power Indonesia is the only one that differs by also offering the possibility for their clients to sell back their older solar panels to the company so that they may purchase newer ones at a lesser overall cost. This is an interesting additional After-Sale Service that is well tailored to deal with the uncertainty of customers regarding the constant improvement of solar panels over time.

Moving on to the Cost & Revenue Structure for these companies, the trends for both Costs and Revenues are common, with some small outliers. On the cost side, all of the companies have to incur the same types of costs, including material and component costs, internal costs, transportation costs, but SPI, which doesn't cater to large tender, IPP or mini-utility projects, will not incur as much costs on installation and regulation/certification as the other companies that do. On the revenue side, the pricing strategies are straightforward an directly dependent on the type of project. For mini-utility projects, the pricing will be based on a price per/kWh, similar to IPP projects where returns will be based on a pre-arranged PPA. In the case of the sale of a system or components, the payment is made upfront or in installments.

One note to be made about these different forms payments based on the different types of agreements reached with customers, is that only Akuo Energy chose the path of a mini-utility project, and only for the two years after COD, at which point the system ownership is transferred to the local community. Although projects exist which consists of mini-grids, these are usually commissioned by either PLN, the Ministry of Energy and

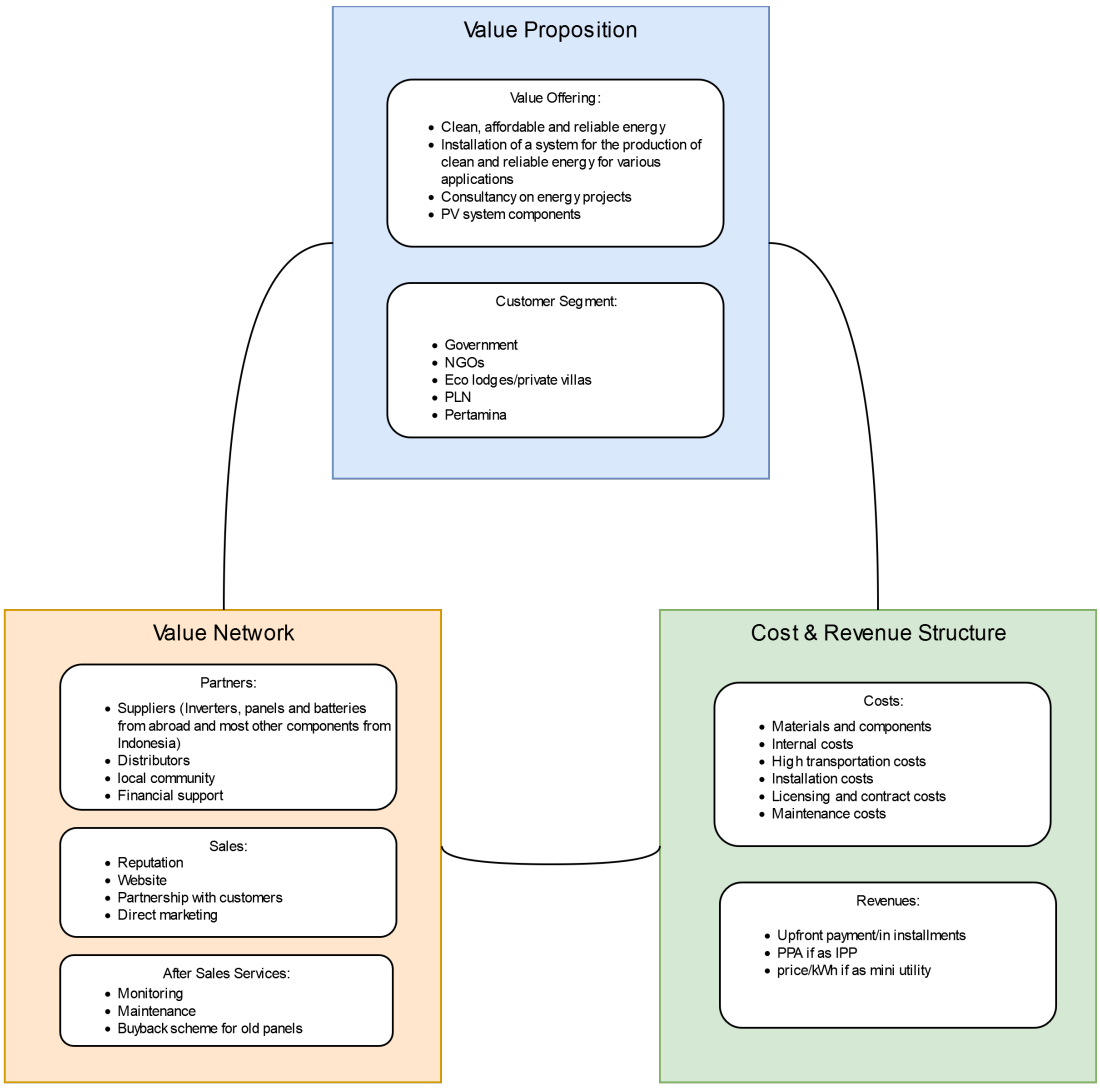

Figure 4.5: Business Model for rural renewable energy in Indonesia

Mineral Resources or local governments and ownership is not retained by the renewable energy company. And if ownership is maintained by the renewable energy company over the lifetime of the system, the energy is not sold to the end users directly but to whichever governmental organization commissioned the project based on a PPA which will usually be only about 65% of the national electricity price. This is probably because recouping the costs from these communities can be complicated, especially when no subsidies or alternate sources of funding are available to abate the costs on the customer side.

Also, regarding the difference between a tender project and an IPP project, although tender projects will also require that the companies involved act as an IPP, they will be chosen on the basis of a cost competitive comparison with any other company that presents itself. Alternately, companies have the option to propose a project directly to a government organization, including local governments, and thus have the option of acting as an IPP without the stringent competition associated with a tender project. On the other side, this approach comes with its own set of problems, as it thus befalls on the company to come up with all the relevant timelines, capacity proposals and survey reports required for the project to start, instead of PLN for the case of tenders. Also, as mentioned previously, this would only work for regions where PLN does not have a pre-existing interest for developing their own source of electricity generation.

Regarding the effect of external factors on the Business Model, all of the companies were in agreement that the main influence comes from policy and regulations. Not only is it through these regulations that these businesses gain access to new markets (such as the private grid-connected market with the implementation of a feed-in tariff), but it is also these regulations that set the profitability of such projects. As an example, it was mentioned by a certain CEO of a renewable energy company in Indonesia, that while there are no subsidies in place

for renewable energy, both fuel prices and electricity prices from non-renewable sources are heavily subsidised by the GoI. In his own words, "it would be a great step forward to just have an even playing field". Indeed, even without stringent policies on the use of renewable energy, if it is required to compete with subsidised non-renewable generation, the financial case for renewable energy in Indonesia is hard to make. Nonetheless, especially for rural communities, the price competitiveness of renewable energy can be made due to higher fuel prices resulting from the extensive transportation it requires. One can also make the point that when fuel subsidies become too heavy a burden to carry, fuel prices will inevitably increase to match international prices more closely, resulting in even more of a competitive advantage for renewables.

Company	**Change**	**Cause**	**Affected component**	**Type**
SPI	Removal of wind energy from Product Offering for off-grid	Efficiency Opportunity	VP→VN/CRS	Type CF
	Partnership with PV producers	Efficiency Opportunity	VN→CRS	Type CC
	Partnership with battery producers	Efficiency Opportunity	VN→CRS	Type CC
	Change from lead acid to lead carbon batteries	Technology [E5]	VP→CRS	Type CF
	Move to private on-grid market	Supportive Policy [E4]	VP/VN/CRS	
	Buyback scheme for solar panel	Lack of Social Acceptance [E7]	VP→VN/CRS	Type CF
CE	Development of reverse osmosis systems	Market Opportunity & Technology [E5]	VP→VN/CRS	Type CF
	Development of PV cold storage systems	Market Opportunity	VP→VN/CRS	Type CF
	Development of PV hybrid systems	Market Opportunity	VP→VN/CRS	Type CF
	Improving lightning resistance due to broken inverter from strong lightning storm	Natural Threat	VP→CRS	Type CF
	Hiring various different boats amongst the community for transport	Social Threat	VN	
	Improved packaging methods to ensure no damage occurs during transport	Natural Threat	VN	
	Training locals to become operators	Social acceptance [E8]	VN→VP/CRS	Type CC/CF
	Move to private on-grid market	Supportive Policy [E4]	VP/CRS	
	Partnership with financing company	Supportive financial system [E2]	VN→CRS	Type CC
Sedayu	Development of PV hybrid systems	Market Opportunity	VP→VN/CRS	Type CF
	Development of PV water pump systems	Market Opportunity	VP→VN/CRS	Type CF
	Change in method of shipping to all at once	Efficiency Threat	VN/CRS	Type FF
	Increased communication and collaboration with locals	Social acceptance [E8]	VN→VP/CRS	Type CC/CF
	Move to private on-grid market	Supportive Policy [E4]	VP/VN/CRS	
	Sale of Zero Mass Water systems	Market Opportunity & Technology [E5]	VP→VN/CRS	Type CF
Akuo	Training locals to become operators and perform maintenance on power plant	Social acceptance [E8]	VN→VP/CRS	Type CC/CF
	Partnership with local developers	Efficiency Opportunity	VN→VP	Type CC
	Application of Agrinergie® technology	Market Opportunity	VP→VN/CRS	Type CF
	Application of Aquanergie® technology	Market Opportunity	VP→VN/CRS	Type CF

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure | C: Choice | F: Forced

Table 4.7: Changes to Business Model components

As for the changes to the Business Models of the companies in question, the summary of these can be found in Table 4.7. In this table, apart from the change and affected components, the cause is also given. To clarify on the types of causes that are given, for the ones that relate to a factor as determined by the literature study

(Table 2.9), the associated code can be found. As for the other causes, these had to be classified based on their characteristics.

To begin with, an Efficiency Opportunity refers to an opportunity for a process within the focal firm or within its Value Network, to be improved and made more efficient. For example, partnerships with manufacturers can be seen as opportunities to improve the communication and transaction efficiency between them and the focal firm. Or in a more straightforward manner, the case of SPI removing wind energy from its Value Offering is another good example. This particularly related to the efficiency of producing energy from wind when accounting for its bulky packaging and consequent effect on transportation when compared to PV. As such, removing wind from the Value Proposition could be seen as improving the transportation efficiency of the system. This can also be related to an Opportunity Threat, where the difference is that instead of identifying opportunities for improved efficiency, it is rather discovering the existence of current inefficiencies.

As for Market Opportunities, these relate to an opportunity that exists within a specific market, and that can therefor be take advantage of by catering to this specific market. This opportunity is exemplified in the various Value Propositions that are developed by the companies in this case study. For example, as previously mentioned, a solar pump makes use of the market opportunity existing within regions that are both unelectrified and have no access to running water. This is an adequate focus as far as a target market relating to this opportunity, but can be further targeted if looking for example at off-grid farming communities with no running water. The intense manual labor that would then be required for crop irrigation becomes an additional incentive for the adoption of a solar irrigation system. As such, this type of opportunity lies within the market that it is related to.

Looking at Natural Threats, this has to do with threats that can be related to natural circumstances, such as storms, weather conditions, natural disasters and even the natural topology of certain regions. This last example of a Natural Threat relates specifically to the example of the change in Contained Energy's Business Model that had to do with components getting damaged during transportation. This is an interesting one because it has to do with circumstances that are particular to the off-grid market, namely, the topology of the terrain in such regions. One can easily imagine how infrastructure, specifically roads, will not be in their best shape in regions that are considerably isolated. Of course this has to do with the location's distance from the nearest major town or city, but one could also see how certain topologies would worsen this effect. This is particularly the case with locations that are either distant small islands, or in heavily mountainous areas, where roads are hard to build. As such, this is why this type of issue is also categorized as a natural threat.

Several things can be noted based on the dynamics of these different Business Models. To begin with, one can see how a change in one component will most often result in a change in another component. This is relevant when looking at the importance of understanding these interrelationships in the first place, as it implies that Business Model component will not simply have a chance of affecting one another, but that they are more likely to do so than not.

One can also notice two things regarding the initial causes of these changes: first of all, they seem to mainly be responses to opportunities rather than threats (although responses to threats do occur), but also, the initial changes are focused on the Value Proposition and Value Network and never start at the Cost & Revenue Structure.

The next thing that can be noticed is how the most common interrelationship is of type CF, where an initial strategic choice leads to a forced change. This can be explained by how some similar recurrent changes can be found in the Business Models of the different companies. For example, the type of change related to complementing the Value Proposition with a new Value Offering is a typical case of an initial strategic choice to change the Value Proposition followed by a necessary change in the Value Network and Cost & Revenue Structure to meet this Value Proposition.

Some commonalities can also be noticed between different companies, namely that 3 out of the 4 companies explicitly moved to the on-grid market when the regulations allowed for it, and that 3 out of the 4 companies worked on building ties with local communities as well as training and educating them. These two examples each outline the importance of a certain factor on the dynamics of rural renewable energy projects. In the first case, this is illustrative at how financially attractive the on-grid market appears compared to its off-grid counterpart, and how it was mainly a lack of policy and regulation that prevented Indonesian companies from capitalizing on this. This also goes to show that these two types of market focus are often combined within a company thanks to the overlap in required technology and expertise. As for the collaboration with local people, this is indicative of a good degree of dynamic capabilities on the part of the Indonesian firms, as one can argue that collaboration, education and training provide a good amount of benefits but that are not immediately apparent. Indeed, by allowing the local community to take an active role in maintaining and managing a renewable energy system, social acceptance for the project will increase, the local community will have a big-

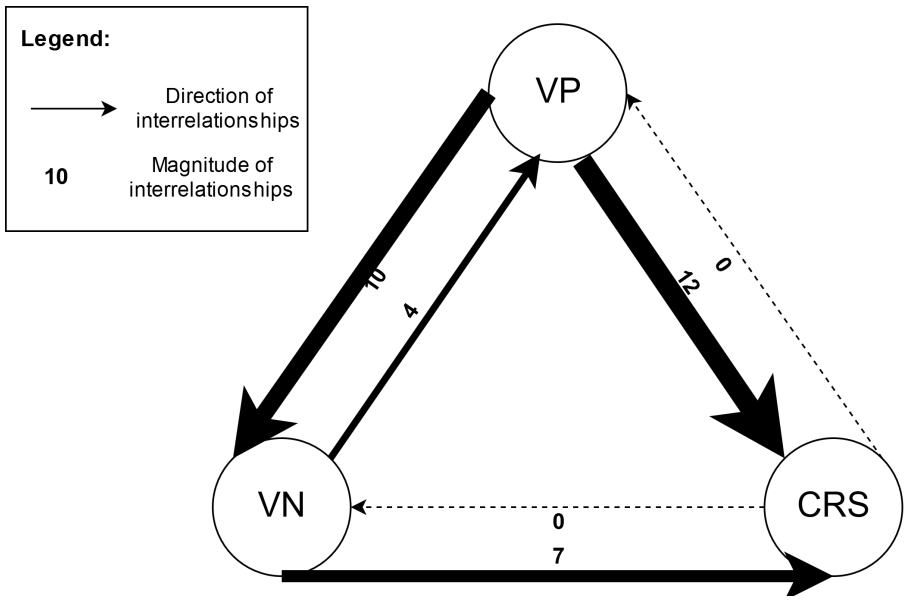

Figure 4.6: Summary of interrelationships between Business Model components of case study companies

ger interest in taking care of the system, which will lead to a more reliable and sustainable project in the long run.

Similarly to how the interrelationships of Business Model components were displayed in the literature study to represent the magnitude of each relationship between the different components, this was done for the interrelationships as found in the case study and represented in Figure 4.6. The first thing to be noted about this figure is that once again allows for a better representation of the tendencies of components to affect one another. For example, in the case of these companies in Indonesia, the most notable things to note from the figure is the dominance of the Value Proposition in affecting other components. This is followed by the Value Network, which while it affects the Value Proposition sometimes, mostly affects the Cost & Revenue Structure. Finally, in the case of the Cost & Revenue Structure affecting other components, it was not found to have been an initial cause for any changes, and rather changing as a result of other components changing. This does not necessarily mean it is not possible for this to happen, as the literature seems to indicate it is, but at the very least means it is not very likely.

Chapter 5

Conceptual Model and Case Study Comparison

Having now looked both at the development of the framework based on the literature study and its application to the case of companies in Indonesia, it is now possible to analyse its advantages and disadvantages in the context of analysing Business Model Dynamics, and to try and improve the framework to improve on these.

5.1 Completeness

On the topic of Completeness, one could say that the Business Models of the companies that were interviewed all fall under the expected Business Models of renewable energy companies in general. What could be said to though, is that the information obtained about their Business Models does indicate certain trends. For example, for almost all cases of installing renewable energy systems in off-grid rural communities, the user is not the customer. In other words, even if the local community can make use of the system, it has been payed for by a third party. Such trends could be useful indicators of how rural renewable energy Business Models tend to be set up.

The way this could be reflected in the framework is by seeing these different Business Model elements as data points. In this sense, the list of elements for the completeness criteria would be generated from actual data from companies. This would also help further in analysing trends that occur in different markets and different countries. As such, the data obtained from the case studies would also have to be sub-categorized based on the fact that it came from companies in Indonesia, working on renewable energy in off-grid regions. This would result in three specific tags to this data, each pertaining to a different sub-category of the market. This would allow for researchers to more easily analyse the effect of different variable on a market, or to look at difference between markets. For example, this would make it easier for someone to look at the difference between a renewable energy company and other types of energy companies, or to look at the difference between renewable energy companies in different countries with different contexts. In other words, this would allow for both a top level analysis of Business Models in general, but also how they get differentiated based on their sub-categories. Going back to the three tags that would be used for this data, one could argue four tags would be more useful: One for the off-grid aspect, the second for the fact that the companies are based in Indonesia, the third to specify that they are renewable energy companies, and the last would then be to specify that they are an energy company. This is simply due the commonality that energy companies share in general, and which would be an extra step of generalization that would be interesting to look at. In other words, looking at what are the common traits or tendencies in energy companies as a whole.

The tables that were obtained for the completeness criteria in the chapter on the conceptual model, which themselves were obtained from the literature study, can be complemented by the data from the case studies to expand their components and to establish some trends with regard to off-grid project in Indonesia. At this point it is once again important to remember that the general information for the literature study was obtained for the case of renewable energy in general, which was then narrowed down to the case of off-grid projects for the conceptual model chapter, and is now being further specified for the case of Indonesia.

The results of this can be found on Tables 5.1 and 5.2, where the components that were found in the case studies and correspond to an element from the literature are written in bold, and the components that were found in the case studies that were not in the initial literature are written in italic.

Elements	Sub-components	BM elements and their occurrence
VP	Customer Segment	• **IDOs** & **NGOs** (3) • **BoP communities** (4) • **Governments** (3) • *Local governments* (4) • **Individuals** (3) • **community leadership** (3) • **commercial entities** (3)
VP	Value Offering	• **Knowledge/advice** (1) • **Product delivery** & **sales** (2) • **Technology** & **system design** (4) • *Technology and system integration with local applications* (4) • **Large scale supply of energy services** (3)
VN	Partners	• **Network** (1) • **Local installers** & **technicians** (4) • Other entrepreneurs: knowledge & skills • **Manufacturers** & **suppliers** (4) • **Government/community leaders** (3) • **IDOs, NGOs, etc.** (2) • **Local business/utilities** (2) • **Financial organizations** (1) • *Distributors* (4)
VN	Sales Process	• **Word of mouth marketing and reputation** (4) • **Company website** (4) • **Web** & **print advertising** (1) • **Tender process** (4)
VN	After Sales Services	• **Maintenance** (4) • **Customer Support** (4)

Table 5.1: Business Model elements for rural renewable energy projects in Indonesia (Adapted from Gabriel and Kirkwood (2016))

Elements	Sub-components	Typical examples
CRS	Costs	• **Materials and components** (4) • **Logistics** & **operations** (4) • **Hiring and retaining human capital** (4) • **Subcontracted human capital** (4) • **Import duties and taxes** (4) • *Licensing and permits* (4)
CRS	Revenues	• **Advice/knowledge transfer** (1) • **Tender projects** (4) • **System design and sizing (**& **overseeing installation)** (4) • **Product sales** (& installation) (2) • **System sales** & **infrastructural integration** (4) • *System integration with local applications* (4)

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure

Table 5.2: Business Model elements for rural renewable energy projects in Indonesia continued (Adapted from Gabriel and Kirkwood (2016))

What is interesting to notice here is that the conceptual model's list of components, which was barely changed from the components obtained in the literature study, quite appropriately represents the components that were found in the case study. Indeed, only one element, in the Value Network, was not mentioned in the case study, namely a partnership with entrepreneurs for knowledge and skills. This is a good indicator that there is some level of commonality between Business Model constructs on different levels.

As for the external factors, the same process can be done of complimenting the elements as given by the conceptual model with the data obtained from the companies to get a better picture of these effects for the case of Indonesia (see Figure 5.3). Again, we can find a commonality between the results from literature and the case studies, in that half of the external effects found from literature were also observed in the case studies. On the other hand, an equal amount of factors were added to the framework purely from the case studies. This can be seen as a good example of how the framework itself can constantly be improved by adding additional data to it. Again, this data would have to be categorized accordingly to maximize the utility of such a condensation and representation of information. In this case, all data obtained from the case studies would be accounted for in a general view of renewable energy Business Models, as well as a more refined view of off-grid renewable energy projects or looking at the case of Indonesia in general, but would obviously be excluded if the focus was on on-grid renewable energy projects in particular, or on renewable energy projects in a country in particular other than Indonesia.

Another interesting thing to be noticed here is how the distribution of the causes of changes in the Business Model are relatively well spread out amongst the different types, but with some emphasis on Market Opportunities and Efficiency Opportunities. This makes sense from the perspective of the sources of Value Creation as posited by Raphael Amit and Christoph Zott (2001), which apart from lock-in and complementarities, are novelty and efficiency. Efficiency opportunities quite aptly refer to an opportunity to improve Value Creation through efficiency. As for Market Opportunities, these are not solely related to novelty, but novelty is a good indicator of a Market Opportunity. Indeed, Market Opportunities can be seen as changes caused mainly by the application of Dynamic Capabilities in identifying opportunities in certain markets. And these opportunities do not have to depend on technology, natural or social circumstances, but on what need or desire is not being met. This makes this category quite broad as it can include elements that can also be classified as a technology caused change, or of different other types. But as it is the main consideration for various changes in the Business Model, it needs to be looked at as its own type of cause.

Effect	Type of Factor	Code	Occurrence in case studies (%)
E.T→CRS	Constraining Financial System (Hamwia & Lizarralde, 2017)	E1	
E.O→CRS	Supportive Financial System (Hamwia & Lizarralde, 2017)	E2	1 (4%)
E.T→VP/CRS	Constraining Policy and Regulatory Framework (Emrah Karakaya & Hidalgo, 2016; Leisen et al., 2019)	E3	
E.O→VP/CRS	Supportive Policy and Regulatory Framework (Huijben et al., 2016; Sawhney et al., 2014; Shakeel et al., 2017)	E4	3 (12%)
E.O→VP/CRS	Technology (Hall & Roelich, 2016)	E5	3 (12%)
E.T→VP/VN/CRS	Competition (Horváth & Szabó, 2018)	E6	
E.T→VP/VN	Lack of Social Acceptance (Stigka et al., 2014)	E7	1 (4%)
E.O→VP/VN	Social Acceptance (Stigka et al., 2014)	E8	3 (12%)
E.T/O→VP/VN	Landscape Changes (Budzianowski et al., 2018)	E9	
I.T→VP/VN/CRS	Production Issues (Horváth & Szabó, 2018)	I1	
E.O→VP	Market Opportunity		8 (32%)
E.O→VP/VN	Efficiency Threat		1 (4%)
E.O→VP/VN	Efficiency Opportunity		4 (16%)
E.T→VP/VN	Social Threat		1 (4%)
E.T→VP/VN	Natural Threat		2 (8%)

E: External | I: Internal | O: Opportunity | T: Threat

Table 5.3: Factors affecting Business Model elements

5.2 Interrelationships

Along the same basis as with the completeness criterion, the interrelationships that were obtained from the case studies can be compared to the results from the literature study as framed in the conceptual model. In this case, the different interrelationships from the case studies were counted based on their types and added to a table with the interrelationship types from the literature (Figure 5.4).

What is interesting looking at this comparison between the data obtained in the literature study and in the case studies is where the similarities and differences lie. For example, there is a similarity in the two data sets regarding the typical type of relationship between the Value Proposition and the Value Network, namely that it is usually of type CF, starting with a strategic choice to change the Value Proposition leading to a forced change in the Value Network. This is also found regarding the effect of the Value Proposition on the Cost & Revenue Structure usually being of type CF as well.

We also find a similarity in how the Value Network's effect on the Value Proposition is usually of type CC, indicating that when changing the Value Network by choice, this often results in a choice to change the Value Proposition. This is interesting as it outlines the difference between the relationship from the Value Proposition to the Value Network, which is likely to force a change in the Value Network, and the relationship from the Value Network to the Value Proposition. This can be explained by the underlying rule relating the Value Network to the Value Proposition, which could be expressed as: "the Value Network needs to be such that it can provide, along with the focal firm, for the creation of the Value Proposition." This is to say that if the Value Proposition is changed, by choice or not, the Value Network will need to adapt for this change if necessary. On the other hand, the Value Network only forces a change in the Value Proposition if it is constrained, not when it is improved. This makes it unlikely for the Value Proposition to be forced to change from a strategic change in the Value Network.

A combination between the data from literature and from the case study results of the total number of interrelationships between Business Model components can be found on Figure 5.1.

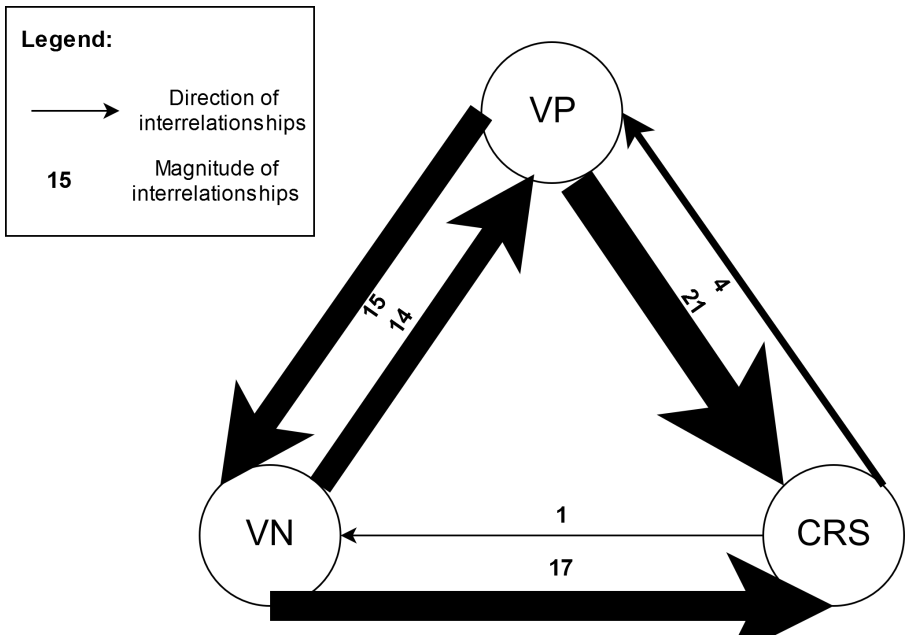

Figure 5.1: Summary of interrelationships between Business Model components overall

Relationship	Type	Interrelationships	IRs (Refs)	From case studies	Total
VP→VN	CC	IR1.10	1(1)	0	1
	CF	IR1.6, IR1.11	2(2)	10	12
	FF	IR1.2	1(2)	0	2
			Total: 4(5)	Total: 10	15
VN→VP	CC	IR1.1, IR1.4, IR1.5, IR1.9	4(7)	4	11
	FC	IR1.3, IR1.8	2(2)	0	2
	CF	IR1.7	1(1)	0	1
	FF	IR1.8, IR1.9	2(2)	0	2
			Total: 7(10)	Total: 4	14
VP→CRS	CC	IR2.3, IR2.5	2(5)	0	5
	CF	IR2.5, IR2.6, IR2.7, IR2.9	4(6)	11	17
	FF			1	1
			Total: 5(9)	Total: 12	21
CRS→VP	FC	IR2.2	1(1)	0	1
	CF	IR2.8	1(1)	0	1
	FF	IR2.1, IR2.4	2(2)	0	2
			Total: 4(4)	0	4
VN→CRS	CC	IR3.1, IR3.2	2(6)	1	7
	CF	IR3.4, IR3.5, IR3.6	3(4)	5	9
	FF	IR3.4	1(2)	1	3
			Total: 5(10)	Total: 7	17
CRS→VN	CF	IR3.3	1(1)		1

VP: Value Proposition | VN: Value Network | CRS: Cost & Revenue Structure | IR: Interrelationship | C: Choice | F: Forced | Refs: References

Table 5.4: Interrelationships between Business Model components by type including case studies

5.3 Changes Over Time

Looking at how the framework represented changes over time in the case studies, several things can be noted about this. Starting with some of the strengths of the framework, it can be said that the its major advantage is its ability to display a large amount of information in a concise way. This is a useful characteristic for the

analysis of Business Model dynamics, especially when looking at large amounts of cases and trying to draw conclusions on similarities and differences. Indeed, having the same components and type of information displayed about these components allows for comparisons on an even playing field, where the same type of information is isolated and displayed. Showing it on a figure also makes it faster to interpret this information than if it was all given in the text, as of course, the text would contain much more information than what is displayed by the figure. This would still be the case, as any information that cannot be displayed in the figure would have to be given in a table or in the text, but the figure allows to a quick top level view of the general dynamics of the Business Models being analyzed.

This strength can also be extrapolated to the advantages this brings to research into Business Model dynamics, as the framework would provide a level playing field for any researcher to compare his findings with other researchers using the same framework. On top of this, the framework would then yield reference data for future research that can then be more easily interpreted. Trends would more easily be discerned from the figures, at which point the text would be used to explain the exact reasons for these trends, whereas in the current research on Business Model dynamics, both the trends and explanations are derived either from the text of past case studies, or from actual case studies of companies. In this sense, the framework isn't a replacement to the current methodology of research in this topic, but a complementary tool to help in this endeavor.

As for the weaknesses of the framework, one such example would be the inability to properly analyze developments on a time axis. This is not impossible, as the three axes of development (Value Proposition, Value Network and Cost & Revenue Structure) can all be used a time axes to show the time-wise innovations in each element, this is not the best option visually. Indeed, this would either cause clusters of information where innovations would be too close in time, or cause the overall figure to be too large and thus have to be shrunk to fit on a page, making it hard to look into its details.

Another disadvantage of the framework is the display of too large an amount of information. This was also marked as a strength as it allows the user of the framework to rapidly obtain as much information as possible at a glance. Where this advantage reaches its limit is the point where the amount of visual information is such that it becomes a complex task to discern to which innovation or relationship each element belong to. Additionally, because it is not possible to display all of the information within the figure, the information that is not there will be provided as a supplement to the figures, either in a table or in the text. In this case, some of the excess information in the figure could be relegated to a table or to the text to ease the analysis of the figure itself.

The point can also be made that the current framework for the representation of Business Model dynamics depends on the existence of only three Business Model components. This is because of the fact that with any Business Model framework containing more than three elements under this representation, causal lines representing the effect of one component on another would then cross the figure through its center. This would make the figure exponentially harder to interpret the more information it would contain.

In order to address these weaknesses of the framework while conserving its strength, it becomes necessary to look at other types of representations that might be able to do so. For this purpose, inspiration can be drawn from the figure that was used to classify the different types of interrelationships (Figure 2.9). This is because the representation of interrelationships between two Business Model components, can be extrapolated to the representation of three components, or even more. This is where this representation finds its first advantage over the previous one, in the sense that it addresses the previous framework's inability to represent more than three elements without becoming too complex.

An example of such a representation of the Business Model dynamics, as based on Figure 2.9, can be found on Figure 5.2. This new representation makes use of two additional band above the Business Model elements to represent the initial causes of changes. The first big difference is that instead of showing the initial cause as an element affecting components (displayed by an arrow), the changes are categorized by letters: E for external, I for internal, F for forced change and C for strategic choice. So for example, the label E-CF on Figure 5.2 refers to an external effect leading to a strategic choice to change a first component, followed up by a forced change in a second component.

The initial changes and subsequent effects of theses changes are represented by different arrows, as explained in the figure's legend. A new Business Model framework is also represented by an additional element on all rows corresponding to the different Business Model elements. This is an easier representation than in the previous framework, as it better allows for the changes in the Business Model elements to be differentiated between the old and new Business Model. This had to be done with different colors on the old framework but ended up cluttering the figure as well.

This new framework can also be said to address the disadvantage of the previous framework relating to the

complexity of representing changes on a time axis in all three directions. This is remedied in this representation as all elements are on a common time axis. As for displaying too much information, this is partially remedied in how the representation can be stretched out. Indeed, while representing a long period of time in the old framework meant that the inner changes would become ever smaller and ever harder to discern, while in this representation, as time goes on, the figure can just be extended. This could end up taking more than one page to represent a considerably dynamic Business Model over longer time periods, but this is not a possibility with the old representation.

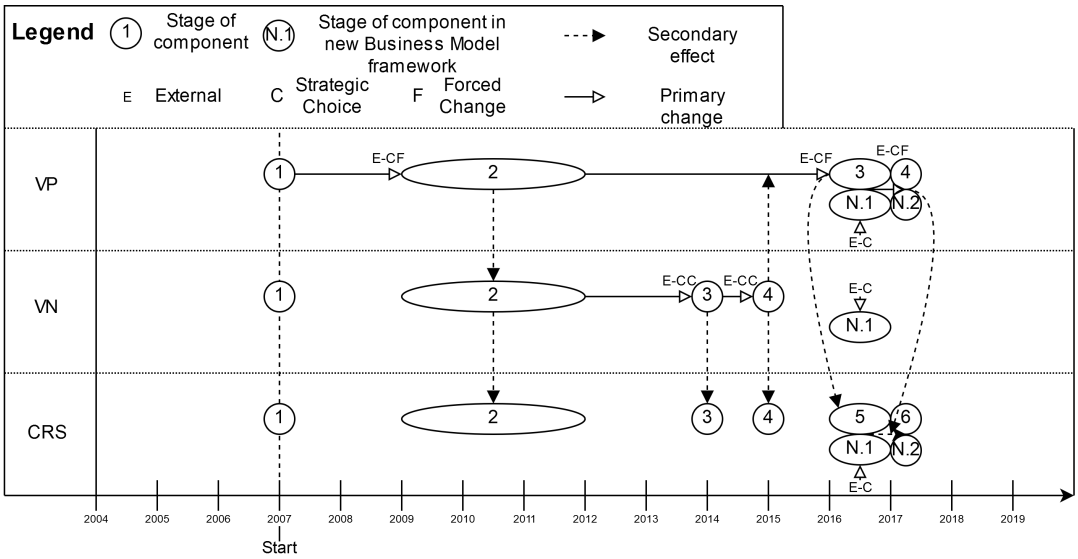

Figure 5.2: Framework representation of changes to Solar Power Indonesia's Business Model under the new representation

Chapter 6

Conclusion, Discussion and Recommendations

Having now gone through an extensive literature study on Business Models and their dynamics, the development of a conceptual model for their representation, case studies on real businesses in Indonesia and a comparison of the literature and case study results, the conclusions of this work can be presented. This is followed by discussions on different aspects of the works and its broader findings. Finally, limitations and recommendations are given regarding the contents of this work.

6.1 Conclusion

The conclusions that can be drawn from this work can be separated into different categories to give a clearer picture of how it has answered the initial Research Questions. This section will therefore start with the conclusions relating to Research Question 1.1 to 1.4, continuing with conclusions relating to Research Question 1.5, and finally finish with the conclusions relating to Research Question 2. Each of these will be explained with regards to the relevant chapters that contributed to their respective conclusions.

RQ1.1 - What are the main components of Business Models for rural renewable energy projects?

For the case of the actual components of the Business Model for rural renewable energy projects, this was done in several stages. In the first stage, the three main components of Business Models that can be seen as being present in all types of Business Model: The Value Proposition, the Value Network and the Cost & Revenue Structure, where obtained from the literature study. It was also found what sub-categories can be used within each component to get a broader picture of the Business as a whole. For the Value Proposition, these are the Customer Segment and the Value Offering. For the Value Network these are Partners, the Sales Process and After Sales Services. And for the Cost & Revenue Structure these are simply the Costs and the Revenues.

These components, for the case of renewable energy projects, can be found in Tables 2.7 and 2.8. From these components obtained in the literature study, several conclusions can be drawn. For starters the possible Customer Segment is quite broad, with different scales of projects leading to significantly different target customers. This Customer Segment can either be an individual, a commercial entity, an NGO (Non-Governmental Organization) or IDO (International aid and Development Organizations), or even a governmental organization. The possible Value Offering for such companies is just as broad, and often reflects the Customer Segment it targets. From the sale of individual components, or small systems for individual use, to the design and implementation of large systems for commercial entities or governments, a strong link is already found between the Customer Segment and the Value Offering. It is also found that it is in the categorization of Value Offerings that this sector finds its diversity. Indeed, while the Value Offering of designing or implementing a system for energy generation is variable mostly in size, the Value Offering of designing and implementing a renewable energy system for a specific use has much more variability. This variability is also reflected in the Revenue Structure, where certain revenue streams such as the transfer of knowledge, can be associated to a specific Value Offering (such as consultancy) and a specific Customer Segment (organizations with a use for knowledge on renewable energy systems). In the typical partners, variability is mainly in the willingness of the company to cooperate with other entrepreneurs or to involve companies or organizations that are not directly related to the production and distribution of their system (Governments, NGOs and IDOs). The conclusion regarding the other sub-components of Business Models for renewable energy projects is that they are both quite common and not very variable between companies. In the sales process, this is due to the limited amount of methods used

for obtaining new customers, which are usually combined to yield the best effect. In the after sales services, it is the fact that maintenance and customer support are both very important in expensive systems such as renewable energy projects. Finally, the elements of the Cost Structure are quite common amongst renewable energy companies, as even though the exact costs vary based on the type and scale of Value Proposition, they will all incur material/component costs, logistics and operational costs, costs of hiring and retaining human capital and most will experience subcontracting costs and import duties and taxes.

From the development of the conceptual model, the components of the Business Model for renewable energy projects were given for the case of rural projects in particular, as found in Tables 3.1 and 3.2. The main conclusion that was drawn from this was that the applicability of these components can be quite broad with regard to the different types of renewable energy projects (i.e: on-grid or off-grid), as almost all of the components were found to have applicability in an off-grid context.

The information that was obtained regarding Business Models for off-grid renewable energy projects in Indonesia from the Case Study, as compared with the literature in Table 5.1, further confirmed some of the conclusions obtained in the literature study. For example, the main variability between the companies in Indonesia was in their Customer Segment, Value Offering, Partners and Revenue Structure, whereas the biggest similarities between the companies was in their Sales Process, their after sales services and Costs. Five sub-components were also added to the list based on the cases in Indonesia, such as adding "distributors" to the list of partners or adding "licensing and permits" to the list of costs. The three other additions had to do with projects with local applications, which were reflected in the Customer Segment, the Value Proposition and the Revenue Structure.

The other conclusion that could be drawn from this addition of new components to the list is that the list itself is not an exhaustive list of all the possibilities, but rather gives the tendencies that such companies have regarding their choice of Business Model components. Using a representation that includes past data for each component also helps to identify outliers, which further reinforces the ability to analyze Business Model dynamics within a given market. For example, although it is hard to draw conclusions from only four companies, it seems from the information that was obtained that engaging in partnerships with networks of companies, other entrepreneurs or with financial institutions is an outlier, and not a common element of Value Networks for this market. Other outliers that were found were transfer of knowledge as a Value Offering and source of Revenue, and the use of web and print advertising as a Sales Process. On the other hand, this also implies some considerable cohesion in the other components, as they are all used by half or more of the interviewed companies.

RQ1.2 - What are the main internal and external factors influencing the components of Business Models for rural renewable energy projects?

Regarding the internal and external factors influencing the components of the Business Model, the results of the literature study can be found in Table 2.9. A conclusion that can be drawn from the results of the literature study is that many factors, such as the financial system, policy or social acceptance, can both be opportunities or threats depending on their state. It can also be concluded that the majority of factors are external to the focal firm, as only one example was found of an internal factor (production issues). A conclusion can also be made regarding the variability of factors even within a certain type. More specifically, that these factors can either cause a change due to themselves having changed, such as new technologies leading to new business applications, or can cause a change due to the realization of their existing potential, such as using old technology for new applications.

From the development of the conceptual model it was concluded that all of the factors found in the literature study were applicable to an off-grid context. This, along with the previous results for the Business Model components, further indicates the applicability of certain considerations on different levels of market division. In this case, indicating that a majority of effects to renewable energy Business Models are also applicable to off-grid renewable energy Business Models as well.

As for the results obtained from the case studies, while half of the factors from the literature were also found in the case studies, five new types of factors were also added to the list. This is a testament to the need for actual data to further develop and improve the framework and refine its different considerations. As for what this data seemed to indicate, it is the tendency for these factors to be an opportunity rather than a threat. This indicates that even in the off-grid market, companies are more likely to change as a response to a perceived opportunity than to a threat. The data from the case studies also confirm the fact that the majority of factors are external to the focal firm.

Another conclusion that can be drawn regarding these factors, in the case of renewable energy projects, is that they tend to be quite evenly distributed, with some tendencies still appearing, namely regarding responses to Market Opportunities, representing 32% of the results, and Efficiency Opportunities, representing 16% of the

results. After Market and Efficiency Opportunities, the next most common factors were Supportive Policy, Technology and Social acceptance, all representing 12% each of the total causes for changes in the Business Models. This was followed by Natural Threats representing 8% off all changes and finally, a Supportive Financial Framework, Lack of Social Acceptance, Efficiency Threat and Social Threat were the least likely factors, representing 4% each of the total results.

It can of course be pointed out that the total data from the case studies, representing 25 different examples of factors influencing the Business Model, is still quite a small data set. But even within this data set, certain trends, like the tendency to respond to opportunities rather than threats as further exemplified by the majority of threats being in the lowest percentage, can be identified. The point that can then be made is that using similar references as a basis for the comparison of factors influencing the Business Model in different contexts, the more data is obtained the more representative the framework is of the real tendencies of companies, along with some reasoning regarding their responses.

RQ1.3 - What are the interrelationship between these Business Model components and their influencing factors for rural renewable energy projects?

For the interrelationships between Business Model components, this started again with the literature study. Each relationship between two components was researched individually, resulting in certain interrelationships for each type. The first thing that can be concluded for the results of the literature study with regards to these interrelationships is how they tend to reflect underlying rules between these components. For the Value Network, this was that it must by definition be able to provide for the creation of the Value Proposition. For the Cost & Revenue Structure, this is that it must reflect the costs expended in the Value Network and on the Value Proposition as well as the potential revenues deriving from the sale of the Value Proposition.

In the development of the conceptual model, these interrelationships were categorized based on their type, which further corroborated the effects of the underlying rules behind the relationships between Business Model components. In the case of the Value Network, this was through the fact that although the Value Network often changed as a forced result of a change in the Value Proposition, the Value Proposition was mostly strategically changed following a change in the Value Network. This would make sense when looking at the fact that the Value Network needs to be adequate to the production and delivery of the Value Proposition. If the Value Proposition changes, this will often result in a forced change in the Value Network to be able to provide the new Value Proposition, whereas if the Value Network changes, it does not force a change in the Value Proposition as long as elements crucial to the current Value Proposition are not removed from the Value Network. It can also be noted about the types of interrelationships that although the Cost & Revenue Structure is not often the starting point for a change in the Business Model, when it is it usually forces a change in the other components.

In the case studies, these interrelationships were once again classified based on their types. One of the conclusions that could be drawn from those results is how the effect of the Value Proposition on the Value Network tended to be of type CF, or a strategic choice to change the Value Proposition leading to a forced change in the Value Network. This was also the case for the case study data regarding the effect of the Value Proposition on the Cost & Revenue Structure. It was also found that the effect of the Value Network on the Value Proposition was mostly of type CC, meaning that the Value Proposition was rarely forced to change as a result of a change in the Value Network, but also that the Value Network was usually changed by design and not by force.

After comparing the results from both the literature study and the case studies, some of the observations on these interrelationships were fortified. This was namely the case for the type of effect from the Value Proposition to the Value Network and from the Value Network to the Value Proposition. It was also found that overall, in both cases, the effect of the Cost $ Revenue Structure on the other components of the Business Model is quite rare, and the relationship usually has an effect in the other direction.

Another interesting result from this comparison was that when looking at the effect of the Value Network on the Cost & Revenue Structure, this is usually either of type CF or type CC, meaning that the initial change in the Value Network is usually a strategic choice and not a forced change. This goes along with the Value Network effect on the Value Proposition usually being of type CC, again implying a strategic choice in the initial change to the Value Network. This result also fits with the previous conclusion on factors influencing Business Model components usually being opportunities rather than threats. This is because an opportunity can be related to a strategic choice to take advantage of it, while a threat will mostly imply a forced change to avoid the threat.

RQ1.4 - How do Business Models for rural renewable energy projects change over time?

From the literature study, the main changes occurring to Business Models were found to be related to the components that are affected. For the Value Proposition, these were changes due to technology, competition, new opportunities or diminishing returns. For the Value Network, these changes were due to the development of new products, increasing requirements from customers and to find new sources of revenues and new Value Offerings on the customer side. It can be said that information was lacking on this particular topic, which is further explained in the section on limitations and recommendations. Nonetheless, some conclusions could be drawn from this information, namely that the typical changes have a typical component they affect. It can also be noted that changes in the Cost & Revenue Structure is the least common change amongst the three.

From the case studies, it was found that although changes do indeed tend to start by affecting a primary component, due to the interrelationships between components, the Business Models for the companies in Indonesia tended to develop quite homogeneously. In other words, no one component was changing much more than the others. Another thing that could be concluded from the results of the case studies is how the Value Proposition is the most common element to be initially changed. Out of the 25 changes in total amongst the four interviewed companies, 15 were changes starting in the Value Proposition and the other 10 were changes starting in the Value Network. These results reinforce the previous conclusion that changes in the Cost & Revenue Structure are the most uncommon and usually result from its interrelationships with the other two components.

A conclusion can also be drawn from the results of the case studies regarding the trends of changes over time in relation to external factors. Namely, changes to the Value Proposition following the development of technology can be seen in changes such as the sale of "zero-mass water" for the production of water from ambient humidity, or the use of reverse osmosis systems for the purification of water, both of which required the technology to be well developed to be applicable as a product. This type of trend can also be seen in the companies adapting to changes in policy in Indonesia, namely regarding the implementation of a net-metering, which gave the incentive for companies that still only catered to the off-grid market to expand to the on-grid market. Nonetheless, it can also be seen that changes over time are not simply correlated to external factors but largely depend on the strategic choices of the company, which can be seen in the fact that despite technology being at the level where reverse osmosis projects are more than feasible, only one of the interviewed companies expressly provides such systems as part of their Value Offering.

Interestingly it could also be noticed from the results of the case studies that most of the companies implemented changes to their Business Model related to the increase of collaboration with local communities, including training them to become operators and educating the general community on the benefits and applications of renewable energy. This type of trend is especially interesting as it is not as straightforward to explain as changes due to trends in technology or in policy and regulations. Indeed, a trend for companies to collaborate more with locals could be attributed to and increased knowledge regarding the possible economical benefits of such interactions. Or it could be caused by an increased importance of social value as a business considerations and within broader culture.

RQ1.5 - How can these interrelationships and changes over time be expressed in a comprehensive framework?

To answer this question, a framework aiming at expressing these interrelationships and changes was developed. The first aspect of this framework was the representation of the completeness and interrelationship elements of Business Model dynamics by laying out the common examples of components and interrelationships for the case of rural renewable energy Business Models. This information is provided in tables and serves as a basis for the understanding of what types of factors affect Business Model components, what components are typical to the field and how do these components react to changes in other components or to other influences. As such, the conclusion as to how to represent the completeness of elements in a framework is that relevant components and sub-components of Business Models for a given market type, are given with their respective rate of occurrence in gathered data. As was seen in the conclusions regarding the Business Model components, using such a representation allows to better identify the trends in the market, as well as outliers within different sub-components. One could argue that such information would better lay out the "tried and true" methods within different markets, but also what Business Model components are tried by first movers and innovators. Unfortunately, the developed framework does not account for the actual effect of the choice of these components on firm performance, which is further addressed in the section on limitations and recommendations.

The framework also provides the representation of interrelationships based on if the initial change in a component and the subsequent changes in other components are forced or the result of a strategic choice. These are denoted as the letter F for forced changes and the letter C for strategic choices and thus results in four interrelationship

types: FF, FC, CC and CF. This was shown in the conclusions on the interrelationships between Business Model components to be useful in uncovering the underlying relationships between Business Model components.
As for the actual representation of the changes over time, a representation was created that would be able to display the actual changes over time of a company, and thus showcase how each element would change and as a response to what effect. The initial representation (Figure 3.1) consisted of a triangle where each point represented the development of one of the three elements of the Business Model. Each point would grow with each change in its corresponding component. The type of cause, either external or internal, an opportunity or a threat, are also shown on this representation. By representing initial cause, the initial component that is affected is also shown, as well as the subsequent effect it has on other components.

The advantage of this framework was the representation of several key aspects of the whole framework in a single figure. Indeed, this representation quite well represents the interrelationships as defined in previous chapters, looking at the initial cause, the initial change, and subsequent changes to the Business Model. It could also be argued on the other hand, that other aspects, such as the interrelationship type, would not be well conveyed in this framework representation. As a result, an improved version was obtained by combining it with the representation of interrelationship types as seen in Figure 2.9. This combination is represented in Figure 6.1.

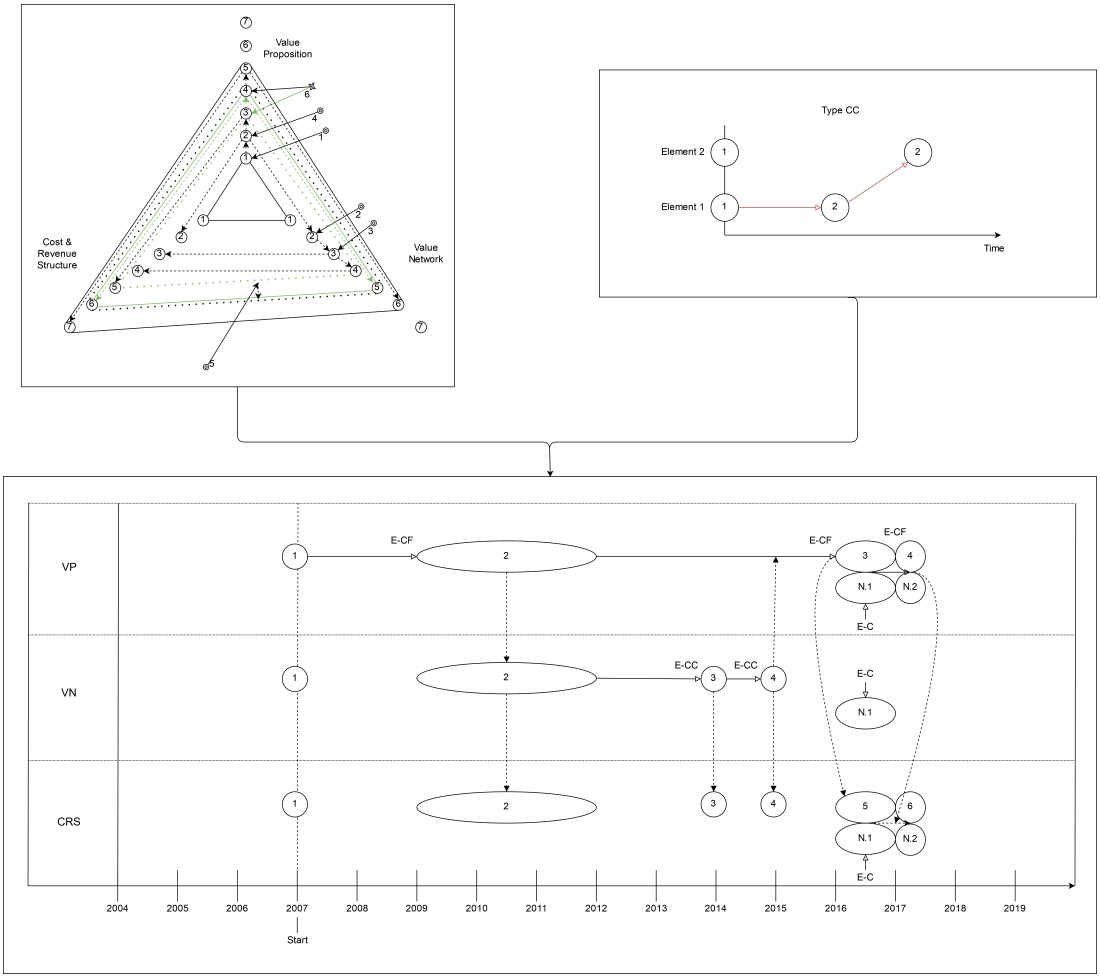

Figure 6.1: Development of New Framework from Previous Frameworks

This new representation shows each element of the Business Model on a common time axis, while keeping the relevant information that was given in the previous framework. It also shows the type of interrelationship that occurs within the company over time using the F and C types of interrelationships, giving more consistence to the framework as a whole.

As such, this work offers this representation as a method of expressing the changes in a Business Model over time, including the initial effect as well as the interrelationship between Business Model components. It also provides a unifying framework and definitions for the classification of Business Model components that can be

used to gain further insight from past data.

RQ1 - What are the dynamics of Business Models for renewable energy systems in rural communities?

Having gone through all of the sub-questions of the first research questions, overall conclusions can be drawn regarding the dynamics of Business Models for renewable energy. Firstly, it must be emphasized that these dynamics occur in every company that has lasted a certain amount of time, indicating that a lack of flexibility in the Business Model inevitably leads to ruin. This is important because it underlies the very cause for the research into Business Model dynamics, that even though these dynamics exist, they are often ignored as a consideration when establishing a Business Model.

As for what these dynamics are, it was found that changes will always have an initial cause, which can be an opportunity or a threat and internal or external, which itself will cause a change in one of the three main components of the Business Mode. These are considered in the completeness aspect of the Business Models dynamics framework and show that opportunities and threats can often be two sides of the same coin, arising for example, from enabling or prohibiting policies and regulations. The components found for the renewable energy sector were found to be broadly applicable to different sub-markets, and exhibiting trends in components such as the Sales Process, the After-Sales Services and the Cost Structure. They also large overlaps in their Value Proposition and Value Network, namely the sale of renewable energy systems in its different forms in the Value Proposition, and the provision of components and materials from suppliers and making use of distributors to deliver their product in the Value Network.

Regarding interrelationships between components, the main conclusion that can be drawn is that there are basic rules underlying why certain components will affect others, but while some are quite self-explanatory, such as the Value Network being sufficient for the provision of the Value Proposition, some are not, such as the Cost & Revenue Structure being sufficient for innovation in the Value Proposition. These interrelationships also bring up the concept of freedom of choice on the part of managers regarding the changes to the Business Model over time, as such interrelationships are looked at from the lens of being either forced or a choice. The conclusion on this aspect is that these interrelationships are either causal, in the case of forced changes, or lead to the potential for a change if they are a strategic choice. It is found in this respect, that managers therefore have some freedom in deciding which component to change and how.

The changes over time that were found in the literature and through the case studies seems to indicate that the Value Proposition and the Value Network are the main sources of changes, and that these often end up affecting the Cost & Revenue Structure. The similarity was also in the type of changes to the Value Proposition, which mainly involved adding new applications for the use of the electricity from their renewable energy systems. It was also found that the companies all started to collaborate more with local communities, indicating some shift in the mentality of the market as a whole.

Finally, the framework provides a way to aggregate data on Business Model components, influencing factors and interrelationships, a way to display these interrelationships and how they play out over time in a concise figure, and a way for managers to make use of this framework to develop or improve their Business Model framework, whilst accounting for dynamics.

All in all, the answer to this research question is that there tends to be trends in the components, influencing factors, interrelationships and changes over time of the Business Model within a specific market. These are outlined for the case of rural renewable energy projects, and then further for the case of Indonesia, but it is doubtless that there will be considerable differences when looking at different markets. Uncovering these trends, finding the outliers, and understanding why the trends exist, is fundamental to better understanding the topic of Business Modelm dynamics as a whole.

RQ2 - What are these dynamics in the case of Indonesia?

The answer to this question was the goal of the case studies of Indonesian companies and it gave some interesting information. Of course some of this was mentioned in the previous sections, but to go over once again, the findings from the case studies, we can start with the completeness element of dynamics, which was explained to contain internal components of the Business Model and factors influencing those components. For the case of Indonesian companies, it was found that those were mostly as could be expected from the literature and so from any renewable energy company in general. Their Customer Segment included private companies, individuals, the government, IDOs and NGOs, their Value Offering included the installation of systems, the maintenance and operation of systems, the sale of electricity, the sale of products, their partnerships had to do with local collaboration, networks of companies, component manufacturers, financial companies and their Cost & Revenue

Structure, as expected, covered the costs of the production of systems, accounted for hiring and subcontracting, logistics and transportation, and all associated costs to the production and procurement of renewable energy company.

Where the dynamics of the companies could be said to be specific to either the off-grid or Indonesian sector is in those changes due to the isolation of certain islands or the rough conditions of roads in secluded regions. Such changes are typical of this type of market and even more so in an archipelago country like Indonesia, where some of the most distant inhabited regions are small islands vast distances away from the nearest city in the nearest big island.

It was also found that in the case of the interrelationships between components, no effect was found starting with a change in the Cost & Revenue Structure and so all changes originated in either the Value Proposition or Value Network. Yet the overall changes in each component were about equal overall, implying that while the Cost & Revenue Structure is rarely the starting point of change, it is likely to change as a response to a change in the Value Proposition or Value Network.

As for changes over time, it can be said that some trends were found amongst the different companies, such as the expansion to the on-grid market as soon as policy allowed for it, or the development of improved collaboration with local communities, including the training of system operators and educating the general community. It could also be noted that there was also a trend of learning from experience in the field to make adapted improvements to specific operations, such as the improvement of packaging based on rough road conditions, the improvement of lightning resistance based on damage from a rough thunderstorm, or the change to the frequency of shipping components based on delayed shipments leading to idle workers on the project site. These types of changes exemplify how changes to the Business Model can be somewhat forced by the experiences a company goes through. On the flip side, it must be noted that the changes caused by threats were a minority of all the changes that were found, but that they do tend to occur regardless, in various forms.

6.2 Discussion

It can be said that apart from answering the research questions that were defined in the introduction, many topics were explored that brought up different questions or implications regarding different aspects of the work. Some of these deserve to be further discussed due to their relevance to either the field of Business Model dynamics, or off-grid renewable energy.

6.2.1 Further Applications of the Framework

Starting with some further considerations regarding the development of the framework, there are several points that can be made about its application. The first would be that such a framework would benefit greatly from its continued use and adaptation. As has been explained, one of its advantages is that the use of such a framework would conform the type and format of information being provided on the topic of Business Model dynamics, which in turn would allow for a broader comparison and analysis of these dynamics across different Business Model types. Combined with the use of past data to provide guidelines for the completeness and interrelationships elements of Business Model dynamics, this means the more the framework is being used, the better it becomes at informing people of the current trends.

This can also be true of the actual representation of the framework, as even within the context of this work, it was adapted to better represent Business Model changes over time. This representation is susceptible to modifications and improvements and can be further developed to even more succinctly express the changes over time. But until this happens, it is the opinion of this work that the given representation can be of great use in identifying trends in Business Model dynamics.

This is not only true due to the graphical representation, but can also be said to be due to the additional information that is gathered through the framework, namely the types of interrelationships between Business Model components. Indeed, it was explained how these different types can be seen as representing different aspects of Dynamic Capabilities. In the case of relationships of type CC, this would give more information on how elements can be changed in a way that allows for more freedom in the choice of other elements, thus looking at more general changes to the Business Model as a whole. For relationships of type CF, this would help inform on the possible consequences of a change in a given component, yielding a deeper understanding of how certain relationships will force other components to change as a response to a change in another component. Relationships of type FC on the other hand, would allow for a better understanding of what forced changes to a component may result in added freedom in other components, thus improving the chance for users of the

framework to make use of opportunities that arise from forced circumstances. Finally, relationships of type FF indicate forced changes in both the initial and subsequent Business Model component, this can help in understanding what would cause such changes that are outside of the choice of the firm's managers and thus hopefully avoid undesirable changes of this type by better understanding their usual cause.

In this case this is another element of the framework that would greatly benefit from the framework itself being used. Indeed this type of classification is not necessarily a common one and perfectly exemplifies how the use of a common framework for the analysis of Business Model dynamics would yield much more insightful results. In the case of these different types of Business Model relationships, a large amount of data from different types of Business Model would allow for a better understanding of the underlying causes for Business Model relationships to have the trends they do.

6.2.2 Implications for Managers and Entrepreneurs

Seeing how the framework could be applicable for research and to unify concepts regarding the analysis of Business Model dynamics, it also follows that it finds some use in being a tool for managers and entrepreneurs to create or further develop their Business Models to account for such dynamics. This being said, there is also a broader point to be made about the implications of this research for managers and entrepreneurs, namely regarding the overall importance of dynamics when looking at businesses in general. Indeed, it has been found in this work that businesses are for from being static and that the Business Model framework simply offers a representation of a business at one point in time. Knowing this, it is therefore crucial for managers and entrepreneurs to be aware of how these dynamics work in the context of their particular market.

This is important as it was also found that just like the Business Model framework itself, Business Model dynamics are highly context dependent and will vary amongst different markets. As such, for a given type of market, managers and entrepreneurs need to be aware of what the typical causes for change are, what are typical components that are affected and how do these components relate to one another to cause further changes to the Business Model from an initial change. This is also important in the context of looking for new opportunities, as it is found that it is in these changes that companies have the most freedom to change components, to varied effects.

6.2.3 On the Underlying Assumptions Governing the Framework

Given that the framework gives a theoretical representation of real world concepts, but that not all considerations can be accounted for, some simplifying assumptions are made that are important to look at to have a better understanding of where the framework falls short of an accurate representation of reality and where further research may be necessary. Such an assumption is the fact there is a single starting change within one component leading to changes in other components, when in reality, it may be the intention of the manager to change several components at once.

Another assumption is that managers are aware of circumstances that should force a change in their Business Model. This is to say that the model assumes a clear distinction between forced changes and strategic changes to the Business Model. If this was the case in reality, companies would not so frequently fail in their endeavors. This point is further elaborated on in the discussion on the types of interrelationships between Business Model components.

Finally, it can be said that the framework assumes that the most relevant components of the Business Model that should be looked at are the Value Proposition, Value Network and the Cost $ Revenue Structure. Although it is the opinion of this work that these are indeed the most overarching themes of Business Models that are the most broadly applicable, it may be that a fourth component could be added, or that the separations of the Business Model into its component parts could be done entirely differently.

6.2.4 Generalization of the Framework and Broader Implications for Business Model Dynamics

Another interesting topic that was brought up is the level of generalization that appear in different parts of this work. This started with the level of Business Models in general in the initial investigation of Business Model components, then narrowed down to renewable energy when looking at the different stages of Business Model dynamics. This was further narrowed down to off-grid areas in particular in the conceptual model and then for the case of Indonesia in the case study. Some of the similarities between results on different levels, which was especially considerable for the case of Business Model components at different levels.

This brings up some interesting questions about the generalizability of the framework itself, as there seems to be some applicability of components, interrelationships or changes over time that occur in renewable energy companies as a whole to the case of off-grid renewable energy Business Models in Indonesia. This makes sense considering that on an upper level, elements of Business Model dynamics for renewable energy in general will include all types of different subcategories of renewable energy companies.

Where this bears more discussion is in how this can be further accounted for in the framework. It was mentioned in Chapter 5 that the data from companies in Indonesia that was obtained in the case study would have to be tagged to represent the different subcategories of the Business Model it belongs to. This method of tagging the data based on its Business Model type can allow for a deeper look at these generalizations as it would easily allow to filter for different types of Business Models. For example, one could look at all renewable energy Business Model components, interrelationships or changes over time, and then filter for only off-grid Business Models and see where the overlap lies. This could also be done with an overlap between different subcategories on the same level, such as a comparison between off-grid and on-grid Business Models.

Another consideration that is interesting to look at is the relationship between generalizability and completeness. Indeed, completeness was defined as the accounting of internal components of the Business Model and all of the influencing factors affecting these components and so by increasing the completeness of a certain Business Model framework, its generalizability lessens. This is due to the fact that by being further refined and accounting for more components and sub-components, a Business Model framework will become more applicable to a given market type.

6.2.5 On the Benefits of a Central Tool for the Generation of the Framework Representation

What could greatly help with the framework's reliance on feedback for its own improvement, is some central repository and implementation software that would store all past data of Business Model dynamics including its tags identifying the type of Business Model it relates to. This type of software could be used to both generate framework representations of changes over time, which would be easier than having to manual create them every time and to inform users of the software about past data on the type of Business Model they are generating.

This type of software was quite unfortunately outside of the scope of this work, but would certainly be of use in ensuring some form of coherence in the use of the framework as well as in the implementation of improvements based on past data.

6.2.6 On the Types of Interrelationships Between Business Model Components

In this work, the interrelationships between Business Model components are separated into four types based on whether changes to the related components are forced or a strategic choice. Although this was considered to be the best classification of interrelationship type given the goal of the framework to gain a deeper insight into the underlying causes for these relationships, there are some points that warrant further discussion.

For example, although a forced change and a strategic change are somewhat presented as dichotomies, being completely separate from one another, the difference between the two is not always straightforward. This is especially true for initial changes, which cannot be forced by the underlying relationship between components. In this case, a forced change is considered to be one where the company has no choice but to change a component of its Business Model. Where this is complicated is that in the strictest sense possible, companies always have a choice in changing their Business Models or not. Changing the definition to changes that would be necessary for companies not to close down makes it somewhat more robust, but it can still be argued that there is no clear line in the sand that dictates when action becomes necessary to prevent financial failure. Such problems in the very classification of things is indicative of a broader problem regarding the subjectivity of concepts considered to be widely agreed upon. On the surface, a forced change seems quite straightforward, and for the most part, people will agree on changes that are forced and changes that aren't, but when looking at the border between forced changes and strategic changes, the distinction becomes less clear.

On the topic of forced changes, it can therefore be said that there is actually a difference between a forced initial change in a component and a forced change to a component due to a change in another component. This was already briefly mentioned, but has to do with changes caused by other components being tied to the interrelationship between components whereas initial forced changes, being the result of circumstances forcing an initial change. It can also be said that when looking at these types of causalities between Business Model components, they will often imply quite a small time scale in relation to the lifetime of the firm. In other words, if the evolution of the Business Model was looked at on large time scales, the interelationships between components would just appear as a simultaneous change in those components that are affected. This brings

into perspective the different time scales on which dynamics can be analyzed to different results. On a larger time scale, what would mainly be observed is the different stable configurations that the Business Model would settle in, whereas on smaller timescales, the turbulence caused by changes in the Business Model could also be analyzed.

A final thing that can be noted regarding the types of interrelationships between Business Model components is how the trends that were found in these interrelationship types seem to indicate some underlying rules dictating these interrelationships. For example, one could easily conceive of an underlying rule relating the Value Network and the Value Proposition, namely that the Value Network needs to be such that it can provide the necessary services for the creation and distribution of the Value Proposition. This would mean that if the Value Proposition changes beyond the capabilities of the Value Network, the Value Network will have to be changed to match those capabilities, but if the Value Network is changed beyond the necessary capabilities for the provision of the Value Proposition, it is a choice to improve the Value Proposition for these new capabilities. And indeed, from the trends of interrelationship types, it was found that a change in the Value Proposition would more often result in a forced change in the Value Network while a change in the Value Network would more often result in the choice of a change in the Value Proposition.

6.2.7 On the Possible Effects of Bias on the Work

Bias is a consideration in every field of research and is important to take into consideration regarding its possible implications on obtained results. For example, it could be argued that there is a possibility for bias in the result of the case studies. More specifically, it was found for example that almost all of the changes that were found in the companies were the result of opportunities and not threats. Although this could very well be true, if this was the result of bias, this is certainly the direction that the bias would lean towards. Indeed, it would be in a company's best interests to oversell their ability to seize opportunities and undersell changes that they were forced to implement due to internal or external threats.

This brings up the question of how data could be obtained in a way that would minimize the possible introduction of bias. Unfortunately, it can even be argued that given unbiased data, the interpretation of this data is not necessarily free of its own bias. This is simply because any researcher runs the risk of getting attached to certain theories and concept and to look for evidence backing them up rather than objectively looking at all of the evidence. This brings up the importance of repeatable and traceable research, where the processes used to obtain data can be replicated by other researchers and that the data itself is traceable its sources.

6.2.8 Social Costs and Revenues

From the beginning of this work, from the information that was given on the BoP market, to the social benefits of projects that were given through the case studies, Social Costs and Social Revenues have been a recurring topic. As was explained, this is mainly due to the abundance of possible social benefits that can be generated by renewable energy projects, but also due to the benefits of social revenue as a whole. For example, the case of productive use of energy was brought up in the introduction, in reference to the BoP market in particular. It was explained that the best way to implement technologies like renewable energy systems in poor communities, is by generating revenue from the use of the system itself.

In other words, to provide systems for productive use. Here, the social benefit can be seen in the form of empowering the user of the system and allowing them to generate additional revenue. While this may be the initial social benefit, one can easily see how this increased productivity can lead to additional benefits down the road. For example, a fishing community which now has access to solar cold storage, can now more easily maintain the value of their fish for longer periods, thus increasing their revenue, but maybe this also allows this community to have a more stable source of food for themselves. This increased stability in their source of food can lead to further benefits, such as allowing people that would usually have to travel to other villages to purchase food to contribute more to their own village. Increased food stability may also lead to reduced chance of disease from malnutrition or consumption of spoiled food. This may all just be an example, but illustrate quite concisely what type of social benefits could be derived from certain projects, which would not usually be included in a traditional Business Model.

Of course, it can be said that there is currently a shift within Business Model research that is putting more emphasis on Social Business Models, with new frameworks being developed such as the Triple Layered Business Model Canvas (see Figure 6.2) or the Sustainable Business Model Canvas. These types of Business Models look at the effect and consequences of the business' activities beyond the scope of economics and try to minimize the business' overall negative effects. In the case of the Triple Layered Business Model Canvas for example, each element is viewed from three perspectives: the usual Business Model perspective focused mainly on the economics and transactions of the business; an environmental perspective focused on environmental costs and

revenues, looking at minimizing the business' impact on the environment as a whole; and a social perspective focused on social costs and revenues and other social considerations of the business as a whole. As for the Sustainable Business Model Canvas, it simply adds two components to the traditional Business Model Canvas: eco-social costs and eco-social benefits. This could be seen as the simpler alternative in accounting for such considerations without going too far from the traditional Business Model Canvas.

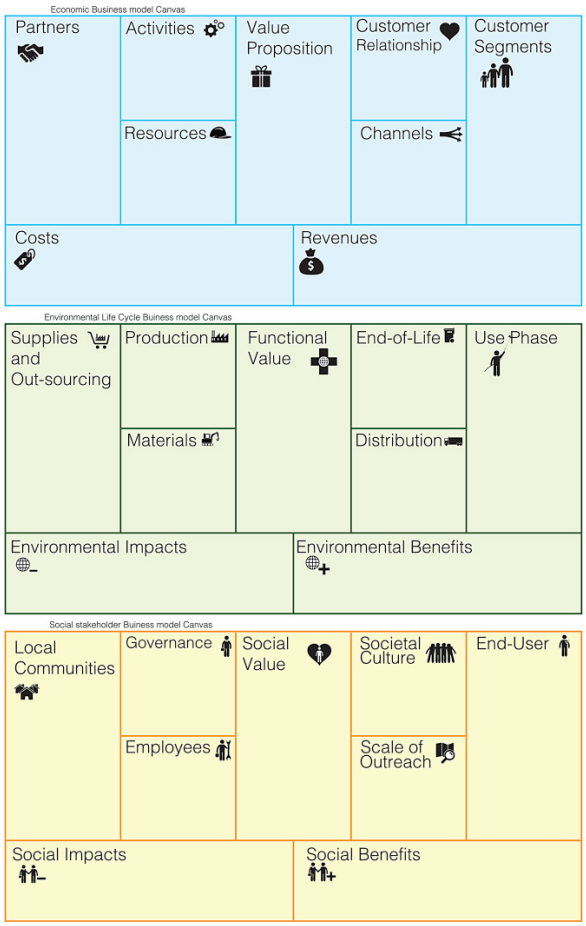

Figure 6.2: Triple Layered Business Model Canvas from (Joycea & Paquin, 2016, p. 10)

An interesting thing regarding the use of a more social based approach and how this can tie in with Business Model dynamics can be drawn from the results of the case study. This was specifically regarding the improvement of relationships and collaboration with local communities on local projects. The realization that was drawn from this example is that although the initial effects can be quantified mainly in terms of social benefits for the community in question, the dynamic considerations of the customer sided Value Network will allow for some predictions as to the future effects of this social value. This can be in the form of improved local expertise for further developing projects in the community, the increase in local purchasing power allowing for locals to spend more on expanding or improving current projects or finding new applications for the technology. The point that can be made here, is that in some sense, a dynamic perspective of the Business Model gives more incentive to take into account social and environmental considerations, such as in the Triple Layered Business Model Canvas, as these will undoubtedly have effects on the traditional Business Model in the long term.

6.2.9 Productive Use for Rural Development

Looking at the topic of productive use of renewable energy in rural communities, which is a good example of an application with positive social implications, more can be said about the applications this form of Value Offering has in the context of Business Model dynamics. For one thing, the effect this type of Value Offering has on the other components of the Business Model is interesting to see. For starters, natural changes to the customer sided Value Network as well as the resulting social benefits are one side of the changes. On the other side, the reorganization of the focal firm to adapt the technologies necessary for the given Value Offering will provide new connections in the Value Network and new knowledge and methods.

More can also be said about how this type of solution is especially catered towards off-grid rural communities. This is because off-grid rural communities, while still likely to have some form of local production, will usually rely either on manual labor or diesel based generators. This makes it easier to apply renewable energy, as it would either replace manual labor, and thus improve local production, or replace diesel generators, which especially in isolated areas will be considerably more expensive over their lifetime than renewable energy systems. It was mentioned in the introduction that in BoP markets, revenue has to be produced by the product itself, which is the essence of systems for productive use.

This type of application was found in the different companies interviewed for the case studies, in the form of solar water pumping and cold storage, which in some way contribute to Value Creation, or in the case of cold storage, rather Value Conservation. Yet it can be argued that when it comes to productive use, the applications can be even more varied, covering anything from the processing of crops for farming applications, to the use of power tools for wood carving or other types of artisanal labor.

6.2.10 Importance of Policy

One of the recurring themes that was found in the case studies is how the biggest external factor that was given by all the companies is the effect of policy. This is understandable in the context of renewable energy in Indonesia, which was seen to have a considerable amount of restrictions when it comes to policy and regulations on renewable energy generation and procurement.

This brings into light the broader importance of policy as a tool for development and diffusion of emergent technologies. This can be seen in the context of new technologies which are not yet financially viable but have a great amount of room for improvement, but also in well established technologies such as renewable energy, that have already proved their viability in the market. This is because most countries will have incumbents that will make this transition more difficult, and this is particularly the case in Indonesia.

From subsidies going to lowering the price of petrol and natural gases to the subsidies going to lowering prices of non-renewable electricity, renewable energy would have a hard time competing with these forms of energy generation even if it was not constrained in any way. The problem is that on top of the subsidies going to non-renewable generation, renewable energy also isn't priced at national electricity prices but at a certain percentage of it that depends on local electrical infrastructure costs.

The restrictions also exist with regards to what markets renewable energy companies are allowed to cater to, and to exemplify how these restrictions affect these companies, and conversely, how changing restrictions with incentives helps in the diffusion of renewable energy, there is no better case than the expansion to the private market that all but one company in the case study talked about. This expansion was mainly driven by the change in regulations regarding the provision of electricity in grid-connected houses. While this was initially not permitted at all, a feed-in-tariff was eventually implemented, which was then changed into a net-metering scheme. This change in the regulations prompted a quick change in most renewable energy companies, which now had a new market to target that was previously not financially attractive.

A final thought about these policies, is that it seems that from the point of view of the Indonesian government, the one and only priority regarding policy is what would be most beneficial economically. Although this does make sense as a concept, this is neither necessarily true, especially in the long run, but also completely disregards social and environmental effects. Indeed, this is another advantage that could be found in such considerations in Business Models, namely that if it becomes common enough that even governments and governmental organizations start taking into account such considerations when drawing up new policies and regulations, renewable energies would have a much higher chance of getting more help from these.

6.3 Limitations and Recommendations

There were several limitations to the study that constrained both how much information could be obtained, and subsequently, the reliability of the conclusions that could be drawn from it. To begin with, the amount of information that was available in the literature was quite scarce. This was exemplified in the introduction when looking at the amount of literature resulting from using different search terms. This showed how articles mentioning the terms "Business Model dynamics", "renewable energy" and "rural" represented only about 5% of all articles on Business Model dynamics in general. This is simply because both "renewable energy" and "rural" are both subsets of the "Business Model dynamics" category, and that while an article on Business Model dynamics for either one of these subsets might be rare in and of itself, an article included in both subsets will be even more uncommon. Added to this, the fact that Business Model dynamics are still a developing field, with no established or agreed upon methodology regarding its analysis and development, means that it is not likely for an article to cover the topic in depth for a subset of Business Model dynamics. It was also found that when an article does focus on a subset when looking at Business Model dynamics, it rarely looks at the evolution of Business Models within an industry or company over extended periods, but rather, usually looks at one innovation in particular as an example of the type of innovation that can be employed in the sector. In other words, looking mainly at niche developments in the sector's usual Business Model.

Another limitation was the amount of information that could be obtained from the case studies. The first barrier to this was the fact that certain renewable energy companies either did not have an easily reachable website or other presence online, or were only in Indonesian and thus required the search terms to be in Indonesian. The next barrier was the fact that few of the companies that were reached out to actually responded, and that some of the ones that initially responded, eventually stopped. This left only four companies that were willing to share some information regarding their experience with off-grid projects and the related evolution of their Business Model. This lack of information made it hard to determine the reliability of trends, and effectively impossible to draw any verifiable conclusions regarding these trends, only plausible theories. As such, a recommendation for future research would be to compliment the data found in this work with additional data from other companies

in Indonesia to help broaden the picture and refine the trends in the Business Model dynamics.

On the topic of limited information, one could also argue that this work is somewhat limited in drawing broader conclusions on the off-grid market for renewable energy outside of Indonesia, as most of the relevant information specifically on the off-grid sector was obtained from the case studies. Indeed, the rest of the information was obtained from literature on renewable energy in general, and so is only applicable insofar as it corresponds to actual trends in off-grid markets. This was verified for the case of Indonesia, but no other country, and so no conclusions can be drawn about how generalizable these results are across different off-grid markets in different countries. A recommendation for further research would therefor be the use of the framework in the analysis of Business Model dynamics for off-grid renewable energy projects in other countries than Indonesia as well, to further establish the correlations in dynamics across different markets.

It could also be said that the information that could be obtained from the literature on the changes to rural renewable energy companies over time was quite limited. This is mainly due to the fact that the analysis of individual companies and their evolution over time is not the most common approach for research on Business Model dynamics, and so even less common for specific applications such as this one. Most of the information that can be obtained on this topic has to be extracted from papers on different topics that happen to mention specific changes over time. It also doesn't help that most of the information on Business Models is given in the context of a single point in time, and so even if a change is mentioned for this point in time, it is impossible to place it inthe context of the firm's overall development.

A limitation of this work also lies in the fact that there is no indicator of the benefits of certain Business Model components or their dynamics. The components are given, as well as the relevant interrelationships and changes over time, but if these actually have a positive effect on the functioning of the firm is not found or expressed in the framework. This could be an area of significant interest for future research, as it is definitely an important consideration to know what changes would actually be beneficial and which should be avoided.

The fact that no interview was achieved with relevant members of the government can also limit the amount of information that can be obtained about the possible negative economic and social effects of renewable energy development. This could have helped regarding the type of collaboration with the government and other actors in the Value Network that could have overcome these negative effects. This could also have have given a more complete picture of the reasoning behind the policies and regulations in place, giving the government's point of view instead of just the renewable energy companies' points of view.

As for some other recommendations for further researched, as mentioned in the discussion, it would be of great benefit to the framework developed in this work if it was complimented with some software that would allow for the generation of the framework representation of changes over time based on certain input data, and that would also store information about Business Model dynamics for different categories, which would be used as a basis to further refine the framework and all its considerations.

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