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The Relationship Between Firm Innovativeness and Barriers to Business Model Innovation

A Study of the Swedish Electricity Retailers' Shift Towards Broader Incorporation of Solar Energy

Master of Science Thesis
in the Management and Economics of Innovation Program

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ABSTRACT

The global climate changes are putting pressure on companies across industries to reduce their greenhouse gas emissions. The electricity industry is part of this changing landscape, moving towards more renewable alternatives. This has led to the rising attractiveness of solar energy production systems as a means to increase the amount of renewable energy. What this change, posed by an emerging technology, will entail for electricity retail companies is yet uncertain.

To guide industry actors through this changeable environment, the aim of this report is to provide indications on the potential relationship between the innovativeness of the firm and encountered barriers when performing business model innovation. Business model innovation is a means to counteract the external forces driving change in the industry, to adopt to the new setting and become competitive.

By examining the largest electricity retailers and analysing their business model innovativeness, a set of actors were selected to be included in the empirical data collection. Information was additionally gathered by interviewing these firms, where discussions regarding seven categories of barriers to business model innovation were held. Isolation of innovativeness was based on firm attributes, to disregard other factors to the largest extent possible. This along with grouping firms by other factors revealed interesting findings.

The findings indicate that there is no positive relationship between high innovativeness and fewer barriers. However, signs of negative relationship were observed, indicating that there might instead be a relationship between innovativeness of the firm and the ability to overcome and learn from encountered barriers. Moreover, when grouping firms by other factors, findings indicate a potential relationship between encountered barriers and the size of the firm's customer base, as well as the ownership structure.

Implications for future research will be to further study a suggested grouping of barriers to business model innovation, which may explain the unclear relationship between innovativeness and barriers. Additionally, the effect that dimensions of business models have on business model innovation could be studied more closely. Lastly, strategic managers for electricity retailers can become aware of which barriers to business model innovation that are most prevalent, which may be helpful in their aim to handle the transformation of the industry successfully.

Keywords: Climate change, business model innovation, electricity retailer, emerging technologies, innovativeness of the firm, transformation challenges

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Terminology

Barrier	A counterforce to the planned path; challenge, hinder, obstacle etcetera.
Business Model	A plan for the operation of a business to create, deliver and capture value
Business Model Innovation	Developing a new Business Model
Energiöverenskommelsen	An agreement regarding the electricity industry across the political coalitions in Sweden
Innovativeness	The degree of being innovative, introducing something new
Nord Pool	Nordic electricity market
Producing retailers	Retailers that produce electricity
Prosumer	Customer who produces its own electricity
Pure retailers	Retailers that do not produce electricity
R&D	Research and Development
Retailers	Companies buying and selling electricity to consumers
Smart house	A house connected through Internet of Things to increase efficiency
Solar PV	Solar photovoltaic used to convert solar energy to electricity
Svenska Kraftnät	The authority owning, controlling and developing the Swedish national electricity transmission grid
Utilities	International retailers who might perform multiple activities in the electricity value chain

1 Introduction

1.1 Empirical Background

Due to human influence, the climate has been through unprecedented warming which has resulted in substantial environmental issues. Driven by economic and population growth, the problem has caused the atmospheric concentration of methane, carbon dioxide and nitrous oxide being at the highest point for the last 800,000 years. Fossil fuel consumption, in particular, is identified as a major reason for this development, as it contributed about 78 per cent to the total greenhouse gas emission increase between 1978 and 2010 (IPCC, 2014). The problematic situation has resulted in large global efforts to reduce climate influence, such as the Paris agreement, where an overwhelming majority of countries has set up mutual targets as an attempt to achieve a sustainable society (United Nations Climate Change, 2016).

The response by the Swedish energy market to the climate issue has taken many forms, with various quantitative and qualitative targets introduced, as the debate of energy policy has become increasingly connected to environmental issues (Brandel, 2015). The topic has additionally been affected through one of the most important electricity sources, nuclear, being heavily debated for other disadvantages (Sveriges Radio, 2013). One example of a legislation that has affected the Swedish market is the introduction of emission allowances in the European Union to make countries accountable for their environmental impact (Naturvårdsverket, 2019). A recent domestic target is "Energiöverenskommelsen", which was established in 2016, setting long-term objectives for the Swedish energy market (Regeringen, 2016). The plan of having 100 per cent renewable electricity production in 2040 in addition to zero net emissions of greenhouse gases in 2045 requires a significant shift in the industry, as a high amount of energy sources will have to be replaced (Berneblad, 2017).

Solar energy is a renewable technology that is considered to be a strong contender for replacing fossil fuels eventually, due to its environmental advantages and falling prices (UN Environment, 2018; MIT, 2015). The increased utilisation globally has been substantial, growing from 15 GW in 2008 to 391 GW in 2017 (IRENA, 2018). Already by 2025, installed solar energy capacity is expected to have experienced a near three times growth compared to 2018 levels (International Energy Agency, 2018). Although, Sweden essentially does not use electricity generated from fossil fuels and had 51 per cent renewable electricity generation in 2016, considerably higher than the world average of 14 per cent in 2015, solar energy only contributed to 0.14 per cent of the generation in 2016 (Swedish Energy Agency, 2018; SCB, 2018).

The recent political pressure, in addition to significantly reduced manufacturing costs, has however resulted in solar cells becoming increasingly attractive for private households, businesses and energy producers (TT, 2018). The increased value of installing and utilising solar cells reduces the need for the established electricity system and enables electricity consumers to become increasingly self-dependent. How the technology's novel characteristics will impact the energy industry of Sweden is yet to be determined.

Electricity retailers (from now on referred to as retailers) are today a vital part of the energy value chain and act as the middle-man between the electricity grid and consumers. However, solar energy brings the possibility of a development where consumers become increasingly independent of retailers' services. Should, for example, solar PVs become a significant generator of electricity to households across Sweden while possibly being privately-owned, the demand for retailers' services would consequently become reduced. As a more decentralised

electricity production thereby potentially poses a threat to the current business model of the retailer companies, their response to the emerging solar energy segment could have important consequences for their future businesses.

A situation where the attraction power of a certain technology to an industry is increasing while simultaneously being a potential threat allows for a particular type of analysis, the companies of the industry can be compared in how they respond to the new development. It can be expected that companies have different interpretations of the situation regarding what opportunities and threats the technology brings, from sceptics to enthusiasts. An analysis of the two ends of the spectrum could provide a further understanding of why companies decide to innovate, and the factors that may hinder them.

1.2 Problem Analysis

The growing attractiveness of solar cells indicates a potential of disrupting the business of electricity retailers or, as the general phenomenon is known as, a disruptive technology (Frankel, Ostrowski & Pinner, 2014). Countless examples have emerged of companies failing to address the need for innovation before it is too late, leading to entire industries subsequently becoming largely marginalised (Bower & Christensen, 1995; Lepore, 2014; Lucas & Goh, 2009). There are various types of responses that incumbent companies can use in such situations, for example protecting core business or attacking the disruptive newcomer. Another possible response is business model innovation (Vorbach, Wipfler & Schimpf, 2017), which has emerged recently as a popular area of science. Business model innovation can if implemented successfully, give companies a competitive advantage through forming and adapting new business models. There have been indications that business model innovation even can be more valuable than innovative products or services (Foss & Saebi, 2017). As business model innovation's importance has grown, some attempts have been made to develop an index to represent the innovativeness of new business models (Spieth & Schneider, 2016; Zott & Amit, 2007). Using such a framework, the innovation of establishing a certain new business model can be estimated.

The difficulties for companies in innovating their business models are often referred to as barriers to business model innovation (Chesbrough, 2010; Sivertsson & Tell, 2015; Ulvenblad, Barth, Björklund, Hoveskog, Ulvenblad & Ståhl, 2018) or business model inertia (Vorbach et al, 2017). The types of barriers that companies might face are of different nature. For example, a study by Amit and Zott (2002) showed business model innovation often was in conflict with established business models. New business models were generally less profitable initially, resulting in incumbent companies many times reacting too late. Still, there are companies that clearly show recurring successful business model innovation (Koen, Bertels & Elsum, 2011).

Companies showing differing success in business model innovation is evident, but the connection to barriers to business model innovation is yet unexplored. To the question of why not more companies innovate their business models before they are rendered obsolete, Chesbrough (2010) found that it is due to them facing substantial barriers. However, barriers to business model innovation are additionally referred to as "overcomable" (Chesbrough, 2010; Richter, 2013b). The ambiguity of barriers suggests that barriers are not equal in their impact on the business model innovativeness of companies. Through a comparison of companies with different levels of business model innovativeness, an understanding of a potential relationship to business model barriers could be obtained. Perhaps companies successful in business model innovation do not perceive the same barriers as those who are unsuccessful. Thus, companies could potentially face equal barriers and simply manage them with dissimilar success. In the context of solar energy technology, distributed energy resources bring several opportunities for

different types of business models (Burger & Luke, 2017). Business models for solar energy have been evaluated on to what extent they are suitable for retailers, and it is established that they require a various amount of effort to be implemented (Schoettl & Lehman-Ortega, 2011). Thus, there is an opportunity to see how retailers have reacted by analysing how their business models have been innovated. The research question is the following:

What is the relationship between barriers to business model innovation and business model innovativeness for retailers in the electricity industry?

Being a fairly recent science area, knowledge about business model innovation is still moderate. By completing the study, it is expected to achieve a better understanding of why the ability to renew themselves differs between companies. Additionally, it should bring clarity to what approach Swedish retailers companies have taken towards solar energy, thus bringing guidance to how the Swedish energy market will evolve over the upcoming years and how solar energy is perceived in the perspective of retailers. This will be beneficial for several actors within the field, such as policymakers, researchers, managers and investors receiving a better foundation for making appropriate decisions.

1.3 Delimitations

It is difficult to generalise between retailers operating on different markets, since national electricity market regulations vary, resulting in the activity scope of international retailers differing from Swedish retailers (Gilbert & Kahn, 2007). Therefore, "utilities" will be used hereinafter to describe international retailers, where there might be such activity differences. The article *Solar Energy Strategies in the U.S. Utility Market* (Herche, 2017) provides insight into how a multitude of complicated factors, which vary geographically, substantially affect utilities' decision-making. This point is further highlighted in the report *Electricity Market Design* where locational differences are described as crucial (Cramton, 2017). Cramton (2017) further states that not only location and access to natural resources affect how the market is structured, but there is additionally an element of path-dependence as a result of different political and economic settings. Further, Strupeit and Palm (2016) highlight the importance, and differences, of the national context for deploying solar PVs which is supported by Shum and Watanabe (2009) who stated that there is a large difference in the learning curve between the Japanese and American context. Subsequently, this will be a Sweden-focused study on retailers' business model response to solar energy. Additionally, the study is limited to incumbent companies of the industry, as the sample is the 30 biggest retailers of Sweden due to their assumed resources and capabilities enabling them to offer solar.

The theory has been confined to studies on barriers in industrialised countries to better fit the studied case. Consequently, some barriers prominent in developing countries will not be covered in the study.

2 Theoretical Framework

The purpose of the theoretical framework is to bring understanding to how barriers to business model innovation may be related to business model innovativeness and provide the necessary knowledge to understand the context of the Swedish retailers. Theories explored in the following section will guide the study to a choice of method and a lens to analyse the results.

2.1 Business Model Innovation

The innovation of business models has surfaced as a complement to the more conventional kinds, such as product and process innovation (Zott, Amit & Massa, 2011). Depending on the technology that is supposed to yield economic returns, business models differ in their effectiveness (Chesbrough, 2010). In this regard, firms need to innovate their business models to the same extent that they innovate their technologies if they want to maximise their returns. The rapid technological development of recent decades has additionally increased the number of potential business model compositions (Casadesus-Masanell & Zhu, 2013). Chesbrough and Rosenbloom (2002) further emphasise the importance of the business model. Even though technology has a high potential of being diffused and becoming successful, it still requires the appropriate business model to work in conjunction. Without this alignment between the technology and the business model, there is a risk of failure. As there is value to be created through business model innovation, firms need to develop capabilities that enhance their possibilities to innovate their business models (Chesbrough, 2010). Through experimentation with the current business model, to change any of the building blocks that it consists of, firms will gain insights to identify new opportunities and what changes bring this new value (Chesbrough, 2010). Identifying fundamentally new business models can additionally serve as a strategy against disruptive technology (Vorbach, Wipfler & Schimpf, 2017).

Theories of business models have been around since the 1950s, but it was in the 1990s that a holistic view of the linkages between a firm's key business processes legitimately started to appear (Foss & Saebi, 2017). While the general concept of a business model is well-known, the interpretation of it varies significantly (Osterwalder & Pigneur, 2010). One perspective is that the business model can be seen as the mediator between the technology provided by the firm and economic outputs (Chesbrough & Rosenbloom, 2002). Osterwalder and Pigneur (p. 14, 2010) define a business model as: *"A business model describes the rationale of how an organization creates, delivers, and captures value"*

Chesbrough and Rosenbloom (2002) present the business model as a composition of six different parts which focuses on the value delivery to a specified market where competitors act. Osterwalder and Pigneur (2010) present a business model canvas consisting of nine building blocks with the same focus. The building blocks of the model describe the activities within an organisation in a standardised format, which allows for illustration and easier manipulation for strategic opportunities (Osterwalder & Pigneur, 2010).

The use of building blocks to describe business modes appears to be common, and there are apparent similarities between the frameworks. Comparing the business model innovation framework by Spieth and Schneider (2016) with the business model canvas developed by Osterwalder and Pigneur (2010), an overall similarity is noticed. The interim elements of the two models are grouped together in Table 2.1 below. The two frameworks can be seen specifically in Table 2.2 and Table 2.3.

Table 2.1 - Comparison of business model dimensions and elements by Spieth and Schneider (2016) and Osterwalder and Pigneur (2010).

Osterwalder & Pigneur	Customer Relationships	Customer Segments	Value Proposition		Key Resources	Key Activities	Key Partners	Channels	Revenue Streams	Cost Structure
Spieth & Schneider	Target Customers		Product and Service Offering	Positioning	Core Competencies & Resources	Internal Value Creation	External Value Creation	Distribution	Logic of Earnings	Logic of Costs

Table 2.2 - Nine building blocks of the business model (Osterwalder & Pigneur, 2010)

Customer Segments	**Value Propositions**	**Channels**	**Customer Relationships**	**Revenue Streams**	**Key Resources**	**Key Activities**	**Key Partnerships**	**Cost Structure**
The customer segment(s) the organisation serves	What customer problems the organisation satisfies	Communication, distribution and sales channels	The relationship with the customer segments	Revenues from delivered value propositions to customer segments	Assets necessary for delivering the offer	Activities necessary for delivering the offer	Required activities and resources outside of the organisation	Previous elements result in the cost structure

Table 2.3 - Business model dimensions and elements (Spieth & Schneider, 2016)

Value Offering			**Value Architecture**				**Revenue Model**	
Target Customers	Positioning	Product & Service Offering	Core Competencies & Resources	Internal Value Creation	External Value Creation	Distribution	Logic of Earnings	Logic of Costs
Whom do the company want to serve?	How does the company differentiate itself?	What does the product and service offering comprise?	Which competencies and resources are utilised?	Which are the activities that create value internally?	Which are the activities that create value externally?	How does the offering reach the target customers?	What forms of revenue is generated and what are their drivers?	What is the cost structure and what drives the costs?

With the above similarities, the selection of a specific framework appears to be of little importance. However, Spieth and Schneider's model was created with regard to business model innovation and was thus chosen for further use. Spieth and Schneider (2016) identify dimensions which describe a company's business model. These are value offering, value architecture and revenue model. These dimensions comprise a number of elements respectively.

Value offering represents the value proposition and the company's relation to its customers. The new value should fulfil customer demand that already exists, consciously perceived or not, but is unfulfilled. The elements of the value offering, therefore, are target customers, positioning and product and service offering. These elements together illustrate the benefit the company provides to the market along with the differentiation from the competition.

Value architecture relates to how value is created, through exploration and combination of resources and activities within and beyond the company. The elements of the value architecture, therefore, are core competencies and resources, internal value creation, external value creation and distribution. These explain how resources and capabilities are employed for the creation of value, including the approach of reaching customers with offers.

Lastly, revenue model describes the economic logic of the business model. By designing methods for meeting additional customer demand while creating a new rationale for earnings

and costs, companies are able to improve their performance. The elements of the revenue model are logic of earnings and logic of costs.

There are different opportunities for business models to be executed in a specific environment, which may be difficult as the environment is constantly changing (Osterwalder & Pigneur, 2010). There is an entrepreneurial aspect when it comes to identifying a new business model and bringing this to execution (Chesbrough & Rosenbloom, 2002). This notion could be seen as business model innovation. The notion of business models being innovatable was explicitly introduced by Mitchell and Coles (2003), but gained traction later (Zott et al, 2011) and has since received increasing attention (Foss & Saebi, 2017). The recent popularity and growth have led to the subject being studied from various angles, resulting in several sub-areas within the field, two of which will be in focus.

CEO-level surveys show that business model innovation is a crucial source of continuous value creation (Economist Intelligence Unit, 2005). Therefore, studies have developed methods for assessing the performance of business model innovation. This area will be covered in Section 2.2. Chesbrough (2010) states that the information shared to the decision-makers in a company is based on what information is important in relation to their current business model. Therefore, information that could bring new ideas to innovate the business model might never reach decision-makers. This is an example of the challenges that arise with business model innovation. When performing innovation there exist factors that create barriers and challenges (Chesbrough, 2010). This area will be covered in Section 2.4.

2.2 Measurement of Innovativeness

The term *innovativeness* describes the magnitude of an innovation's newness. It is common to associate innovativeness with product innovation, which describes how new products differ from current alternatives (Garcia & Calantone, 2002). Measuring companies' effort for business model innovation may be difficult, as there are multiple perspectives of the analysis (Snihur & Wiklund, 2018). Typically, indicators of general innovativeness are divided into two categories, input and output of the innovation process (Flor & Oltra, 2004). The input consists of elements that enable innovation to take place within a company, such as R&D budget, ongoing research cooperation projects or simply the existence of formalised R&D. The output of the innovation process can, for example, be measured by assessing the number of patents and innovations or analysing the percentage of new products of total sales (Flor & Oltra, 2004). This structure could potentially be utilised to measure business model innovativeness as well. By isolating R&D budget, projects, patents and results directly related to innovation of business models, an appreciation of the business model innovativeness should be obtained. However, there may arise difficulties when comparing companies on metrics such as these. The level of disclosure provided by companies often varies substantially, which results in interpretation and codification from the researcher being necessary. Gathering this type of data from retailers was, therefore, concluded as difficult, and the categorisation by Flor and Oltra (2004) as impractical.

In the article *Measuring firm innovativeness: towards a composite innovation index built on firm innovative posture, propensity and performance attributes* (Carayannis & Provance, 2008), a measurement model for innovation is suggested. The 3P framework; Posture, Propensity and Performance, provides a systematic view of the innovation process. Similarly, to Flor and Oltra (2004), the authors emphasise examination of both input, through process and capabilities, and output, both on short and long timeframes. Separating such data from a general level to only regard business model innovation appears difficult. It would require complex data, such as a deep understanding of relevant internal processes and company culture to assess the

business model innovativeness, and performance metrics directly related to business models. This data is likely not readily available nor easy to codify.

Spieth and Schneider (2016) propose that their framework for business models, as seen in Table 2.3, can be used as a measurement for business model innovation. The authors suggest that in order for a business model to be considered innovative in comparison with an existing business model, at least one dimension needs to be innovated. The model was validated through a study of 200 German firms. It does not account for whether companies are incumbent or new-to-the-industry. Consequently, companies of similar characteristics should be compared. Both the initial and subsequent position regarding business models appears to affect business model innovation, visualised in Figure 2.1. As the other methods of measuring business model innovation were regarded as difficult to apply, Spieth and Schneider's framework was chosen due to its feasibility and not being a method for measuring general innovativeness. In order to apply this model, an understanding needs to be established of how retailers conventionally conduct their business, and what business model opportunities there are in solar energy. A comparison with their conventional and solar business models can subsequently be made and therefore an appreciation of the business model innovativeness.

Figure 2.1 - The difference between business models can be seen as business model innovation

2.3 Business Models for Retailers

The following section will explain the relevant business models for retailers, both conventional and those relevant to solar energy. The business environment of the retailer is described below.

There are various actors on the electricity market, who can be distinguished based on which step(s) of the value chain they are active in (Bausch & Schwenker, 2009). Richter (2012) developed a model to describe the various steps of the electricity value chain, see Figure 2.2.

Figure 2.2 - The electricity industry value chain (Richter, 2012).

The first of these is the *Generation* of electricity, where actors produce electricity through various sorts of power plants. The second step of the value chain is *Transmission,* which entails the transportation of high voltage electricity over long distances. In Sweden, Svenska Kraftnät is managing this step as a monopoly (Svenska Kraftnät, 2019b). The third step is *Distribution*, which comprises the delivery of low voltage electricity to customers. The distribution grid is connected to the transmission grid through a small number of linkages. In Sweden, distribution grids are natural monopolies (Konkurrensverket, 2018). Companies in this part of the value

chain are however examined by a government body in Sweden, to avoid unfairly pricing (Energimarknadsinspektionen, 2019). The fourth step, *Retail,* is mainly administrative. It regards the communication with customers and is the step where retailers are present. Lastly, Richter puts *Consumption* as the final part of the value chain, where the electricity is utilised by consumers.

The Swedish electricity market became liberated in 1996 and electricity is since sold on the Nordic and Baltic market Nord Pool between producers and retailers (Konkurrensverket, 2018). This change had the generation and consumption steps of the value chain opened up for competition (Karlsson, 2005). The market price on Nord Pool is affected by a multitude of factors, such as weather, water levels for hydro plants, working status on nuclear plants in addition to international prices on oil and coal (Konsumenternas Energimarknadsbyrå, 2019). The price ultimately determined by auctions between producers and retailers (Energimarknadsinspektionen, 2017).

2.3.1 Conventional Retailer Business Models

In the Swedish Context, there are two basic possible business models for retailers. They will be presented using the dimensions of Spieth and Schneider (2016), as explained in Section 2.1.

2.3.1.1 Pure Retailers

A pure retailer is a retailer who is active only in the retail phase of the value chain. Hence, it has no electricity production. The value offering of its basic business model consists of selling electricity to customers while handling services such as billing and metering. Retailers may offer various types of arrangements and differentiate themselves through several factors, such as pricing, green energy or local profiling. The value architecture regards the ability to trade electricity competitively, through Nord Pool or directly with electricity producers. Employees identify offers which customers find attractive and communicate with them through their choice of channels, such as websites or commercials. Lastly, regarding the revenue model, the most common type of electricity deal has a variable price (Konkurrensverket, 2018), but there are also offers with different levels of fixed prices. Retailers must charge a slightly higher price than what they pay for electricity, to cover for their expenses. This margin is typically lower than ten per cent of the total price (Konkurrensverket, 2018).

2.3.1.2 Producing Retailers

A producing retailer is a company which is active in both the Generation and Retail phase of the electricity value chain simultaneously, although it is common for Swedish corporate groups to have the activities conducted in separate subsidiary companies (Konkurrensverket, 2018). Therefore, besides doing the business model of pure retailers, producing retailers additionally conduct the business model explained below.

The value offering is electricity, which value may differ to the pure retailer, depending on how the electricity has been produced. Regarding the value architecture, there are various methods for production of electricity. In Sweden, around 80 per cent of produced electricity comes from nuclear and hydropower, where the remainder is wind, heating and solar power (SCB, 2018). Nuclear and large-scale hydropower are however limited to a few and large retailers, while the rest are mostly concerned with other means for production (Energimarknadsinspektionen, 2006). These power plants will have to be maintained and controlled to perform competitively. The electricity is then either sold directly to retailers or, most commonly, through the market Nord Pool (Konkurrensverket, 2018). Lastly, the revenue model. Through managing and

running energy plants at a lower cost than the price of electricity, electricity producers are able to make a profit. The revenue model and costs may vary substantially depending on which type of generation is utilised (Energimarknadsinspektionen, 2017). The most apparent difference is the relation between variable and fixed costs. Renewable energy generally has lower variable costs, due to lower taxes and no input being required, compared to other means of electricity production.

2.3.2 Solar Business Models for Retailers

As described in the introduction, the emergence of solar energy technology allows retailers to participate in new activities. Several studies have examined these business model opportunities, one of which is *Utilities' business models for renewable energy: a review* (Richter, 2012). Richter argues that there exist two basic choices: utility-side business models and customer-side business models. Connecting back to Richter's (2012) value chain model of the electricity market, Figure 2.2, these two business models are located at the opposite ends of the chain, *Generation* and *Consumption* respectively. Utility-side business models are typically centred around fewer sizable projects. Similar to conventional utility-business models, the electricity is produced at a large scale and is subsequently distributed to the customers. Customer-side business models, on the other hand, implies a high number of small projects. By installing solar panels at customers, the customers produce their own electricity and become increasingly independent of typical utility services. These projects are typically financed by the customer paying a one-time expense to the utility, or through leasing with monthly fees. The utilities can either perform all activities of this business model, such as installation and customer service, or outsource to specialised firms. There is additionally the possibility for utility companies of purchasing back unconsumed produced electricity. While the business models undoubtedly can be labelled as either utility-side or customer-side, it appears that nuances of solar business models might get lost using such a framework. As this study attempts to differentiate 30 companies on their business model innovativeness, a higher degree of distinction was deemed to be required.

In *Photovoltaic business models: threat or opportunity for utilities?* (Schoettl & Lehman-Ortega, 2011), the authors identify six general models that are applicable:

- Hassle Free Project
    - The company provides a "one-stop"-opportunity, where industrial or commercial customers who are interested in solar PVs are able to make orders without being too knowledgeable about all details. The retailer is not the owner of the PVs.
- Complementary Revenue Provider
    - The retailer is the owner of the solar PVs and provides additional revenue to the customer by access to the solar PVs through leasing or similar.
- Value Added Service Provider
    - The company provides a specialised service somewhere along the value chain or acts as an orchestrator. Consulting or project development are examples of such services. The company does not own the PVs.
- Construction and Installation Service Provider
    - The company performs the installation and construction of solar PVs. Local project management is a key capability.
- Large PV Facility Operator
    - The company owns a large solar PV facility and subsequently is an electricity producer. It requires the capabilities of managing and funding large projects.

- Energy Controller
    - The company oversees supply and demand and is able to create value through trading.

These business models are not exclusive to each other, i.e. the same company may perform any combination of them. However, according to the authors, not all are as suitable for utilities' resources and capabilities: construction and installation service provider is described as the least appropriate to these companies' typical competencies, while large PV facility operator is closest to their conventional activities. Comparing with the categorisation by Richter (2012), these can potentially also be labelled as either utility-side or customer-side. The additional distinction this framework provides by having more business models, allows additional differentiation between companies, while being sufficiently general to make categorisation feasible.

Another study exploring business models is *Overcoming barriers to renewable energy diffusion: business models for customer-sited solar photovoltaics in Japan, Germany and the United States* (Strupeit & Palm, 2016). The authors find that the typical business model differs between the nations due to the national context. In the United States, third-party ownership has been an attractive model for companies to implement. By leasing PVs to customers, the customers' need for capital is significantly reduced. Customer can expect reduced electricity rates while the utility, or other third-parties having the business model, will receive a share of the return as compensation for the investment. In Japan, cross-selling solar PVs with the construction of homes is a key strategy for the industry. The building industry has, therefore, a leading role in the diffusion of solar PVs. Lastly, the dominating business model in Germany is assessed. Through early political actions, the German market has been boosted by feed-in tariffs and low-interest loans. Local, fairly small, installers dominate the market and install PVs at the homes of customers, who normally want full ownership. The study by Strupeit and Palm (2016) provides examples of how diverse solar business models may be, further strengthening Richter's (2012) categorisation not being suitable for the study. Strupeit and Palm (2016) do not offer a framework for categorisation. The idea of how national context affects business models appears critical, as the characteristics of electricity markets additionally were noted to substantially vary by Cramton (2017). Both the conventional retailer activities as well as new solar business models should consequently be adapted to how they appear in the Swedish context.

Concluding on the measurement of innovativeness, both the initial and subsequent position regarding business models appears to affect business model innovation. With this model, barriers to business model innovation appear in the intermediary stage, either being overcome or inhibiting companies to adopt new business models.

2.4 Barriers to Business Model Innovation

Identifying a new business model and executing it in a constantly changing market (Chesbrough & Rosenbloom, 2002) allows for challenges, or barriers, to occur when innovating the business model. This applies across industries and is, therefore, true for the electricity retail industry as well. Strupeit and Palm (2016) mention the effect of the national context, which results in the need to understand what barriers Swedish retailers might encounter.

It is during the stage of business model innovation, moving from Model A to Model B, barriers may occur. These barriers can hinder firms from reaching the desired business model, visualised as Business Model B in Figure 2.1. However, encountered barriers do not need to

be obstructing the way towards Model B, in the case that the firms retain necessary capabilities to overcome barriers, which is an area of research in itself.

This section will act as a guide through the categories of barriers to business model innovation that exist in the current literature, incorporating different geographical contexts as well as various levels of aggregation. The barriers explained within each category, and subcategory, will first be described from a general point of view, followed by deepening the knowledge into the renewable energy and even more specifically the solar energy segment. Further, multiple barriers may occur within each subcategory. Thus if a paragraph starts with a general case, the presentation of a new barrier has begun. The categories that will be further explored, along with their related subcategories are described in Table 2.4, which includes the dimension of the business model that the specific category, or subcategory, is related to. For each category, there will be a paragraph linking the described category to at least one of the three dimensions where business model innovation can take place, as elaborated upon earlier in Section 2.2, based in the framework by Spieth and Schneider (2016)

Table 2.4 - Categories and subcategories of barriers and their respective association with dimension(s) of business model innovation

Category	Subcategories	Business Model Innovation Dimension(s)
Organisational	Ambidexterity	Value Offering, Value Architecture
	Culture	Value Offering, Value Architecture, Revenue Model
	Leadership & Commitment	Value Architecture
	Structure & Decisions	Value Architecture
Resources & Capabilities	Prioritising & Distribution	Value Architecture, Revenue Model
	Skills & Competencies	Value Offering, Value Architecture
Business Environment		Value Architecture
Market & Value	Customer-centric	Value Offering
	Demand from the Market	Value Offering
	Effectuation	Value Offering, Value Architecture, Revenue Model
Awareness & Behavioural		Value Offering, Value Architecture
Financial & Political	Financial	Value Architecture, Revenue Model
	Political	Value Offering, Revenue Model
Technological	New Technology Potential	Value Offering, Value Architecture, Revenue Model
	Uncertainties & Risks	Value Offering, Value Architecture, Revenue Model

For the specification of sources see Table 2.5.

Table 2.5 - Level of aggregation and associated authors for barrier identification

Level of Aggregation	Authors
General	(Amit & Zott, 2002), (Burgelman, 1983), (Chesbrough, 2010), (Doz & Kosonen, 2010), (Girotra & Netessine, 2014), (Hargadon, 2015), (Tripsas, 1997), (Christensen, 2000), (Glasmeier, 1991), (Maier, 2015) and (Tushman & O'Reilly III, 1996)
Specific	(Bergek, Berggren, Magnusson & Hobday, 2013), (Brennan, 2014), (Huijben, Verbong & Podoynitsyna, 2016) and (Overholm, 2015)
Specific Renewable	(Aslani & Mohaghar, 2013), (Engelken, Romer, Drescher, Welpe & Picot, 2016), (Guerra-Mota, Aquino & Soares, 2018), (Masini & Menichetti, 2013) and (Richter, 2013)
Specific Solar	(Blansfield & Jones, 2014), (Horváth & Szabó, 2018), (Nillesen, Pollitt & Witteler, 2014), (Richter, 2013), (Richter, 2013b) and (Sioshansi, 2014)

2.4.1 Organisational Barriers

Regarding the organisational aspect of barriers to business model innovation, the literature seems to be of a mostly general character, i.e. it does not refer to any specific industry. The general theory for potential organisational barriers and challenges is assumed to be applicable for the solar energy segment since the barriers could occur within any general industry and therefore also the solar energy industry.

2.4.1.1 Ambidexterity

Tushman and O'Reilly III (1996) have studied different industries over the decades. The authors describe that what ambidexterity is differs from industry to industry, and firm to firm, depending on the respective internal and external settings. One challenge for firms is to find the right balance between being evolutionary for the current business and being revolutionary for the new (Tushman & O'Reilly III, 1996). There is a constant conflict between the business model for exploiting the current, money-making business, and business model(s) needed for exploring new technologies (Chesbrough, 2010). Incumbents struggle to combine complex offerings with new technologies at the same time as evolving their established technologies (Bergek, Berggren, Magnusson & Hobday, 2013).

In the case of renewable energy, and more specifically solar energy, Richter (2013a) highlights the importance of managers being ambidextrous within the value proposition part of the business model. Thus, new technologies require new ways of creating value. In contrast, utilities put efforts into slowing down the pace of using new technologies, delaying or diminishing the challenge of ambidexterity (Engelken, Romer, Drescher, Welpe & Picot, 2016), since the current business model has been in place for a long time, with a lot of confidence (Richter, 2013b), making incumbent utility firms being in charge of the technological evolution of the industry (Engelken et al., 2016).

The wrong balance between putting efforts toward new possibilities and at the same time continuing with the old business model could, therefore, act as a barrier to business model innovation. These barriers could be of both value offering and architectural dimensions in Spieth and Schneider's framework (2016) since ambidexterity is important for the value

proposition (Richter, 2013a) but also associated with internal organisational factors (Maier, 2015; Tushman and O'Reilly III, 1996).

There are various general organisational factors affecting the ambidextrous possibilities; such as organisational culture, leadership and structure (Maier, 2015; Tushman and O'Reilly III, 1996), implying that the organisational subcategories might be interrelated, but not necessarily.

2.4.1.2 Culture

Chesbrough (2010) highlights the importance of a strong culture in a complex environment, related to business model innovation, to promote initiatives that bring larger benefits for the firm, instead of pursuing local objectives of middle managers. This statement is further built upon by Burgelman (1983), stating that allowing individuals to take strategic initiatives autonomously is a necessity, since technological ventures originate from corporate entrepreneurship within individuals. The organisational culture widely affects the possibility of pursuing new business opportunities (Maier, 2015; Tushman & O'Reilly III, 1996). The organisational culture could be developed so that it supports experimentation with the business model construct (Chesbrough, 2010). Organisations cannot, however, abandon the culture related to the current business model, and must, therefore, have an ambidextrous culture, to be aligned with all initiatives. Allowing the culture to explore potential new ideas give rise to the difficulty of establishing boundaries (Chesbrough, 2010).

Doz and Kosonen (2010) conclude that taking an agile approach to the business model concept, and not being rigid, will allow continuous business model renewal, and thus, exploring potential ideas. In order for this business model renewal to be possible, there is also a need for gaining organisational support to receive necessary resources and capabilities to move from an idea into a corporate venture (Hargadon, 2015). New business models might put middle managers in a tricky situation where they will be exposed to put their reputation at risk, if choosing to promote new innovative ideas out of scope (Burgelman, 1983). Thus, a strong organisational culture is necessary at all levels to encourage support and exploration (Chesbrough, 2010). This fact is supported by Richter (2013b) for the specific solar industry, stating that the upper management culture favour conventional electricity production system, even though it might be different on other hierarchical levels.

Therefore, the organisational culture, both in terms of meaning for the individual but also the aggregated culture that spans horizontally and vertically could act as a barrier when developing new business models. Cultural barriers are associated with every element of the firm and could be hindering for any of the three dimensions (Spieth & Schneider, 2016).

2.4.1.3 Leadership & Commitment

Leadership and commitment is important for accelerating business model renewal (Doz & Kosonen, 2010). For change to occur, committed individuals or departments are vital to drive change, along with defining who carries responsibility, in a form of structured leadership (Chesbrough, 2010). In opposition, some managers carry out discussions in order to win their point as quickly as possible, not allowing for the possibility of exploring other options (Doz & Kosonen, 2010). Further, Doz and Kosonen (2010) highlight the importance of speaking openly to allow for new ideas to be explored, keeping away from defining winners and losers and build mutual trust. This allows individuals to reveal deeper motives and further integrate, align and care for new business initiatives (Doz & Kosonen, 2010).

Moreover, managers need authority from upper management, to perform enough tests and experimentation for analysis, and move forward based on the results (Chesbrough, 2010).

Although this is insufficient, there exists a need for long-term leadership as well, since some experimentation may take time and managers need to create a broad and deep understanding for the organisation (Chesbrough, 2010). The challenges are not only related to leadership capabilities, but also for subordinates to feel commitment from their leader, in order to be assured in performing change and developing new business ideas (Hargadon, 2015).

Therefore, lacking leadership talents and long-term commitment from several hierarchical levels might be challenging when innovating the business model. These challenges are mainly derived from interpersonal collaboration, and thus associated with the internal value creation element of the value architecture dimension (Spieth & Schneider, 2016).

2.4.1.4 Structure & Decisions

Management is in a position to structurally affect the possibility of pursuing new potential ideas. This does not imply creating new venture divisions for new ideas, but rather to allow the organisation to autonomously nurture and develop new possibilities (Burgelman, 1983). Doz and Kosonen (2010) propose a total of 15 steps, including potential barriers, when performing business model renewal. When performing business model innovation, specifically towards e-businesses, there is not a single process defined to explore new possibilities. Instead, there is a combination of different processes for evaluating the potential value creation (Amit & Zott, 2002). This statement aligns well with Doz and Kosonen's (2010) five processes that are focused on strategic sensitivity; anticipation, experimentation, distancing, abstracting and reframing. These five processes must be supported by the organisational structure (Doz & Kosonen, 2010). Coordination of processes requires communication and continuous interaction between internal departments, to avoid conflict when promoting and evaluating new ideas. Different departments equal different perspectives (Chesbrough, 2010). This statement is supported for the specific industry of renewable energy, where perspectives of different managers and the coordination among them affect the possibilities to pursue new business ideas (Aslani & Mohaghar, 2013).

Coordination and communication is a necessity. To be able to be ambidextrous, restructuring the allocation of resources to explore a potential business model, refers to the strategic agility of the organisation. Strategic agility affects the organisation horizontally and requires commitment from a wide and deep span of leaders and managers (Chesbrough, 2010). To have the right person at the right place can radically improve the decision-making process, and thus, create a more flexible organisation (Girotra & Netessine, 2014). Further, to have the right person at the right place is not sufficient according to Girotra and Netessine (2014), organisations also need to make the right decision, at the right time. Usually, decisions have to be made before there is enough information to act rational, which relates to the barrier of effectuation (Chesbrough, 2010; Richter, 2013a; Aslani & Mohaghar, 2013; Guerra-Mota, Aquino & Soares, 2018; Sioshansi, 2014). Specifically, in the renewable energy industry, Aslani and Mohaghar (2013) state that agility towards business model renewal is partly dependent on coordination of general planning both on a strategic and practical level.

Therefore, the structure of the organisation and related processes along with the decision-making process will affect the way that business model innovation is performed. These topics relate to the value architecture dimension proposed by Spieth and Schneider (2016), and more specifically the internal value creation element and the correct structuring of resources and competencies for efficient decision-making.

2.4.2 Resource & Capability Barriers

2.4.2.1 Prioritising & Distribution

Prioritising between resources is related to the concept of ambidexterity when choosing between new and old technologies, but leave out prioritising between different projects involving the same technology (Chesbrough, 2010; Maier, 2015; Tushman and O'Reilly III, 1996), which will be covered in this topic.

In the general business model innovation literature, Doz and Kosonen (2010) conclude that making resources more flexible will ease the process of changing the business model. Firstly, resources could be used in parallel between multiple business models (Doz & Kosonen, 2010). Although, for managers to prioritise resources between projects and balance the shift when moving resources to new business model initiatives is challenging (Chesbrough, 2010). Secondly, autonomous initiatives usually, to a larger extent, have to compete for resources since these initiatives often contain objectives that have been identified as impossible by upper management (Burgelman, 1983). Instead, resources could be decoupled in order to be more flexible, and thus, be used commonly in both autonomous initiatives as well as projects closer to the core business (Doz & Kosonen, 2010). Thirdly, associating resources to ownership could be inhibiting (Doz & Kosonen, 2010). Gaining resources enough for new business ideas to thrive independently, entails the idea of avoiding being affected by other conflicting interests from a resource perspective (Hargadon, 2015). Lastly, acquiring resources outside of the main business scope in order to transform the model is challenging, although, it can stimulate change (Doz & Kosonen, 2010).

More specifically, renewable electricity production requires different resources and capabilities compared to the conventional business model of retailers. Renewable electricity production is dependent on highly required resources, resulting in barriers to potential market entry and lacking scalability (Guerra-Mota et al., 2018). The required resources are outside of the core competencies and need to be acquired (Richter, 2013b). Without resources enough to act on a potential business idea, the possibility of gaining sufficient information to further develop and evaluate the venture is impossible, which act as an equivocal barrier in the focus of scarce resources and relates to the phenomenon of effectuation, which will be elaborated upon later.

These described barriers might appear in the architectural value dimension (Spieth & Schneider, 2016), since prioritising and balancing resources between conflicting interests (Chesbrough, 2010; Hargadon, 2015) that might be outside of the core business (Richter, 2013a), relates to necessary resources and both internal and external value creation. Acquiring resources inflict costs (Horváth & Szabó, 2018; Richter, 2013a; Aslani & Mohaghar, 2013) and thus affect the logic of costs, which is part of the revenue model dimension (Spieth & Schneider, 2016).

2.4.2.2 Skills & Competencies

The general literature highlights the fact that in order to develop a new business model, the importance is substantial of having the right team with the right competencies, in order to create a link between customer need and value proposition (Hargadon, 2015).

However, even when incumbent firms have the necessary skills and competencies, they sometimes struggle (Bergek et al., 2013). Thus, skills and competencies are not single-handedly a barrier that will prevent business model innovation.

In the renewable energy industry, Engelken et al. (2016) put emphasis on the lack of people with the right skills and competencies to deploy projects. Further, the accumulated knowledge and competencies that have been acquired in the utility-side production is generally not shared with new segments. Although, most competencies that are needed are different between segments (Richter, 2013a). Aslani and Mohaghar (2013) also state that there is a lack of specialised skills needed for renewable electricity production systems. The required skills regard products, services and pursuing innovations (Guerra-Mota et al., 2018).

The required skills for solar energy systems are out of scope in relation to the core competencies for conventional utility companies, conventional skills are seen as managing large-scale investments into electricity production systems (Richter, 2013b). Richter (2013b) further explores the field for solar energy production and conclude that different competencies are needed for private contra corporate segments. Required skills depend on the size of the project. Horváth and Szabó (2018) support the statement by their identification of a barrier in the form of a competence gap in the field of residential customer market segment for solar energy since different skills were required compared to utility-side production. Some German firms express that they missed developing the necessary skills for the solar energy business models (Richter, 2013b).

Therefore, to have the correct team assembled, with the associated competencies, in relation to the business idea to be performed is essential to avoid facing barriers. This category of barriers is directly appropriate to the dimension of value architecture through the elements core competencies and internal value creation (Spieth & Schneider, 2016). The field is also linked to the value offering dimension since competencies are needed to elaborate on the relationship between value creation and customer need (Hargadon, 2015).

2.4.3 Business Environment Barriers

When constructing new business models in general and creating value through inter-actor transactions, it seems to be necessary to be involved in partnerships, both on a strategic and on an operational level, which could yield profitable transactions. Firms do not only need to rely on these partnerships but some form of interconnectivity between the actors in the industry is needed for innovating the business model (Amit & Zott, 2002). Further, theory for business model innovation explores the effects of being involved in partnerships, and therefore a form of industry network, which might bring challenges since different business models are used. Involved actors may use different technologies, which might affect decision-making negatively, due to conflicting interests. The hierarchy and structure of organisations inflict differences in time to respond to change, and how this change is proposed to be carried out. These differences might cause problematic situations for actors to form a single voice to innovate their respective business models, and therefore cause organisational or industrial inertia. Even if change is performed, the taken actions might be insufficient to reorganise for sufficient alignment with an emerging technology (Glasmeier, 1991).

Regarding the renewable energy industry, Richter (2013a) sheds light upon the increasing importance of external partnerships in his study of the German electricity companies. Richter (2013a) found three main forms of partnership to be successful in promoting new value propositions, which depend on the magnitude of the firm and the vertical integration. Nevertheless, it is still unclear which partnership structure will yield the largest business opportunities and the focus area for the value chain seems to be uncertain for utilities (Richter, 2013a).

Going deeper into the theory regarding solar energy, Nillesen, Pollitt and Witteler (2014) supports the statement about the unclear structure of the electricity industry, as to what firm will benefit from the current opportunities in solar energy, and how. Not only the value chain focus is diffuse, but also by what actor(s) value is created and captured (Nillesen et al., 2014). Thus, how firms organise and position themselves in the business environment will affect the possibilities to innovate the business model to include a broader aspect of solar energy.

By innovating the way that the specific firm is organised in the business environment could be by focusing on developing the value architecture (Spieth & Schneider, 2016). This is due to reorganising the partnership structure (Amit & Zott, 2002) and transforming the degree of vertical integration (Richter, 2013a), which is part of external and internal value creation. Partnerships could also be used in the distribution processes.

2.4.4 Market & Value Barriers

2.4.4.1 Customer-centric

Amit and Zott (2002), within general business model innovation theory, state that business models that exploit a particular opportunity, are designed with the customer in the centre. Customer-centric designs extend the possibilities of creating value and involving customers can be advantageous (Amit & Zott, 2002). Demand from customers is not the main driver for investments in renewable energy projects (Richter, 2013a).

For distributed solar energy production systems, firms fail to provide attractive products and surrounding services. These value propositions are of complex nature and related to high uncertainties in partnerships and performed activities (Richter, 2013a). Yet, no definitive offering has been found, thus the value proposition for distributed solar energy systems could create a barrier (Richer, 2013b). Richter (2013a) highlights the paradox of creating a valuable offering for the customer, but at the same time be profitable for the firm. Distributed solar energy systems are not (at the time of writing) cost-competitive compared to large-scale production. There exists a need to package the offering to increase the value presented to the customer (Aslani & Mohaghar, 2013; Richter, 2013a). Instead of buying and selling electricity through the wholesale market conventionally, for solar energy solutions, new value has to be created and delivered to the customer (Richter, 2013a). New ways of delivering value could be: to create a green image towards customers (Richter, 2013a), offer solutions specifically for the customer, differing between corporate or private and the size of the system (Richter, 2013b) and to gain public acceptance and meet expectations (Richter, 2013a). What the value proposition will be, specifically in the solar energy segment, is still undefined (Blansfield & Jones, 2014).

Not all incumbent industry managers have similar perceptions of the degree of change, compared to authors, in value proposition as a result of the introduction of renewable energy resources (Richter, 2013a). Although, the general theme seems to be that there is a need to change to renewables, but not how the change will affect the value proposition. Nillesen et al. (2014) extend this statement for the more specific solar segment by highlighting the fragmented aspects of the question of how value is created and captured. By disregarding customer involvement, firms will face the risk of creating customer resistance and putting the business in danger. Investments in solar energy must be approved, or better yet proposed, by customers to gain social legitimacy and avoid phenomenon such as the NIMBY, *not in my backyard*, syndrome (Richter, 2013a). Therefore, not involving the customer when exploring, developing and evaluating new business areas could act as a barrier.

Barriers to designing and deploying a customer-centric business model are found in the value offering dimension. How firms will deliver value, through solar energy production, to their customers (Richter, 2013b) is part of the strategy of positioning themselves on the market (Spieth & Schneider, 2016). Further, the packaging of the product, its features and related services to match customer needs (Amit & Zott, 2002) is associated with the product and service offering.

2.4.4.2 Demand from the Market

The uncertainties related to matching the value offering with the customer demand is something that all firms face when moving into unknown business areas (Girotra & Netessine, 2014). Thus, it is a major risk. New customers and accordingly new distribution channels need to be put in place for new businesses (Chesbrough, 2010).

In the renewable energy industry, this aspect receives lacking interest from managers (Richter, 2013a). Incumbent utility firms, as described by Richter (2013a), see no demand to enter the renewable area due to unattractiveness and lack of market potential. In contrast, Aslani and Mohaghar (2013) show that there is a misalignment in the present research regarding what the customers want and their demands regarding renewable energy.

New businesses in solar energy should be pushed from management, not be based on customer demand, in a pro-active rather than a re-active approach (Richter, 2013b). The solar energy demand is undergoing constant changes involving complex dynamics (Blansfield & Jones, 2014). Complex dynamics entail the risk of insufficient demand (Richter, 2013b) or temporal value creation (Nillesen et al., 2014). Without customer demand in solar energy, there exists no need to innovate and leave conventional segments (Richter, 2013b). Blansfield and Jones (2014) propose that firms should exploit the dynamics of demand. Although, exploitation might be difficult due to uncertainties. The incentive for investing in solar energy depends on the appreciation of the long-term relationship with the customer (Richter, 2013b). There is still a demand for distributed solar energy, mainly where customers act as private investors and are therefore in direct competition with utility firms (Richter, 2013b).

Therefore, identification, creation and location of demand along with the correlated satisfaction of this demand could hinder innovating the solar energy market. Through innovating these respective areas, Spieth and Schneider's (2016) work suggest that the business model innovation would be related to the value offering dimension, and more specifically the element of the target customer and relationship management.

2.4.4.3 Effectuation

The general notion of effectuation is the syndrome of not taking action on a potential new business idea because there is insufficient data for analysis. The paradoxical dilemma is that not taking any action will, in turn, not generate any data for analysis (Chesbrough, 2010). Emerging potential business ideas often lack sufficient data to be analysed (Chesbrough, 2010). Effectuation has been further explored in the more specific renewable energy industry by Aslani and Mohaghar (2013), who state that general information about the market, demand and potential of the industry segment is insufficient. On the contrary, investments are taking place in the renewable energy industry, as research and pilot projects regarding the infrastructure for distributed solutions, to gain needed data (Richter, 2013a). As stated in the previous sections, the way value is offered in solar energy differs from conventional ways and is further affected by new actors and services such as prosumers and smart houses. What actors that will be involved in the solar energy value creation, and how this is performed is yet undetermined, thus no information is available for decision-making (Guerra-Mota et al., 2018). What this new

information will mean for the solar energy eco-system as a whole is unknown, both from an industry as well as a technology perspective (Sioshansi, 2014).

Insufficient information could affect any of the three dimensions of Spieth and Schneider's (2016) framework. Cases where effectuation has acted as a barrier for retailers can be related to a specific dimension depending on the nature of the information paradox.

2.4.5 Awareness & Behavioural Barriers

In the general business model innovation literature, Chesbrough (2010) states that the information received in the decision-making context is dependent on business logic in the general case. This business logic is important in order to navigate in a chaotic daily life and daily operations, which builds on the foundation that information is available. More specifically for the renewable energy segment, low public awareness is an important barrier to consider to be successful. (Aslani & Mohaghar, 2013).

Literature regarding the solar energy segment states that understanding the cognitive setting of the customer is essential (Horváth & Szabó, 2018). A large concern, according to Richter (2013a), is that most managers in German utility companies do not see the technology for producing solar electricity as a threat. Although, German utility managers still consider this a significant industry segment, but does not necessarily affect the business model (Richter, 2013a). Other managers and decision-makers are under the influence that the business opportunity within the market segment for solar PVs has already passed, or is about to do so (Sioshansi, 2014). Horváth and Szabó (2018) state that there exists a barrier as an information gap between market actors and customers, concerning the benefits of distributed solar energy.

Literature covering general path dependence theory states that when transforming a business model, decisions and essentially any other action taken by a firm have affected the direction the business is moving in. Prior experience in relation to new product or service development might hinder the creation of new value offerings. To manage and rearrange skills and architectural knowledge is proven hard for firms and might create a barrier. (Tripsas, 1997)

The same trend seems to be apparent in the segment for renewable energy, since utilities have made decisions dependent on the past to be as favourable as possible, inflicting a pressure to delay the transition to new ways of organising, internally and externally (Guerra-Mota et al., 2018; Aslani & Mohaghar, 2013).

The electricity grid affects the variety of possibilities that are available across all electricity segments, including solar energy solutions. Having been this way for centuries, it affects the decision-making process through historical dependence (Sioshansi, 2014). The concept of path dependence for the solar energy industry is further supported by German utility managers, who are blocked by cognitive barriers to pursuing radical ideas for new business models while the current one is still profitable (Richter, 2013a). Therefore, lack of cognitive abilities to create awareness regarding benefits and receiving broad and relevant information, in order to make rational decisions, might hinder new business ideas in the solar energy segment.

Business model innovation barriers derived from awareness and behavioural challenges might prohibit innovation in both the value offering dimension, as well as the value architecture dimension from Spieth and Schneider's (2016) work. The value offering dimension is affected by customer demand (Horváth & Szabó, 2018) and potentially missing out on value creation (Amit & Zott, 2002). The value architecture dimension might be distressed by missing out on ventures due to corporate strategy misalignment (Burgelman, 1983) or by suffering by path dependence in a negative manner (Sioshansi, 2014; Tripsas, 1997).

2.4.6 Financial & Political Barriers

2.4.6.1 Financial

When it comes to investments to innovate the business model in general, but also in the renewable energy industry, budgetary limitations act as a barrier (Aslani & Mohaghar, 2013). Richter (2013a) states that if there is no economically viable financial model, then there are no incentives to invest, according to German utility managers.

Compared to conventional large-scale electricity production, renewable electricity production facilities get a lower priority, since production costs are higher for small renewable projects (Richter, 2013a). In contrast, Guerra-Mota et al. (2018) state that renewable energy production is not dependent on heavy input resources, as for conventional plants. Although, it requires heavy investments in resource structure before production might start. A problem that arises for small-scale projects is that the costs for customer-side distributed energy production must be lower than the wholesale market price. Otherwise, insufficient revenues will be earned to truly compete with conventional facilities, where all costs should be included; grids, storage, taxes etcetera (Richter, 2013a). For those electricity systems involving batteries as a means of storing electricity, the high cost of batteries poses a threat (Engelken et al., 2016).

The lack of viability for the more specific solar energy segment might be due to the high initial investment costs and the long payback time (Horváth & Szabó, 2018). Solar energy projects lack profitability due to large production costs and lack of scalability possibilities (Richter, 2013b). Utilising solar energy technologies inflict costs that are transferred onto the end-user and affecting the related demand (Aslani & Mohaghar, 2013; Sioshansi, 2014). Policies and subsidies have been put into place, with a moderate result, to enable further investments in renewable energy solutions and decrease the risk of financial barriers (Masini & Menichetti, 2013). For solar energy offerings, Sioshansi (2014) highlights the need for a new more dynamic pricing model in the electricity market. This dynamic price model should reflect the costs of production, and not single-handedly be based on supply and demand.

All initiatives related to the investment process could belong to either the architectural value dimension or the revenue model dimension (Spieth & Schneider, 2016). Investments are required to acquire resources (Guerra-Mota et al., 2018) and thus part of the architecture needed to provide value, along with the potential revenue and profitability barriers that are directly linked to the revenue model.

2.4.6.2 Political

The political landscape affects the way business is conducted. The electricity industry has shifted into a new paradigm of renewable energy resources, which is inflicted by policies from the European Union (Guerra-Mota et al., 2018). The current firms active in the renewable energy industry do not only try to align the business model with the current regulatory framework, but also design the business model to be flexible in order to benefit from future policies and regulations (Huijben, Verbong & Podoynitsyna, 2016).

The political policies that are being initiated lack a clear focus, leading to supporting both new energy solutions but also supporting business models based on old conventional technology (Aslani & Mohaghar, 2013). In contrast, Huijben et al. (2016) state that the subsidies for renewable energy ventures are too high. The authors explain that high levels of subsidy make entrepreneurial companies lose incentives towards being creative, and thus, new businesses will not benefit from new radical solutions.

Lack of incentives for innovation is further elaborated upon within the solar segment since the process for regulations and subsidies discourages innovative thinking and fosters a slow process for business model renewal (Sioshansi, 2014). Further, Aslani and Mohaghar (2013) shed light on the absence of political initiatives to secure long-term initiatives in renewable energy. Statements for the renewable energy segment is supported by Horváth and Szabó (2018) regarding solar energy, saying that the unstable political environment and currently insufficient political incentives and assurances for minimising risks and uncertainties, hinder the production of electricity on customer-side. This has, in turn, led to longer payback periods than necessary, since the price does not differ from conventional energy sources, which further decreases incentives for distributed solar energy (Horváth & Szabó, 2018).

Therefore, the political environment, with its wide influence, might affect the whole business model innovation process in solar energy venture creation. Through aligning the business by political frameworks (Huijben et al., 2016) and adjusting internal processes (Blansfield & Jones, 2014) the dimension of value architecture is influenced (Spieth & Schneider, 2016). Further, value creation can be based in political initiatives (Aslani & Mohaghar, 2013) and will have an impact on the related costs and earnings (Horváth & Szabó, 2018; Huijben et al., 2016; Sioshansi, 2014), thus further affect the value offering and revenue model dimension of Spieth and Schneider's (2016) business model innovation structure.

2.4.7 Technological Barriers

2.4.7.1 New Technology Potential

Christensen (2000) states that, in the beginning, new technologies are generally more expensive, but still inferior compared to established technologies when it comes to performance. Although, they have a long-term potential to outperform the established technology, in addition, to become more affordable. In the field of business model innovation, new technologies are being deprioritised and do not receive as much attention nor resources compared to established technologies (Chesbrough, 2010). Customers show little interest in new radical renewable energy production innovations. Instead, customers want continuous innovations for current products, since these match their needs, thus giving less room for new business ventures based on out of the box ideas (Richter, 2013a). The solar energy technology lack in performance compared to conventional energy sources, in ways such as difficulties with storing energy (Aslani & Mohaghar, 2013).

2.4.7.2 Uncertainties & Risks

For renewable energy technology, Guerra-Mota et al. (2018) highlight the risks of using new technology. The risks are related to, and reduced by, the compensation that is guaranteed through fixed tariffs and governmental subsidies in many countries, increasing the incentives to use renewable energy technology. In contrast, Overholm (2015) sheds light on the incentives related to continuing with the current technology, since the actors involved in the industry are dependent on a coherent eco-system, and thus the related business models are based on conserving the current technology. Some renewable energy production technologies lack in quality, in terms of exploration and utilisation, compared to conventional technologies (Aslani & Mohaghar, 2013). Distributed solar production creates risks associated with the performance of the electricity eco-system (Horváth & Szabó, 2018). A larger share of renewable technology, such as solar and wind, in the electricity system, creates larger fluctuations in supply compared to other sources (Engelken et al., 2016; Horváth & Szabó, 2018). Horváth and Szabó (2018)

further explain that fluctuations in distributed solar energy production put larger pressure on the electricity grid compared to centralised production.

The technology perspective of barriers to business model innovation is both wide and deep, spanning across all dimensions and elements. The purpose of the business model is to act as a mediator between the technology and the economic outputs (Chesbrough & Rosenbloom, 2002). Thus, the technology is a substantial part of the business model and will impact all three dimensions of Spieth and Schneider's (2016) framework.

2.5 Concluding Remarks

From studying the theory, a few themes critical for developing the method appeared. Firstly, the most practical method for measuring business model innovativeness appears to be a comparison of initial and new business models. Regarding the initial point, as producing retailers handle electricity production facilities, they are expected to have access to other types of resources than pure electricity retailers in the later analysis. By subsequently analysing what business models the retailers conduct, an indication of retailers' respective innovativeness can be obtained, as visualised in Figure 2.3.

Figure 2.3 - Approach for acquiring business model innovativeness

Barriers to business model innovation are obstacles of varying nature that companies face when transforming from one business model to another, implying that the barriers may be encountered regardless of whether business model innovation was successful or not. These barriers are visualised in Figure 2.4, where they might occur during the innovation of moving from Model A towards Model B. These barriers might take different forms and originate from a diverse set of factors, see Table 2.4. Connecting to the research question, the different barrier categories thus may have various relations with business model innovativeness.

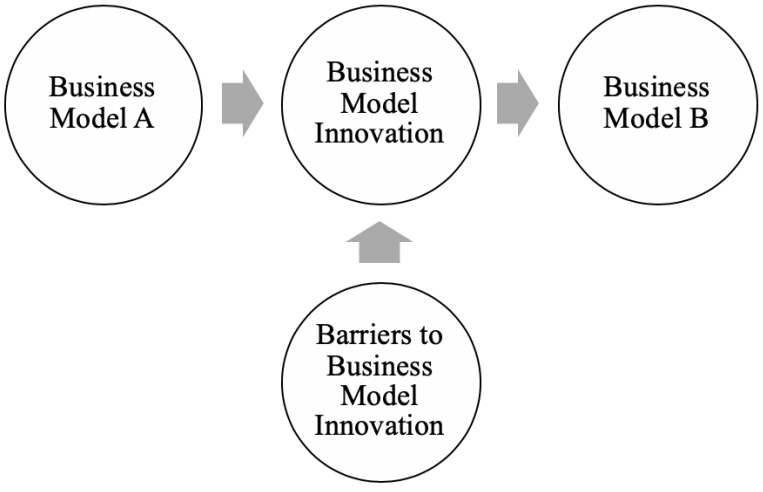

Figure 2.4 - Barriers in the Business Model Innovation Process

3 Method

This section contains the method used in the study. The initial part cover the study design and gives an overview of the process. In following sections, the two subsequent rounds of case selection, data collection and data analysis are described in detail.

3.1 Study Design

There are several strategies to conduct research. Yin (2003) describes the circumstances that are appropriate for various strategies. When the research question does not require control of behavioural events but does focus on contemporary events, the appropriate strategy is a case study. Yin (2003) further explains that the case study method concerns studying phenomena in their context empirically. As the research question regards the contemporary context of the Swedish retailers, where there is no control of behavioural events, a case study was chosen as research strategy.

Yin (2003) additionally explains that case studies come with different basic types of designs, depending on if there are one or multiple cases. The rationale for focusing on one case is if the context is representative of something common, which in this case is companies facing a technological development, serving both as an opportunity and a threat. Case studies additionally depend on whether they are holistic, based on one unit of analysis, or embedded and based on multiple units of analysis. Embedded studies are preferable when logical sub-units of analysis can be identified within the case. With all these considerations, a single context-embedded design was applied, with Swedish retailers as units of analysis.

Qualitative analysis is, according to Cresswell (2003), suited for open-ended research questions that can be described with text rather than numbers, and therefore found applicable for the study. The design of the study has mainly been deductive, i.e. previous theories and conclusions have been a foundation for observing causality in empirical data (Bryman & Bell, 2003). The study was additionally completed iteratively, meaning that subsequent data collection was affected by considerations from the initial data (Bryman & Bell, 2003). For example, the interview template was affected by insights gathered from previous interviews.

The study focused on the two areas below, visualised in Figure 3.1, to find a potential relationship. The study was divided into two sub-studies, with two separate case selections, data collections and data analyses conducted concurrently.

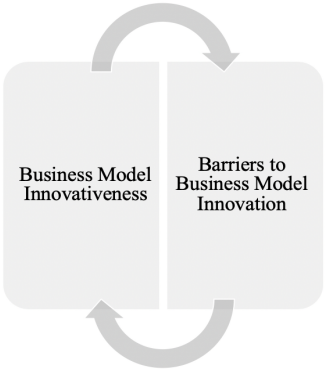

Figure 3.1 - Main areas of the study

The steps in the procedure were as follows:

1) Measuring business model innovativeness of retailers
    - Case Selection
        i) Choosing which retailers to study
    - Data collection
        i) Identifying which solar business models retailers conduct, mainly through secondary data
        ii) Searching literature and empirical data to estimate the innovativeness of various solar business models
    - Data analysis
        i) Linking Business Model A and B, from Figure 2.1, to appraise the business model innovativeness of each retailer

2) Enquiry of which barriers to business model innovation retailers experience
    - Case Selection
        i) Sampling of retailers based on business model innovativeness
    - Data collection
        i) Interviews with retailers based on barrier framework developed from literature
    - Data analysis
        i) Statements collected from interviews analysed to assess which barriers the retailers faced

These steps are described in detail in subsequent sections.

3.2 Case Selection for Measuring Innovativeness

Case Selection is highly important as the case is supposed to represent the characteristics of the general population (Seawright & Gerring, 2008). There are multiple strategies for this process, which have various benefits and disadvantages. For this study, the case of the emerging solar energy technology was considered to be a *typical* case where retailers have the opportunity to innovate their business models. By exploring their reaction to solar energy business models, generalisable findings regarding retailers' business model innovation were expected to be made. All retailers on the Swedish market were not included in the study however. A compilation of the Swedish electricity market by Accenture (2018) provided a list of the 30 retailers with the largest customer bases and these were chosen to be the sample of the study. These retailers had 4.9 million customers altogether. Retailers smaller than these were assumed to be negligible when analysing the general development of these actors.

3.3 Collection of Business Model Data

The initial phase of the analysis of the Swedish retailer market consisted of ranking the companies in terms of business model innovativeness. Due to the high number of companies included in the study, this phase was mainly conducted through the collection and analysis of secondary data. By assessing annual reports and official websites, offerings to customers and other solar energy-related aspects were mapped using the solar business model framework by Schoettl and Lehman-Ortega (2011). To perform this categorisation, the article in *How to Plan and Perform a Qualitative study using Content Analysis* (Bengtsson, 2016) was used as a

guideline. The first step, the decontextualisation, consisted of identifying statements from the sample which could be used as meaning units. These were subsequently translated into codes and gathered in a coding list, to reduce the risk of a cognitive change and to strengthen the reliability of the method (Bengtsson, 2016). For example, a statement such as "We offer solar panel-solutions where planning and installation are included." would be attached with the code "Offers total solution". Conversely, a statement such as "Last year our solar park, which is the biggest in Sweden, was finalised and is now available for our customers." would receive the code "Has solar park". During the recontextualisation phase, the original material was re-read with its attached meaning units in mind, to see whether they convey the text truthfully. Thirdly, the categorisation consisted of assembling the various meaning units of the companies into its respective code category, resulting for example that the code "Has solar park" leading to the retailer being attached with the business model "large PV facility operator".

As the examples of business models displayed by Strupeit and Palm (2016) show that national context substantially affects business models, additional interpretations and definitions were required to distinguish the domestic wide spectrum of opportunities. Further, additional guidelines were used for consistency. For example, a company would not be assigned a business model if their website promoted a partner or parent company performing a qualifying service. Retailers having district heating plants were labelled as producing retailers, due to the assumed similarity between producing electricity and heat.

Based on the theory, the general solar business models were achieved by the retailers if the offers fulfilled the criteria for each business model, seen in Table 3.1:

Table 3.1 - Solar business models by Swedish retailers

Business Model	Theory	Criterion	Example of statement
Hassle Free Project	The company provides a "one stop"-opportunity, where industrial or commercial customers who are interested in solar PVs are able to make orders without being too knowledgeable about all details. The retailer is not the owner of the PVs.	An offer where assistance with planning and installation of solar PVs are included. The services are not necessarily provided by the retailer, but they act as an orchestrator and channel to the customer.	"With our complete solar panel package you will get going quickly with production of electricity. We help you with everything from planning to installation"
Complementary Revenue Provider	The retailer is the owner of the solar PVs and provides additional revenue to the customer by access to the solar PVs through leasing or similar.	Essentially, there were two types of offers appearing in this category. The first was very similar to the hassle free project, with the only difference that the customers were able to lease instead of paying a one-time fee. The other was a solution where customers were able to rent or buy part-ownership in solar parks.	"We offer leasing of solar panels to make it easier for customers to live green"

Value Added Service Provider	The company provides a specialised service somewhere along the value chain or acts as an orchestrator. Consulting or project development are examples of such services. The company does not own the PVs.	This category was defined fairly broadly by the authors, which resulted in it being performed by many retailers. Examples of services that would qualify are: Providing estimates of value for solar PVs to customers Providing mobile applications that give the owners of solar PVs additional value Offering help with paperwork and applications for subsidies Retailers that provided any of the above mentioned were decided to perform this business model, regardless of if that service required payment or not. The occurrence of this business model was often related to companies doing hassle free projects, as such offers often included services that would qualify as value adding.	"Contact us for guidance in applying for subsidies"
Construction and Installation Provider	The company performs the installation and construction of the solar PVs. Local project management is a key capability.	There were no found occurrences of companies carrying out the installation and construction of solar PVs. Clarification through email correspondence and interviews was required in many cases, as the initial sample often was unclear of this aspect. Through the responses, it appeared that many had partnerships with subcontractors responsible for the installation.	N/A
Large PV Facility Operator	The company owns a large solar PV facility and subsequently is an electricity producer. It requires the capabilities of managing and funding large projects.	There were two main categories of occurrences for this business model. Firstly, there were the typical solar parks which were utilised as power plants, which in some cases were located abroad. They could also be stationed at the roof of the companies' office. No distinctions regarding the size of the PV facility were made, as the capacity rarely was disclosed. Secondly, an example of solar parks that was encountered was funded through part-ownerships by customers. Although they were not entirely owned by the retailer, they were still assigned with the business model large PV facility operator, as they were the entity responsible for managing the plant.	"We have one of the largest Solar Parks of Sweden"
Energy Controller	The company oversees supply and demand and is able to create value through trading.	As this business model regarded overseeing supply and demand and creating value through trading, companies who bought overproduced electricity from solar PV owners were attributed to this business model.	"We offer good prices when buying back the electricity you generate"

The method used for this phase of the study had to be appropriate for the relatively high number of subjects while still enabling time left for remaining phases. Using mainly secondary data allowed the phase to stay within an acceptable time frame but brought a risk of missing indicative information. E.g. a retailer might not display all their offers on their website, resulting in the risk of business models not being detected and thus wrongly not assigned to the retailer. To reduce the risk of these errors, companies were additionally sent emails to seek confirmation regarding some data.

3.4 Analysis of Business Model Data

In order to assess the business model innovativeness of the retailers and subsequently compare it with their barriers to business model innovation, the following step regarded ranking the retailers in terms of business model innovativeness based on gathered data. Using the framework developed by Spieth and Schneider (2016), the innovativeness of the six generic solar energy business models was estimated, depending on whether the retailers are producing or pure. For every dimension of the framework, value offering, value architecture and revenue model, each of the respective elements was given a score between zero and one, for every solar business model. These scores were based on the perceived level of change that the elements would require. For example, the element Logic of Earnings for the business model hassle free project was assigned a high score, as it substantially differs from the typical business model of a retailer. Providing a hassle free project for customers typically means a one-time, fairly high payment, while electricity rates are typically paid monthly. Conversely, the element Positioning was given a zero for the business model energy controller. As the model only requires companies to offer buying overproduced electricity from solar PVs, it was evaluated that no significant re-positioning of the company was required.

The average score of the elements for each of the dimensions were added, resulting in an innovativeness index for each business model. The companies were subsequently assigned the sum of the innovativeness index score of the solar business models they were conducting. The innovativeness of the respective business models is located in Appendix B.

The method for ranking the retailers was unavoidably partly based on a subjective estimation of innovativeness. Although, by using an empirically verified framework for measuring business model innovation, a sufficiently good ranking was deemed to be obtained as the purpose of this stage mainly was to differentiate the top and bottom innovators of solar energy business models.

To ensure that the formulated model did not result in a misleading ranking, sensitivity tests were made. For example, ignoring whether the retailers were producing retailers or pure retailers made no difference to the ranking. This was due to three facts:

1. Large PV facility operator and construction and installation service provider were the only business models having different innovativeness depending on being a producing or pure retailer.
2. Companies who were attributed as large PV facility operator were all producers.
3. No companies were attributed with construction and installation service provider

Additionally, a test was run based on the assumption of all six business models being equally innovative, i.e. having the same innovativeness score. The ranking was unchanged. Some retailers that were close in the original ranking became equally scored in this test, but there was no example of a retailer surpassing another in the ranking, thus increasing the validity of this process.

3.5 Case Selection for Study of Barriers

With the ordering of the companies finalised and potential barriers explored, the subsequent phase regarded selecting retailers for further interviews. Due to limited time and resources, enquiring all retailers for their barriers was not possible. Sending out a survey to all retailers may have resulted in a complete data set, but it was not perceived as appropriate due to the complexity of the topic and a probable need for clarifying questions. Additionally, surveys come with bias issues and and lack of objectivity (Speklé & Widener, 2018). Alternately, to examine how barriers to business model innovation are affected by business model innovativeness, the sample was designed to cover both ends of the retailer ranking, giving time for in-depth inquiring. As the sample became limited, the matching technique was used, which reduces the effect of confounding variables (De Graaf, Jager, Zoccali & Dekker, 2011). By equally distributing subjects exposed and unexposed of the confounding variables, a higher validity could be achieved. The sample was thus chosen through matching retailer by retailer through *individual matching* (De Graaf et al., 2011). The subjects were paired through an audit of factors believed to affect their way of conducting business:

- ➔ Is the retailer owned by shareholders or by a municipality?
  - ◆ This was believed to have implications on objectives and perhaps on factors such as organisational culture
- ➔ Is the retailer a producer of electricity or does it only trade?
  - ◆ This factor was included as it distinguishes the retailers presence on the value chain
- ➔ How large is the retailer? How many customers do they have?
  - ◆ The size of the retailer might affect their ability to enter new business segments
- ➔ Where is the retailer situated geographically?
  - ◆ Location affects the time of sunlight

De Graaf et al. (2011) emphasise that matching does not completely remove the issue of confounding variables, but it is a well-used technique due to its simple implementation and relatively high effectiveness. The choice of companies was additionally slightly affected by proximity to Gothenburg, where the study has been conducted, to increase the possibility of visiting the facilities for face-to-face interviews.

The sampling process resulted in retailers seen below in Table 3.2. Having a complete match on all factors was not achievable, but the result was fairly close. For pair B, it was only possible to compare a high-innovative with a medium-innovative retailer as the amount of large pure retailers was low. Having a larger difference in innovativeness for that pair would be more suitable for the research question, but the pair was nonetheless decided to be used as the sample was intended to cover both pure and producing retailers. Firm D was additionally added to the assessment of other factors than innovativeness, elaborated upon in Section 3.7.

Table 3.2 - Overview of basic firm information

Firm	Ownership	Size	Geographical Location	Pure or Producing Retailer	Degree of Innovativeness
A1	Municipality	Large	South	Producing	Low
A2	Municipality	Large	South	Producing	High
B1	Shareholders	Large	Middle	Pure	High
B2	Shareholders	Large	Middle	Pure	Medium
C1	Municipality	Small	North	Producing	High
C2	Municipality	Small	South	Producing	Low
D	Municipality	Small	Middle	Producing	Low

3.6 Collection of Barrier Data

As barriers to business model innovation is an intricate subject, the process of gathering its data must be appropriate and thought through. Interviewing is a helpful tool to achieve an in-depth understanding of qualitative research (Taylor, Bogdan & DeVault, 2016), and was, therefore, the chosen method for this stage. For cost-saving purposes, all interviews could not be held face-to-face, where some were over telephone or video. Gillham (2005) explain that having distance interviews comes with implications. On the positive note, interview subjects might be more willing to participate and most importantly, it allows for interview subjects that would not have been possible to meet physically. On the other hand, the distance interview loses an element of interpersonal chemistry which could be fundamental in truly understanding respondents.

The interviews were semi-structured, as it gives a balance between structure and quality of obtained data (Gillham, 2005), and focused on receiving key data points while additionally allowing the interviewee to express other, possibly not considered previously, dimensions through open questions. A brief presentation of topics and time-plan of the interview was sent out beforehand to enable interviewees to be prepared and get a sense for time allocation. The interviews were recorded for deeper data collection to reduce the risk of misunderstanding. The initial phase of the interview regarded obtaining an understanding of the retailer's solar business models, to verify the previous data gathering based on secondary data. Next, the barriers and elements of business model innovation were in focus. Based on the framework developed in the literature study, the various categories were discussed to find indicators of whether they were acting as barriers or not. The interview template is found in Appendix C.

3.7 Analysis of Barrier Data

After performing the interviews, a large set of data was obtained, both through written and audio format. This data was consolidated and categorised to be able to be compared across firms. Spreadsheets were used for this purpose, which allowed a simple technique both for pairwise and cross-pair analyses. All of the data presented is in relation to solar energy business models, since this has been the focus during the interviews.

When assessing whether a category was a barrier, the statements from the retailers were analysed based on the framework developed in the literature study. Consequently, the interview

subjects were asked indirect questions to evaluate whether an area was hindering. Having several questions per category together resulted in an understanding of the respective areas of the companies. Their own perception of whether a category was a barrier was thus not necessarily decisive. For example, if it was clear that a retailer has an organisational climate where there are no structures to support creativity and innovation, their own perception of still not having any difficulties is not sufficient to label the category as a non-barrier. The analysis section consists of two fields: pairwise analysis and cross-pair reference analysis. By studying the matched pairs one by one, barrier category by category, conclusions were reached by applying the literature. The barriers that appeared for the firms in their respective pairs were later related to their low or high innovativeness. Lastly, the general themes that stretch across each pair were presented in the concluding remarks.

Realising that pairwise analyses might bring bias or possibly missing interesting findings, a cross-pair analysis was conducted. The firms were instead grouped by the factors presented in Section 3.7, with the addition of innovation definition. These are as follows:

- ➔ Is the retailer owned by shareholders or by a municipality?
- ➔ Is the retailer a producer of electricity or does it only trade?
- ➔ How large is the retailer? How many customers do they have?
- ➔ Where is the retailer situated geographically?
- ➔ How does the retailer define innovation?

Later the analysed results were summarised and distinctively labelled as positive relationship, negative relationship, no relationship or unclear (denoted as "-" in Chapter 4). For the cases where there was a barrier and this barrier only occurred for the firm considered to have low innovativeness, then there was a sign of positive relationships. However, if the barrier occurred for the high innovativeness firm in the pair instead, there was a sign of negative relationship. If both firms had encountered the barrier, then no indication of relationship was given. Additionally, for the cases where no firm had encountered a barrier, there was no relationship, since the absence of a barrier indicates an absence of a relationship. The cases where the analysis of the occurrence of barriers were diffuse, no conclusions were made.

3.8 Limitations

The empirical research for this report has some flaws, and therefore act as a limitation for the conclusion. Expanding the empirical data collection would increase the validity of the report. The reasons for the mentioned limitation is based on four factors and relates to the interviews with the purpose of verifying business models and explore potential barriers.

Firstly, only one to three managers at each firm have been interviewed. Instead, a collection of managers at different hierarchical levels of the organisation could have been included, along with members of the board and subordinates with a more operational focus in order to get a more complete and diverse picture of the firm. Although, it would be difficult since the collection is extensive and thus could exceed the time and cost available.

Secondly, out of all the retailers in Sweden only a handful were selected and interviewed. A total of seven companies were chosen to be analysed, from a shortlist consisting of the 30 biggest firms, which in turn were selected out of the 150+ existing retailers in the Swedish context. However, as the 30 largest retailers have such a high amount of customers, they do largely represent the total industry. A more complete empirical research could be done by collecting barrier data from these 30 firms, to further strengthen insights of this report.

Thirdly, the conducted interviews have covered one or two appointments with each firm. Time spent per interview has varied in the range from 30 to 120 minutes, most commonly 90 minutes. To get the full understanding of the business model climate in a company during a single, or two, relatively short meetings is nearly impossible. Therefore, improvements in this aspect to enhance the validity of the report can be made by increasing the number of interviews with the same people and lengthen the time spent during each interview. This would enable following up initial answers and further discuss the answers of other firms, to verify the result.

Lastly, most interviews have been performed through voice and video due to the large geographical distances, as mentioned in Section 3.8. Interviews performed in-person are considered to be more effective in the means of communication compared to those performed by video and phone (Daft & Lengel, 1986). Some interviews have been followed up by email, which lacks efficiency compared to in-person meetings, in the same way. To strengthen the empirical data collection interviews could have been held in-person to a larger extent. Although, this has been limited both by travelling time as well as financially for this report.

The trustworthiness of the study can be assessed with the evaluative criteria developed by Lincoln and Guba (1985). The first factor they propose is credibility, and regards whether the researchers have confidence in their findings. While the data sample could be larger, the 30 biggest retailers have a substantial share of the market and is therefore considered to be sufficient. Additionally, the study has a high degree of foundation in previous relevant research and is conservative when drawing conclusions. The confidence in the findings is therefore high. The second factor is transferability, i.e. the applicability of the findings in other contexts. Directly translating the findings to retailers of other countries might be difficult, as there are many indications of the national context differing substantially for electricity markets. However, the authors believe that the findings from examining the increasing use of solar energy can be applied at other emerging technologies for the electricity market, as the barriers are quite general. The third factor is dependability and refers to if the findings are replicable and consistent. To ensure this, the method has been aspired to be written as transparent as possible. The main issue which could affect the replicability is which individuals that are interviewed at the respective companies. Lastly, the final factor is confirmability and regards the neutrality of the researchers. The authors have no professional ties to any related industry and have naturally strived for maintaining neutrality at all times. In conclusion, the method fulfills these criteria well. A more extensive data collection could however have enhanced the dependability of this report by interviewing a wider range of employees at the companies.

4 Results & Analysis

The theoretical foundation described in Chapter 2 is applied to the data to reveal some findings. The theory is two-fold. Firstly, the literature on how to determine the innovativeness of a firm was presented. Secondly, the barriers to business model innovation identified by the literature were presented.

Through assessing the business model innovativeness of retailers through secondary data and obtaining an understanding of their barriers to business model innovation through interviews, the relationship between the factors could be evaluated. The result will be organised below in two different forms. Firstly, the retailers will be analysed as pairs with similar characteristics, but on different ends of the business model innovativeness ranking. Secondly, cross-pair comparisons will be made to evaluate potential relationships to alternative factors.

4.1 Retailers' Business Models and Innovativeness

The gathering of business model data and appreciation of business model innovativeness resulted in the ranking seen in Appendix A. This ranking of innovativeness was the foundation when creating pairs to include one more, and one less innovative firm. An overview of the firms, and their business models, chosen for further analysis is presented in Table 4.1.

Table 4.1 - Overview of firms' business models, that led to their respective innovativeness ranking

Alias	Producer of Electricity	Hassle Free Project	Complementary Revenue provider	Value Added Service Provider	Construction and Installation Service Provider	Large PV Facility Operator	Energy Controller
Firm C1	Yes						
Firm B1	No						
Firm A2	Yes						
Firm B2	No						
Firm A1	Yes						
Firm D	Yes						
Firm C2	Yes						

In addition to the firms included in the pairwise analysis, an interesting outlier has been included in the analysis, namely Firm D. The reasons why Firm D is regarded as an outlier, but still interesting to study is the following. Firstly, it is a small firm, located in the centre geographic segment where it is not within close distance of other firms or large cities. Secondly, Firm D produces its own electricity and all is from renewable sources, through wind turbines and biomass power. Further, the organisation has been troubled by strict routines from upper management hindering the creativity and possibilities to take advantage of new business opportunities, but the previous CEO was replaced a few years ago. These factors considered, Firm D will assist in providing valuable input for the upcoming analyses regarding ownership and size. Firm D conduct the solar business model energy controller, through buying overproduced electricity from solar PV owners.

4.2 Pairwise Analysis

In order to isolate the degree of innovativeness in relation to barriers to business model innovation, a total of three pairs has been formed. Each containing one firm with relatively high innovativeness and one with low. Matching pairs by different innovativeness and keeping external factors similar is assumed to increase the validity of the relationship between innovativeness and barriers.

4.2.1 Pair A - The Municipality Producers

First out of the three pairs is Firm A1 and A2, where A2 is regarded to have high innovativeness, and consequently, A1 to have low. These firms are a good match because of four reasons. Firstly, both firms are owned by a municipality. Secondly, they are located in the same geographical area. Thirdly, both are producing retailers and, lastly, they are both considered to be relatively large.

Firm A1 is a large retailer located in the south of Sweden. It produces electricity through wind turbines and biomass energy and is owned by the local municipality. When asked if it defines innovation as something new to the firm, industry or the world, they answered the firm. Firm A1 has a fairly optimistic belief in the future role of solar energy and sees itself as a contributor, relative to other Swedish retailers, to the transition of increased solar energy utilisation. When developing new business models, the value offering is the most important dimension. Firm A1 conducts the following solar business models:

- ➔ Value Added Service Provider
  - ◆ Through helping customers through the purchasing decision and application for subsidies
- ➔ Energy Controller
  - ◆ Through buying overproduced electricity

The other business models were however discussed in the company. One business model was only months from being launched. Firm A1 was however placed in the lower half of the sample in business model innovativeness.

Firm A2 is, similarly to A1, a large retailer that produces electricity, through wind turbines and district heating plants. Firm A2 is located in the south of Sweden and is owned by the local municipality. It too believes that the use of solar energy can grow significantly and that they are assisting more than most competitors in this development. Firm A2 states that it has helped private customers with solar PVs previously, but not anymore due to the non-economic viability. Now, it is concerned with corporate customers in the segment. It considered value offering to be the most important dimension of business model innovation. Firm A2 conducts the following business models:

- ➔ Complementary Revenue provider
  - ◆ By having a solar park where customers can buy part ownership
- ➔ Value Added Service Provider
  - ◆ Through providing estimations of value for corporate customers interested in solar PV systems
- ➔ Large PV Facility Operator
  - ◆ By operating the previous mentioned part ownership solar par
- ➔ Energy Controller
  - ◆ Through buying overproduced electricity from prosumers

Firm A2's business model innovativeness was subsequently ranked highly among the other retailers.

4.2.1.1 Comparative Analysis

Business Model Analysis

Comparing the solar business models the two companies conduct, complementary revenue provider and value added service provider are the main differences, while the other business models were assigned for fairly similar activities. Firm A2 is labelled with the two additional business models through having a solar park where customers can buy part ownership, which was fairly rarely encountered in the data gathering of the 30 retailers. Looking at the dimensions of business models, solutions such as these are estimated to mostly require innovation in value architecture. Firm A1 may thus have additional difficulties of innovating that dimension, compared to value offering, which they perceived as most important.

Organisational Barriers

As described in Chapter 2, organisational barriers can be present in regard to ambidexterity, culture, leadership and commitment along with structure and decision. Interviews with both firms reveal data regarding all subcategories apart from leadership and commitment.

Both firms describe their organisation as promoting new ideas and ventures. However, Firm A1 emphasises that the culture is promoting creativity across all hierarchies. Firm A2 states that even though there is room for new ideas, it still comes down to what extent the firm wants to utilise the generated ideas compared to conventional products.

Forum for interdepartmental communication, as physical gatherings to openly express ideas and to inspire creativity, exists within Firm A1, but not Firm A2. Firm A2 express:

"We do not organise evenings with berets and red wine to be creative."

When it comes to decision-making, both firms appreciate that they move quickly on new ideas, usually about one month from idea to initiating a project group. Although, the firms generally have different origins of their ideas. Firm A1 is working from the inside and out, while Firm A2 only focuses on the demand from its strategic customers and does not generate new ideas within the firm.

None of the firms consider the organisation to be hindering when it comes to business model innovation. Firm A1 highlights that change is promoted within the organisation and has to be on top of everyday tasks.

From literature, we learned that not having strong organisational culture across the entire hierarchy is a barrier to business model innovation (Chesbrough, 2010). Although, there are no evident signs of Firm A1 experiencing such climate. Firm A2 additionally describes its organisation as advocating for new ideas, but its issue of balancing ideas with established products could act as a barrier of ambidexterity (Tushman & O'Reilly III, 1996; Chesbrough, 2010). The forums for interdepartmental communication, which seem to exist for Firm A1 but not for Firm A2, suggest a difference in the coordination of processes among the stakeholders. Having such issues may imply that Firm A2 is being affected by the barrier of structure and decisions (Chesbrough, 2010). Therefore, Firm A2 seems to be more affected by organisational barriers to business model innovation, in spite of its higher business model innovativeness.

Resources & Capabilities

Resources and capabilities barriers consist of prioritising and distribution along with skills and competencies, which both were present in the data collected from the interviews with firms in Pair A.

As noted, Firm A2 conducting the business model complementary revenue provider and value added service provider were the differences in business models for these retailers. Solar energy projects pursued by Firm A2 receive more resources per revenue unit in general, compared to conventional projects. To incorporate solar energy into their general electricity eco-system requires competencies across departments. In contrast, fewer resources and capabilities are needed for Firm A1 to pursue solar energy projects since solar energy initiatives involve other types of tasks, that partly are delegated to partners. Firm A1 has had a shift devoting more resources than earlier for solar initiatives, with about ten per cent of total resources.

The skills that are needed to transition to the solar segment differ between the firms. Firm A1 states that new skills are required, but these are acquired through partnerships with intermediaries. The knowledge that is needed is, however, developed in-house and driven by personal interest where they risk losing substantial skills due to retirement. Firm A2 has had to acquire new IT skills to keep up with the competitive landscape. These are not used specifically for solar energy, but rather for the services in a variety of offerings. The firm states that IT is not their core business and that their software skills will not provide the solutions the market demands. Instead, Firm A2 assumes that tech companies will provide these services.

Through perceiving solar energy projects as requiring more resources, Firm A2 could be limited, relatively to Firm A1, when investing in solar projects by prioritisation and distribution barriers (Chesbrough, 2010). Hence, the difference in business models, complementary revenue provider and value added service provider, could be the reason for why Firm A2 perceives solar as requiring more resources. Both firms have had the need of acquiring new competencies, but Firm A1 has not yet responded by hiring new employees. Firm A2 is acquiring new competencies in unconventional areas and confirms the issue of retailers being out of scope regarding required competencies for solar energy systems, described by Richter (2013b). Even though barriers might be present for the firms according to literature, neither of the firms perceive the category as a barrier. Therefore, it is difficult to evaluate whether the category has been acting as a barrier, although there are some indicators from the literature.

Business Environment

Since both firms are owned by the municipality, they both work in strategic long-term partnerships with the respective municipality. When discussing trends regarding new actors in the value network, the opinions of the firms differ. Firm A1 puts a lot of emphasis on unethical providers and installers of solar PVs causing quality problems. Firm A2 focuses on the trends among the existing actors, recognising that there is a race to seize the largest market share possible.

The opinions regarding the business environment as a barrier to business model innovation are diffuse. Firm A1 states that unserious actors are hindering, but the benefits of working closely and long-term with the municipality and other information providing partners, to increase the delivered value to customers, outweigh the negatives. At the same time, Firm A1 says that the structure of the industry is not optimal for solar energy, thus hindered to some extent by path dependence, since earlier decisions have affected the initial position for solar energy negatively. Firm A2 takes another approach, explaining that all municipalities have a

sustainability plan, but it is unclear what part solar energy will play. Further, they state that the development of the industry is uncertain.

The firms view regarding how the business environment has evolved, with many actors and tough competition, suggests a hectic setting. Connections can be made to the description of newcomers' effect on the general value chain resulting in industry structure being uncertain (Guerra-Mota et al., 2018). Richter (2013a) additionally describes this concern for retailers, alongside the question of where the value will be captured in the value chain for solar (Nillesen et al., 2014).

It appears that both firms have developed well-functioning partnerships and assess the business environment in similar ways. Neither of the firms are worried enough, regarding the development of the business environment, for it to be hindering the solar business models.

Market & Value

The following analysis is based on both subcategories of the barrier, customer-centric and demand from the market.

For the private customer relations, Firm A1 is under the impression that the customer interest has increased and that customers want close relationships with retailers within the solar segment. In contrast, the customer relations of Firm A2 are of different nature depending on the customer. Some customers want a deep and long-lasting relation, others only care about the price.

Both firms agree that the demand for solar energy is increasing and have the impression of a stable market. Firm A1 says that the market is growing quicker than expected, which is supported by Firm A2 which mentions that the price drop for the technology has been promoting the spread of solar energy systems. Firm A1 emphasises the effect of servitization of solar energy as a contributing factor to increasing demand. Firm A2 states that the interest is high, but sometimes the road to a decision for customers is long and difficult, implying a more hesitant attitude towards the growth of demand.

When developing the value proposition for customers in the solar energy segment, the firms face a higher level of complexity than before. Firm A2, with corporate customers, emphasises the importance of considering the customers of these customers, in an iterative process. This perspective is new for the solar segment compared to conventional businesses due to new value creation and delivery.

Firm A2 highlights the difficulty to offer off-the-shelf solar solutions and reducing costs and resources. This challenge exists since the level of knowledge differs substantially between customers. Further, Firm A2 is under the impression that not all customers are aware of what is required to set up a solar energy production system. This acts as a barrier to entering the market segment since customers typically expect electricity to simply arrive at the power outlet, not contemplating the underlying complexity. However, Firm A1 emphasise the important role of the customers for spreading solar energy technology in general, regardless of business models, through sharing information and creating awareness among other customers. Thus, according to A1, it is not acting as a barrier.

With both firms being optimistic of the market development, they do not appear to experience the uncertainties related to matching value offering and demand (Girotra & Netessine, 2014). Firm A2's description of a long customer decision-making process, in addition to other difficulties that come with the need of specialised solutions, are however previously encountered according to literature (Richter, 2013a; Nillesen et al., 2014). Firm A2 thus

appears to think customer-centric barriers are problematic, which Firm A1 does not appear to face to the same extent.

Awareness & Behavioural

When discussing the general attitude towards solar energy, both firms seem positive, although Firm A1 has a more engaging approach. It moves forward into solar energy "to 100 per cent", but states that it has to be careful and rethink the role of energy in the future and its compatibility with the current electricity system. A more passive expression is given from Firm A2, wondering if Sweden actually is the best-suited country for solar energy, due to the already fossil-free production of electricity. Neither of the firms describe awareness and behavioural factors as hindering when entering new business areas, as long as the barrier category does not interfere with the financial aspects, and further not with the brand for Firm A1.

The presented data do not completely relate to specific literature within the barrier category. However, according to their own appreciation, the category appears to have caused issues for both firms, although likely not substantial enough to block progress forward. Thus, awareness and behavioral is labelled non-barrier for both firms.

Financial & Political

Profitability seems to be a challenge for solar energy business models. Both firms state that solar energy is not as profitable as conventional electricity production techniques. At the same time, both firms accept a lower rate of return for solar projects. It is important for both firms that the profitability is positive but for Firm A2 solar projects with lower profitability are not deprioritised due to conventional projects of higher profitability. Firm A1 greatly believe in the possibility to combine profitability with improved customer relations. Firm A2 states that there are large profitability differences in completed solar projects depending on the scale of the project and if the produced electricity is consumed outside or inside of the grid. Political financial benefits are available depending on the effect of the system, both as subsidies and as tax deductions, which influence the attractiveness of solar energy projects.

"The market and the demand are insecure from a political view." - Firm A1

Both firms express that political actions are necessary for solar energy. Firm A2 expects the market to cease otherwise, stating that it is in a transition phase that will not last in the long-term. The price that retailers pay for solar-generated electricity from micro-producers is substantially greater than the market price, thus not viable from a profitability perspective, but entails other positive values.

While solar energy is not as profitable as other business areas, as noted by (Richter, 2013b), both Firm A1 and Firm A2 continue to utilise it due to other advantages. From the interviews, economic aspects do not appear to be significant barriers currently, but both appear to see the risk of political changes affecting that, as found by Aslani and Mohaghar (2013). Therefore, political uncertainty seems to be a significant barrier for both Firm A1 and A2 when innovating their business models.

Technological

The following analysis is mainly based in the subcategory uncertainties and risks of the technological category.

The development of the solar PV, up until today, has been beneficial and is no longer considered as an obstacle for either of the firms. Firm A1 compares the PVs to the development of personal computers and does not regard the technology of solar energy to be a barrier. Both

firms have seen a tremendous development of the technology and appear to appreciate the potential of it. Firm A2 especially, seems to be concerned with how storage facilities have not yet been sufficiently developed, which could be connected to the fear of fluctuations in renewable generation of electricity (Engelken et al., 2016; Horváth & Szabó, 2018). Therefore, Firm A2 seems to be more affected than Firm A1 by technological barriers.

"Solar energy needs storage facilities and to be financially viable - Otherwise it will not work." - Firm A2

A tendency for the firms seems to be that storage capacity for electricity is a critical factor for the expansion of solar energy. The electricity storage industry is accelerated by the electric automotive segment, according to Firm A2.

Other Remarks

The location and availability of space or area are considered a long-term barrier by both firms and is regarded as the biggest barrier by Firm A1 due to lower output production per area used compared to conventional energy systems.

Firm A2 returns to the software dimension, solutions to track the interplay between consumption and production, as a focus area drawing attention from other potential business opportunities, such as solar energy. When solar energy is growing, the complexity of the general electricity system will increase. To coordinate the complete system involving a multitude of decentralised micro-producers using different production technologies will be the challenge of the future.

4.2.1.2 Concluding Pair A

Generally, for the first pair the categories of technological, resources and capabilities along with awareness and behavioural do not seem to have caused any significant barriers, as seen in Table 4.2 below. The political uncertainty seems to be the most prominent challenge for both. How both firms gain organisational support for new ideas, as well as where the ideas originate from differs between them, where the organisational support seems to be stronger for Firm A1 with lower innovativeness. Firm A2, considered to be innovative, appears to face and recognise barriers to a larger extent compared to Firm A1. Firm A2 is more affected by organisational barriers, the business environment, challenges with customers and the development of the technology. Thus, the first pair does not entail any distinct positive relationships between innovativeness and barriers to business model innovation. However, there are signs of the opposite relationship, suggesting that lower innovativeness is related to fewer, or less significant, barriers.

Table 4.2 - Summary of categories regarded as barriers or non-barriers for firms in Pair A along with a potential relationship to innovativeness

	Firm A1	Firm A2	Relationship to Innovativeness
Organisational	Non-Barrier	Barrier	Yes - Negative
Resources and Capabilities	Non-Barrier	Non-Barrier	No
Business Environment	Non-Barrier	-	-
Market and Value	Non-Barrier	Barrier	Yes - Negative
Awareness and Behavioural	Non-Barrier	Non-Barrier	No
Financial and Political	Barrier	Barrier	No
Technological	Non-Barrier	Non-Barrier	No

Whether the difference in barriers is related to the business models the firms conduct is difficult to assess. Both firms conducts the business models value added service provider and energy controller, but there are some differences in how the first one is done. While Firm A2 can rely on an automated service on their website providing estimations of value for customers' roofs, Firm A1 has an unautomated service of helping customers applying for subsidies. Firm A2 additionally conducts complementary revenue provider and large pv facility operator. Their difference in barriers, Firm A2 having organisational barriers along with market and value barriers, are mostly comprised of the business model dimensions value offering and value architecture. Value architecture is additionally the most important dimension in the business models that separate Firm A2 from A1. Consequently, although being more successful in innovating the dimension, it is a dimension where Firm A2 perceives barriers where Firm A1 does not.

4.2.2 Pair B - Shareholder Owned Pure Retailers

The second pair consists of Firm B1 and B2, where B1 is considered to have high innovativeness and B2 is placed in the middle range. The reason for including Firm B2 in the innovativeness middle range is because there is no other firm who is a pure retailer with a similar sized, fairly large customer base in the low innovativeness range. Further, both are owned by shareholders and the geographical distance is relatively low, which supports the pair as a good match.

Firm B1 is a large shareholder owned retailer located in the middle region of Sweden. It has no production of electricity and is hence a pure retailer. Innovation is regarded as something new to the industry, and the firm considers value offering to be the most important dimension when innovating business models, followed by value architecture and then revenue model. Firm B1 is fairly positive regarding the future role of solar energy, but do not consider itself as either leader or laggard in the development. Firm B1 conducts the business models:

- ➔ Hassle Free Project
  - ◆ Through offering corporate customers total solutions but using partners for most tasks
- ➔ Complementary Revenue Provider
  - ◆ By aiding customers with the financing of solar PVs
- ➔ Value Added Service Provider
  - ◆ By providing an estimation of value for the solar PVs
- ➔ Energy Controller
  - ◆ Through buying overproduced solar electricity

Through these business models, Firm B1 was ranked highly in business model innovativeness.

Firm B2 is a large pure retailer situated in the middle region of Sweden. It too considers innovation to be something new to the industry and thinks value offering is the critical dimension of business model innovation, followed by revenue model and then value architecture. Firm B2 conducts the business models:

- ➔ Hassle Free Project
  - ◆ By providing total solutions for customers interested in solar PVs but using partners for most tasks
- ➔ Value Added Service Provider
  - ◆ It has been helping another company with the planning of building a large solar PV facility
- ➔ Energy Controller
  - ◆ Through buying overproduced solar electricity

Firm B2 was placed in the middle among retailers in the business model innovativeness ranking.

4.2.2.1 Comparative Analysis

Business Model Analysis

Comparing the solar business models conducted in the pair, the main difference is complementary revenue provider, by Firm B1 helping customers to obtain solar PVs by offering financial support. The dimension estimated to require most innovation to achieve such a business model is value architecture. Firm B2 regards the value architecture as the least important dimension when innovating their business models, which may explain why it has not initiated this business model.

Organisational

The following analysis is based in the subcategories ambidexterity, culture along with structure and decisions of the organisational category.

Firm B1 and B2 share some thoughts regarding their organisational culture, where both similarities and differences can be noticed. Firm B1 views itself as “curious” and “not afraid to change”. It additionally thinks there is room for employee creativity. However, the high risk of electricity trading might restrain some autonomy. The ownership structure of Firm B1 has some implications on the creative work. As their subsidiary companies have designated missions, there are certain limitations for ideas.

Firm B2 has had a rebel self-image previously, along with a somewhat "cultish" working environment. From Firm B2 previously driving the change, it now views itself as a more conventional company when others have caught up. It believes that it is soon time to "put its neck out" once again. The firm strives for leading innovation, which is not perceived to originate from the owners but from the company itself.

Both firms are moving into new business areas through creativity, implying that promoting new ideas outside of the business scope does not pose a risk to restrain business ideas, as proposed by Burgelman (1983). Firm B2 is leading innovation moving forward into new areas compared to Firm B1 which has creative constraints from above, suggesting that favouring conventional energy systems as a barrier for solar energy (Richter, 2013b) is greater for B1 than for B2. This could, in turn, be an effect of organisational agility (Aslani & Mohaghar, 2013; Chesbrough, 2010) Therefore, organisational culture might be acting as a barrier to a larger extent for firms with higher innovativeness.

Resources & Capabilities

The following analysis is based in resource and capability subcategories Prioritising and Distribution along with the Skills and Competencies.

When discussing resources and capabilities with both firms, a key challenge that emerges is managing the balance of allocation between new projects and regular activities. Firm B1 mentions that a few people have highly valuable knowledge that might be bottlenecks for projects, which limits the potential for new ones. Firm B2 says that it has to put a lot of energy into new products, as it aspires to break new ground.

Regarding what resources solar business model innovation require, both firms agree that entering the new area is not too demanding. Both utilise partnerships extensively and do not conduct many new activities themselves. Firm B1 mentions that educating salespeople to an adequate level was required, as the firm has become the channel for customers to solar PVs.

Both firms seem to face the barrier of Prioritising and Distributing resources to favour new projects, as has been elaborated upon in literature (Chesbrough, 2010; Maier, 2015; Tushman & O'Reilly III, 1996), which could be derived from high resource coupling (Doz & Kosonen, 2010). However, the commonalities of the firms suggest that solar energy does not require massive resources, thus the amount of resources does not extort a barrier, as proposed for renewable energy projects (Guerra-Mota et al., 2018), which is explained by the use of partnerships.

Firm B1 expresses that required skills are associated with specific employees and thus potentially insufficient, in contrast to what was found in the literature, that insufficient competencies might not be a barrier on its own (Bergek et al., 2013). Further, the skills might be insufficient for Firm B1, however, there was no statement saying that competencies are inadequate, as suggested as a potential barrier according to Horváth and Szabó (2018) and Richter (2013b). Therefore, resources and capabilities do not seem to be a barrier to exploring solar energy business opportunities.

Business Environment

Aiming attention at how the firms utilise their partnerships, both regard the installation of PVs as an important task to outsource and are currently looking for additional partnerships as the market is growing. Firm B1 thinks that new partners do not necessarily need to be from the electricity industry, but thinks there are additional areas promising for creating value. One difference between the firms is that B1 includes partnerships on a strategic level, while B2

sustains a more operational approach, which was further presented by Firm B1 including their partners in the decision-making process while B2 did not. They both agree on the importance of identifying partners that appear stable, as there has been some turbulence in the sector. Additionally, they share the view of how an increasing number of retailers and electricity producers have included solar into their business models.

Both firms agree that they depend on past decision-making, but for different reasons. Firm B1 mentions the structure of their business group, which gives its subsidiary a specific assignment, making it difficult to break new ground. Firm B2 regards their identity as connected to renewable electricity since long, which helps in continuing their commitment. Firm B1 and B2 both consider finding the right partners to be key in succeeding in the solar energy market.

"Partnerships are a win-win situation - They gain access to the customer base, and the retailer gets a margin of every sale." - Firm B2

There is a difference between the firms regarding the organisational structure as well as the value chain arrangement. This will affect the possibilities of both firms to respond to the changing environment, with a potential to avoid inertia which could be hindering (Glasmeier, 1991). However, there is no best practice when it comes to industry structure which makes it difficult to conclude which initial position is favourable. As implied in literature, the structure of the renewable and solar value chain is diffuse (Nillesen et al., 2014; Richter, 2013a). This study suggests the same. Therefore, the business environment and structure's role as a barrier for solar business model innovation is unclear.

Market & Value

The following analysis is based in the market and value subcategories, customer-centric and demand from the market.

When it comes to involving the customers in the decision-making, Firm B1 says that decision-making is mostly made externally through their partners. Firm B2 mentions that it fairly recently began selling PVs, but that buying overproduced electricity from micro-producers is an excellent opportunity to create long-term relations. Both firms think that a major issue with their industry is a general lack of connection between retailers and customers, but solar energy provides a means to improve customer loyalty.

"The value for the firm of solar is branding and customer relations. The financial benefits must increase for the segment to expand." - Firm B1

Regarding how the market for solar may evolve, both firms believe that there is potential for substantial growth, but B1 is slightly more concerned with the risk of a decline. Firm B2 believes that part of the customer value for firms comes from the PR-value of being able to improve sustainability reports through solar energy. Firm B1 mentions the high financial complexity for the customer, in solar business models, while B2 partly agrees.

Both firms seem to struggle to develop an attractive value offering for their customers, that at the same time is profitable for the firm. This is a complex challenge that could act hampering, since profitability in combination with product and service packaging is fundamental for project viability (Aslani & Mohaghar, 2013; Blansfield & Jones, 2014; Richter, 2013a). However, Richter (2013b) points out that new business should not be based on market demand, but rather pushed from management. This, in turn, adds another level of complexity to the diffuse market. Therefore, the level of customer involvement and opinions from the market segments are believed to have caused a barrier for both firms due to the intricate nature.

Awareness & Behavioural

Both firms are positive in the general move towards solar energy. Firm B2 thinks that the technology has a risk, although very small, to become a threat, while Firm B1 thinks a scenario with complete business focus on solar could be great for retailers. B1 further perceives that customers are getting increasingly aware of solar energy solutions, and help increase this awareness through their social media channels. Firm B2 believes it is too easy for retailers and electricity producers to appear environmental-friendly, so it has taken measures to increase the customers' knowledge of retailers' actual renewable energy quota.

Neither of the firms would consider solar energy as a real threat, the same as in Germany (Richter, 2013a), instead, the focus for Firm B1 seems to be the benefits of a bigger solar system. This implies that the opportunity to incorporate solar energy into the business models has not yet passed, which could have been a challenge according to Sioshansi (2014). Hence, the cognitive abilities for the organisation and the market do not seem to be a barrier.

Financial & Political

The two firms differ in their views on the profitability of solar energy. Firm B1 does not yet consider it profitable but wants to obtain a favourable market position for when the market shifts. It emphasises that solar energy is an exception when it comes to prioritising profitability, as it has a long-term relationship building quality.

In contrast, Firm B2 thinks that the business models already are profitable, but agrees on the importance of loyal customers due to the high costs of recruiting new. Firm B1 mentions that the pricing on solar offers is too competitive, that firms pay more when buying overproduced electricity than from Nord Pool. Additionally, solar PVs being attractive for customers is dependent on subsidies, and the political development is difficult to predict. Firm B1 emphasises that solar PVs are good investments for customers, with a payback time of ten years and free electricity afterwards.

The opinions of the firms regarding the financial viability are interestingly divided. The non-financial aspects of long-term customer relationship seem to be important. Firm B1 states that the price, which is paid to solar micro-producers, is substantially higher than the market price, but still competitive. This statement stands in contrast to Richter's (2013a) view of the German utility market, stating that solar will not be competitive if the price is above the wholesale market. Instead, Swedish retailers, seem to pay a premium for this electricity. This is aligned with the solar business challenge of requiring a new pricing model (Sioshansi, 2014) since the total cost of production is not reflected in the price, through subsidies, according to Firm B1.

Both firms seem to be aware of the unstable political landscape, and that the political future is dependent on a set of factors in the Swedish context. This aligns well with literature of other national contexts, stating that political actions are both promoting and unstable at the same time (Aslani & Mohaghar, 2013; Horváth & Szabó, 2018; Huijben et al., 2016). Therefore, the political landscape is a barrier, although not necessarily related to innovativeness. However, the financial viability could be of larger concern for more innovative firms.

Technological

The following analysis is based in the subcategory new technology potential of the technological category.

Both firms regard the technological potential of solar energy to be large. Firm B1 adds that the potential is "astonishing" if battery storage technology is developed further. Storage is an important challenge, according to both firms. Further, B2 does not think that the price

reductions of PVs will be as substantial as they have been over the last years. Firm B1 thinks that the time-bound productivity of solar PVs could be a problem for customers who are accustomed to having fairly stable electricity prices. Further, Firm B1 regards the solar energy technology as a potential threat to retailers if they become too prevalent, an issue which e.g. wind power does not bring.

From the opinion of the firms regarding the solar PV technology, it does not seem to be hindering, as could be the case for new technology (Christensen, 2000), even though the price reduction might be modest in the upcoming years, as Firm B2 expects. However, the surrounding technologies bringing out the potential are critical to not be hindering the spread of solar energy, such as storage capabilities, as proposed as a barrier in the literature (Aslani & Mohaghar, 2013). Therefore, the technology is not a barrier for any of the firms, thus not implying any relationship to innovativeness.

4.2.2.2 Concluding Pair B

The firms in Pair B are relatively similar when it comes to the degree of innovativeness, as mentioned when describing the pair at the beginning of this section. Thus, it is more difficult to be distinctive when assessing the relationship between innovativeness and barriers. There were organisational barriers, mainly for Firm B1, and financial and political along with the market and value barriers for both, as visualised in Table 4.3. When it comes to resources and capabilities, awareness and behavioural along with the technology for solar energy, the firms in the second pair do not seem to have encountered barriers. Analysing the business environment barrier, the findings were ambiguous. Hence, the analysis of the shareholder owned pure retailers, Pair B, does not suggest a positive relationship between innovativeness and barriers to business model innovation. However, there is a potential negative relationship specifically in the context of the organisation, where the less innovative firm, namely B2, does not experience the category to the same extent as B1 with higher innovativeness.

Table 4.3 - Summary of categories regarded as barriers or non-barriers for firms in Pair B along with a potential relationship to innovativeness

	Firm B1	**Firm B2**	**Relationship to Innovativeness**
Organisational	Barrier	Non-Barrier	Yes - Negative
Resources and Capabilities	Non-Barrier	Non-Barrier	No
Business Environment	-	-	-
Market and Value	Barrier	Barrier	No
Awareness and Behavioural	Non-Barrier	Non-Barrier	No
Financial and Political	Barrier	Barrier	No
Technological	Non-Barrier	Non-Barrier	No

Relating these findings to what business models the firms conducts, a tendency can be observed. Both firms conduct the business models hassle free project, value added service provider and energy controller, but there are some differences in how the second is done however. While Firm B1 offer help with applying for subsidies, Firm B2 has an automated service of estimating solar panel value at customers' roofs. The difference between the retailers is Firm B1 conducting complementary revenue provider, by offering solutions that does not require capital from customers, and perceiving an organisational barrier to business model innovation, while B2 does neither of these. The business model dimension of complementary

revenue provider requiring most innovation is value architecture, which additionally is the most apparent dimension in organisational barriers to business model innovation. Although, the other business model dimensions are still present in this barrier category as well. However, Firm B1 perceives a barrier which is mostly affected by the business model dimension value architecture that the firm has innovated more successfully in their solar business models.

4.2.3 Pair C - The Small Green Producing Retailers

Last of the pairs is Firm C1 and C2, where Firm C1 is considered to have high innovativeness, and C2 low. These firms are a good match since both are producing retailers and have similarly sized customer bases in the smaller ranges in the industry. Further, both firms have a hundred per cent renewable energy production. One concern is that the firms are located far away from each other. Firm C1 is located in the north and C2 in the south.

Firm C1 is a small producing retailer located in northern Sweden that is owned by the local municipality. It has a district heating plant, a share of a hydropower plant, wind turbines and solar PVs. It believes that the use of solar energy should grow significantly and that it is assisting more than most competitors in this development. Firm C1 conducts the following business models:

- ➔ Hassle Free Project
  - ◆ By providing a total solution for customers interested in PVs
- ➔ Complementary Revenue Provider
  - ◆ Through allowing customers to lease PVs
- ➔ Value Added Service Provider
  - ◆ By examining the condition of roofs, to see whether they are suitable for PVs
- ➔ Large PV Facility Operator
  - ◆ By producing electricity through PVs on their roof
- ➔ Energy Controller
  - ◆ Through buying overproduced electricity from PVs

Firm C1 was thus ranked highly in business model innovativeness. Through the interview, it was clarified that the firm's solar facility was smaller than what was assumed in the initial data collection. However, as it was difficult to have a lower-limit capacity set for the particular business model, no subsequent alterations were made.

Firm C2 is a small producing retailer, through the burning of waste, that is located in southern Sweden and is owned by the municipality. It too believes the use of solar energy can grow significantly, although not revolutionising the industry but as a strong complement. Firm C2 is about to launch more offers regarding solar energy, but currently it only does the business model energy controller, through buying overproduced electricity. Soon, however, it believes it will be contributing more than other comparable companies to the transition towards more utilisation of solar energy.

4.2.3.1 Comparative Analysis

Business Model Analysis

Comparing what business models the two firms conduct, there is a substantial difference. Besides energy controller, which C2 does, C1 additionally conducts hassle free project, complementary revenue provider, value added service provider and large PV facility operator.

Consequently, as these models together require significant innovation across all business model dimensions, it is difficult to isolate a single dimension where the companies differ.

Organisational

The following analysis is based on the theoretical subcategories ambidexterity, structure and decisions along with culture.

The general organisational culture seems to be open and not excluding for both firms, with a tendency to be slightly more open for new solar energy ideas for Firm C2. Firm C1 describes that the conventional business areas negatively affect the work with new ideas and that creativity is explored by being a group of enthusiastic individuals to perform the change.

"It requires, for example, to be two or three people who fight as fools to carry something through." - Firm C1

Both firms seem to be relatively fast to move on new ideas, but indicate that there is still room for improvement. Firm C2 states that a private start-up environment could be quicker, but feel that it still can act similarly, while C1 indicates that improvement regarding launching new ideas is rather a question of resource capacity.

The conventional business seems to obstruct the possibilities to explore new potentials for Firm C2, and thus is affected by ambidextrous challenges (Chesbrough, 2010; Tushman & O'Reilly III, 1996). Both firms tend to have a relatively flexible organisation when making decisions regarding new ideas, but not optimal. However, it does not seem to be to the extent where the Structure and Decision subcategory appear as a barrier (Doz & Kosonen, 2010), for either of the firms. Organisational barriers, therefore, are present, and more prominent for Firm C1, compared to C2.

Resources & Capabilities

The following analysis is based on all theoretical resource and capability subcategories prioritising and distribution along with the skills and competencies.

Firm C1 emphasises that resource allocation towards new autonomous projects, run by few individuals, is an area which could be improved. However, there are more resources dedicated towards new ideas now compared to previously.

Regarding new Skills and Competencies, the opinions of the firms are aligned. Solar energy initiatives require a new set of competencies and a new way of thinking. Firm C1 states that it views itself as being a bit behind regarding acquiring skills necessary, compared to others in the industry. Firm C2 emphasises that it uses its partnerships to utilise its knowledge of solar PVs, but long-term it is necessary to acquire competencies in-house as well.

Firm C1 describes resources and capabilities as a barrier historically, but that it is starting to disappear. This statement aligns well with the literature, saying that new competencies are necessary to pursue solar energy projects, and that these are fundamentally different from conventional businesses (Guerra-Mota et al., 2018; Horváth & Szabó, 2018; Richter, 2013b). However, the development and acquirement of knowledge combined with the involvement in partnerships seem to have diminished the potential competence barrier. For Firm C1, where insufficient resources are allocated towards new initiatives, it could be posing as a barrier due to the more competitive setting for autonomous projects to receive resources (Burgelman, 1983). Therefore, resources and capabilities seem to be a barrier for Firm C1 with higher innovativeness, while not for Firm C2.

Business Environment

Both firms actively engage in partnerships with other actors in the business environment. The municipality and PV installation firms seem to be present for both. Further, Firm C1 is involved in broader long-term initiatives on a national level.

"We also engage in partnerships with four other retailers. A 'development cluster'." - Firm C1

Firm C2 states that the involvement is of long-term strategic nature. Regarding the decision-making process, neither of the firms expresses that it hinders them and thus is not acting as a barrier.

"We work with strategic partnerships to provide a complete solution for energy. We want to hold the customers' hand throughout the whole initiating process and the continuance of the customer relations." - Firm C2 regarding their strategic business customers

The trend of actors in the business environment is regarded differently. However, both agree that they are continuously monitoring the development. Firm C2 emphasis that a wide set of actors have emerged both within, and outside of, the electricity industry, while Firm C1 states that there are many small dishonest actors offering to install PVs.

The literature states that different kind of partnerships will have different beneficial effects, however, the best solution for specific cases is uncertain (Amit & Zott, 2002), which does not lead to any findings for the firms in Pair C. Nillesen et al. (2014) further explain that the specific business environment for the solar energy industry is still diffuse from multiple perspectives, which seems to be the experience of Firm C1 and C2 as well. Therefore, the data collected does not imply any findings related to whether the business environment is acting as a barrier or not.

Market & Value

Regarding the market and value category, analysis based on customer-centric and demand from the market will take place.

Both firms tend to involve the customer when developing the offerings, thus using a customer-centric approach. The opinions about the importance of customer relations seem, however, to differ between the firms. C1 wants long-term relations, since that is what the industry is shifting towards, while C2 wants to keep a distance.

"We want to avoid customer contact since it is exhausting." - Firm C2

Firm C1 states that the main demand for solar energy has previously been from a niche customer segment, but that it is now starting to expand to a broader customer base. Firm C2 agrees by saying that they are experiencing many inquiries about solar energy.

When discussing topics related to the complexity of the solar energy value proposition, neither of the firms emphasise that it has been hindering, rather the opposite.

Both firms seem to be using a customer-centric approach, which could be a barrier when developing new value offerings (Amit & Zott, 2002). However, Firm C2 does not want to keep the customer close, which is a choice of their own, and thus not a barrier. Further, neither experience any problems with finding an appropriate offer to match the customer demand (Girotra & Netessine, 2014; Richer, 2013b). Additionally, the potential higher complexity of the new segment (Nillesen et al., 2014) is not perceived by the firms. Therefore, the findings indicate that no relationship between innovativeness and market and value barriers exist, since no barriers are present in this category.

Awareness & Behavioural

Both firms in pair C have a positive approach towards solar. Additionally, Firm C2 sees it as a possibility although it, to some extent, is a threat towards the retailers since it decreases the demand for centralised production. Firm C1 explains that depending on what person in the firm is asked, different answers will be given regards the potential threat of solar. Neither of the firms consider this category as a barrier, since they both believe that spreading awareness of solar and its advantages will be beneficial for themselves.

The data suggest that both firms have the information necessary to be aware of the possibilities of the solar segment as a business area. Thus, the business logic for the firms does not discard information about new business models (Chesbrough, 2010). Additionally, neither of the firms have experienced any unawareness of solar energy from customers, which could have been posing as a barrier (Horváth & Szabó, 2018). Therefore, awareness factors do not pose as a barrier for either of the firms.

Financial & Political

When discussing the profitability of solar energy with the firms of Pair C, some similarities are noted. Both regard solar energy as profitable in itself, and do not see any challenges with the financial aspect. Further, the firms state that there are additional beneficial effects of offering solar energy as a product and service.

"Previously the price (for PVs) was quite high. Right now we gain benefits of packaging solutions to larger customers. We are 'picking low hanging fruits'." - Firm C2

When prioritising between initiatives and business opportunities, both state that the financial result is not the most important factor, as long as the returns are positive.

"The long-term deals are a so called 'double-dip', since the customers are locked to the firm in multiple ways." - Firm C1

Regarding the political factors, both seem to agree that they are affecting the solar energy business model. Both further mention a set of different political actions that help them to offer solar currently. However, they state that the political landscape creates a long-term insecurity. Firm C2 further explains that the political benefits are mainly focused toward private customers who demand small-scale solutions, rather than supporting large-scale business solutions. Firm C1 adds that the short term solar subsidies should be evaluated and changed in order to stabilise the industry.

"All political solutions are really good, but they do create an insecurity." - Firm C1

The findings clearly suggest that the financial aspects are not regarded as a barrier, since solar energy is appreciated to be profitable in itself, contrasting the literature stating otherwise (Horváth & Szabó, 2018; Richter, 2013a; Richter, 2013b). However, no indication of complete inclusion of costs is given by the firms, as suggested by Richter (2013a) in order to truly compete with conventional production.

Both firms are unified regarding the long-term insecurity imposed by the politics, which is in line with statements done by Aslani and Mohaghar (2013) as well as Horváth and Szabó (2018), and acts as a prominent barrier. Firm C1 further agrees to some extent that subsidies are too high (Huijben et al., 2016), which by the authors decrease incentives to be truly entrepreneurial. Therefore, the findings clearly show that the political landscape hinder the firms' possibilities to a stable inclusion of solar energy into their businesses.

Technological

The following analysis is based in all subcategories, new technology potential along with the uncertainties and risks, of the technological category.

Both firms see positively on the future potential of solar energy technology, as a complement to the existing energy system, but not as a substitute to conventional technologies. Further, C1 tends to have a slightly more problematic view of the technology when comparing the statements of the firms. C1 highlights the challenges of the sun needs to shine, the supportiveness of the grid and, once again, the need of a solution for storing the electricity. Firm C2's main concern is regarding the 30-year guarantee for solar PVs to be productive.

"Everything that is going on is positive for the solar photovoltaic development." - Firm C2

The barrier that could exist according to Chesbrough (2010) is that new technology does not receive enough attention nor resources. This, however, does not occur for the firms in Pair C. Firm C2 briefly mentions the quality assurance of the technology, which is highlighted in existing literature by (Aslani & Mohaghar, 2013). Additionally, C2 emphasises potential future challenges, which aligns well with research regarding solar energy technology (Engelken et al., 2016; Horváth & Szabó, 2018). Therefore, Technology as a barrier might be present for Firm C2, but is dependent on the future development. Thus, the findings are unclear for the relationship to innovativeness. For Firm C1 however, the technology does not seem to be hindering the business model innovation.

Further Remarks

Firm C1 states that Sweden is probably not the best-suited country for solar energy. This is however not due to the cold climate and potential absence of sun, but rather because of the nearly fossil-free energy mix in the electricity system.

4.2.3.2 Concluding Pair C

Analysing the third pair reveals the following findings. Firstly, as observed earlier, the category where Political is included is regarded as the most prominent barrier. Secondly, for market and value, awareness and behavioural and also mainly the technological category, no barriers were encountered or appreciated by either of the firms, as presented in Table 4.4 below. Thirdly, the business environment seems to be unclear for Pair C as well. Lastly, organisational barriers along with resources and capabilities barriers seem to be occurring as barriers during business model innovation for firms with high innovativeness, thus indicating a negative relationship.

Table 4.4 - Summary of categories regarded as barriers or non-barriers for firms in Pair C along with a potential relationship to innovativeness

	Firm C1	**Firm C2**	**Relationship to Innovativeness**
Organisational	Barrier	Non-Barrier	Yes - Negative
Resources and Capabilities	Barrier	Non-Barrier	Yes - Negative
Business Environment	-	-	-
Market and Value	Non-Barrier	Non-Barrier	No
Awareness and Behavioural	Non-Barrier	Non-Barrier	No
Financial and Political	Barrier	Barrier	No
Technological	-	Non-Barrier	-

Relating back to the solar business models, the difference was substantial. Both firms conducts energy controller through buying over-produced solar electricity from producers. However, Firm C1 additionally conducts the business models hassle free project, complementary revenue provider, value added service provider and large pv facility operator. With the substantial difference, no specific business model dimension was able to be isolated. However, for the organisational and resource barrier categories, where the relationship was established as negative to innovativeness, value architecture is the most prominent business model dimension, in line with observations from previous pairs.

4.2.4 Aggregated Pair Analysis

When summarising the findings from each analysed pair, regarding encountered barriers when innovating business models toward solar energy, there are a few remarks across the three studied pairs. The general findings are that organisational and political barriers seem to be occurring for most firms. Further, the categories resources and capabilities, awareness and behavioural along with technological do not seem to entail a challenge. The findings are summarised in Table 4.5 below.

Table 4.5 - Summary of categories regarded as barriers, non-barriers or unclear for either of the firms in the respective pairs

	Pair A		**Pair B**		**Pair C**	
	Firm A1	**Firm A2**	**Firm B1**	**Firm B2**	**Firm C1**	**Firm C2**
Organisational	Non-Barrier	Barrier	Barrier	Non-Barrier	Barrier	Non-Barrier
Resources and Capabilities	Non-Barrier	Non-Barrier	Non-Barrier	Non-Barrier	Barrier	Non-Barrier
Business Environment	Non-Barrier	-	-	-	-	-
Market and Value	Non-Barrier	Barrier	Barrier	Barrier	Non-Barrier	Non-Barrier
Awareness and Behavioural	Non-Barrier	Non-Barrier	Non-Barrier	Non-Barrier	Non-Barrier	Non-Barrier
Financial and Political	Barrier	Barrier	Barrier	Barrier	Barrier	Barrier
Technological	Non-Barrier	Non-Barrier	Non-Barrier	Non-Barrier	-	Non-Barrier

When studying the relationships between the barriers and the innovativeness of the firms, some tendencies could be observed. Neither of the categories with potential barriers show a positive relationship between innovativeness, as visualised in Table 4.6 below. Thus, high firm innovativeness does not imply absence of barriers when performing business model innovation towards solar energy.

Table 4.6 - Relationships between barriers and degree of innovativeness for analysed pairs

	Pair A	Pair B	Pair C
Organisational	Yes - Negative	Yes - Negative	Yes - Negative
Resources and Capabilities	No	No	Yes - Negative
Business Environment	-	-	-
Market and Value	Yes - Negative	No	No
Awareness and Behavioural	No	No	No
Financial and Political	No	No	No
Technological	No	No	-

However, the findings show a few themes across the analysed pairs. Firstly, the organisational category mainly suggests a negative relationship, i.e. that organisational barriers occur for firms with high innovativeness. Secondly, the findings propose that there is no relationship between financial and political along with awareness and behavioural and the degree of innovativeness. Thirdly, regarding the three categories of resources and capabilities, market and value as well as technological, the findings are uncertain. Lastly, the findings regarding the category for business environment show a clear pattern of the barrier impact being unclear, thus might be interesting to further research.

Having connected the perceived barriers to business model innovation to what business models the retailers conducted across the three pairs, a tendency can be observed. In two of the pairs, the main business model dimension was value architecture for the business models that differed between the compared retailers. In the third pair, a single business model dimension could not be isolated as the main difference. However, when additionally looking at the difference in what barriers the retailers perceive in all pairs, value architecture is the most prominent business model dimension that these barriers regard. This indicates that the value architecture dimension might be more important, or affect the possibility of performing business model innovation, when compared with the two other dimensions where business model innovation might take place. Therefore, the retailers which have been successful at innovating value architecture, generally see more barriers related to the same dimension.

4.3 Cross-Pair Reference Analysis

As described in Chapter Three, cross-pair reference analyses have been done with regard to ownership, size, geographical location, type of retailer and how firms define innovation. Of these, mainly ownership and size resulted in interesting findings and the following sections are therefore focused on these two factors.

4.3.1 Ownership

The type of ownership for the firms is either by municipality or by shareholders. The pure retailers included in the study are owned by shareholders and located in the middle region of Sweden. All other firms are owned by a municipality and are spread across the country. Firms owned by shareholders are regarded as more innovative and pursue a wider set of business models, as presented in the beginning of Chapter Four. Below follows a comparative analysis for each barrier category between shareholder owned firms, B1 and B2, and municipality owned firms, A1, A2, C1, C2 and D, see Table 3.2.

Organisational

The following analysis is based in the theoretical subcategories of structure and decisions along with the culture.

Municipality owned firms are not completely united in their experience of the organisational aspects, but there are some observable tendencies. Municipality owned retailers are involved in many activities along the value chain and have traditionally experienced a certain working environment which is far from, the more efficient environment present for shareholder owned retailers. Thus, it may have taken additional time for a more modern climate, such as using agile approaches, to reach municipality owned firms. The previous state of these retailers is described as frustrating and slow-paced. The shareholder owned firms think that there is room for employee creativity, however the high risk of electricity trading might restrain some autonomy, as described in Section 4.2.2.

"Not the slow large company of the municipality." - Firm B1

Having an agile approach to business model innovation is crucial for development and not becoming rigid (Doz & Kosonen, 2010). As the organisational aspects have affected several of the municipality owned firms negatively for long, it is regarded as a barrier. Shareholder owned firms are moving into new business areas through creativity, implying that promoting new ideas outside of the business scope does not pose a risk for restraining business ideas, as proposed by Burgelman (1983). Organisational barriers seem to be affecting municipality owned firms to a wider extent than shareholder owned, therefore indicating a potential relationship between the high innovativeness of the shareholder firms and the absence of organisational barriers.

Resources & Capabilities

The following analysis is based on all theoretical resource and capability subcategories of prioritising and distribution along with the skills and competencies.

Among the municipality owned firms, there is consensus of solar projects having received an increased proportion of resources over the last few years. However, there is a general sense of needing additional, not currently at hand, resources and capabilities. When discussing resources and capabilities with shareholder owned firms, a key challenge is managing the balance of allocation. However, they state entering the new area is not too demanding from a resource perspective, as mentioned in Section 4.2.2.

According to municipality owned firms, recruiting new employees and additional development of the current workforce is viewed as necessary to compete within the new solar segments. There are concerns of not being able to recruit younger generations, and how the impact will be on older employees.

Comparing the two subcategories of barriers regarding resources and capabilities, the municipality owned companies seem more concerned with the barrier of having access to the right skills and competencies (Engelken et al., 2016; Hargadon, 2015) than prioritising the resources available correctly (Chesbrough, 2010), which seems to be the main focus for shareholder owned firms. Barriers in this category are more prominent for firms owned by municipalities than shareholders, thus implying a potential relationship between encountered barriers and innovativeness.

Business Environment

Partnerships with municipalities, for firms owned by a municipality, have strategic implications on their businesses. The municipalities are often described as being able to make long-term commitments, which aids investments for sustainability. Many describe this circumstance to be an advantage, compared to shareholder owned firms, as profitability is not always the primary objective. However, municipality owned firms are required to make public procurements, which slows down the process of engaging in partnerships with new actors. Many firms add that the municipality can occasionally hinder new ventures.

Shareholder owned firms utilise their partnerships. They regard the installation of PVs as an important task to outsource, as presented in Section 4.2.2. They emphasise the importance of identifying partners that appear stable, since finding the right partners tends to be key in succeeding in the solar energy market.

It seems that all firms, regardless of ownership, might be involved in a wide variety of partnerships with potentially unaligned goals, thus the problem of collective action might be present (Glasmeier, 1991). The structure of the solar value chain to gain business possibilities is diffuse (Nillesen et al., 2014; Richter, 2013a). Whether the business environment acts as a barrier and subsequently the potential relationship to innovativeness is diffuse, as there are multiple messages across the ownership spectrum, and therefore also the innovativeness spectrum. The finding of retailers being positively supported in making long-term investments if they are owned by municipalities has not been identified in the literature.

Market & Value

The following analysis is based on the subcategories customer-centric and demand from the market.

According to most firms owned by a municipality, involving the customer is viewed as highly important when developing the offers. Solar is generally viewed as a means for creating long-term relationships with the customers and the development of the market for solar energy is viewed with optimism. Shareholder owned firms think that a major issue with the electricity industry is a general lack of connection between retailers and customers, but solar energy provides a means to improve loyalty among customers. Shareholder owned firms seem to struggle to identify an attractive value offering for their customers, which aligns with the common opinion from municipality owned firms stating that the complexity of developing the solar offers is difficult, as the value proposition might differ from customer to customer. Finding methods for reducing this complexity is emphasised by municipality owned firms as crucial for making solar more attractive.

The complexity in offering solar energy is well covered by Richter (2013a) and seems to apply for all firms regardless of ownership. Further, the need for identifying offers that fit more customers (Aslani & Mohaghar, 2013; Richter, 2013a) entails a barrier for all firms in this study. Therefore, barriers in this category are present, for all firms, and thus no relationship to innovativeness exists.

Awareness & Behavioural

When analysing this category for the municipality owned firms, no general trends were observed. Questions asked in this category may have been difficult to interpret. However, a general theme is present for shareholder owned firms, as described in Section 4.2.2, where the attitude towards solar energy is perceived as positive and does not pose as a threat. The firms state that they have been affected by previous decisions, thus indicating the potential risk of

path dependence (Tripsas, 1997) to be obstructing the incorporation of solar energy. However, this generalisation is fairly vague and thus it is unclear whether awareness and behavioural aspects are a barrier.

Financial & Political

All firms owned by a municipality agree that to initiate projects, the economic forecast needs to at least show some profit. The important role of current tax deductions in maintaining solar PVs attractiveness, is further shared by all. All firms additionally agree that the uncertainty of the political situation is a major issue when dealing with products that have long life cycles, such as solar PVs. The opinions of shareholder owned firms are divided, regarding the financial viability, thus no remarks are able to be made. They are, however, aware of the unstable political landscape as explained in Section 4.2.2.

Both groups are perceiving the political landscape as unstable, which aligns well with the literature that implies that political actions are both promoting and unstable at the same time (Aslani & Mohaghar, 2013; Horváth & Szabó, 2018; Huijben et al., 2016). Political barriers are considerable, as they create such uncertainty for long-term strategies. There is, however, no relationship to the degree of innovativeness, since the barrier exists for both firm groups.

Technological

The following analysis is based on the subcategory uncertainties and risks.

All municipality firms agree that the technological potential of solar energy is large. They are fairly alike in their perspective on what obstacles and challenges the technology has, such as storage possibilities in addition to further integrated panels. As all agree that solar panels have such growth possibilities, there are no indications of technology being a significant barrier. However, solutions such as batteries appear to be viewed as a factor deciding if solar energy can grow even more than currently, to be one of the bigger sources of energy. Thus, it is difficult to interpret whether technology is a barrier. As presented in Section 4.2.2, firms owned by shareholders both regard the potential of solar energy technology to be large, along with the shared concerns about the electricity storage challenge.

The uncertainty regarding the technological development and lack of commercial approaches for storing energy is found in previous studies (Aslani & Mohaghar, 2013; Richter, 2013a) and seems to be of a challenge for the firms in this study as well. However, the effect of this challenge is unclear and thus no finding of a prominent barrier can be made along with any clear relationship to business model innovativeness.

4.3.1.1 General Analysis of the Ownership Factor

To summarise, for companies owned by municipalities, barriers were perceived in the categories organisational, resources and capabilities, market and value, and financial and political, while the categories business environment, awareness and behavioural and technological were unclear. For shareholder owned companies, barriers were perceived in the categories market and value along with financial and political. The categories business environment, awareness and behavioural along with technological were perceived as unclear. Lastly, the categories organisational along with resources and capabilities were not perceived as barriers. The findings can be seen in Table 4.7 below.

Table 4.7 - Summary of categories regarded as barriers or non-barriers for firms grouped by ownership along with a potential relationship to innovativeness

	Municipality Owned	**Shareholder Owned**	**Relationship to Innovativeness**
Organisational	Barrier	Non-Barrier	Yes - Positive
Resources and Capabilities	Barrier	Non-Barrier	Yes - Positive
Business Environment	-	-	-
Market and Value	Barrier	Barrier	No
Awareness and Behavioural	-	-	-
Financial and Political	Barrier	Barrier	No
Technological	-	-	-

When comparing encountered barriers between firms owned by municipalities and shareholders, a couple of matters are noted. Firstly, companies owned by municipalities appear to face more barriers to business model innovation than privately owned companies, which was especially seen in the categories organisational along with resources and capabilities. Secondly, there were no barriers prominent for shareholder owned firms that were not present for municipality owned. Thirdly, the category financial and political is perceived as a barrier regardless of the type of ownership.

Findings made when relating the barriers of the group of firms with regard to the groups' general innovativeness, as seen in Table 4.7 Indicating that there might be a possible relationship between high innovativeness and absence of barriers for the categories organisational along with resources and capabilities, and additionally no relationship for market and value along with financial and political. However, these relationships were not present during any of the pairwise comparisons, implying that the relationships between innovativeness and barriers to business model innovation might be founded in other factors, such as the type of ownership.

Noteworthy is that for the firms owned by a municipality, all out of the seven categories, where potential barriers could exist, are either regarded as a barrier or unclear. Consequently, none of the categories was labelled as a non-barrier. Hence, municipality owned firms seem to encounter barriers in a wider range of categories compared to shareholder owned firms.

4.3.2 Size of the Firm

The number of customers for each retailer in this study has differed. Comparing the collected data with regard to the size of the firm will be done in the following section. Firms are considered to be small if their customer base consists of less than 100,000, and consequently large if they exceed this limit. The large firms consist of A1, A2, B1 and B2, and the small of C1, C2 and D, as presented in Table 3.2. Generally, the firms of larger size are regarded as more innovative compared to the smaller firms. The pure retailers included in the study belong to the group of large firms. Both groups consist of firms with a wide geographic scope, with a tendency for the larger firms to be located further south. Firms of large size pursue a wider set of business models, as presented at the beginning of Chapter Four. For each category of barriers, a comparative analysis between large and small firms will follow.

Organisational

The following analysis is based on the theoretical subcategories of ambidexterity, structure and decisions along with the organisational culture.

All large firms generally have an open culture regarding who people can speak to. Most firms are quick to move from decision to initiate change, about one month's time. The large firms in the study consider organisational barriers differently. Half say that they do not exist, that change is promoted and the firms are responsible for the change, while the other half state that the organisation, including its owner's organisation, is hindering.

Historically, the culture seems to have been inadequate for small firms. However, during the later years, structural changes and new initiatives have been put in place to enhance the culture. Generally, for small firms, the speed to a decision is relatively short, but most firms still indicate that there is room for improvement, for example, compared to a start-up environment.

Richter (2013b) states that upper management favour conventional projects compared to renewable due to organisational culture, which might have been the case for small firms up until recently. The changes have however strengthened the culture to favour solar energy projects instead. Regarding the larger firms, their general experience of a creative business climate for exploring new business ideas speaks against the barrier of individuals not sharing potential opportunities through deeper revelations (Doz & Kosonen, 2010). However, two of the large firms do not state that they have a creative climate.

These two findings along with relatively short time span for decision-making imply that both large and small firms possess a relatively agile and flexible organisation (Chesbrough, 2010; Girotra & Netessine, 2014), which impose a negligent barrier. Therefore, historically the smaller firms' organisation might have been posing as a barrier, however, the opinions are divided in addition to the unclear theoretical foundation. The barrier category is diffuse for large firms as well. Hence, no findings regarding the relationship to innovativeness were made.

Resources & Capabilities

The following analysis is based on all theoretical resource and capability subcategories of prioritising and distribution along with the skills and competencies, which is in the main focus.

The types of competencies that are required vary substantially for large firms, in addition to how these are acquired and where in the organisation these new competencies belong. Opinions regarding if new competencies are required, are not equal. These differ for IT, sales and more technical competencies. The acquisition is performed in different ways, all from developing in-house, using partnerships or simply by external recruiting. Generally, large firms consider that

they have the necessary competencies and do not consider resources and capabilities, in general, as a barrier.

In contrast, to acquire and utilise the right competencies seems to fairly difficult for most small firms. The industry is undergoing a transition where the old meets the new, both regarding resources and capabilities. When discussing this topic, one firm said the following in regard to competencies:

"It will be one of the biggest challenges for small firms in smaller cities."

This firm perceived it as harder to attract the younger generation than the old.

The theory does not mention anything about acquiring competencies from different generations. However, literature shows that the skills needed for deploying solar energy electricity systems differ from the conventional activities (Horváth & Szabó, 2018; Richter, 2013b). It seems that this poses as a challenge for most small firms, which could be derived from younger potential employees find it less attractive to work for a small firm in a smaller town.

The large firms, however, have acquired their required skills in their own way, thus preventing the barrier of lacking the right people with the right skills and competencies (Aslani & Mohaghar, 2013; Engelken et al., 2016; Guerra-Mota et al., 2018; Richter, 2013a).

Therefore, large firms do not encounter a barrier, and smaller firms do, when it comes to resources and capabilities. This implies a positive relationship to innovativeness, since large firms are more innovative.

Business Environment

For the large firms, the type of partnerships differs in addition to the degree of involvement, all from operational to strategic. When it comes to partnerships with firms that install and provide PV solutions for households and companies, most retailers have chosen to exclude a set of actors, focusing on a small set of partners for long-term relationships and avoiding small local pop-up actors. All large firms mention that earlier decisions in the industry have affected the way business is conducted, but at the same time state that the business environment has not been acting as a barrier. A few are more careful, saying that the rapid change in actors is limiting partnerships, although many state that partnerships are key to success. The general theme seems to be that the business environment for large firms in solar energy is still undefined, thus yet to be determined.

The tendency for small firms in the study is to be involved with a fixed, fairly limited, set of actors for installation of solar PVs. Further, the partnerships are rather on a strategic level than an operational. Regarding the business environment, small firms seem to be affected by their partnerships when it comes to decisions, which has acted hindering when wanting to take a large leap towards solar energy.

The PV installer partnerships seem to be of a particular character for the large firms, not including the wide variety of upcoming actors. When innovation is underway, room for smaller actors with new offerings emerge (Guerra-Mota et al., 2018). The choice by the large firms to exclude most of the installers could be hindering in the long run, depending on how the business environment will develop. This seems to be unclear according to the large firms, in line with the existing literature (Nillesen et al., 2014; Richter, 2013a). What the small firms are experiencing could be related to the concept of collective action problems as explained by Glasmeier (1991), since the involvement with other actors is affecting the possibilities to move on solar energy opportunities.

Therefore, the business environment does not seem to be a barrier for large firms, but it appears to be so for small firms. This indicates a positive relationship between business environment barriers and business model innovativeness.

Market & Value

The following analysis is based on all subcategories of the market and value category: customer-centric, demand from the market and effectuation,

In general, large firms are acting in somewhat different customer segments. However, there is a resemblance between the large firms regarding the involvement of customers. All large firms agree that the involvement of the customer and the closeness of the relationship, to gain a green image reputation, are advantages with the solar energy segment compared to conventional offerings. Customer involvement is a substantial part for small firms as well, otherwise, they will not be market competitive. Opinions are unified that customer relations are moving toward being more long-term oriented, and that business is conducted differently as the industry becomes more sustainable. This has probably been the reason behind the notice of increased demand and attractiveness to offer solar energy for small firms. Most firms, regardless of size, state that the solar energy segment is a stable market with rapid growth. Additionally, all recognise the market as attractive and want to increase their market share. Firm B1 has a positive attitude towards the markets future development.

"Micro-production will be substantial in ten years' time" - Firm B1

For large and small firms, the complexity seems to be related to the type of market segment, or what product or service is offered. Some firms state that the complexity, in general, is high, some low. Creation of value propositions can come from a set of perspectives, such as the servitization of solar offerings, create long-term relationships, to deliver a complete solution or have the same vision as Firm B1.

"We want to be the Tesla of retail electricity agreements." - Firm B1

Interestingly, all small firms agree that the new value offering, for solar energy to future market segments, is different from the conventional offering. The large firms do not consider the market, customer or value offering as a potential barrier for innovating their business model to include more solar energy.

Blansfield and Jones (2014) state that the market for solar energy is under constant change, giving rise to complexity, which is aligned with the small firms' opinions since the value offering is different for solar energy proposals. However, the complexity is not regarded as a barrier by the firms. This absence of a barrier might be related to the stable market and unceasing demand, gaining incentives to invest in solar energy which depend on the long-term relationship with the customer (Richter, 2013b). Therefore, the market, customers and the value proposal does not entail any significant challenges for small firms.

The value offerings are not considered to be complex in general. Yet, the literature suggests that the value creation nature, for solar energy offerings, is both complex and uncertain (Aslani & Mohaghar, 2013; Richter, 2013a; Richer, 2013b). It is interesting that there is little unity from the firm groups regarding what the value proposition should be, how it will be created and how the value chain will be composed. This is, in contrast to the firms' perception of the value offering complexity, aligned with the current literature (Nillesen et al., 2014; Richter, 2013a).

Involving customers when creating new businesses is perceived as important and the information gained from the market seems to have helped all firms in developing more

attractive and less complex value offerings, thus effectuation (Guerra-Mota et al., 2018; Sioshansi, 2014) has not been considered a barrier for either group.

The market, customers and value proposition, in general, might be regarded as a barrier with its diffuse and complex solar energy environment. However, most firms, regardless of size, seem to have avoided this barrier by focusing efforts on specific market segments, products or services, with a certain set of customers and related value proposals to reduce complexity.

Awareness & Behavioural

Larger firms seem to generally have a positive attitude towards solar energy, but opinions are divided regarding if they perceive solar as a threat. Some small firms regarded solar as a threat in the past, but not anymore.

Some small firms are mentioning customer awareness as a contributing factor, while one firm states that customers only want simplicity. In contrast, larger firms state that by being more aware of the potential benefits of solar, the value of solar energy is increased for customers. Besides, there is the bonus of higher appreciation for green and sustainable electricity retailers. None of the large firms regard awareness as a barrier, rather as a driver since sustainability awareness could be a temporary competitive advantage.

If solar is a threat or not seems to be a difficult question, both for firms and for the existing literature (Richter, 2013a). The lack of information to be aware of the changes and opportunities that are occurring in the industry is a challenge in itself (Chesbrough, 2010), not being able to act as a consequence of blindness or absence of information (Aslani & Mohaghar, 2013; Chesbrough, 2010; Guerra-Mota et al., 2018; Richter, 2013a; Sioshansi, 2014).

The awareness and behavioural category does not pose as a barrier according to large firms, however, if it has been a barrier for small firms is yet undefined

Financial & Political

Regarding the profitability for the solar projects of the large firms, the opinions differ. If compared to conventional technology, solar is less profitable, but most are still under the impression that it gives a positive return on investment. In contrast, small firms are stating that solar is financially viable and that there does not seem to be any lack of financial incentives for investing in solar.

Literature state that small renewable projects get less priority due less profitability potential compared to conventional projects (Richter, 2013a). Retailers in this study, however, seem to have other opinions, some agree compared to conventional projects, some regard solar as profitable standalone, and thus does not inflict a barrier, especially for small firms.

A theme for firms regardless of size, is that they all consider the political landscape as a prominent barrier. Some larger firms even state that it is the largest barrier of all. Small firms agree that the political actions are helping the financial viability, however, these are only considered to be helpful in the present. To change the industry towards more solar, long-term actions and political incentives must be present according to all, which they do not believe is the case as of now.

Huijben et al. (2016) state that firms in the renewable energy industry hold a flexible approach to benefit from future political initiatives, which could affect the attitude of retailers toward the political landscape. This might be related to the barrier caused by the absence of long-term political initiatives to secure the segment, as proposed by Aslani and Mohaghar (2013). Therefore, financial factors do not seem to be hindering for small firms, but might be for large

firms. However, the political long-term security seems, once again, to be a major challenge for all firms regardless of size. This implies the absence of a relationship, since there are few differences related to innovativeness.

Technological

The following analysis is based in all subcategories, new technology potential along with the uncertainties and risks, of the technological category.

All firms are unified that the technology for solar energy production, that is the PVs, is not acting as a barrier. The small firms elaborate this statement by considering the potential for solar energy to be great, and it is only a matter of time before solar energy will be a substantial part in the electricity system of the future.

"The potential for solar energy is astonishing if the battery storage technology will be developed further." - Firm B1

Most firms, regardless of size, debate regarding the technological development of energy storage possibilities, and more specifically electricity storage in batteries. This is appreciated to be the largest technological barrier for solar energy, but also for the electricity industry in general. Small firms further highlight the challenges of integrating solar into the current processes and electricity system.

The opinions tend to be that solar will be a substantial technology. However, it might not outperform or replace the current technologies, as proposed by Christensen (2000) for disruptive innovations, but rather be a complement to some of the conventional technologies. The firms imply that solar technology is regarded as high performing, and thus, do not consider solar technology in itself as a barrier. However, surrounding technologies might be a critical barrier to the future potential and deployment of solar energy. The retailers' opinions, especially for large firms, seem to be aligned with the current literature regarding the difficulties of storing electricity in batteries (Aslani & Mohaghar, 2013), and the related high costs of doing so (Engelken et al., 2016). Therefore, the technological development of batteries could create a barrier, mainly for large retailers, for solar energy in the long run, depending on future development. If this applies for small firms as well, the findings do not state, and the technological category is therefore unclear, along with the potential relationship to innovativeness.

4.3.2.1 General Analysis of the Size Factor

Findings revealed by studying large firms differ from findings noted for small firms. For firms with a large customer base, political and technological categories seem to be the most prominent barriers when innovating the business model. Further, resources and capabilities, market and value, business environment along with the category for awareness and behavioural do not seem to imply a barrier. Findings regarding organisational barriers seem to be unclear.

Summarising the findings for the small firms reveals that the resources and capabilities, business environment and the long-term political landscape act as barriers. Further, market and value, financial and solar technology in itself have not been barriers. However, the technological category, in general, is unclear, since the surrounding technologies supporting the increase in solar energy is unsure. Small firms regard the organisational barriers and the awareness and behavioural barriers as unclear.

Table 4.8 - Summary of categories regarded as barriers or non-barriers along with relationship to innovativeness for firms grouped by size

	Large Firms	Small Firms	Relationship to Innovativeness
Organisational	-	-	-
Resources and Capabilities	Non-Barrier	Barrier	Yes - Positive
Business Environment	Non-Barrier	Barrier	Yes - Positive
Market and Value	Non-Barrier	Non-Barrier	No
Awareness and Behavioural	Non-Barrier	-	-
Financial and Political	- / Barrier	Non-Barrier / Barrier	No
Technological	Barrier	-	-

When comparing the findings from analysing large and small firm respectively, Table 4.8, interesting tendencies are revealed. Firstly, the political landscape seems to be hindering regardless of the size of the firm, especially the long-term stability since the current financial viability is accepted. Secondly, the effect that the organisational barriers has on business model innovation depending on the size of the firm seems unclear, since no definitive findings have been made for each group. Lastly, the major difference in the findings between small and large firms is that resources and capabilities and the business environment tend to be distinctive barriers for small firms since the same barriers are non-existent for large firms. This indicates a relationship to innovativeness for those categories, since large firms were found to be more innovative in this study, and do not face barriers in the mentioned categories, apart from small firms. However, these relationships between encountered barriers and innovativeness are not definitive, since the presence of relationships were diffuse when isolating other factors apart from innovativeness during the pairwise analysis. Therefore, the findings imply that other factors, apart from innovativeness, could be related to the barriers that firms face, and possibly overcome, when performing business model innovation towards the broader inclusion of solar energy.

4.3.3 Concluding Cross-Pair Analysis

When not isolating the factor of innovativeness, some interesting trends were found. The difference in occurrence for the different labels: barrier, non-barrier and unclear, based on the kind of ownership and size of the firm seems to follow the same trend. Firms owned by shareholders or of larger size perceive fewer categories as barriers compared to municipality owned or smaller firms respectively. Additionally, firms owned by shareholders or those of larger size perceive more categories as non-barriers compared to municipality owned or smaller firms. Therefore, it is an indication of potential relationships between factors, other than innovativeness, and barriers to business model innovation when incorporating the solar energy segment.

5 Discussion

All results considered, it is difficult to make any general conclusions regarding the relationship between business model innovativeness and barriers to business model innovation. The data does not suggest that having more barriers to business model innovation implies a lower business model innovativeness, which may have been an intuitive hypothesis of the study. The general relationship between the two factors rather seems to be slightly negative. Additionally, looking further into the business model dimensions that are related to both innovativeness and barriers, one dimension was found to have the highest importance. Value architecture was most prevalent dimension, out of the three presented in Chapter 2, as the difference between the firms in the compared pairs, regarding both barriers and conducted business models. The findings could imply that companies who have successfully innovated business models in the value architecture dimension become aware of its difficulties, and subsequently perceive related categories as barriers. The slightly negative relationship between the two examined factors will be explored further below. Firstly, however, there are certain categories of barriers to business model innovation where interesting tendencies can be observed.

The role of partnerships appears to be crucial for retailers entering the solar segment. Resources and capabilities were mostly perceived as non-barriers in the pair comparisons. Many retailers regarded it as a non-barrier, since acquiring all necessities through partnerships and outsourcing to other firms, were not seen as difficult. How the relationship will develop between these actors in the industry remains to be seen. The current approach means that retailers can keep focusing their attention to their main area of business, but it could, however, be unfavourable if current partners would find methods of circumventing the retailers' position of being the channel to the customer in the value chain. Relevant to this issue, the enquiry of the business environment category showed that many retailers had few dedicated employees for working with solar energy. The observations indicate how valuable partnerships may be for utilities, which is in line with the findings of Richter (2013a).

Organisational aspects had highly cohesive data over the pairs as a barrier to business model innovation. As innovation often is connected to well-functioning organisational culture (Maier, 2015; Tushman & O'Reilly III, 1996), organisational barriers for innovation seems logical. However, it is interesting that retailers with high innovativeness are more prone to view it as such, implying a negative relationship with business model innovativeness. It could be that those companies have had to confront these issues in order to perform change, and therefore are acquainted with the related challenges. Organisational barriers were often referred to as employees being less inclined to entering renewable segments or adapting to e.g. agile working approaches. However, as the retailers generally gain experience and become accustomed to the solar segment, one could imagine organisational barriers would be reduced over time across the industry.

No clear connections could be made between barriers and business model innovativeness. However, financial and political barriers seem to be one of the most prominent categories for firms in general. Regarding its first component, many firms seem to regard solar as less financially attractive than many other options but decide to develop solar business models regardless, due to other benefits that follow. Hence, it seems to be a barrier, although overcomable. Political aspects are regarded as a major risk for the retailers, as the subsidies still are fundamental in making the offers commercially attractive. Although Sweden has relatively clear directions regarding the development of the energy sector, it appears that retailers perceive the political support uncertain enough to regard it as one of their largest barriers. Promises of further long-term political support would likely reduce this barrier, but

excessive subsidies would additionally result in a less effective energy system, a trade-off which politicians will have to continue to consider.

As the positive relationship between business model innovativeness and barriers to business model innovation appeared to be uncertain, another potential relationship for evaluation emerged. Overcoming barriers to business model innovation, i.e. reaching Business Model B, could be related to the level of business model innovativeness, and is recommended for further research to increase the knowledge of how certain companies are able to adapt and innovate their business models repeatedly while others do not.

Barriers to business model innovation seem to be related to other factors than business model innovativeness, which resulted in a set of more distinctive patterns emerging. Municipality owned retailers appear to face more barriers to business model innovation than shareholder owned retailers. The aspects that come with working in a municipality owned retailer, such as having a large scope of activities and having to make public procurements, seem meaningful, and could be the reason for them seeing additional difficulties in acquiring the right capabilities or adapting value propositions to the market. Their type of ownership seems to create opportunities for long-term sustainability investments, but in some cases additionally reduce autonomy and cause rigidness. It is difficult to conclude what the effect of type of ownership could be on the future retailer industry. The municipality owned retailers' particular starting position, appear to cause additional barriers when innovating their business models for the solar segment. If overcoming these, municipality retailers may have a substantial advantage in the solar segment due to other distinctive qualities described above, compared to shareholder owned.

Comparing small retailers to large retailers additionally gave interesting results, as the compared groups differed in which categories they perceived as barriers. For example, small retailers perceived resources and capabilities as a barrier. This could be due to small retailers being generally situated in smaller towns, which perhaps do not hold the same competencies as bigger cities. Additionally, the new generation of younger academics may be difficult to appeal to, compared to retailers in larger cities, since this is not regarded as a barrier for large retailers within larger cities. As the largest retailers in Sweden have not agreed to participate in the study, their information could aid in further investigating whether this is the case. Small retailers additionally, conversely to large retailers, perceived business environment as a barrier, which may be explained by that larger companies might have a more powerful position, due to their size, when drawing up contracts with partners. As the business environment was perceived as a critical aspect of entering the solar segment, small retailers may subsequently have difficulties to successfully compete against large retailers, due to the fact that they seem to face more barriers to business model innovation than large retailers.

That firm ownership and firm size showed indication of a potential relationship with barriers to business model innovation suggest that there may be more factors related to these barriers. Further studies on the topic could confirm these initial findings of these factors and additionally investigate how other firm attributes are related to certain categories of barriers to business model innovation.

Looking back at the broad picture, there is a slight tendency of companies with higher business model innovativeness being affected by more barriers to business model innovation. This again raises the question of the relationship between business model innovation and its barriers and whether barriers perceived by a company is inherently negative. We propose that a possible explanation for these findings is that barrier categories could be classified into groups according to the following model, visualised in Figure 5.1.

1. Barriers that are common for highly innovative companies and uncommon for less innovative companies.
    - The presence of barriers in this group could be explained by a potential relationship between the innovativeness of firms and the possibility to overcome barriers.
    - Barriers encountered and overcome by firms with high innovativeness could be explained by that they have become aware of the barrier after succeeding to reach Business Model B.
    - Firms with lower innovativeness may, however, never have encountered these barriers. If the firm has never reached Business Model B, there is a risk of never encountering barriers in this group, that might occur during the process. However, if encountering a barrier, the potential of overcoming it could be low for less innovative firms.

2. Barriers that are common for less innovative companies, uncommon for innovative companies.
    - Probably is a barrier which all may not confront. These are likely difficult to overcome if encountered, often resulting in companies not reaching Business Model B, if the companies have low innovativeness. However, firms with high innovativeness would most probably reach Business Model B.

3. Barriers that are common for companies regardless of the degree of innovativeness.
    - Barriers placed in this group probably occur as a consequence of external factors. These external factors may be of such nature that they are not influenceable by the firms. For example, political initiatives.
    - The occurrence of these barriers may also depend on other internal factors other than innovativeness, such as the size of the firm or the ownership structure.

4. Barriers that are uncommon for companies regardless of the degree of innovativeness.
    - These barriers have not occurred to the same extent as other potential barriers and are therefore difficult to analyse. They could be explained by the same scenarios as explained in group three. However, it is difficult to say whether they are barriers or not. Further research is required to understand these.

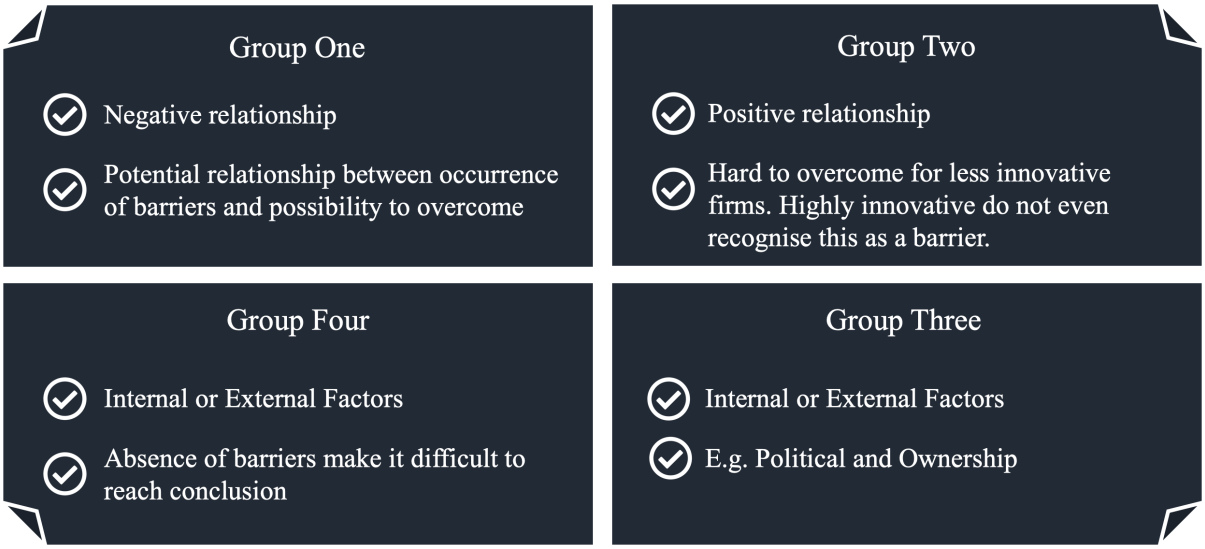

Figure 5.1 - Proposed model for classifying different barriers to business model innovation into different groups

6 Conclusion & Implications

The purpose of this report was to inquire whether there is a relationship between business model innovativeness and barriers to business model innovation. This relationship was explored in the context of electricity retailers and the emergence of solar cells.

There neither seems to be a direct nor clear relationship between the degree of business model innovativeness and barriers to business model innovation that firms face when moving into solar business areas. For certain categories of potential barriers or dimensions of the business model, the relationship to innovativeness was more coherent than others.

Further, when analysing the findings based on innovativeness, a relationship between high firm innovativeness and the ability to overcome barriers is suggested, and consequently, low firm innovativeness and inability to overcome and learn from encountered barriers.

Additionally, when aiming attention at the dimensions of business models (Spieth & Schneider, 2016), value architecture was an important difference in the pair analyses regarding both the firms' business model innovativeness and barriers to business model innovation.

Moreover, when analysing the findings of barriers, there might exist other relationships than to innovativeness. The findings hint that there could be a relationship between barriers in certain categories and either the size of the firm or the kind of ownership. It seems probable that there exist further relationships between barriers and other attributes of firms. With these findings in mind, a new model for grouping of barriers to business model innovation is suggested.

Implications for Swedish policymakers is to stimulate the long-term security for solar energy if they wish the segment to continue to grow, instead of focussing on short-term actions to secure the current financial viability which tend to disappear if no further political incentives are given. If new actions are put in place the possibilities of firms to move forward towards new territory, for a more sustainable society without risking the welfare of their company, could be enhanced.

Suggested areas for further research are fourfold. First, the proposed model in the discussion can provide deeper understanding of the diffuse relationship between innovativeness and barriers. By applying the model when studying barriers to business model innovation, a classification of barriers to the four groups can be made to further understand their effect on business model innovation. Second, the findings propose that there might be a relationship between innovativeness of the firm and the ability to overcome barriers. By viewing barriers as objects which either block innovation or are overcome, the procedure of overcoming them should be equally valuable to study. By assessing this aspect, additional understanding of the differences between companies with high and low business model innovativeness could be established. Third, by studying further into the business model dimensions' effect on business model innovation, knowledge could be obtained regarding why value architecture seems to have such a crucial role. Fourth and last, findings indicate a possible relationship between barriers to business model innovation and other factors, such as firm size and ownership structure. As these factors were not part of the initial scope of the study, further research could elaborate upon these potential relationships and additionally examine other factors. This would broaden the field of literature regarding when barriers are encountered when performing business model innovation. Either of these four areas could be of substantial value for the field of business model innovation literature.

Implications for electricity retail managers comprise knowledge regarding which categories of potential barriers that are most prominent, and which that are not. These seem to depend on the attributes of the firm, such as the size or type of ownership, or other similarities with the

analysed pairs. This knowledge will hopefully guide managers to improve the rate of successful business model innovation towards more solar energy in the industry.

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Appendices

Appendix A - Utility business models and innovativeness ranking

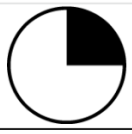
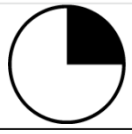
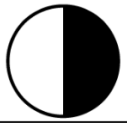
Alias	Producer of Electricity	Hassle Free Project	Complementary revenue provider	Value added service provider	Construction and installation service provider	Large PV facility operator	Energy Controller	Innovation index
N/A	Yes							6.83
N/A	Yes							6.83
Firm C1	Yes							6.83
N/A	Yes							6.83
N/A	Yes							6.83
Firm B1	No							5.67
N/A	Yes							5.46
N/A	Yes							5.46
N/A	Yes							5.46
Firm A2	Yes							4.69
N/A	Yes							4.29
Firm B2	No							4.29
N/A	Yes							4.29
N/A	Yes							4.29
N/A	Yes							4.29
N/A	Yes							4.29
N/A	No							4.29
N/A	Yes							4.29
N/A	No							4.29
N/A	Yes							4.29
N/A	No							4.29
N/A	Yes							3.56
Firm A1	Yes							2.15
N/A	No							2.15

N/A	No							1.02
N/A	No							1.02
N/A	Yes							1.02
Firm D	Yes							1.02
Firm C2	Yes							1.02
N/A	No							0.00

Appendix B - Appraising innovativeness of Solar Business Models

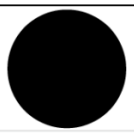
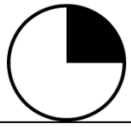
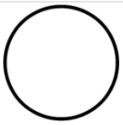
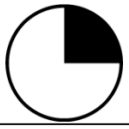
Appendix B:1 - Producing Retailers

	Value Offering			Value Architecture				Revenue Model	
	Target customers	Positioning	Product service Offering	Core competencies and resources	Internal value creation	External value creation	Distribution	Logic of earnings	Logic of costs
Hassle Free Project	0.5	0.25	1	0.25	0.5	1	0.5	1	1
Complementary Revenue Provider	0.25	0.25	0.25	0.5	0.5	1	0.5	0.5	0.5
Value added service provider	0.25	0.25	0.25	0.75	0.25	0.25	0.25	0.5	0.5
Construction and installation service provider	0.5	0.5	1	0.75	0.75	0.75	0.5	1	1
Large PV Facility Operator	0.5	0.25	0.5	1	0.5	0.25	0.25	0	0.5
Energy Controller	0.5	0	0.5	0.25	0.25	0.25	0	0.5	0.5

	Value Offering - Target customers - Positioning - Product service offering	**Value Architecture** - Core competencies and re - Internal value creation - External value creation - Distribution	**Revenue Model** - Logic of earnings - Logic of costs	Sum
Hassle Free Project	 0.58	 0.56	 1.00	2.15
Complementary Revenue Provider	 0.25	 0.63	 0.50	1.38
Value added service provider	 0.25	 0.38	 0.50	1.13
Construction and installation service provider	 0.67	 0.69	 1.00	2.35
Large PV Facility Operator	 0.42	 0.50	 0.25	1.17
Energy Controller	 0.33	 0.19	 0.50	1.02

Appendix B:2 - Pure Retailers

	Value Offering			Value Architecture				Revenue Model	
	Target customers	Positioning	Product service Offering	Core competencies and resources	Internal value creation	External value creation	Distribution	Logic of earnings	Logic of costs
Hassle Free Project	0.5	0.25	1	0.25	0.5	1	0.5	1	1
Complementary Revenue Provider	0.25	0.25	0.25	0.5	0.5	1	0.5	0.5	0.5
Value added service provider	0.25	0.25	0.25	0.75	0.25	0.25	0.25	0.5	0.5
Construction and installation service provider	0.5	0.5	1	1	1	1	1	1	1
Large PV Facility Operator	0.5	0.5	0.5	1	1	1	0.75	1	1
Energy Controller	0.5	0	0.5	0.25	0.25	0.25	0	0.5	0.5

	Value Offering - Target customers - Positioning - Product service offering	**Value Architecture** - Core competencies and re - Internal value creation - External value creation - Distribution	**Revenue Model** - Logic of earnings - Logic of costs	Summa
Hassle Free Project	 0.58	 0.56	 1.00	2.15
Complementary Revenue Provider	 0.25	 0.63	 0.50	1.38
Value added service provider	 0.25	 0.38	 0.50	1.13
Construction and installation service provider	 0.67	 1.00	 1.00	2.67
Large PV Facility Operator	 0.50	 0.94	 1.00	2.44
Energy Controller	 0.33	 0.19	 0.50	1.02

Producing retailers	**Value Offering**	**Value Architecture**	**Revenue Model**	**Total**
Hassle Free Project	0.58 - Although solar panels ultimately provide electricity, the product and target customers differ from a regular electricity deal	0.56 - Does not require substantial internal competencies but a reliance on external value creation	1.00 - Typically a large one-time earning, vastly different from a typical electricity monthly plan	2.15
Complementary Revenue Provider	0.25 - As ownership of solar cells is no longer included in the product, the value offering differs slightly less compared to hassle free project	0.63 - Except for additional competencies for building the slightly more advanced financial model compared to hassle free project, the value architecture is similar	0.50 - The revenue model of Complementary Revenue Provider is more conventional with regular payments	1.38
Value Added Service Operator	0.25 - The value of this business model in providing guidance in decision-making regarding solar cells. No too dissimilar to customer-service, which utilities normally have	0.38 - Besides acquiring solar knowledge and competencies for aiding customers, the value architecture is not necessarily that different from existing activities	0.50 - Business models in this category may vary regarding revenue model, from being offered free to costing high consultant fees.	1.13
Construction and Installation Service Provider	0.67 - The value offering of an installation differs substantially from conventional utility activities	0.69 - Several new competencies are likely required, the value creation is contrasting the typical activities of utilities	1.00 - Payments and costs per project rather than on monthly basis results in a high dissimilarity	2.35

Large PV Facility Operator	0.42 - Although already offering power from other power plants, the value offering from solar parks is slightly different in terms of target customers and the selling point of renewable energy	0.50 - Would require high competencies for building and maintaining the solar park. Otherwise, the creation of value is similar to other generation of electricity	0.25 - Logic of revenues is the same as for other power plants while the logic of costs differs	1.17
Energy Controller	0.33 - Buying electricity is already commonplace for utilities, but the target customers are different for the solar equivalence	0.19 - As it is similar to what many utilities already do, achieving the value architecture is, relative to other business models, fairly simple	0.38 - As utilities often offer premium prices for overproduced solar electricity, the revenue model is slightly different compared to buying from e.g. Nord Pool.	1.02

Differing categories for pure retailers	**Value Offering**	**Value Architecture**	**Revenue Model**	**Total**
Construction and Installation Service Provider	0.67 - The value offering of an installation differs substantially from conventional utility activities	**1.00 - The value architecture for non-producers requires even more innovation for this business model, as they do not have experience in building or maintaining any power plants.**	1.00 - Payments and costs per project rather than on monthly basis results in a high dissimilarity	2.67
Large PV Facility Operator	**0.5 - The value offering of having a Solar Park would imply a higher degree of positioning for utilities that previously did not produce electricity**	**0.94 - The innovation of value architecture is considerably higher for utilities with no experience of producing electricity**	**1.00 - With no producer-experience, both logic of revenues and costs would require new business rationale to be developed**	2.44

Appendix C - Final template for interviewing energy producers and traders active in the Swedish market

Interview Template

Introduction

- Hi, **NAME** and **TITLE**
- We perform this interview with the purpose of identifying what challenges exist in the Swedish electricity market when performing business model innovation. With a focus on electricity traders and producers shift towards solar energy.
- We will preserve your full anonymity. Your firm will be denoted with an alias similar to *Firm X.* This will also help us keep bias out of the analysed results.
- Is it fine for us to record this interview?
- We would also want to get confirmation from you that the topics discussed during this interview can be included in our data collection for analysis as part of our Master Thesis at Chalmers University of Technology. Is this OK?

Questions Regarding Categorisation and Index for Innovativeness

1. **Producer of Electricity**
    a. Do you produce any electricity on your own? **Yes / No**
        i. How much?
        ii. Is this a core business for your firm?
2. **Hassle Free Project**
    a. Do you provide solar PV packages for installation to your customers?
3. **Complementary Revenue Provider**
    a. Do you offer customers to utilise solar energy through leasing or collective owning of solar energy park?
    b. Are you involved as support in the potential customers process for decision-making / paperwork / financing?
    c. Are you responsible for maintenance of any large-scale solar energy park where you are not owners?
4. **Construction and Installation Provider**
    a. Do you perform the physical installation of solar PVs?
5. **Large PV Facility Operator**
    a. Do you have ownership of any large-scale solar production system?
        i. What is the effect? (KW/MW)
6. **Energy Controller**
    a. Do you utilise fluctuations in solar energy production in any way? For example, purchasing the overproduction micro-producers?

Regarding the Business Models that you are **not** currently pursuing - Have you considered investing in these?

1. Why did / did not investment take place?
2. Why have you not considered the other Business Models?

When performing changes in your business model - what is the priority between the following three focus areas?

1. Value Proposition -
2. Value Architecture -

3. Revenue Model -

Regarding Business Model Innovation - What define innovation within your firm? **New to the firm / New to the industry / New to the world**

Questions Regarding Barriers

Organisation

1. How would you describe the general organisational culture?
    a. Does it differ between hierarchies?
    b. What is the general attitude towards creativity?
2. How is the culture between leaders and subordinates?
    a. How does this affect the possibilities for subordinates to propose new ideas?
3. How would you describe the decision-making structure for new ideas and business opportunities?
    a. How fast is the organisation from decision to action? **Days / Weeks / Months**
4. Is there any form of interaction between different departments in relation to decision-making?
5. Depending on the discussion - Would you generally appreciate the topics of discussion, regarding your organisation, as potential barriers when developing new business models?

Resources and Capabilities

1. What is the distribution of resources between the ones devoted to the current business model versus resources devoted to explore new potential business opportunities?
    a. How large is the share of solar energy involvement in new project?
2. Do projects in solar energy require more or less resources? Compared to conventional project.
3. Is there any difference in required competencies to pursue solar energy initiatives compared to non-solar projects?
    a. Do you have the required competencies?
    b. How do you acquire new competencies?
4. Depending on the discussion - Would you generally appreciate the topics of discussion, regarding resources and capabilities, as potential barriers when developing new business models?

Business Environment

1. What kind of partners are you involved with in order to deliver products and services within the solar energy segment?
    a. Are the partnerships on a strategic or operational lever?
    b. Are there other potential partners that you do not work with?
        i. Why not?
2. Does the collaboration with other external firms and partners affect the decision-making process?
    a. In what way?
3. What are the emerging trends regarding what actors are present within the electricity industry?
    a. Does this affect you value chain?
4. Do historical decisions affect the current decision-making process? I.e. is there any presence of Path Dependence?

    a. How? To what extent?
5. Depending on the discussion - Would you generally appreciate the topics of discussion, regarding the business environment, as potential barriers when developing new business models?

Market and Customers

1. To what extent do you involve your customers when developing a new business proposition?
2. How important are customer relations within the solar energy segment?
3. Would you say that your firm has a *green image* towards the customer base?
    a. Is this, in general, an important element in the electricity industry?
4. How would you appreciate the demand for solar energy from your specific firm?
    a. Does it differ between customer segments?
5. How do you develop value offerings within solar energy?
    a. Is it the same as the customers ask for?
6. How complex is the development of solar energy value proposals compared to more conventional value proposals?
    a. Does it differ between large-scale industry and private small-scale segments?
7. How do partnerships, and other collaborations, affect the value proposition?
8. Would you define the solar energy market as stable or unsure?
9. Are the possibilities to offer solar energy to your customers an attractive alternative from your point of view?
10. What is the process for moving into new potential customer segments?
    a. Do you perform any market validation?
11. Depending on the discussion - Would you generally appreciate the topics of discussion, regarding the solar energy market and customers, as potential barriers when developing new business models?

Financial

1. Are solar energy projects regarded as profitable?
    a. Compared to conventional projects?
2. What solar energy factors are driving costs compared to traditional projects?
3. How important is the financial parts when prioritising between projects?
    a. Does it differ between the nature of the project? I.e. solar energy versus other projects.
    b. Do you implement different price strategies?
        i. What are these?
4. Depending on the discussion - Would you generally appreciate the topics of discussion, regarding the finances, as potential barriers when developing new business models?

Political

1. How does the political climate and situation affect your business in relation to solar energy?
2. Do political initiatives, such as subsidies and regulations, affect the investment process?
    a. To what extent?
    b. In what ways?
3. Depending on the discussion - Would you generally appreciate the topics of discussion, regarding the political climate, as potential barriers when developing new business models?

Awareness and Behavioural

1. What is your general attitude towards solar energy?
    a. Do you consider solar energy as a threat against your current business model?
2. Do you actively promote initiatives to make your customer more aware of solar energy, your involvement and its effects?
3. How is the information configuration set up in relation to deciding what solar energy projects that may, or should, be pursued?
    a. Are other actors outside of **Firm X** involved?
        i. What is the effect of this?
4. Does your day-to-day tasks affect your possibility to be creative and generate new potential business ideas?
5. Depending on the discussion - Would you generally appreciate the topics of discussion, regarding general awareness and behaviour, as potential barriers when developing new business models?

Solar Energy Technology

1. What is the potential for solar photovoltaics?
2. What potential challenges and obstacles could solar energy face?
3. Depending on the discussion - Would you generally appreciate the topics of discussion, regarding the solar energy technology, as potential barriers when developing new business models?

Questions in Relation to Previous Interviews

Are the firms experiencing different barriers?

- Why?

Are they experiencing the same barriers?

- Different capabilities to overcome barriers?

"Three firms have experienced this barrier - Have you encountered this as well?"

- Why? Why not?
- Following up previous data collection which enhances the validity of the data collection.

Questions and Discussion to Round-up

Do you think that solar energy will revolutionise the electricity industry?

Are there any other topics of discussion that has acted as a challenge when you have been trying to transform your business, focusing on solar energy?

Final Statements

Thank you so much, **Name,** for taking the time to be part on this interview.

After listening and summarising the interview we will probably have a couple of follow-up questions - Is it fine to send these to you by email?

We will get back to you when we have finalised our report - This will most likely be sometime around the middle of June.

We hope that you have found the discussions interesting. And might have broadened the perspectives on solar energy.

General Follow-up Questions

Two fairly similar questions regarding attitude and deployment of solar energy

On a scale from 1 to 10 - How much do you want the electricity industry to transform to solar energy?

- 1 = Solar energy should not be developed and deployed by the electricity traders or producers.
- 10 = Solar energy should in the long run be a significant energy provider - Similar to hydropower in Sweden.

On a scale from 1 to 10 - How much are you contributing to transform the industry towards a larger share of solar, when comparing to other firms?

- 1 = We are doing least
- 10 = We are doing the most