The impact of competition regulation on the prospect of solar energy innovations by SMEs

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ABSTRACT,

This research aims to describe in what way the competition context for SMEs with solar energy innovations shaped by regulation affects the prospect of innovation. This competition context is based on the openness of the market and the forces that shape competition within a sector. The information is obtained through qualitative research, by conducting interviews with SMEs that are considered to be innovative. The results show that in general, the competition context in this sector is favorable in the sense that markets are open and anti-competitive behavior is limited. The nature of the competition can be said to act as a stimulating factor of the willingness to innovate. The regulations that shape the competition however, are not as favorable in both cases, which can be attributed to the rigidity of the regulations. This implies that with more flexible regulation, new product innovations in the solar energy sector could be better stimulated. Future research could be conducted on a larger scale, including both successful cases and unsuccessful cases.

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1. INTRODUCTION

This research aims to explore the impact of competition regulation on solar energy innovations by SMEs in The Netherlands. The key assumption in this research, when it comes to competition regulation, is that competition is being promoted by keeping markets open and protecting incentives to innovate. This research explores whether competition law does indeed fulfill this key assumption, by analyzing the context in which SMEs compete and observing the link between the competition context and prospects for success of innovations, from an SME perspective. This is done through qualitative research in the form of interviews with SMEs that have commercialized solar energy innovations in the energy sector. The information gathered from the interviews is used to analyze in a descriptive manner whether competition regulation helps innovations to access and compete on the market or not, and to see where failures may occur.

1.1 Background

The problem at hand is that in the past decades, there has been a decreasing trend of innovation in The Netherlands (Panteia, 2014) and in the European Union as a whole (Pelkmans & Renda, 2014). A factor that has been identified as contributing to the lack of innovations is the ability to introduce the energy innovations to the market. Innovations run the biggest risk of perishing not necessarily in the R&D phase, but rather in the market entry and commercialization phase, which is the so-called Valley of Death (Osawa & Miyazaki, 2006). This innovation problem is also persistent when it comes to the Dutch energy transition (Hisschemoller, 2008). The energy transition has increasingly gained importance in the recent decades, as it has become more and more evident that fossil fuels are not a sustainable source of energy. The energy transition entails the transition from unsustainable sources of energy to sustainable sources of energy, such as renewable energy. The importance of renewable energy and sustainable energy in general has become evident in the climate objectives set by supranational organizations, such as the Paris Agreement in 2016, and the emphasis that is put on renewable energy in government policies that have been implemented, such as the Nationaal Actie Plan in 2010. As of current, The Netherlands is the country to lag second most behind its goal of achieving a 14% share of renewable energy in total energy generation by 2020 (Eurostat, 2016). Despite the success of the energy transition not solely being based on technological solutions, technological innovations do play a role in transitioning towards more sustainable energy (Weterings, 2010). SMEs are considered to be a major source of innovation within a sector or a market(Roth, 2011; Rotmans, 2011). Coincidingly, the Dutch energy industry is one that is mostly comprised of SMEs (Fris, 2014). Considering the energy transition and the innovative characteristic of SMEs, it is relevant to research, what enables or constrains SMEs from realizing innovations (Pelkmans & Renda, 2014).

1.2 Relevance

As innovations are developed to meet the needs of a market, one that either already exists or one that will be created, innovations are subject to competition. In this research, the solar sector is analyzed, which has shown great growth relative to other renewable energy technologies in recent years (REN21, 2017). Furthermore, in a competitive market, the competition may act as an incentive to innovate to keep up the competition. However, if the competition intensity is too high, in the long run it might mean that the incentive to innovate is lower (Aghion et al., 2005) While competitiveness might lead to the diffusion of innovations, it might be the case that such innovations are inferior to those that could emerge if the competition context would more easily allow for innovations to be commercialized. The context in which (innovative) companies can enter the market and compete is shaped by regulations. In the light of the innovation problem that has been described earlier, it is interesting to see whether the competition context that is created by regulation enables or constrains firms from commercializing their innovations. Empirical research on this matter has not yet been done, despite it being established that there is a link between regulation and innovation, as will be discussed in the existing literature section. So far, there is a lack in research on the extent to which competition regulation affects SMEs specifically. Due to their innovative nature, however, it is also of interest to consider SMEs separately (Pelkmans & Renda, 2014). This research aims to fill the gap by analyzing how the regulation of competition regulations affects. This is done through reviewing to what extent the market is perceived as open and fulfilling of the competition principles of the OECD, and to what extent this openness affects the ability of SMEs to commercialize and compete on the market with their solar energy innovations.

In the literature review section, it is discussed that the relationship between the two variables can be rather complex. This is due to the different types of policies that could affect certain sectors differently, and external factors that affect innovation altogether. Therefore, when it comes to this type of research, rather than general conclusions, it will result in "limited conclusions at lower levels of aggregation, such as within industries, areas of technology, or types of regulation" (p.197 (Stroetmann, 1977). In this research, it is aimed to draw conclusions regarding the impact of competition regulation on SMEs with solar energy innovations.

1.3 Research Question

The question that is central to this research is "What is the impact of competition regulation on the likelihood of success of solar energy innovations by SMEs?"

This question will be answered making use of the following research sub-questions:

1. What is the innovation context for SMEs?
2. What is the competitive context for SMEs in the solar sector?
3. How does the competitive context affect the success of SME innovations?

The purpose of the first sub question is to understand the importance that SMEs attach to innovation, how they engage in innovation and the nature of their innovation. The second sub question will aid in identifying how SMEs perceive their competition environment. This includes the different aspects of market competition that can be influenced by regulation, such as the degree of openness of the market that is entered with innovations. The third sub question will explore how SMEs perceive the relationship between the different components of competition and the prospect of successful innovation.

2. THEORETICAL FRAMEWORK

In this section, firstly the existing literature regarding the impact of regulation on innovation will be reviewed. The findings in these papers are rather ambivalent. Based on certain conditions, some researchers find there to be a positive impact and others find there to be a negative impact. The conditions that have led to different results will be discussed. The second part of this section includes the theoretical models and frameworks that are utilized to conduct this research. These models and frameworks will be operationalized in the next section.

The rationale behind using government policies to stimulate eco-innovations, such as solar energy, comes from the market failures and institutional failures are persistent. In the case of market failures, there is an incentive to innovate. However, due to the uncertainty of the innovation in contrast to existing alternatives that have profited from a learning curve, firms often underinvest in R&D. (Faber & Kemp, 2005). In the case of innovation system failures, the climate for innovation is not optimal. This relates to the institutions within an innovation system and the attitudes towards innovation. Examples of system failures are a lack of entrepreneurial activity and regulations that obstruct innovation. (Smith, 2009). The government can stimulate innovation through pursuing a technology push or a demand pull approach, or to act as an aggregator within the innovation system by bringing parties together. (Faber & Kemp, 2005)

Further studies that have researched drivers of innovation, have confirmed that government policies and regulation are in fact factors that relate to the diffusion of energy-saving innovations and the acceleration of the energy transition (Dieperink, Brand, & Vermeulen, 2004; Verbong & Geels, 2007). According to these studies, if applied correctly, regulations promote the diffusion of innovations. However, Dieperink et al. have also noted that in some cases, government regulation hampers regulation. The complexity of this relationship is further supported by research that explicitly examines how regulation relates to innovation. The main point that becomes clear when reviewing the literature regarding the relationship between regulation and innovation is that there is in fact a relationship between the two variables. The direction of this relationship, however, is rather ambivalent. Furthermore, the importance of regulation as a factor in innovation is not always perceived in a similar manner. These points will be discussed below.

2.1.1 How does regulation affect renewable energy innovation?

One type of regulation that has often been researched in relation to clean or energy efficient innovation is environmental regulation. In this area of regulation, the relationship with innovation provides ambivalent results (Marcus, 1981). Early studies on this relationship within the US industry sector find the relationship to not be positive. Gerstenfeld (1977) notes that rather than having a direct relationship, regulation indirectly affects innovation through creating an innovation climate that is found to be unfavorable for innovation. Rothwell (1980) states that while companies perceive certain types of regulations to have an influence on their innovations, it is very rarely a main factor. These views are not supported by Ashford (1999), who noted that regulation is one of the most important factors in fostering and accelerating environmental innovations. According to Ashford, regulations affect innovation through shaping the three factors that are prerequisites for technological innovation to take place: (1) the willingness to innovate; (2) the opportunity to innovate; (3) the capacity/capability to innovate.

More recent studies have made clear that in some cases, regulation positively affects innovation, whereas in some cases it has a negative effect. Pelkmans & Renda (2014) mention the manner in which stimulating factors of regulation and the compliance costs that come with regulations are balanced. Considering this balance, regulations are found to either act as a stimulating or a hampering factor for innovation. One explaining factor in this this difference in perceptions by earlier research and more recent research, however, can be explained by the government approaches that have been developing towards fostering more innovation.

A further discrepancy in views comes from the relevance of firm size. According to Gerstenfeld (1977), government regulations do not affect smaller firms differently. Whereas Rothwell (1992) states that small firms are affected by regulations in general in a disproportionate way which would “tend to reduce the overall rate of innovation in industries where small firms’ innovatory contribution was high” (p. 455). More recently, studies have recognized the innovative importance of smaller firms. This has also become evident in government policies that aim to stimulate SME innovation, such as the Mkb-innovatiestimulering Regio en Topsectoren (MIT), which provides subsidies for SMEs that are willing to innovate. Pelkmans & Renda (2014) have emphasized that it is important to also examine the relationship between regulation and innovation from an SME perspective, which is what this research aims to do.

Lastly, the studies make it clear that regulation does affect innovative behavior of companies. However, the direction of impact depends on the type of regulation that is being analyzed. Pelkmans and

Renda state that rigid regulation may hamper innovative activity, whereas with flexible regulation innovation can better be stimulated. Rigid regulations are considered to reduce the attractiveness of engaging in innovative activities by creating lock-in effects.

2.1.2 How can the difference in these results be explained?

As recognized by several authors, the differences in results of studies regarding the relationship between regulation and innovation come from the definitions that are used by the researchers. This entails whether inputs or outputs of innovation are measured, but also the types of regulations and sectors that are considered. (Marcus, 1981; Pelkmans & Renda, 2014; Rothwell, 1980) What further adds to this complexity is determining the direction of the relationship. It is found to be rather difficult to separate the impacts of regulation from other forces that might impact innovation. (Rothwell, 1980)

Blind (2012) distinguishes four aspects to be taken into account when researching the relationship between regulation and innovation. Namely: (1) Sector specificities (2) Company type, meaning the size, age, and the companies' position relating to existing technological frontier (3) The time range of regulatory impact that is considered (4)The flexibility of regulation implementation. This implies that the results might differ based on the unit of measurement. This view is supported by Pelkmans and Renda, who have added the dimension of administrative burden to this list. They consider it important to assess the relationship between regulation and innovation empirically on a case-by-case basis.

2.2 THEORETICAL FRAMEWORK

In this section, the theoretical models and frameworks that are applied to analyze the two variables, competition regulation and innovation, are discussed.

The two variables that are to be analyzed can be fitted into the technological innovation prerequisites as described by Ashford (1999). The *willingness* to innovate is determined by a firm's knowledge about innovation and their attitude towards the prospect of innovation. This is addressed in the first part of this section. The second prerequisite that is addressed is the *opportunity* to innovate, which is determined by factors on the supply-side and the demand-side. In this case, competition and regulatory conditions relating to competition can be considered as a demand-side factor influencing the opportunity to innovate. The notion is that open markets and favorable competition conditions provide firms with an opportunity to innovate. It is, however, not discussed whether the firm has the *capacity* to innovate.

2.3 Assessing Innovation

Innovation, in the Schumpeterian sense, is the commercialization of an invention. This entails the attempt to profit from innovations by incorporating them into the products and services that are used or sold in the marketplace.

The literature on innovation defines two characteristics for breaking down what can be classified as innovation. The first characteristic is the type of innovation. Five types of innovation have been proposed by Schumpeter (1934): products, processes, markets, organization and sources of supply. The OECD approach to innovation, however, is one that is firm based, meaning only firm-specific innovations such as products and processes are considered (OECD/Eurostat/EU, 1997).

The second characteristic is the degree of novelty of the innovation. This is the novelty of the technical aspect of the innovation, incremental innovation versus radical innovation. And it is the extent to which the innovation has been applied, new to the world/sector versus new to the firm.

As discussed earlier, based on the chosen measurement of innovation, the results of the research may change. Innovation can be measured based on the inputs of innovation such as R&D expenditure, and on outputs such as Intellectual Property Rights (IPR), number of innovations, and firm performance (Potters, 2009). In the case of measuring IPR, it has been argued that e.g. patents are indicators of inventions, rather than innovations and that it may exclude those technologies that have not been patented, or cannot be patented (Van Ophem et al., 2002). In this research, the outputs of innovation are measured in the form of commercialized innovations.

Literature on measuring innovation distinguishes between different approaches for measuring innovation. Two main approaches are considered by the OECD/Eurostat (2005) are the subject approach and the object approach. The subject approach analyses the innovative behavior and activities of a firm and tries to get insights on the factors that may influence the innovative behavior of a firm. The object approach looks more distinctively at specific innovation outputs of a firm, the number and characteristics of individual innovations. Both approaches, however, consider innovation inputs. Furthermore, these approaches are based on gathering detailed information from surveys in large quantities to ultimately be used to make statistical inferences and comparing results from different sectors. This makes them not very applicable in this research. However, despite the scope of this research relating to how regulation affects the innovation *outputs*, considering the incentives to innovate and the importance of innovation for SMEs will help gain a better understanding of how firms innovate. Understanding this innovation context could provide useful insights regarding possible differences in how firms perceive the regulation impact. Therefore, the descriptive measurements of both approaches, regarding the innovation context of firms, are relevant in this research.

Janger et al. (2015) have stated that there have not yet been methods developed that clearly measure innovation output. Figure 1 below represents a cycle of innovation measurement.

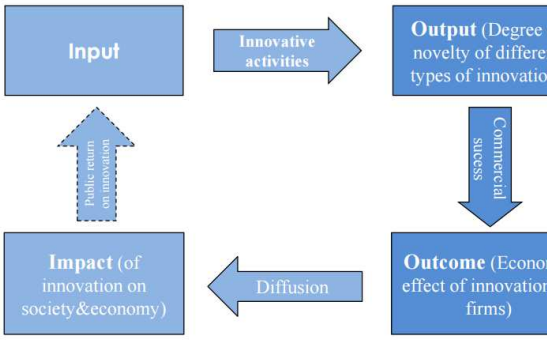

Figure 1: Innovation Measurement (Janger et al. 2015)

In this research, the impact of competition regulation on the commercial success of an innovation is measured. In order to do so, outputs of innovation are measured. In order to have a better understanding of the innovation outputs of a firm, the innovative activities of the firms are considered, to a certain extent. The inputs of innovation are the monetary resources, human resources and knowledge that a firm uses to innovate. The innovative activities are the manner in which firms transform the inputs into outputs. This is considered to be a black box, as firms possess tacit knowledge, which might be hard to measure. Barriers and incentives to innovate are also relevant to measure in this stage. The innovation output relates to the novelty and the type of innovation.

2.4 Assessing the Competition Context

There is not a specific framework for measuring regulations, which is an issue that has been addressed by authors that have researched the relationship between regulation and innovation. In this research, regulation is considered in a more broader sense. Rather than assessing the impact of specific regulations on innovations, the effects of competition regulation are measured through an assessment of the competition context in which SMEs with solar innovations operate, as this context is one that is shaped by the regulatory context. The competition context will be assessed based on the openness of the market and the factors that shape competition within a market.

In this research, a key assumption regarding competition law is followed, which is that governments regulate competition in order to keep the markets open and prohibit anti-competitive behavior that might be harmful for competition or consumers. The OECD (2015) provides a framework for assessing to what extent a competition policy limits the openness of the market. This is done by reviewing how policies limit the following points: (1) the number or range of suppliers, (2) the ability of suppliers to compete (3) the incentive of suppliers to complete (4) the choices and information available to customers. For the full checklist, please see Appendix A. Each of these points have specific indicators, which may or may not be applicable depending on the characteristics of the sector that is reviewed. This framework, however, has been developed for governments to use to assess the degree to which their policies limit the oppenness of certain markets. As this framework has a different use than is intended in this research, the framework is adapted in a way that is more applicable to this research by the exclusion of certain indicators that are less relevant to this research.

In order to assess the factors that shape the competition within a market, the Porter's Five Forces framework will be the used. Porter (1979, 2008) has identified five forces that determine the state of competition in an industry (Figure 2). An industry is considered to be unattractive to enter if all five forces are ranked as high. This framework gives a comprehensive overview of different market actors and includes areas in which the regulation of competition may be of importance, such as in the case of powerful buyers or powerful suppliers or competitors that abuse their power. Therefore, these are the three forces that are used complementary to the assessment of market openness.

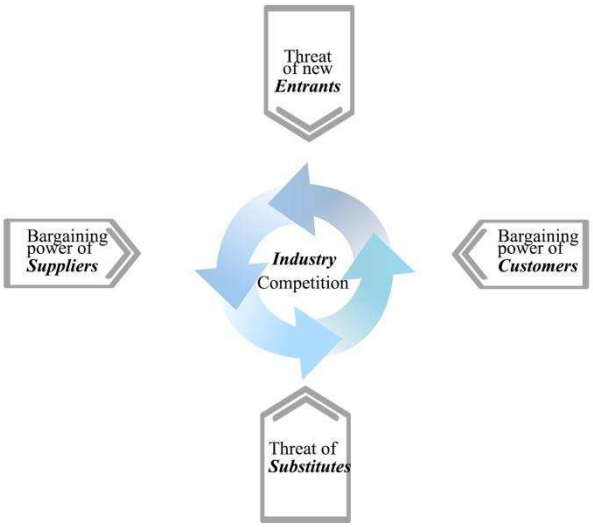

Figure 2: Porter's Five Forces. Based on Porter (2008).

The use of these frameworks will lead to a description of the competition context, as is perceived by SMEs.

3. METHODOLOGY

In order to gather the information that is needed to answer the research question, the two key variables and the relation between these two variables are measured. The definitions, or rather conceptualizations, of competition regulation and innovation have been discussed in the prior section. In this section, the approach to gathering the required data is discussed. Furthermore, the operationalization and measurement of the variables is discussed.

3.1 Approach

3.1.1 data

In order to be able to describe and analyze the impact of competition regulation on the likelihood of success of energy innovations by SMEs, qualitative data is gathered from SMEs. The main reason that qualitative data is gathered rather than quantitative data is that the purpose of this research is to describe the SME perceptions of how regulation impacts their innovations, rather than trying to define this

relationship by the use of quantitative data. This perception could also be identified through means other than interviews, however, it is preferred to go more in depth. The use of this approach will enable the gathering of additional data for context, if that is necessary. A downside to this approach, however, is that depending on the amount of interview questions and the ease with which the questions can be answered, interviews might not be as quick to complete as other methods for gathering data, such as surveys. This might lead to SMEs being reluctant to participate due to time constraints. In this research, two SMEs have been interviewed telephonically. This option has been offered by the firms due to the geographical distance of the firms. Due to a lack of technical options available, the interviews have not been recorded. However, notes have been taken during the interviews.

3.1.2 Sample selection

In this research, the EU definition of SME is used, which is divided into the employee count and annual turnover. As the information on annual turnover is not publicly available and SMEs might be reluctant to answer questions regarding their turnover, only the employee count is used as an indicator of the firm size. A firm is considered to be micro sized if it has fewer than 10 employees, small sized if it has fewer than 50 employees and medium-sized if it has fewer than 250 employees . The SMEs are selected and contacted based on the criterion of having solar energy related innovations and ultimately operating in similar markets. In order to be able to draw conclusions from an analysis with a small sample, as is the case in this research, the contexts of analysis should not be too different. This is the reason to select similar, if not the same, markets and innovations, so that competition context are similar enough for there to be drawn conclusions. Further descriptions of the firm characteristics are given in the results section.

In this case, rather than selecting innovations based on the types of novelty that have been discussed before, innovations are selected based on the category they fall under within the solar energy sector, which is the generation of electricity and thermal heat for households and small communities through the use of photovoltaics The reason to not further specify the degree of novelty is that given the time constraints and the observed unwillingness, or inability, of firms to participate in interviews, a further distinction into types of novelty (e.g. incremental – radical) might not result in a sample that is large enough.

The innovations are found through the industry's perception of the novelty of the innovation(s) of certain firms. This includes e.g. nominations in industry or general innovation awards, such as the MKB Innovatie Top 100 or the Accenture Innovation Awards, and mentions in articles about novel innovations within the sector. This approach is preferred, as the industry can be considered qualified to judge whether an innovation is novel within the industry. A downside is, however, that innovation awards and industry articles might not have the same innovation criteria to assess to what extent an innovation is novel. Unfortunately, this approach has not yielded many interview respondents. Of the few firms that responded, most firms specified that they were not able to participate in interviews due to time constraints and a rather limited amount of employees. Another reason for certain firms to not participate in the interviews is that they considered themselves to not be large enough to consider competition. In a way, it could be tentatively implied that the SMEs do not necessarily attach importance to the impact of competition on their innovations.

3.2 Operationalization of Variables

Table 1 below represents how the two variables are operationalized. This has been done using the frameworks in the previous section and modifying them in a way that makes them applicable for the research question. This table is further expanded upon with the interview questions that have been asked during the interviews. For this table, please see appendix B. It must be noted, however, that in some cases, the answer to certain questions is given in a more elaborate answer to a different question. In those cases, the questions to answers that have been given have not been asked, for the sake of not unnecessarily prolonging the interviews.

Variable	Conceptualization	Operationalization
Innovativeness	Innovation output	Type of innovation
		Degree of novelty
Competitive Context	Innovative activity	Importance of Innovation
		Innovation process
		Perception of own innovativeness
	Openness of the market	Number or range of suppliers
		Ability of suppliers to compete
		Incentives for suppliers to compete
		Information and choices available to customers
	Market forces	Market entry
		Bargaining power of buyers
		Bargaining power of suppliers
		State of competition

Table 1: Operationalization of the main variables relevant to this research

4. RESULTS

In this section, the data that is gathered from the interviews is represented. Each case is discussed separately and is further divided into the two variables that have been researched.

4.1 Case 1

The first company that has been interviewed, has less than 50 employees, which classifies it as a small firm

according to the EU definition. They have been established in 2013, after launching their most important innovation, which is their roof tile that has solar cells integrated within. This means that it is no longer necessary to have PV panels placed on top of regular roof tiles, as the solar roof tiles themselves will generate electricity.

4.1.1 Innovation

The technical novelty is that production technology allows for the integration of solar cells in ceramic roof tiles. So far, there has not yet been an innovation like this on the market. Nevertheless, similar innovations have been launched by other market players, such as Tesla. The difference, however, is that the solar tiles produced by Firm 1 are made of ceramic, whereas the other roof tiles are made of plastic. This difference has implications for the areas in which the products can be applied. There are certain regulations that do not allow the use of plastic roofing on historic buildings. Furthermore, it is prohibited for historic buildings to have PV panels placed on them if the roof is not flat. This poses difficulties for the desire to make historic buildings more energy efficient, which is where the innovation of Firm 1 comes in.

A major reason for Firm 1 to innovate is the energy transition. The prospect is that many things are changing with regards to need of energy efficiency of housing. Firm 1 wanted to be part of this change. Furthermore, they consider PV panels to be very aesthetically unpleasing and aim to create sustainable and more visually pleasing streetscapes.

Two major factors that Firm 1 considers to constrain their innovations are regulatory based. The first factor is the regulation with regard to VAT returns. According to this rule, households can have a portion of their solar panel investment reimbursed through VAT. However, solar roof tiles are not considered to be PV panels, instead they are considered to be roofing. This means that the VAT rule does not fully apply, which can make it less attractive for certain customers to purchase solar roof tiles rather than regular PV panels. This leads to a retardation of the diffusion of their innovation. The second factor, relates to anti-dumping duties imposed by the European Commission (EC) on solar panels and components imported from Chinese suppliers. The duties that are to be paid by Firm 1 can vary between 33.7% and 64.9% of the product, which greatly affects the price. Firm 1 considers this to be constraining for their innovation, as they consider firm growth and innovation to go hand in hand. This is made more difficult by having to ask a higher price for their innovation to be economically viable, which makes it less interesting for potential customers to pursue this option. Due to these factors that influence the viability of their innovation, Firm 1 is reluctant to commercialize another innovation that is being developed, which is the hybrid PV rooftile which can both generate electricity and heat.

4.1.2 Competition conditions

Regarding the ability to enter the market, we found that in this sector, Firm 1 does not consider there to be regulations that prohibit the market entry either directly or through the requiring of licenses or permits to sell PV panels or solar cells, or in this case integrated roof tiles. As such, this aspect of openness does not negatively affect their innovations.

Regarding the ability to compete, innovations of Firm 1 are not constrained by either price ceilings/floors and required uses of certain production technologies. However, there are two regulations that heavily influence the ability to compete, which are the VAT and anti-dumping measures, as explained before. Consumers compare different solar options and are likely to select the cheapest option that will guarantee them the highest efficiency. However, due to these regulations, the prices of the products have to increase to stay financially viable, which puts Firm 1 at a disadvantageous position relative to their PV panel competitors. We find that the incentives to compete are not influenced by the regulatory context of the market. The players on the market are subject to the same regulations. According to Firm 1, the production norms for their roof tiles are the same as those that apply to PV panels. However, the type of norms and the compliance costs to these norms have not been discussed by the respondent. Lastly, the customers within this market are free to choose their own suppliers of

As for the competition context, we find that the competition, which Firm 1 considers to be quality based, does not affect the prospect of innovation. Firm 1 considers their solar roof tiles to be significantly different than regular PV panels. However, from a consumer perspective, the solar roof tiles does compete with regular PV panels.

The firm is not aware of anti-competitive practices present on the market. On the supplier side we find that it is difficult for Firm 1 to find suppliers that offer the type of intermediate goods that are required to produce their solar roof tiles. The implications of this on their competitive position has been discussed prior. On the buyer side we find that the position of Firm 1 vis-à-vis their buyers is not weak. The prices of the products are known up front, meaning there is no room for buyers to exert influence in order to lower the prices. Furthermore, Firm 1 works with retailers that distribute their products. However, there is no exclusivity granted to these parties, meaning Firm 1 is free to decide who is used as an intermediary.

4.2 Case 2

The second company that has been interviewed, has less than 50 employees, which classifies it as a small company according to the EU definition. However, they consider themselves to be a fast growing company and aim to double the amount of employees within the next few years. This company has been established in 2007 as a wholesaler in PV panels. In 2015 they have launched their innovation that integrates PV and photothermic heating (PT) into one module (PVT).

4.2.1 Innovation

PVT technologies have already existed within the solar energy sector. However, the innovation in question is the development of a component that can be placed behind all types of PV panels in order to

transform it into a PVT panel, without requiring an extra power converter. Firm 2 sees the solar energy sector as a very innovative one. They consider themselves to be more innovative than other PV wholesalers that operate in The Netherlands. The innovation takes place in a separate engineering department which has been set up solely for the purpose of coming up with new inventions and testing them, which differentiates them from wholesalers that solely distribute products. We found that the main reason to innovate is the nature of the solar sector as a whole, which they consider to be innovative. This means that firms constantly have to develop cheaper and better solutions. The main barrier to the innovation is that PVT technologies are more expensive than regular PV systems or regular PT systems, which might make it less attractive for potential customers to pursue this option. A major supporting factor is the government and the subsidies they provide. Firm 2 considers the solar sector to be one driven by subsidies that give incentives for households and businesses to become more energy efficient.

4.2.2 Competition conditions

Regarding the ability to enter the market, we find that Firm 2 does not consider there to be regulations that prohibit entry to the market, or make market entry less attractive. The market is considered to be very easy to enter. We find that this lack of market entry regulations makes it easy to innovate for Firm 2, as there are fewer things to be taken into account when innovating.

Regarding the ability to compete, we find that there are no government or sectoral regulations that impose restrictions on price levels or impose quality standards. The price in the market is set by the fierce competition, meaning that if a firm prices their product at a level higher than others it becomes less attractive for customers that consider options based on price. We find that this lack of regulation regarding quality stimulates Firm 2 to further innovate and improve the quality of their products.

Regarding the incentive to compete, we find that there is no self-regulatory or co-regulatory regime present within the solar sector. Furthermore, firms are not required to disclose information regarding the quality of their components. They only choose to do so if they want to acquire certain certifications. Regarding the information available to customers we find that there are requirements to be met regarding the offering of product warranties. However, it is not necessarily required to provide a warranty. Firm 2 mentions that within the sector, there are certain institutions that monitor such claims to provide the consumers with a better understanding of what their warranty entails. However, it is up to a firm whether they want to disclose information on the quality of their products. The ease with which these certifications can be acquired has not been discussed. We find that the availability of certificates is seen as a stimulator for Firm 2, as through such certificates it is possible to make guarantees and statements regarding the quality and thus further strengthening their reputation.

As for the competition conditions, we find that the market is characterized as one with heavy price competition. This does not affect the stable position of Firm 2. However, anti-competitive practices such as installers drastically decreasing their prices and sacrificing their profit margins, and wholesalers falsely claiming to sell products that are of high quality, affect the innovations of Firm 2 in case such practices lead to a price drop to a level that might make it interesting for consumers to switch suppliers.

On the supplier side we find that Firm 2 considers its power vis-à-vis the suppliers to be rather equal. In some cases it is impossible to switch suppliers, however, this is not due to regulations but due to the importance of the component and its unavailability elsewhere. Furthermore, Firm 2 states that it is important to also consider competition, meaning that it is not easy to set up special conditions with suppliers if there are many other competitors present. A firm would, however, be subject to less pressure from the supplier side if the goods are intermediate rather than final goods. We find that the nature of the relationship with the supplier does not affect the prospects of innovation. In the case that the agreements made with suppliers would not be beneficial for the innovative course set by Firm 2, they consider switching suppliers.

On the buyer side we find that in certain situations buyers can exert power over Firm 2, in the form of threatening to switch suppliers if Firm 2 does not have the products in stock. However, this does not happen often. We find that this relationship with the buyers does not affect the prospects of innovation.

5. ANALYSIS

In this section, the results that are presented in the previous section are analyzed. The perceived drivers and barriers are discussed more in depth, as are the impacts of the market openness and the competition conditions.

When inquiring about the different drivers and barriers of innovation, we find that both firms mention regulations. In the case of Firm 1, there are regulations in place that act as a barrier for their innovations by negatively affecting their competitive position, as the firm is left to ask higher prices in order to stay economically viable. The anti-dumping measure that affects Firm 1 is a more clear example of a regulation that is in place to regulate competition. With the growth of the Chinese solar market came the dumping of Chinese solar products on the EU market at a price lower than is asked on the Chinese domestic market. This has led to protectionist measures, such as the anti-dumping measures imposed on solar panels and other key components from China (European Commission, 2013). The rationale behind this is create a level playing field between the European market and other markets. However, Firm 1 imports their components from Chinese exporters, as these components are not offered by European suppliers. Due to the lack of suppliers of such products and the fact that there are also anti-dumping measures on components, rather than PV panels which are also sold on the European market, the innovation of Firm 1 is inhibited. However, there have been agreements made between

the EC and certain Chinese exporters. These exporters are exempt from the anti-dumping measures if they keep to a minimum price Ploumen (2015). The firm can urge the supplying firm to make an agreement with the EC. However, this may also depend on the importance the Chinese exporters attach to this specific buyer. Furthermore, it is not known whether Firm 1 has considered this procedure, and to what extent it is easy for Chinese exporters to negotiate with the EC.

The second type of regulation has been mentioned by both firms. These are the regulations that make it attractive for consumers to pursue the option of solar energy, through subsidies and the possibility to get VAT returns. The subsidies are no longer available on a national scale, but are still offered by certain municipalities. Both firms consider such regulations to be beneficial for the solar sector, as it attracts customers. However, in the case of Firm 1, the rigidity of conditions of these regulations has put them in a disadvantageous position relative to suppliers of PV panels. Due to the focus on PV panels, rather than electricity generation through the use of PV, the solar roof tiles of Firm 1 cannot benefit from these regulations as would a supplier of regular PV panels. As is argued by Pelkmans & Renda (2014), rigid regulations sometimes make it less attractive to innovate. In this case we could speak of a lock-in effect created by the fact that this regulation is not inclusive of multiple types of solar energy generation technologies. If this regulation were to be more flexible by including solar roof tiles, this regulation would possibly not have been an obstruction to the competitive position of the innovation of Firm 1. In the case of Firm 2, such difficulties are not experienced, due to their products being considered solar panel innovations which make it eligible for customers to receive subsidies. In the case of Firm 2, the subsidies work as a supporting factor. This difference can be explained by the main difference between the two innovations. Whereas Firm 1 has created a new application for solar cells by integrating them into roof tiles, Firm 2 has developed a way to enhance existing solar panels.

Regarding the market openness, it can be concluded that in both cases the SMEs do not consider there to be limiting regulations, other than the anti-dumping measures imposed on Chinese exporters. This market openness is considered to be favorable for innovations by Firm 2, as it stimulates the ease with which firms can innovate, as there are not many regulations posed that require compliance. Furthermore, the competition conditions can be considered to be favorable, as the anti-competitive practices on the market are very limited.

6. CONCLUSION

From the discussion about the drivers and barriers to the innovations of the two SMEs it becomes clear that regulation is a factor that affects the competitive position of the firms and indirectly affects the prospect of innovation. However, of the regulations that have been discussed, only the anti-dumping measures are intended to shape the competition. The VAT and subsidy regulations are intended to promote the diffusion of solar energy options and to increase demand. This further accentuates that it is difficult to separate the factors that affect competition and innovation, as discussed in the literature review section.

A second point that has become evident is that the impact of the competitive context, which is shaped by the regulations, is not perceived by the SMEs a very strong one, apart from the aforementioned regulations. The market can be considered to be an open one, which affects the ease with which firms innovate, by not imposing many restrictions.

A conclusion that can be derived from this research is that competition regulation has, to some extent, kept the markets open and successfully protected the markets from anti-competitive practices and this way supported the ease with which firms can commercialize innovations. Furthermore, the competitive nature of the markets is seen as conducive for innovation.

If we consider the prerequisites for innovation that have been proposed by Ashford(1999), it can be said that these prerequisites are fulfilled. In the innovation context we see that both firms are willing to continue innovating and have a positive attitude towards innovation. In the competition context, we see that the competition conditions do indeed give the firms an opportunity to innovate. The capability to innovate, however, has not been discussed. It can be assumed that both firms have sufficient competencies to continue innovating. This is, however, concluded based on a very small sample size. We see that in certain aspects the two firms are affected differently by regulations. Perhaps different, more general conclusions can be drawn with a bigger sample size, and/or one that further distinguishes the degrees of novelty. What would further enrich this type of research is the inclusion of firms with innovations that are considered to have failed and to see to what extent this failure was due to unfavorable competition conditions shaped by regulations. It might be difficult, however, to find and reach out to such firms.

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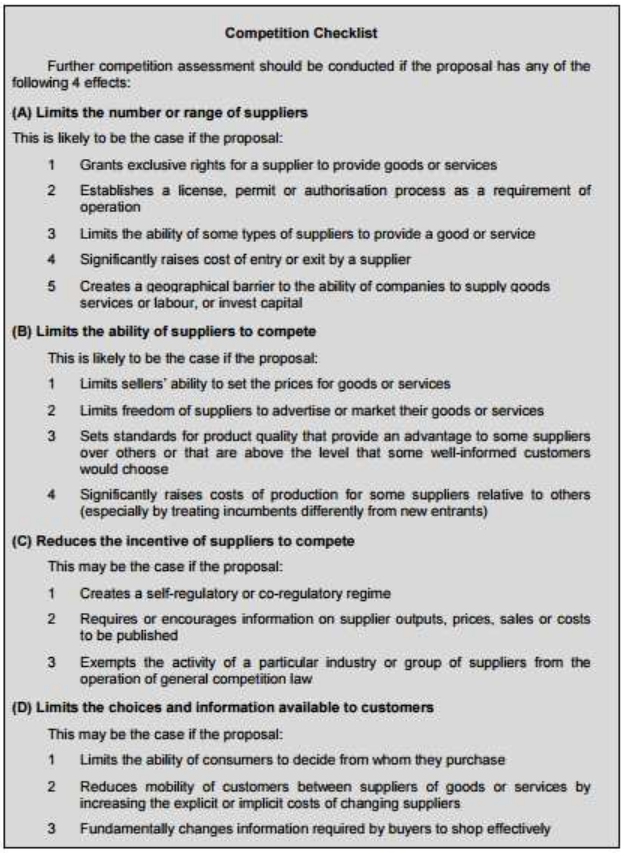
APPENDIX A – THE COMPETITION CHECKLIST



Competition Checklist

Further competition assessment should be conducted if the proposal has any of the following 4 effects:

(A) Limits the number or range of suppliers

This is likely to be the case if the proposal:

1. Grants exclusive rights for a supplier to provide goods or services
2. Establishes a license, permit or authorisation process as a requirement of operation
3. Limits the ability of some types of suppliers to provide a good or service
4. Significantly raises cost of entry or exit by a supplier
5. Creates a geographical barrier to the ability of companies to supply goods services or labour, or invest capital

(B) Limits the ability of suppliers to compete

This is likely to be the case if the proposal:

1. Limits sellers' ability to set the prices for goods or services
2. Limits freedom of suppliers to advertise or market their goods or services
3. Sets standards for product quality that provide an advantage to some suppliers over others or that are above the level that some well-informed customers would choose
4. Significantly raises costs of production for some suppliers relative to others (especially by treating incumbents differently from new entrants)

(C) Reduces the incentive of suppliers to compete

This may be the case if the proposal:

1. Creates a self-regulatory or co-regulatory regime
2. Requires or encourages information on supplier outputs, prices, sales or costs to be published
3. Exempts the activity of a particular industry or group of suppliers from the operation of general competition law

(D) Limits the choices and information available to customers

This may be the case if the proposal:

1. Limits the ability of consumers to decide from whom they purchase
2. Reduces mobility of customers between suppliers of goods or services by increasing the explicit or implicit costs of changing suppliers
3. Fundamentally changes information required by buyers to shop effectively

APPENDIX B – OPERATIONALIZATION OF VARIABLES

Variable	Definition	Conceptualization	Operationalization
Innovation	Innovation output	Commercialization of inventions	What do you consider to be innovation? What do you consider to be the most important innovations of your company? To what extent is it technologically novel? To what extent is it novel on the market? Do you consider the sector to be innovative? Do you consider your own company to be more innovative than others within the sector? Is it a goal for your company to stay innovative? How does innovation take place within your company?

			What do you consider to be barriers to the commercialization of innovation? What do you consider to be supporting factors to the commercialization of innovation?
Competition Regulation	Competition conditions	State of competition	How do you see the position of your company on the market? Is your position threatened by competition or do you perhaps threaten their position? What is the nature of competition ? Do you notice forms of anti-competitive behavior?
		Relationship with the buyers	Do you sell to a range of buyers, or is it rather limited? How do you see your bargaining power when it comes to buyers? How easy is it for buyers to switch suppliers? Do you find yourself in a position in which the buyers can abuse their power?
		Relationship with the suppliers	Do you receive your components from a range of suppliers, or is it rather limited? How do you see your bargaining power when it comes to suppliers? How easy is it for you to switch suppliers? Do you find yourself in a position in which the suppliers can abuse their power?
		Ability of suppliers to enter the market	What do you consider to be the most important regulations an SME should consider for entering the sector? Do the regulations require licenses or permits? Do the regulations forbid certain suppliers from entering? Do you consider such regulations to make it difficult for SMEs to enter?
		Ability of suppliers to compete	What do you consider to be the most important regulations

			when it comes to competing with your innovation? **Are there regulations regarding prices?** **Are there regulations regarding technologies for production?** **Do you consider such regulations to make it hard to compete?**
		Incentive of suppliers to compete	**Are there agreements within the sector regarding the price or quality of your products/services?**
		Information and choices available to consumers	**Are you required to disclose information regarding materials used and the quality?**