Mainstreaming solar

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Mainstreaming solar: Stretching the regulatory regime through business model innovation

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A B S T R A C T
This paper explores how the regulatory regime for Solar PV, defined as a combination of niche shielding and mainstream regulations, affects niche business models, using the Dutch and Flemish regulatory regimes as examples. The regulatory regime does not influence all components of the business model: only one or two components are usually affected. The level of niche shielding influences the dominant niche empowerment strategy. We also identified substantial heterogeneity in fit-and-conform and stretch-and-transform empowerment strategies for dealing with the regulatory regime. These strategies are reflected in business models, and differ in terms of temporal focus, motivation and shielding characteristics targeted. Finally, we show that business model innovation, sometimes in combination with technological innovation, can be used for stretching the regulatory regime. Organizational components of the business model are usually redesigned for this purpose.
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1. Introduction

New, radically different technologies like solar PV require protected spaces or niches to shield them from mainstream selection pressures that are too strict to allow them to be competitive (Geels and Schot, 2010; Kemp et al., 1998; Smith and Raven, 2012). Within niches, the new technology can develop, scale-up, and eventually alter the status-quo. Driven by governmental R&D support, solar PV found its first niche application in space (Oliver and Jackson, 1999). Later, terrestrial applications substituting high-cost competitors followed, including remote industrial applications and telecommunications.

After the 1990s, governmental support shifted from R&D to market building, with governments implementing investment and generation-based subsidy schemes, and quota obligations (Haas et al., 2011; Mormann, 2012). This new wave of financial support provided opportunities for niche entrepreneurs, who started to develop new business models for PV, resulting in fast growing markets (Dewald and Truffer, 2011; Hinnells and O’Neil, 2012; Huijben and Verbong, 2013). Such business models can be considered as vehicles for bringing new technologies to the market and as a form of niche innovation (Bidmon and Knab, 2014; Björk Dahl, 2009; Boons and Lüdeke-Freund, 2013; Chesbrough and Roosenboom, 2002). Research-wise, a business model represents a separate unit of analysis (McGrath, 2010; Zott et al., 2011).

Researchers agree that the formal institutional context has a substantial impact on innovation in general and entrepreneurial activity and business models in the niche (Al-Saleh and Mahroum, 2014; Autio et al., 2014; Blind, 2012;
Eckhardt and Shane, 2003; Hess, 2013; Hinnells and O’Neil, 2012; Huijben and Verbong, 2013; Palm, 2015; Provance et al., 2011). However, how business models are precisely affected by governmental policy is still to be investigated. We therefore follow the recent call by Greenwood et al. (2014) for a renewed appraisal of the effect of institutional settings on organizational forms. Additionally, we answer to a recent request from Strupeit and Palm (2015) for research on the influence of the political context on solar PV business models.

Formal institutions often have governmental origins and define the rules of the game (Scott, 2008). Just like regime incumbents, niche entrepreneurs have to deal with a set of mainstream regulations, including building, financial and electricity regulations. The level of niche shielding, i.e. the amount of financial support, determines the economic competitiveness of new technologies by protecting them from the above-mentioned mainstream pressures and creating space for business model to be developed (Geels and Schot, 2010; Kemp et al., 1998; Smith and Raven, 2012)1. Governments also set regulations regarding niche shielding instruments and as such they “shape the room for a niche to develop in” (Hermans et al., 2013, p. 622). It is this set of particular niche shielding instruments and their related regulations that is unique to the niche. Below, we refer to the set of mainstream regulations and niche shielding instruments as the regulatory regime, setting the boundaries of the business model design space, which encompasses all the legal business model design options available to niche entrepreneurs.

There is also a variation in strategies for dealing with the regulatory regime within the niches. Firstly, niche entrepreneurs can ‘fit and conform’ with the opportunities the regulatory regime provides, while dealing with its limitations (Smith and Raven, 2012). Secondly, niche entrepreneurs also try to alter the regulatory regime in their favor (’stretch and transform’), either individually or collectively (Janssen and Moors, 2013; Hoogma, 2002; Pinke and Groot, 2015; Smith and Raven, 2012; Thompson et al., 2014). Due to these profound differences, niche entrepreneurs are also likely to take a different approach to business models. In this paper we consider niche business models as a “reflection of the firms realized strategy” and a specific locus of scientific inquiry for theory building and empirical investigation (Baden-Fuller and Morgan, 2010; Casadesus-Masanell and Ricart, 2010, p. 195). By studying the different types of business models employed in the niche we can reveal different niche empowerment strategies for dealing with the regulatory regime. We thereby contribute to a recent call by Raven et al. (2015) for more research on the mechanisms behind niche empowerment. Our potential contributions to the transition studies and business model literature are as follows: First, we link niche-level empowerment strategy to business models by exploring the potential heterogeneity of the empowerment approaches within the same niche. Second, we challenge the assumption that governmental policies affect the entire business model, by showing how the regulatory regime affects business models differentially, at individual component level. Third, we explore the extent to which business model innovation can be used as a distinct means for stretching the niche business model design space.

In this study we employed embedded case study design by incorporating both the country (i.e., regulatory regime) and business model level of analysis (Eisenhardt, 1989). We researched cases of solar PV business models in two countries: the Netherlands and Belgium, focusing on the Flanders region in the latter to limit the variation in language and the associated cultural variations. Though geographically close, both countries differed highly in terms of niche shielding instruments in place over time, resulting in distinct market growth patterns (Audenaert et al., 2010; Beliën et al., 2013; Huijben and Verbong, 2013). The data collection is based on 16 semi-structured interviews with national experts and managers from PV companies in both countries, complemented by field observations during knowledge-sharing meetings, as well as extensive secondary data such as national sector reports, newspaper articles, and websites.

In the following section we first provide the theoretical framework for this paper consisting of insights from both transition studies and business model literature. We then discuss the effect of regulatory regimes on business models, at the business model type and the individual component level. We continue with an overview of entrepreneurial empowerment strategies for dealing with regulatory regimes, and their effect on business models. After a discussion section, we end with our main conclusions and managerial and policy recommendations.

2. Theoretical background

From the 1980s onward, company strategies for dealing with regulatory regimes have gained wide attention in both the scientific community as well as from practitioners (Beardsley et al., 2005; KPMG, 2012; Lichtenberg, 1991; Martin and Rice, 2014; Shaffer, 1995; Tan, 1996; Wesseling et al., 2014; Wilson et al., 2011). Innovative, breakthrough technologies are likely to change the mainstream environment, consisting of various dimensions such as existing infrastructures, user preferences or cultural meaning (Geels and Schot, 2010; Kemp et al., 1998; Smith and Raven, 2012). They start their development in niches, which represent protective spaces for development of such technologies and which operate within a unique set of regulations (Herman et al., 2013; Huijben and Verbong, 2013). Transition studies distinguish between the mainstream environment and niches as part of the regulatory regime affecting the niche innovations. Below we build on a recent discussion on the creation, development and up-scaling patterns of niches, focusing on the processes of niche shielding and empowerment of niches (see e.g., Smith and Raven 2012; Smith et al., 2014; Raven et al., 2015), and relate this to the interplay between the regulatory regime and the development of business models within the niche. Other broader processes in the niche, such as niche

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1 The economic competitiveness of renewable technologies also depends on governmental support for fossil technologies. For example, in the Netherlands, fossil energy received about four times as much financial support as renewable energy in 2010 (Delft and Ecofys, 2011).
nurturing are dependent upon understanding of these dynamics (Boon and Bakker, 2015; Smith and Raven 2012; Verhees et al., 2013).

2.1. Niche shielding

Niches are formed by shielding processes which can be defined as “processes that hold at bay certain selection pressures from mainstream selection environments” (Smith and Raven, 2012, p. 1027). Such mainstream selection environments find their origin in various domains such as rules and regulations, end-user practices and existing infrastructures (Geels and Schot, 2010; Kemp et al., 1998; Schot and Geels, 2008). In this paper, we focus on rules and regulations (i.e., the regulatory regime, see above). While shielding can be passive in nature, for example in the case of solar PV or biomass application in off-grid settings, it can also be actively created, for example by setting up a company incubator (Oliver and Jackson, 1999; Verbong et al., 2010; Smith and Raven, 2012) While it was previously assumed that niche advocates would first exploit passive niche spaces and then lobby for active niche shielding in some form, recent research by Raven et al. (2015) has shown that these two processes are actually intertwined. Here we focus on active shielding only and consider this to be enacted by governmental agencies that provide various shielding instruments to PV niche entrepreneurs (Haas et al., 2011; Mormann, 2012). This determines the level of niche shielding. Governments also set regulations for applying for the niche shielding instruments and as such they “shape the room for a niche to develop in” (Hermans et al., 2013, p. 622). Such niche regulations can also be counterproductive reducing the effectiveness of niche shielding instruments and limiting the business model design space (Mormann, 2014). For example, a tax deduction scheme for renewables in the US required the involvement of a company with profitable tax to be involved in the business model. However, this requires adaptation in the business model and leads to extra transaction costs (Mormann, 2014). Moreover, niche entrepreneurs also have to deal with a variety of mainstream regulations resulting in higher costs and limiting the business model design space as well (Mormann, 2011, 2012). In this research we build on Boon and Bakker (2015) who argued that each niche shielding instrument can be characterized by width, depth and duration of shielding. While width relates to the targeted sector for shielding, depth relates to the level of shielding provided. Duration of shielding determines the overall level of support acquired by the niche entrepreneur. Such characteristics of niche shielding instruments are influenced by underlying arguments, i.e. legitimacy, which may change over time. However, how exactly such theories on active niche shielding relate to niche empowerment strategies and business models has not yet been investigated.

2.2. Niche empowerment

Niche empowerment covers two main ways in which niches can be further developed and scaled-up towards the mainstream selection environment (Smith and Raven, 2012). First, niche entrepreneurs can ‘fit and conform’ as such being “competitive with mainstream socio-technical practices in otherwise unchanged selection environments” (Smith and Raven, 2012, p. 1030). Alternatively, niche entrepreneurs can apply a ‘stretch and transform’ strategy to change the mainstream conditions and thereby improve selection criteria for the niche innovation (Smith and Raven, 2012). In their analysis of six cases of solar PV, offshore wind and CCS, Raven et al. (2015) found the fit strategy was dominant, although there were cases of stretch strategy.

Researchers note that business models play an important role in the development of niches (Bidmon and Knab, 2014; Geels, 2011). Niches not only nurture breakthrough technologies like solar PV, but also host a range of novel business models (Huijbens and Verbong, 2013; Jolly et al., 2012). Business models for solar PV can enable niche up-scaling by alleviation of perceived risks as well as removal of investment barriers such as the high up-front costs and unavailability of a suitable roof for a PV system (Asmus, 2008; Drury et al., 2012; Huijbens and Verbong, 2013). However, the role of business models in the niche is likely to be dependent upon the different niche empowerment strategies enacted. So far the role business models play in niche up-scaling and their relationship with niche empowerment strategies for dealing with the regulatory regime has been unclear. Business models can be considered as “a reflection of the firm’s realized strategy” (Casadesus-Masanell and Ricart, 2010, p. 195). Indeed, Schaltegger et al. (2012) found that different sustainability strategies resulted in different types of business model innovation regarding adoption, adjustment, improvement and redesign. In a similar vein, Zott and Amit (2008) demonstrate that there is a joint effect of the firm’s competitive strategy and business model on its performance. In this paper we focus on niche empowerment strategies as a particular sub-set of possible strategies.

2.3. Conceptual framework

This paper aims to contribute to an improved understanding of niche development and up-scaling patterns by focusing on the interplay between the regulatory regime and niche business models. The regulatory regime both positively and negatively impacts the niche business model design space, which encompasses all the legal business model design options available to niche entrepreneurs. These options ensure the variety of different business model types found in a certain niche. The larger the design space, the larger the potential variety (see arrow I in Figs. 1 and 2). Niche entrepreneurs can also follow different empowerment strategies for dealing with the regulatory regime, impacting the available niche business model design space and resulting in different niche business models (see arrow II and III in Fig. 1).
Fig. 1. Conceptual framework: Overview of key concepts under study and their interrelationships.

Table 1
Overview of business model components (Boons and Lüdeke-Freund, 2013; Doganova and Eyquem-Renault, 2009; Johnson et al., 2008; Morris et al., 2005; Osterwalder et al., 2010; Richter, 2013; Schoettl and Lehmann-Ortega, 2011; Zott et al., 2011).

<table>
<thead>
<tr>
<th>Business model component</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Proposition</td>
<td>Product/service offered to the customer</td>
</tr>
<tr>
<td>Customer Interface</td>
<td>Customer segment targeted and relationship with the customer</td>
</tr>
<tr>
<td>Internal Organization</td>
<td>Organizational resources, capabilities and processes needed for delivery of the value proposition</td>
</tr>
<tr>
<td>External Value Chain</td>
<td>Partner organizations, their resources and capabilities enabling the delivery of the value proposition</td>
</tr>
<tr>
<td>Profit Equation</td>
<td>Cost-benefit allocation over the various partners in the business model</td>
</tr>
</tbody>
</table>

3. Methodology

For our research we applied an embedded case study design, for which cases are investigated at multiple levels such as company and industry (Eisenhardt, 1989). We studied business models employed at firm level and their interaction with the regulatory regime at play (country level). Two contrasting case studies have been selected by following an extreme case study selection method for which a key variable is either high or low (Eisenhardt and Graebner, 2007; Flyvbjerg, 2006; Seawright and Gerring, 2008). This method is very suitable for exploratory research and allows for thorough investigation of contrasting patterns in empirical data and deep learning of the phenomenon under study. We selected two cases with distinctively different niche shielding characteristics and PV market growth patterns over time: the Netherlands and the Flanders region of Belgium. The Netherlands had relatively low levels of shielding in place with frequent changes in policy (Huijben and Verbong, 2013; Negro et al., 2012; Verhees et al., 2013). Interestingly, PV market growth from 2008 to 2013 proved to be substantial, mainly in the residential sector, where entrepreneurs smartly exploited the available niche shielding instruments. In Flanders a wide variety of niche shielding instruments was available, with green certificates being the most important market driver, resulting in exponential market growth for both residential, medium and large size commercial applications from 2007 onward and a top-3 classification in the EU market in 2012 (EPIA, 2013; Poilié, 2012; VREG, 2015a). However, in 2012 market support stagnated, resulting in a collapse of market growth (VREG, 2015a,b). In order to create an overview of the regulatory regime at play as well as relevant debates around particular regulations and related niche and mainstream actor responses, we analyzed secondary data for both geographical areas. We conducted a broad sampling methodology until saturation in the obtained information was reached. We started by analyzing official publications of the trade associations and network organizations in both countries including the Flemish PV trade association (PV Vlaanderen) and the Dutch organization for promotion of local renewable energy production (Hieropgewekt). We also investigated the relevant regulatory institutions in both countries. For Flanders, this included both the national and regional electricity market regulators (CREG, VREG) and the Flemish Energy Agency (VEA) as well as tax authorities. In the Netherlands, organizations included the ministry of economic affairs, the Netherlands authority for the financial markets and the Netherlands authority for consumers and markets. We also studied sector reports, websites, conference presentations, blogs, newsletters, newspaper articles, national PV magazines, legal documents and notes of governmental meetings. Since we are interested in exploring the interplay between the regulatory regime and niche business models at the level of individual business model components we aimed for a diverse set of representative business model types in both geographical areas. We used conventional types of business models as defined in prior studies as an input for selection: Community Shares, Turnkey and Third Party (Asmus, 2008; Drury et al., 2012; Huijben and Verbong, 2013). While for Turnkey business models the investor is investing in a solar PV system on their own roof, for Third Party there is an external party making the investment. For Community Shares models multiple investors finance a solar PV system together. In this paper, we analyze business models in the niche at individual component level by distinguishing the following: the Value Proposition, Customer Interface, Internal Organization, External Value Chain, and Profit Equation (Boons and Lüdeke-Freund, 2013; Doganova and Eyquem-Renault, 2009; Johnson et al., 2008; Morris et al., 2005; Osterwalder et al., 2010; Richter, 2013; Schoettl and Lehmann-Ortega, 2011; Zott et al., 2011). The overview and definitions of these business model components are provided in Table 1.

Combined with an analysis of secondary data and snowballing in interviews a sample of representative business model types in both geographical areas was created and triangulated with other experts in the field. Since we were less embedded
in the Flemish solar PV market we conducted an extra interview with the chairman of the Flemish PV trade association to help us create an initial overview of representative organizations for the different business model types. Sometimes, one organization had multiple business models in place allowing for cross-validation of findings for similar business model types from other organizations. A total of 16 semi-structured interviews with company CEOs, project managers and business developers of representative organizations were held including energy companies, PV installers and local energy cooperatives executing a PV project. The interviews consisted of different parts, starting with the description of the business model of the organization at the level of individual business model components. Interviewees were then asked for influence of the current and anticipated or desired future regulatory regime on their organization’s business model. The interview ended with snowballing for saturation of the sample of representative business model types. The interviews were recorded and transcribed, and then interviewees were requested to verify the provided information and to give permission for (anonymous) publication. Two researchers then iteratively double coded the transcripts of the interviews until the full agreement was reached to find the range of empowerment strategies applied as well as the impact on niche business models and the particular business model components involved. In case of compliance with regulations a fit and conform code was applied, while for conscious efforts to push the boundaries of the regulatory regime at play we assigned a stretch and transform code. For stretching of niche shielding instruments we also coded the particular dimension targeted (width, depth, duration). Business model components were coded following the definitions provided in Table 1. This procedure is particularly useful in case of explorative, theory-building qualitative studies (Pratt, 2009). We supplemented our empirical material with the observations of 10 knowledge-sharing meetings organized by network organizations like Hieropgewekt or the ministry of economic affairs, agriculture and innovation in the Netherlands. Such meetings focused around solar PV business models and the effect of governmental policy on the market. Sometimes these focused around one particular regulation, for example the net metering regulation based on zip code area in the Netherlands. Finally, we triangulated our findings by validating them with national experts in the field and by combining evidence from the different research methods as such increasing research validity (Greene et al., 1989).

4. Results

Below, we first discuss the effect of the regulatory regime on niche business models, at the level of both business model type and individual components, assuming a fit and conform empowerment strategy of the niche entrepreneur. We continue by exploring the effect of various empowerment strategies for dealing with the regulatory regime applied in both countries and their impact on niche business models, again at individual business model component level. We thereby differentiate between the following types of business models: Community Shares, Turnkey and Third Party (Asmus, 2008; Drury et al., 2012; Huijben and Verborg, 2013), while the business model components covers Value Proposition, Customer Interface, Internal Organization, External Value Chain, and Profit Equation (Boons and Lüdeke-Freund, 2013; Doganova and Eyquem-Renaud, 2009; Johnson et al., 2008; Morris et al., 2005; Osterwalder et al., 2010; Richter, 2013; Schoettl and Lehmann-Ortega, 2011; Zott et al., 2011).

4.1. Effect of the regulatory regime on niche business models

4.1.1. Niche shielding

4.1.1.1. Effect of niche shielding on business model types found in the niche. The level of niche shielding positively impacts the profit equation component of the business model, enabling entrepreneurs to start thinking about business model design options that could exploit the financial incentive offered. A high level of shielding also attracts external investors and spurs the implementation of Third Party business models. This was the case in Flanders, where extremely high levels of niche shielding in the form of green certificates attracted a range of external investors to the PV market, including banks, companies and public parties and implementation of Third Party business models. Financial support in the form of niche shielding is accompanied by certain regulations, dealing with which comes at a cost for the entrepreneur as well (Mormann, 2014). Other organizations may reduce the burden of dealing with regulations by offering services to potential investors. For example, a new VAT deduction support scheme for residents in the Netherlands was relatively complex and new companies were established to assist households in subscribing to the scheme (van der Zwart Accountants en Adviseurs, 2015). These companies thus implemented a business model that substantiates other business models in the niche targeting residents, as such filling a market void and facilitating further niche development.

4.1.1.2. Impact of niche shielding regulations on niche business model components. Niche shielding instruments may target a particular customer segment such as households or agrarians, leading to implementation of specific business models targeting these customers only (see e.g., Mehrmys and Dooms, 2006). Moreover, regulations may limit the pool of potential investors in a PV project (Customer Interface component). This was the case for net metering regulations in the Netherlands. Net metering is the financial balancing of electricity produced and injected to the grid by a PV facility and electricity taken from the grid on the energy bill. Since electricity prices decrease with increased electricity use, households in the Netherlands pay the highest electricity price, making net metering the most attractive for this customer segment. Not all households have a suitable roof for investment or lack the resources for covering the high initial investment costs. Therefore, projects were started in which multiple households collectively finance a PV system (Community Shares business model). However,
since these systems are installed on roofs of buildings with higher electricity use and lower electricity prices, net metering becomes less attractive, making it very hard to develop a profitable business case. Off-site net metering for the higher household rate is not allowed by the Dutch government. The Dutch government is a major stakeholder in the net metering debate as part of the electricity price consists of taxes and VAT income. In January 2014, new regulations for partial off-site net metering for common PV projects were implemented (Nederlandse Overheid, 2013). Under the new regulations, investors must live within the same ‘zip code rose’ as the project location affecting the pool of potential investors (Customer Interface component)2 (Hieropgewekt, 2015a). Thus, regulations for niche shielding instruments can impact individual niche business model components.

4.1.2. Mainstream market regulations
Entrepreneurs also need to deal with the mainstream regulations in various sectors including energy, building and finance when implementing their business models. As stated above, dealing with these regulations may lead to extra costs, both directly and indirectly due to adapting the business model (Mormann, 2011, 2012). For instance, PV projects in the Netherlands that produce more than 300,000 kWh annually required a special grid connection, leading to extra costs and putting pressure on the financial viability of the Community Shares business model (Profit Equation component) (Hieropgewekt, 2015b). However, from January 2015 the regulation was abandoned. The indirect costs for dealing with regulations may be so high that they outweigh the benefits of available niche shielding instruments, thereby preventing business models from being implemented. This was the case in Flanders, where a bank decided not to offer their residential clients a lease business model since it was too costly for them to deal with all the regulations for protecting customers in lease contracts. Economies of scale may counteract such (in) direct costs arising from dealing with the regulatory regime. Finally, in some cases business models, even though financially viable and able to carry the (in) direct costs of dealing with the regulatory regime, may be restricted by existing regulations that form a mismatch with the business model. In 2012, the municipality of Groningen, the Netherlands, tried to implement the Property Assessed Clean Energy (PACE) business model, which is a Third Party model whereby investments are repaid via municipal taxes on properties. However, this required changes in existing tax legislation (mainstream financial system) which were lobby for ‘stretch and transform’ empowerment strategy, but not approved by the government. This business model then had to be discontinued (Internal Organization component was unfeasible). The above discussion highlights that the regulatory regime both creates and restricts the business model design space. It impacts the various business components, both directly and indirectly, leading to more or less profitable business models (Fig. 2).

4.2. Empowerment strategies and niche business models

4.2.1. Fit-like strategies
As discussed above, entrepreneurs may follow a ‘fit and conform’ strategy to deal with the regulatory regime (Smith and Raven, 2012). We found that organizations choose different fit strategies for dealing with a particular regulation. Energy cooperatives in the Netherlands that were implementing Community Shares business models were confronted with mainstream regulations for energy supply that were geared to large energy companies and so compliance was extremely difficult for them. The cooperatives therefore joined forces and applied for a permit collectively (Duurzame Energie Unie, 2015). Other cooperatives collaborated with mainstream energy players who were willing to share their license if cooperative members became clients (External Value Chain component) (Hieropgewekt, 2015c).

Our cases also show how entrepreneurs can adapt their business model to anticipate changes in the regulatory regime (Future-fit). For example, a company operating in the Netherlands experienced the burden of having too many employees on the payroll when niche shielding levels dropped. When expanding their business to Flanders and implementing both Turnkey and Third Party business models, they decided to keep the core organization small to anticipate fluctuations in niche shielding levels (Internal Organization component). Another Flemish company had to adapt their purchase and sales channels to deal with rapidly declining niche shielding levels (Internal Organization and External Value Chain components). Niche shielding levels declined every three months, setting strict deadlines for new PV projects (VREG, 2015b).

4.2.2. Stretch-like strategies
Entrepreneurs can also astutely adapt their business model, either incrementally or radically, in order to obtain extra benefits from the existing regulatory regime. For example, by spreading the invoice over two years, residents in Flanders could avoid the maximum cap set for a tax deduction scheme (Stretch - Incremental business model innovation). This required adaptations to the internal organization of the company and value proposition to the customer (Turnkey business model). This example shows how stretching can increase the depth of the available niche shielding instrument, which in this case is also directly related to increasing niche shielding duration. One energy cooperative in Flanders applied for an ecology premium (i.e. investment subsidy) to invest in PV systems (Community Shares). However, the ecology premium was meant for companies and not for residents. A court case ruled that the legal status of the energy cooperative (Internal Organization

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2 A zip code rose is a postal code zone including its direct postal code neighbors. The business case becomes less profitable.
component) matched the regulations for the ecology premium, after which it was assigned to the cooperative (Beauvent, 2013). As such, the width of an existing niche shielding instrument was increased, allowing others to benefit as well. The above examples show how entrepreneurs can exploit opportunities in the regulatory regime by either increasing the width or depth of available niche shielding instruments with relatively minor business model adaptations.

Niche entrepreneurs can also more radically adapt their business models to deal with the existing regulatory regime and expand the business model design space (Stretch – Radical business model innovation). As explained above, off-site net metering by households is not allowed in the Netherlands (Agentschap, 2013). This was a major problem for apartment owners wanting to construct a collective PV system on their apartment building (Community Shares business model). In response, a new technological device called ‘Herman de zonnestroomverdeler’ (Herman the electricity distributor) was implemented with which a whole new business model could be built. The first Herman was introduced in 2013; in February 2014 more than fifty devices had been sold (Herman de Zonnestroomverdeler, 2015a). The device allocates the produced electricity of the central system to individual meters (i.e., to different apartments), proportional to the share in the project (Herman de Zonnestroomverdeler, 2015b). Some of the electricity can be directly self-consumed, thereby avoiding buying electricity from the grid; the remainder can be net metered. In this way, all the electricity produced is worth the highest electricity rate, as such increasing the depth of available net metering instrument. An online application enables the apartment owners to change the division of the electricity according to their needs, for example when people move, their shares can be sold (Herman de Zonnestroomverdeler, 2015c). The app also provides information about the electricity produced and the reduced CO2 emissions. This illustrates how new technologies enable the implementation of new business models that can exploit opportunities from the existing regulatory regime in new ways, thereby expanding the business model design space and increasing the depth of the available niche shielding instruments. Another example is the ‘company searches neighbor’ business model where companies and residents collaborate to exploit two types of niche shielding instruments previously not available to them: net metering at the highest possible rate and tax deduction from taxable income for companies, thus increasing the width of available niche shielding instruments (BOERzoektBUUR, 2015). The company invests in a system placed on the roof of a household which can apply net metering for the highest rate (Third Party business model). The company can apply for tax deduction from its taxable income since it is investing in an energy technology. The household pays the regular rate per kWh for a period of six years. After this, the contract ends and the household becomes the owner of the system and profits from free electricity for the remainder of the system’s lifetime.

Additionally, entrepreneurs can openly cross the boundaries of the regulatory regime in order to actively provoke discussion and expand existing regulations (Stretch—Openly illegal operation of business model to provoke discussion). While operating such a business model is illegal, the moral legitimacy of entrepreneurial action protects the actors involved. Several projects in the Netherlands operating a Community Shares business model still applied off-site net metering even though this was prohibited by the Dutch government, thereby aiming at increasing the depth of available net metering instruments. Interestingly, they were supported by local municipalities that would (temporarily) provide the necessary back-up funds if the Dutch central government decided to collect their tax. This strategy is risky since long term financial benefits cannot be guaranteed. Similar strategies were also observed in the Dutch health care sector, where niche entrepreneurs tried to
influence the system context by not conforming to mainstream practices and behaving according to standards that still need to be developed (Janssen and Moors, 2013). In case of urgent healthcare needs, such deviations from mainstream practices can be supported by the rapid set-up of a dedicated niche for experimentation (Boon et al., 2014). Entrepreneurs may also be deliberately illegally appropriating shielding instruments outside society and regulators’ scope (Fraud). For example, Podolefsky (2013) found how overpricing of PV systems by entrepreneurs operating a third-party business model resulted in an excess of $83 million of taxable assets reported in the US, corresponding to $25 million of tax benefits for entrepreneurs between 2007 and 2011.

Finally, entrepreneurs may also prepare their business model to anticipate changes in regulatory regimes, following a stretch strategy. For example, a new ‘Herman’ is under development that will allocate the electricity produced to the apartments where electricity is needed instantly (Herman de Zonnestroomverdeker, 2015c) (Community Shares business model). Thereby the amount of directly self-consumed electricity increases and less electricity needs to be net metered. The new ‘Herman’ is anticipating limitations in net metering (Future stretch - Radical business model innovation). However, this may lead to new changes in regulations like taxing directly self-consumed electricity as well.

The above discussion shows how entrepreneurial entrepreneurs can innovate their business models, create more profitable business cases and deal astutely with mainstream regulations. However, as explained above, this may also come at the expense of higher transaction costs. Moreover, the implementation of these business models can be (intentionally) provoking and lead to discussion on the application of regulations and even to court cases with uncertain outcomes. Thus, profitable business cases cannot be guaranteed. On the other hand, the debate on regulations may also lead to further easing of existing regulations, thereby opening up the market for the wider implementation of similar and new business models as was the case with the Dutch net metering experiments The regulatory regime affects specific parts of the niche business model. However, it is the entrepreneurial strategy for dealing with the regulatory regime that defines the final business model implemented. Table 2 provides a structured overview of the above described examples of the interplay between regulatory regimes, entrepreneurial strategies and niche business models. It indicates how regulatory regimes affect certain components of the business model with usually only one or two components directly affected. The final business model implemented, however, depends on the chosen entrepreneurial strategy for dealing with the regulatory regime, which can differ between niche entrepreneurs. Different entrepreneurs can follow different strategies for dealing with particular regulations, as was for example the case for strategies for dealing with electricity supply regulations in the Netherlands. While some entrepreneurs decided to work together in order to obtain a license, others joined forces with mainstream players. For stretch strategies and strategies anticipating future regulatory regimes we found that it is mostly the organizational business model components (Internal organization, External Value Chain) that are redesigned for this purpose.

Our analysis of different niche empowerment strategies employed in both countries reveals how both fit and stretch strategies can be oriented to the current and anticipated future regulatory regimes (Table 2). Additionally, while the fit-like strategies seem only to differ in terms of temporal focus, the stretch-like strategies also differ in other dimensions. First, we found that the stretching activity aims at either increasing the duration, width or the depth of available niche shielding instruments. Second, stretching can be enabled by both incremental and radical business model innovation. Third, the reasons for stretching may differ from personal gains to contribution to wider PV market up-scaling (openly illegal stretching), where the latter form of stretching can benefit from societal legitimacy.

4.2.3. Level of shielding and choice of empowerment strategy

When dealing with regulatory regimes, niche entrepreneurs can ‘pick their battles’ and decide to actively provoke one regulation while complying with another. Moreover, entrepreneurs can decide to adapt their strategies and business models over time. The strategy chosen may also depend on contextual conditions. In Flanders, high levels of niche shielding led to more straightforward and less creative business model concepts, in line with fit strategies. Only when levels of niche shielding decreased in Flanders could more stretch like strategies and related business models be found in the Flemish market, or as explained by the chairman of the Flemish PV trade association:

“Because of too high levels of subsidy . . . there was no need to be creative with market concepts, this is only about to start”

(Interview Flemish PV trade association, October 2012)

In the Netherlands on the other hand, niche shielding was relatively low and unstable. There has been fierce debate on regulations and implementation of creative business models from the early stages of market development.

5. Discussion

This paper explores the interplay between entrepreneurial strategies for dealing with regulatory regimes and niche business models. Our main findings are summarized in Fig. 3 and will be further discussed below.

Our study contributes to the business model literature by positioning it better in the transition studies literature. While many studies consider that the entire business model is affected by the regulatory regime (Dewald and Truffer, 2011; Provance et al., 2011; Hinell and O’Neil, 2012; Huijben and Verbong, 2013) or certain isolated components (Boons et al., 2013), our study highlights that usually only one or two components are directly affected (arrow I in Figs. 3 and 2). However, we found an impact on diverse subsets. Any component of the business model can be affected by either niche or mainstream regulations. Interestingly, the profit equation is directly affected by the level of shielding, while the niche shielding
Table 2
Structured overview of examples of interplay between the regulatory regime, empowerment strategy and niche business models. For the interplay between the regulatory regime and the business model component affected, see Fig. 1 (indicated in brackets). For shielding regulations, we indicate the related characteristic targeted for stretching, following Boon and Bakker (2015).

<table>
<thead>
<tr>
<th>BM type</th>
<th>Empowerment strategy</th>
<th>Regulation</th>
<th>Regulation type</th>
<th>Country</th>
<th>Main BM component affected (type of effect from the regulatory regime, see Fig. 1)</th>
<th>BM components redesigned by the entrepreneur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community shares</td>
<td>Fit and conform</td>
<td>Partial off-site net metering is only allowed within the same zip code zone</td>
<td>Niche shielding</td>
<td>NL</td>
<td>Profit Equation (1): the business case becomes more profitable</td>
<td>None</td>
</tr>
<tr>
<td>Community shares</td>
<td>Fit and conform</td>
<td>Fee for grid connection in case of heavy load Energy cooperatives have to comply with a set of conditions for being allowed to supply energy to participants/clients</td>
<td>Mainstream regulation</td>
<td>NL</td>
<td>Profit Equation (2): the business case becomes less profitable Internal Organization (5): organization has to be adapted to match requirements for electricity supply Internal Organization, External Value Chain, Value Proposition (5): Supply energy to end-customers through either association of energy cooperatives or mainstream players that already have the supply license</td>
<td>None</td>
</tr>
<tr>
<td>Community shares</td>
<td>Fit and conform</td>
<td>Partial off-site net metering is only allowed within the same zip code zone</td>
<td>Niche shielding</td>
<td>NL</td>
<td>Profit Equation (1): the business case becomes more profitable</td>
<td>None</td>
</tr>
<tr>
<td>Turnkey, Third Party</td>
<td>Future—fit-incremental BM innovation</td>
<td>GSC shielding level decreases every three months</td>
<td>Niche shielding</td>
<td>FL</td>
<td>Profit Equation (1): the business case becomes less profitable Customer Interface (4): there is a large peak in the number of customers/projects before the next lowering of the level of shielding Internal Organization, External Value Chain: purchase and sales channels: lead time adapted to match stricter deadlines for decreasing shielding levels. Internal Organization: employees are on flex-contracts and not on payroll to better match potentially decreasing levels of shielding</td>
<td>Internal Organization, External Value Chain: value proposition (5): double the maximum cap for tax deduction</td>
</tr>
<tr>
<td>Turnkey, Third Party</td>
<td>Future—fit-incremental BM innovation</td>
<td>Potential lower future shielding level in general</td>
<td>Niche shielding</td>
<td>FL</td>
<td>Profit Equation (1): the business case becomes less profitable</td>
<td>Internal Organization, External Value Chain: purchase and sales channels: lead time adapted to match stricter deadlines for decreasing shielding levels. Internal Organization: employees are on flex-contracts and not on payroll to better match potentially decreasing levels of shielding</td>
</tr>
<tr>
<td>Turnkey</td>
<td>Stretch—incremental BM innovation</td>
<td>Tax deduction scheme for households has a maximum cap for tax deduction</td>
<td>Niche shielding Depth, duration</td>
<td>FL</td>
<td>Profit Equation (1): the business case becomes more profitable Internal Organization, Value Proposition (4): one bill provided to household that can be used for applying for the tax deduction scheme</td>
<td>Internal Organization, Value Proposition: spread payment: two bills provided to double the maximum cap for tax deduction</td>
</tr>
<tr>
<td>BM type</td>
<td>Empowerment strategy</td>
<td>Regulation</td>
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<tr>
<td>Community Shares</td>
<td>Stretch—incremental BM innovation</td>
<td>Ecology premium only available for organizations with the legal status of a company</td>
<td>Niche shielding Width</td>
<td>FL</td>
<td>Profit Equation (1): the business case becomes more profitable</td>
<td>Internal Organization: legal status of the energy cooperative is adapted to match requirements for obtaining ecology premium</td>
</tr>
<tr>
<td>Third party</td>
<td>Stretch—radical BM innovation</td>
<td>Two regulations combined: Tax deduction scheme for companies investing in PV, and net metering for households</td>
<td>Niche shielding Width</td>
<td>NL</td>
<td>Profit Equation (1): the business case becomes more profitable</td>
<td>Internal Organization, External Value Chain: smart organization of electricity and money flows between actors to make optimal use of available niche shielding instruments: the company invests in PV system on household’s roof, and the household applies for the net metering</td>
</tr>
<tr>
<td>Community Shares</td>
<td>Stretch—radical BM innovation</td>
<td>Two regulations combined: net metering for households and lower energy taxes for higher electricity use</td>
<td>Niche shielding Depth</td>
<td>NL</td>
<td>Profit Equation (1,2): net metering: the business case becomes more profitable Energy taxes: the business case becomes less profitable (for higher electricity use) Internal Organization, External Value Chain (4): if private persons would like to (co)invest in a PV system on an existing large building (e.g. apartment or office), they would be entitled to a relatively low net metering compensation because the PV system would be connected to the central meter with higher electricity use and lower energy taxes. Thus the business case becomes less profitable</td>
<td>Internal Organization, External Value Chain: smart organization of electricity and money flows between actors using a technological innovation that switches grid connection of the large PV system between the individual households</td>
</tr>
<tr>
<td>Community Shares</td>
<td>Stretch—openly illegal operation</td>
<td>Two regulations combined: net metering for households and lower energy taxes for higher electricity use</td>
<td>Niche shielding Depth</td>
<td>NL</td>
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</tr>
<tr>
<td>Community Shares</td>
<td>Future-stretch—radical BM innovation</td>
<td>Net metering will be revised in 2017, probably resulting in a stepwise decrease in the level of shielding from then on and finally total elimination of the net metering regulation</td>
<td>Niche shielding Depth</td>
<td>NL</td>
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</tbody>
</table>

**Profit Equation (1,2):** Net metering: The business case becomes more profitable Energy taxes: the business case becomes less profitable (for higher electricity use)

**Internal Organization, External Value Chain (4):** if private persons would like to (co)invest in a PV system on an existing large building (e.g. apartment or office building), they would be entitled to a relatively low net metering compensations because the PV system would be connected to the central meter with higher electricity use and lower energy taxes. Thus the business case becomes less profitable

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4 Fitting to this regulation was detrimental to the business case for larger projects with shared investment, therefore lobbying took place with a positive outcome for niche entrepreneurs (the fee was abolished in January 2015) (Hieropgewekt, 2015b).
regulations shape the niche by affecting the other four components of the business model. We thereby highlight that future transition studies should make an explicit distinction between the width and depth dimensions of niche shielding.

Our analysis revealed a variety of fit and stretch-like entrepreneurial strategies for dealing with the current regulatory regime and anticipating any changes. It thereby enriches our current understanding of niche empowerment processes (Smith and Raven, 2012; Smith et al., 2014; Raven et al., 2015). First, it highlights that different fit and stretch strategies could be chosen by the entrepreneurs within the same niche at the same time (arrow III in Fig. 3). Such strategies may follow different temporal orientation (present-future). Business models thus are not only a ‘reflection of a firm’s realized strategy’ (Casadesus-Masanell and Ricart, 2010, p. 195). Our results demonstrate that they also encompass a company’s anticipating strategy for the future regulatory regime. Engau and Hoffmann (2011) find similar strategies for airline executives anticipating future changes in regulatory regimes involving a high level of risk and uncertainty to their companies, by adapting their business models and creating a flat organizational structure. We also show how entrepreneurs not only adapt their business model to fit with future regulatory regimes but also design it for stretching the anticipated future regulatory regime. Second, it demonstrates that a low level of niche shielding can induce a high level of stretching activities even if the niche is in an early development phase. Third, both fit and stretch can occur not only when the niche interacts with the mainstream regime, but also on the interface between the niche (niche shielding) and the different business models within the niche. We also showed how empowerment strategies can relate to different characteristics of shielding institutions (e.g. width, depth, duration) that can even be interdependent. Shielding and empowerment are thus not isolated processes (Smith et al., 2014). We contribute to the literature on niche empowerment by showing the implications of fit and stretch strategies on business models in the niche. Whether or not any component would be redesigned as well as the level of business model innovation depends on the strategy the entrepreneur chooses for dealing with the regulatory regime. For stretching it is mostly the organizational components that are redesigned (arrow II in Fig. 3). Additionally, our results show how combination of technological and business model innovation can be a very effective means for implementation of stretch empowerment strategies (Boons and Lüdeke-Freund, 2013).

Finally, our results highlight how the opposing institutional pressures and prescriptions shape the business model design space available to companies. Such mixed institutional pressures are known as institutional complexity and represent an emergent stream of research within the institutional theory literature (Greenwood et al., 2011; Raaijmakers et al., 2015; Vermeulen et al., 2014). Our results demonstrate that such conflicting institutional pressures can be resolved in a range of stretch-like strategies involving business model innovation. We thereby answer to a recent call for further research on how the different sources of institutional complexity can lead to specific organizational responses (Vermeulen et al., 2014).

5.1. Limitations and further research directions

While this paper did not explicitly focus on niche nurturing as one of the niche development processes, we consider this to be an interesting direction for future research activities, especially on the topic of niche policy learning. Only recently researchers have started to explore learning about shielding instruments by actors within and outside the niche (Boon and Bakker, 2015; Raven et al., 2015). Learning about business models was also indicated as an important feature for niche development. Geels (2011) was the first to acknowledge the importance of learning about business models in the niche. More recently, Huijbens and Verbong (2013) described how different types of business models are undergoing experimentation within the Dutch PV niche and how different actors learn from each other, for example at network meetings. The need for intra and inter-firm business model experimentation and learning is also acknowledged by management scholars (Chesbrough, 2010; McGrath, 2010; Sosna et al., 2010). However, inter-organizational learning about the interplay between the regulatory regime and niche business models has not yet been interrogated.

Finally, Thompson et al. (2014) were the first to examine how sustainable entrepreneurs try to change institutions, a topic previously overlooked in mainstream institutional entrepreneurship and sustainable entrepreneurship literature. They found that entrepreneurs follow different strategies (both individual and collective) such as creating new symbols, measuring the benefits of the technical innovation or forming a trade association that can pool resources and support institutional
change processes. Our analysis revealed that both incremental and radical business model innovation (e.g. Chesbrough and Roosenboom, 2002; Chesbrough, 2010; McGrath, 2010; Zott et al., 2011) can be a very effective and complementary way for sustainable entrepreneurs to stretch the regulatory regime, with mostly the Internal Organization and External Value Chain components being redesigned. Sometimes stretching efforts openly provoke discussion on particular shielding instruments, thereby directly challenging their legitimacy (Boon and Bakker, 2015). As such, business model innovation enables institutional innovation, which is central to sustainable entrepreneurship (Schaltegger and Wagner, 2011). It might also has the potential to overcome the huge impact of mainstream players in policy arenas (Pinkse and Groot, 2015). While our study provides valuable insights on niche empowerment strategies, our sample is limited in size and we expect that different types of strategies can be found for different technologies or institutional contexts. Additionally, such stretch efforts come with a risk of triggering lawsuits from the government (Beauvent, 2013). Risk management strategies that could be used to alleviate such risks are definitely worthy of future research. Similarly interesting for further investigation are the motives for niche empowerment strategies, which for stretching we found to be related to personal gain, wider societal change or both, and other factors underlying the choice for the particular type of the niche empowerment strategy (Lehmann Nielsen and Parker, 2012; Meek et al., 2010; Sutinen and Kuperan, 1999).

6. Conclusion and recommendations

New, radically different business models are essential for transforming our present day non-sustainable energy system. Somewhat counter-intuitive though is the fact that the niche regulations play a major role in this process by both enabling and limiting the business model design space. Our research highlights the different mechanisms channeling the interplay between the regulatory regime and the different business model components, with usually only one or two components being affected. Different fit and stretch strategies can be used for dealing with the regulatory regime, with related business models as an outcome. We found that the choice of strategy was influenced by the level of shielding in place. Empowerment strategies showed different temporal orientation. Stretching of shielding was found to be related to different characteristics of related shielding instruments (width, depth, duration) and was caused by different motivations. In our opinion the business model innovation was a very effective means of stretching the current regulatory regime, even for incremental business model innovation. It is mostly the organizational parts of a business model that are redesigned for this purpose.

6.1. Managerial and policy implications

Based on the above, we encourage niche entrepreneurs to critically assess how their current business model can be improved to smartly exploit available niche shielding instruments or deal with regulatory barriers. Combining technological and business model innovation can lead to very innovative constellations. Even incremental business model innovation can stretch the regulatory regime. Combining two individual niche shielding instruments that target different types of end users into one business model can be a very effective strategy. However, this requires more radical business model innovation, which is also a very efficient way of alleviating the effect of opposing regulations. However, stretching often involves a high risk of disputes and court cases. Since the regulatory regime is continuously shifting, strategic reorientation and business model innovation are constantly needed, forming a main challenge to niche entrepreneurs. We therefore recommend actively learning from peers, for example via network meetings or online information platforms.

Policy makers on the other hand should consider the types of business models they wish to target, which may include previously excluded customer segments such as tenants or those with tight budgets. Niche shielding instruments should be clearly framed in terms of depth, width and duration towards these target groups in order to avoid unnecessary spillover of money to other market segments. Moreover, an overview of mainstream regulatory barriers should be made as well as a strategy for dealing with them. For example, on the one hand we see new experiments announced in the Netherlands in 2013 to try and alter mainstream regulations for the electricity supply to communal PV projects in which shares are sold to (neighboring) residents and companies (Heemstra van, 2013). On the other hand, a third-party business model that needed adaptation in mainstream financial regulations was not supported (Huijben and Verbong, 2013). Finally, shifting regulatory regimes that alter the costs and benefits throughout the energy system should be carefully assessed.

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