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Working paper series
1708-CSE

university of groningen / campus fryslân

Working paper series

Centre for Sustainable Entrepreneurship

University of Groningen/Campus Fryslân

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Editor: Margo Enthoven
Academic director: Dr. Gjalt de Jong
Design (cover): David-Imre Kanselaar

THE DIFFUSION OF NOVELTY AND FIELD CHANGE: A CROSS CASE COMPARISON OF SUSTAINABLE INNOVATION IN GERMANY, SPAIN AND THE NETHERLANDS

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JUNE 2017

ABSTRACT

Earlier studies have illuminated the role of single institutional processes as drivers of isomorphic change, thereby risking heroification of certain actors and underplaying the interactive complexity of innovation diffusion and field change. While this study confirms the importance of previously acknowledged institutional processes, its contribution lies in theorizing on how these processes interrelate. We conclude that by focusing on multiple institutional and competitive processes, and their interactions, a richer explanation can be found for the diffusion of novelty and field change. We theorize on how these processes make up prosperous loops of anchoring of new solutions with field actors, and politicizing of sustainable futures with powerful actors, jointly leading the field to change.

KEYWORDS: Institutional theory, Innovation diffusion, case study

INTRODUCTION

Institutional theory is strong at explaining isomorphic change (Dimaggio and Powell, 1983) or the processes by which actors within the same field adopt newness in similar ways. As an innovation spreads, a threshold is reached beyond which adoption provides legitimacy rather than improves performance (Meyer and Rowan, 1977). Thus, despite the fact that at the micro-level organizations have agency (Oliver, 1991), institutional theory predicts that, at the meso- and macro-level, "the aggregate effect of individual change is to lessen the extent of diversity within the field" (DiMaggio and Powell, 1983:149). For the diffusion of sustainable innovations, this is a good thing, as the wide spread of solar panels, hybrid cars or heat exchange pumps, for example, can play an important role in creating sustainable economic growth whilst decreasing our ecological footprint. However, sustainable innovations do not diffuse fast, and fields do not change rapidly.

This study focuses on the diffusion of solar panels, and changes in the energy industry over the last 12 years. Whereas Sine and David (2003) framed the 1970s oil crisis as a jolt after which taken-for-granted beliefs in the energy industry were questioned and new entrepreneurial opportunities arose, we observe that, overall, most European economies are still as oil-based as before: whereas oil consumption in Europe has decreased slightly since the 70s, this decrease has been compensated for by gas (and coal). Hence, the question how novelty diffuses and fields change remains.

Although previous studies have shed light on this question they focus mainly on *one* institutional process and leave out the interaction between processes (Heugens & Lander, 2009). This is in contrast to the original work by DiMaggio and Powell (1983) that distinguished between three isomorphic processes and stressed

the importance of interaction between them for understanding isomorphic change. Since then, very few empirical studies have addressed more than one or two pressures. After studying 160 empirical papers on institutional theory, Mizruchi and Fein (1999: 664) conclude that: "…The problem here is that the focus on one isomorphic process leads to a failure to consider that an alternative process might be operative". We therefore conclude that there has still been no thorough theorization and analysis of the interaction between institutional pressures (Beckert, 2010; Heugens & Lander, 2009). The focus on institutions has also led to less attention being given to competitive forces, even though DiMaggio and Powell (1983) start their seminal article by arguing that institutional pressures *complement* this "invisible hand". They go on to argue that, especially in the early phases of an innovation's diffusion and in fields in which there is free and open competition, market competition, niche change, and fitness measures play a large role.

In this paper, we argue that both institutional and competitive pressures ought to be included to understand the complex process of ricocheting between pressures (McCool & Stankey, 2004; Zucker, 1987), and we ask how our understanding of the diffusion of novelty and field change changes as a result. By addressing this question, we aim to derive additional explanations of why the diffusion of novelty is dampened or accelerated (Heugens & Lander, 2009) and add to our understanding how sustainable developments advance.

We therefore first develop a method for measuring institutional and competitive pressures, drawing on an extensive literature review. Using this coding scheme, we present three longitudinal cases on the diffusion of solar panels and the changes in the solar industry in Germany, the Netherlands and Spain. As these cases illustrate major differences in how successfully novelty was diffused, we can then compare cases and examine how those differences can be explained in terms of single

pressures, or interaction between various pressures over time. We conclude by theorizing on how the diffusion of novelty and field change can be explained when all pressures are included.

THEORY

In this study we use the diffusion of solar panels as an antecedent for field change as wider diffusion implies greater de-institutionalisation of existing forms of energy production and consumption, and early institutionalisation of new forms. In recent years, the diffusion of innovation in general (Nelson et al., 2004), and the diffusion of sustainable innovations in the energy sector in particular, has received much attention (Jacobsson and Bergek, 2004, Caparros and McDonnell, 2013, D'Alessandro et al., 2010). In institutional theory, innovation has been framed as a potential driver of new dominant institutional paradigms (Kraatz and Zajac, 1996) which involves a process of generating new norms, standards and practices. In this sense, innovation can be seen as a driver behind the generative, rather than reproductive institutional processes (Zucker, 1987, Jennings and Zandbergen, 1995). Sustainable innovations can play an important role in creating sustainable economic growth. In this study, innovation is defined as the generation, acceptance and implementation of new processes, products or services (Thompson, 1965), with 'sustainable' denoting that these should either reduce the negative impacts on people, planet and profit or bring increased benefits (Hart, 1995). Sustainable innovation is unique as its advantages often lie in reducing negative externalities, rather than offering a clear advantage to the buyer. It can therefore be considered as being subject to the same principles as in the 'tragedy of the commons' (Hardin, 1968): although everyone understands that innovation is needed to protect the

common good (nature, welfare), people will still favour solutions that give the individual most benefits (cheaper, easier). This is why explicit attention to the 'rules of the game' or institutions is needed (Senge et al., 2008) as these authoritative guidelines (Scott, 2004) can direct actors towards more sustainable behaviour.

It is only when these institutions change, that fields can transform into more sustainable states. In line with Beckert (2010), we argue that in order to really understand field change, we have to understand how social structures and actors interact. As actors are subject to multiple stakeholders and stakeholder pressures (Mitchell, Agle and Wood, 1997), reactions are the result of combined pressures that might not be the sum of separate pressures. This study therefore focuses on the interaction between pressures as a driver (or inhibitor) of innovation diffusion and field change.

Furthermore, whereas most studies have focused on single historical cases of successful change processes (Sine and Lee, 2009, Hiatt et al., 2009, Barley, 1986), we chose to use multiple cases with varied results. Earlier studies have emphasized particular institutional processes as being dominant in explaining institutional change, for instance jolts (Greenwood et al., 2002, Sine and David, 2003) , institutional entrepreneurship (Battilana et al., 2009), and professionalization (Lounsbury, 2002). However, these studies only looked at successful change and attributed this to a specific process with hindsight. This may lead to heroification (Suddaby 2010), or the attribution of success to specific actors, things or processes, and the failure to see the other explanatory processes at play as only the outcome is measured while assuming the process (Mizruchi and Fein 1999, 664). We therefore compare across cases to be able to discover whether similar processes lead to the same, or different results (Eisenhardt, 1989).

To examine how institutional and competitive pressures influence innovation diffusion and field change, we start by operationalizing institutional pressures into concrete actions and attributing them to actors on the basis of a literature review of more than fifty articles on institutional theory. Appendix A provides an overview of the literature leading to the framework and discusses the various institutional pressures. Coercive pressures are exerted by organizations such as the government or (large) buyers on which field actors are dependent (Moseñe et al., 2013, Dimaggio and Powell, 1983). Central to our operationalisation of coercive pressures is that these pressures have direct financial consequences for actors which can be either negative (e.g., penalties or loss of turnover) or positive (e.g., tax exemptions or increased sales). Coercive pressures can work in two ways: reactively by driving people or organizations to conform to existing rules or norms, and proactively by leading them to anticipate future rules and regulation or shareholder and market expectations (Aragon-Correa & Sharma, 2003; Bansal & Roth, 2000). In the latter situation, organizations can create a competitive advantage which enables them to stay ahead of their competitors (Bansal & Clelland, 2004; Porter & van der Linde, 1995, Clemens & Douglas, 2006. New pollution regulations are an example of how organizations are forced reactively to adopt new practices and work to higher standards (Lampe et al., 1991; Vredenburg & Westley, 1993). In this way coercion can increase the pace of these processes. It is furthermore mainly a reproductive institutional pressure, as it forces organisations to become more similar (Zucker, 1987). Mimetic isomorphism refers to mimicking behaviour under conditions of uncertainty (Dimaggio and Powell, 1983). In the context of innovation, fields can be characterized by high uncertainty: as nascent technologies struggle for dominance, organizations model themselves on companies that seem to be successful. Copying

such organizations reduces uncertainty, but does not necessarily contribute to the performance of the firm (Dimaggio and Powell, 1983).

In our operationalization of mimetic pressures we focus on industry events that signal the direction in which the field is developing. These include, for example, the introduction of new products, increasing firm prestige of front-runner companies, firm growth and strategic changes. If early adopters do well, this will be a signal to the field to mimic them, and also to invest in innovation and build up capacity. This process also works two ways: when front-runners do well, mimetic processes will accelerate adoption of novelty. When front-runners fail, the same acceleration will take place and a field can very quickly abort earlier investments and commitments. By its nature, mimicry is a reproductive, rather than generative institutional process. Normative pressure is operationalized in two ways: as pressure from professionals and scientists, and as pressures from the general public. The first pressure is described by DiMaggio and Powell (1982) as the process of professionalization. It relates to universities where knowledge development, education of professionals, and the development of new norms and standards slowly instils taken for granted knowledge, norms and values. These understandings are then diffused through professional networks in which people are trained on the job, and are infused with a shared knowledge-base and taken-for-granted rules of behaviour.

The second normative pressure is from the public, for instance through actions from NGO's, social movements, or actions and reactions in the (social) media (de Bakker and den Hond, 2008b). Whereas the former mainly defines technical norms (i.e., the state-of-the-art), the latter defines behavioural norms (i.e., what is acceptable). These norms will sometimes be explicit, and sometimes taken for granted or reflected in concrete reactions. The function of normative pressures is

mainly to signal desired behaviour and they therefore initiate a generative institutional process. The institutional pressures are summarized in Table 1.

TABLE 1. Actors and their actions

	Government	Industry	Public	Professionals
Coercive	Proposing new law Introducing policies Introducing a laws(e.g.ban) Technology-forcing standards Introducing fiscal measures Monitoring and law enforcement Subsidizing innovation Reporting requirements Investments in infrastructure	Boycotting contractors and/ or suppliers Lawsuits to resist or enforce innovation	Political consumerism Embargoes, lockouts Occupation of for instance buildings Shareholder activism	
Mimetic		Change in: • Industry adoption of innovation • industry interconnectedness • firm/industry size (number of employees) • firm/industry turnover – profit • firm prestige and visibility • number of innovations /inventions • level of competition		Publish rankings (e.g. % of companies that have adopted norm, sustainability top 50) Training of staff on innovation Spreading new knowledge / sustainable management models
Normative	Voluntary agreements with other actors Public procurement of innovation Awareness campaigns to support adoption innovation Political discussion / Parliamentary motions to put innovation on agenda Certification	Advocacy of innovation Industry association membership and campaigns Coalition between industry actors to promote / halt innovation Self-regulation	Expressions of public opinion Introducing alternative business models Campaigning e.g. in social media Revelation or disclosure of information Civil disobedience NGO membership Lobbying NGO-governmental relations Championing innovation	Introducing new norms and standards Knowledge development and sharing Expression of expert opinions Training/education e.g. development new curricula

Competitive isomorphism assumes a system of open competitive markets in which 'the invisible hand' works through processes of selection and retention (Hannan and Freeman, 1977), i.e. through (relative) prices making an innovation more or less attractive, competition in new and existing markets, and competitiveness of the own organization. Especially in the early phases of the diffusion of an innovation, market competition and fitness measures play a large role (DiMaggio and Powell, 1983). For this study, several competitive pressures are included. The oil price is taken into account as it influences the relative attractiveness of renewable energy production. International competition from non-European producers is included as this strongly affects the price for solar panels, the potential profitability of European firms and opportunities for export. Lastly, access to resources is included as the production of solar panels is dependent on having access to silicon, a scarce resource.

METHOD

To gain a deeper understanding of innovation diffusion and field change, we used theoretical sampling to ensure variation between the cases (Glaser and Strauss, 1967). To measure diffusion we chose sales of solar panels (thermal and PV) as these are sustainable innovations that show big differences in the rate of diffusion across countries. As these are consumer products, the diffusion of solar panels is dependent on actions taken by all actors, including consumers or 'the public'. This would not be the case for the diffusion of wind turbines, for example, as these are seldom purchased by consumers. Lastly, the innovation can be considered roughly the same for all three countries, as the technological maturity of solar panels is the same across

countries, although Spain will have a shorter payback period, due to its sunnier climate.

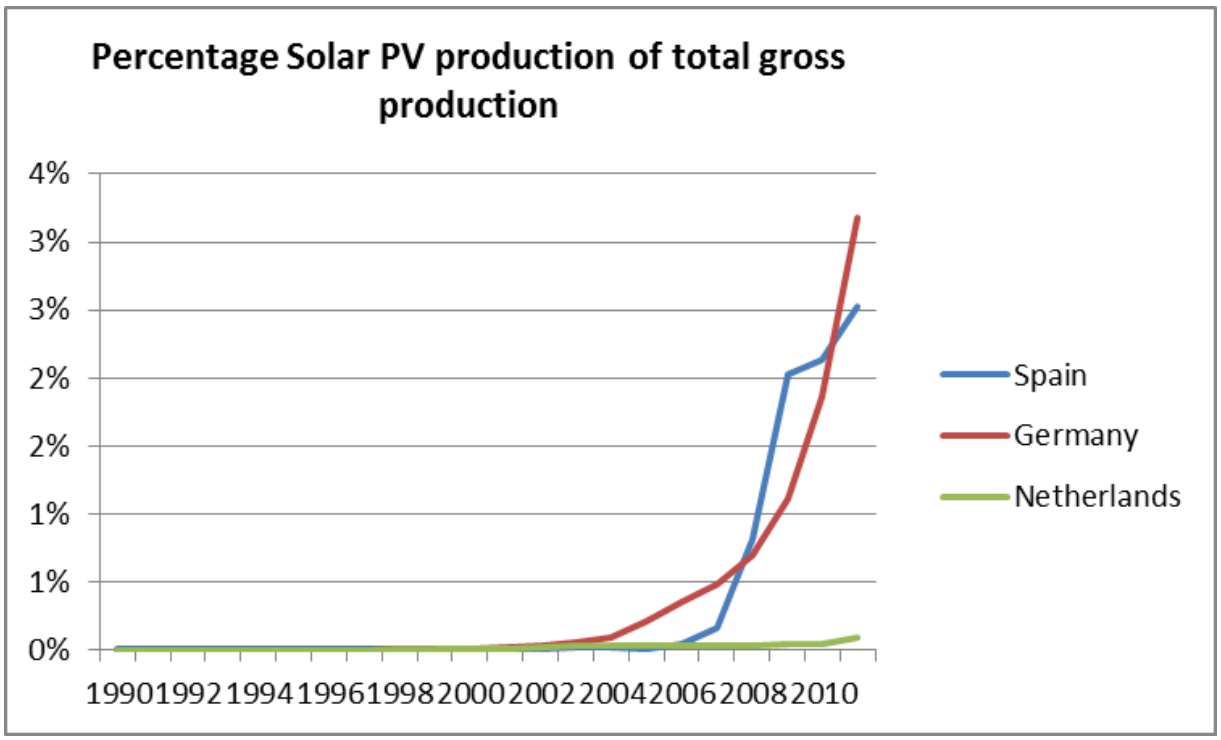

FIGURE 1. Diffusion of solar PV

To measure innovation diffusion we looked at the percentage of electricity produced by PV panels as registered by national statistic bureaus. Solar termal production is not registered, and information on diffusion for this technology is based on event data. To measure field change, we looked at the adjustment of field actors' actions and their expressed beliefs and preferences, i.e., changes in customer preferences, expert opinion, school curricula, companies' strategic choices, and political commitments. When changes in actions and expressed beliefs go together, we deemed it to be real change, whereas changed beliefs (in words) without any changed behaviour, or changed actions without any changes in underlying beliefs, were considered to be potential paths towards change but no real change by itself.

We chose European countries so that countries would be relatively comparable with regard to macro-conditions such as whether they had democratic governments and free market economies. Within Europe we selected Germany, Spain and the Netherlands as they show large differences in their uptake of renewable energy in general, and of solar in particular. Whereas Germany has made an 'energy turn-around' (or 'Energiewende'), the Netherlands lags far behind in its share in renewables, and Spain has seen a fast boom and an equally fast bust. A final reason for choosing to look at solar panels across these countries is that the landscape pressures which affecting the diffusion of solar panels will be roughly the same, as oil prices or a disaster such as happened at Fukushima will be equally felt in all three countries. This is important because jolts can influence the process of de-institutionalisation (Greenwood et al., 2002, Sine and David, 2003). Overall, this theoretical sample should enable us to extract valuable propositions on how institutional pressures influence innovation diffusion and field change, either in isolation (with one leading pressure) or in combination (by interaction between pressures).

Data collection and coding

To enable the process of comparison, longitudinal case studies were conducted (Yin, 1994). Even though the data collected is mainly qualitative, they were quantified using the coding scheme presented in the theory section. The data events were coded and analysed using process analysis (Langley, 1999). This research strategy enables the different layers and perspectives within an institutional field to be examined, enabling us to gain a rich understanding of the actors, context and institutional processes that influence both context and actors. Furthermore, this

approach allows us to collect comparative and contextual data (Saunders et al., 2009).

The data consists of archival data such as news releases, secondary research reports, annual reports, and official government publications on solar panels in each country. The data was gathered by native speakers to ensure that articles were fully understood and could be placed within the context of the country concerned. The time frame was from around 1989 to 2012. A broad range of data sources was chosen to prevent reporting bias and to allow for triangulation (Saunders et al., 2009).

After determining the data sources, key words and search terms were specified in order to gather comparable data for all three countries (Benders et al., 2007). The terms chosen were 'solar panels' and solar energy', plus the names of the dominant actors within industry in each of the countries. These keywords were translated in the native language of each country.

In the coding scheme (see table 2), each event was coded with a description of what it entailed, attributed to an actor (government, industry, professional or public) and to an institutional pressure (coercive, mimetic or normative), and given a qualification as whether the process would be conducive to, or would hamper, the adoption of innovation. In total, 329 events were coded for Spain, 426 for the Netherlands, and 551 for Germany.

TABLE 2. Event coding

Description of event	**The German government is first to introduce the feed-in tariff in Europe**
Institutional pressure:	Coercive government
Description of event	The University of Karlsruhe publishes a report questioning the potential for solar panels
Institutional pressure:	Normative professional

We use process analysis to make sense of how and why things evolve over time (Van de Ven and Poole, 1990), and a narrative strategy to obtain an understanding of the development of solar panels. We use temporal bracketing to compare and structure cases (Langley, 1999). To verify the reliability of the coding process, an inter-rater reliability test was conducted to determine the degree of agreement among multiple observers. The Kappa score was 0.76, which indicates a substantial reliability (Landis and Koch, 1977).

Using solely secondary sources has both advantages and disadvantages (Saunders et al., 2009). An advantage is that fewer resources in terms of time and money are needed than when gathering primary data (Ghauri and Grønhaug, 2005). Using secondary data also allows us to triangulate the findings. Finally, secondary data are likely to be of a higher quality than primary data (Stewart and Kamins, 1993). A disadvantage of using secondary data is that they have been gathered for a different purpose than that of the study, and biases can occur in news sources.

FINDINGS

Our findings are presented in three periods: the first period from 1990-2000 is characterized by slow growth, start-ups and careful exploration of solar technologies, the second period from 2000-2008 by fast growth in Spain and Germany, and the last post-crisis period from 2008-2013 by a severe shake-out of solar companies and a slowing down of RE activity in Spain and Germany.

(I) Period 1990-2000: Renewable energy on the agenda?

The first period is characterized by many very different activities in the Netherlands and Germany, and as yet hardly any activity in Spain. At the international level, there is the Kyoto protocol of 1997.

Germany: Clear goals, reliable incentives, and an entrepreneurial start

A first observation is that solar developments in Germany started as early as in 1991 with an "Act on the Sale of Electricity to the Grid", or the introduction of a feed-in tariff (FIT) which obliged energy companies to purchase the electricity generated by decentralized facilities at a fixed price. In that same year, the "1,000 rooftops programme" (1,000 Dächer-Programm) was launched, whereby 70 per cent of the initial costs of each solar panel was funded by the government. With this scheme, the German government introduced the first incentives for the diffusion of solar energy in Germany.

Government: The FIT and 1,000 rooftops programme proved a big success and were therefore extended in 1999 to the 1,000,000 rooftops programme (1,000,000 Dächer-Programm). In April 2000, the "Act on the Sale of Electricity to the Grid" was amended, resulting in a law on renewable energy, the "Erneuerbare Energien Gesetz" (EEG). The government introduced a fixed price (feed-in tariff) for selling solar energy to the grid, which greatly benefited the solar energy market. It also announced its ambition to make renewable energy account for 20% of the overall electricity generated by 2020 (Handelsblatt, 2003; 2004), and a lively discussion began over whether to continue with nuclear energy production.

Industry: As a result of the clear long-term government goals and guaranteed prices, there was a strong incentive for entrepreneurship. In these early years

companies such as Solon (1996), Ersol (1997), Q-cells and Solarworld were founded, and RWE diversified into PV production (1999).

Professionals: As early as 2000 Bill Gates bought shares in Solarworld, and a large amount of money was allocated to training 8000 engineers in solar technology and renewables.

Public: These developments resonated with the public. In 1999 alone, there were 17,300 information requests to the government about installing solar panels, and another 18,400 in 2000, and this huge interest led to the establishment of the National Energy Office (Deutsche Energie Agentur) to respond to this boom. From the requests it became clear that consumers found caring for the environment 'chic'.

Netherlands: Much debate, no choice, and a slow start

In the Netherlands, the interest in solar arose as early as in Germany but took a very different turn when in 1988 it was Shell, not entrepreneurs, which started investing in solar and wind. Whereas the developments in Germany were greeted with enthusiasm by most actors, in the Netherlands at this time there was much discussion and little action.

Government: In 1991, at about the same time as in Germany, the Netherlands introduced a law to stimulate renewable energy (RE). However, rather than stimulating demand, they chose to stimulate production by introducing a tax deduction program for environmentally-friendly investments (VAMIL)[1]. This made it possible for large companies to invest in RE projects in a fiscally attractive way. In 1995, another tax measure reduced the tax paid on RE. In 1997, the Dutch Solar Thermal week was organized to raise awareness and enthusiasm for solar energy among consumers, and in 1999 a voluntary agreement ('convenant') was reached

[1] VAMIL: Vrije afschrijving milieu-investeringen

with 30 stakeholders from industry and other organizations to achieve 65,000 solar thermal installations within four years (i.e., by 2004).

Industry: In this first phase Shell was the company to make some first, hesitant steps towards RE. Despite investing in solar and wind in 1988, by 1995 it had already sold its PV factories but nevertheless still wanted subsidies in order to compete with BP on RE (1997), and to cooperate with Greenpeace and Stork on solar in 1998. However, in 2000 Shell abandoned all RE activities. As the price of RE was high, and no clear or consistent consumer subsidies were being given, there were no start-ups in the Netherlands, as were seen in Germany.

Professionals: Professional opinions on RE was divided. Some considered it to be solely for idealists, but McKinsey (2000) was optimistic about solar on the condition that large firms could ensure that sufficient scale was reached, and while some urged the government to 'go for RE', others maintained that fossil fuels would remain the dominant energy source.

Public: Despite the half-hearted stance on renewables taken by both the Dutch government and industry, there was a high natural demand from consumers for 'green electricity' and great involvement in the debate on Dutch energy policy. Large energy companies were offering electricity produced from green sources, but could not meet consumer demand and had to import 'clean' energy from countries such as Germany and Sweden. This was despite the fact that green electricity was being sold at a higher price. The public was calling for the government to be more ambitious in its energy policy, and there was a strong lobby to make the use of RE legally compulsory in new builds (i.e., as part of building regulations).

In 1999 and 2000 the anger built, and the united youth divisions of the Dutch political parties joined forces to sue the Dutch government for jeopardizing their future with irresponsible energy policies. Another lawsuit against the Dutch state was

filed in 2000 by Free Energy Europe for unfair support of Shell. However, these actions did not lead to changes in governmental nor industry actions in this period.

Spain: Careful exploration of new options

In Spain there were only very modest activities in this first period. The main player was BP, which was very active, and positive about the potential of solar. A modest diffusion of solar thermal panels was taking place, used chiefly by cities to warm swimming pools (city of Astigarraga in 1998) or buildings (Barcelona in 1999).

(II) Period 2000-2008: Years of growth leading up to the financial crisis of 2008

The second period is characterized by rapid growth of the solar industry and increasing attention being given to sustainability issues at the international level. Around 2000, the EU Ecotax increases the price of all energy sources, including renewables, and in 2005 the new EU-Emission Trading Scheme (EU-ETS) puts a price on emissions, but also makes it possible to trade in emission rights. Aiming to gradually bring down CO_2 emissions, the EU-ETS limits the permissible levels of CO_2 emission for companies. This law mainly affects large energy and manufacturing companies, as buying emissions rights (enabling them to exceed the quota) is costly. Other important international events are the decisions by Japan to reduce its solar subsidies in 2004, thereby forcing prices down, and by China to make large-scale investments in RE production and consumption – thereby creating a new market, but also a main competitor for Europe.

Germany: Radical political choices to support RE entrepreneurship and solar

During this period, the 'Energiewende' in Germany became real in the sense that not only was RE supported, but the country also decided to phase out nuclear power production. It was a period in which there was rapid diffusion of solar technologies, and fast company and economic growth.

Government: Besides the subsidies for solar introduced in 1990 and 1999, there were several other events during this period that favoured the diffusion of solar. In 2002, the German government declared to phase out nuclear power, with the aim of closing all nuclear plants by 2020. For most large German energy firms this meant a major disruption as nuclear was their prime source of production, but for solar start-ups it translated into a positive climate for investment. Although the phase-out law came under pressure when Angela Merkel's conservative party came to power in 2005, the Merkel government reconfirmed the phase-out in 2006 after Angela Merkel had personally consulted the big four energy companies in Germany: Vattenfall, RWE, E.ON and EnBW. In 2004 the government also stated clear goals for RE: by 2010 12.5%, by 2020 20%, and by 2050 50% of all energy used in Germany should be from renewable sources. These goals are regularly expressed and repeated.

Industry: The supportive German rules and regulations had a great effect on both RE entrepreneurship and the way that large firms reoriented their activities. The introduction of the EU-ETS (2005) had a strong negative impact on the financial performance of large energy firms. Coal-generated energy became very expensive, and thus less attractive. On top of that, the big 4 were named and shamed in the Dirty Thirty ranking in 2005, a WWF ranking of Europe's worst climate polluting power stations.

At the same time, small solar firms saw spectacular growth. SolarWorld grew by 200% (2001), Ersol tripled its turnover in 2002 and solar jobs were expected to

grow from 27,000 in 2004 to 93,000 in 2010. Many companies went public and stock prices increased by as much as 275% (Sunways, 2005) or even 500% (Solarworld, 2005). This success was supported by the German "Solar Keymark", a quality guarantee introduced in 2003. With this fast growth, Germany superseded Japan in 2005 as the world's number one in installed capacity, and reached the 1000MW milestone – the same capacity as a single nuclear plant. With the international landscape changing shape (and Japan and China pushing for lower prices), companies started to internationalize in order to remain competitive and reduce their dependence on the home market. Attractive subsidies and regulations lured solar entrepreneurs to Spain, Italy, Greece, China and South Korea. The main foreign activity was the building of solar parcs – for example, Solar Millenium built solar thermal parcs in Spain and Morocco in 2005, and Conergy built PV parcs in Spain in 2007. The size of the parcs increased fast: from 4MW in 2004 to 50MW in 2007.

Professionals: It was in this period particularly that the developments in RE became anchored within the professional and scientific domain. In 2002 German companies started to collaborate with technical institutes as Fraunhofer and the University of Freiburg, and Thuringen Solar Valley (with large investment in labs, support and machines) was launched. Renewable energy production was also integrated into the curricula of 'Hochschulen' (polytechnics) and universities in 2002, and integrated in 2007 at both bachelor's and master's level.

Public: Demand and support for both solar PV and solar thermal remained strong. Although there was discussion on the suitability of solar in Germany, and also on issues such as the safety, reliability and adjustment of the infrastructure, there was general consensus that Germany was, and should be, strong at production, and that investments would benefit the economy (impacting on employment, etc.).

The Netherlands: Lobbying and muddling through

Whereas the period leading up to 2008 was characterized by strong growth and entrepreneurship in Germany, the process in the Netherlands was more akin to a pinball game, with rapidly changing phases of regulation and deregulation, investment and disinvestment. In fact, in 2006 production of RE was actually shrinking (Central Bureau of Statistics, 2006).

Government: After strong public lobbying before 2000, the Dutch government decided to subsidize solar panels from 2000 onwards, and to give tax deductions of 55% for investments in RE. However, adoption remained voluntary: instead of making solar obligatory via building laws, individual homeowners were encouraged to ask for subsidies, making adoption difficult as many complicated forms needed to be filled out. As a result, uptake was still slow. Whereas several initiatives were taken by energy companies and banks to push solar panels on to the market, this had hardly any effect as the government cut subsidies by 46 million euros in the start of 2003, and stopped all support to consumers by the end of 2003.

In a new attempt to stimulate RE, in 2003 the MEP[2] was introduced: a ten-year subsidy programme to make energy production more environmental friendly. However, the programme was so successful that it was aborted in 2005/6, only three years into the programme, as demand was overwhelming and government spending was spiralling out of control as no maximum had been set for the total amount of subsidies (2011). In 2007, after a change of government, this changed again: the SDE[3] law to stimulate sustainable energy brought back subsidies for RE and building laws were altered to require better insulation and use of RE. This law came into force

[2] Ministers' decree on environmental quality of energy production (Ministeriële regeling milieukwaliteit elektriciteitsproductie)

[3] Stimuleringsregeling duurzame energieproductie.

in 2008 and focused on production rather than consumption. As demand for 'green electricity' could not be met by Dutch RE production, Dutch subsidies were spilling over to foreign producers and the government changed this by refocusing their subsidies on Dutch producers.

Industry: There was hardly any industrial activity in this period. Shell continued its 'chop and change' policy, investing and collaborating in solar in 2001 and 2002, but shortly afterwards closed its solar factories in the Netherlands and Germany. In 2004 Shell shareholders forced the company to return fully to oil and gas. There was also no entrepreneurial activity by small companies. It was only around 2008, after a change in government, that the few Dutch solar companies as Solland Solar and Scheuten started to show good growth. They announced large investments in their production facilities in the South of Holland and across the border in Germany.

At the same time, many industrial stakeholders, mainly the energy companies, were increasingly putting pressure on the government to revise its energy policy and increase their commitment to RE. Some companies lobbied individually. For instance, the CEO of Solland Solar lobbied against the government's plans to reduce support, arguing that it would kill investment, innovation and knowledge development, but without result (2003). As the sense of urgency grew, experts and energy companies joined forces, and in 2005 filed an official complaint against the Dutch government for 10 years of unstable and irresponsible energy policy. In 2006 the CEOs of large Dutch companies joined the protest and filed a lawsuit against the Dutch state. They also wrote to the Dutch government asking for clear energy policies. They stated: "We were frontrunners, but now all is lost" (Volkskrant, 14-12-2006). The protest was supported by the VNG (National Council of Dutch Communities), which demanded that subsidies should be reinstated, and by political

parties which wanted the government to change. As the Dutch government was still not providing stable policies or regulations, the CEOs of large energy companies (Essent, Eneco and ECN) continued their efforts to lobby the government for progressive renewable energy policy in the Netherlands (2007).

Professionals: Professionals and experts joined the protests for a more renewable energy policy in the Netherlands. In 2006, for example, they pleaded for a Minister of Energy for the new government, but without success. They had a generally positive outlook in terms of the potential of RE, but some such as the consulting company Ronald Berger concluded that companies in the Netherlands were investing too little in RE (2007). The level of organization was also increasing, and experts and industry came together to form industry associations to lobby for the interests of the slowly emerging RE industry.

Public: As subsidies were low and uncertain, and there was hardly any business activity in RE, the demand for solar and other renewables remained untapped. The enthusiasm and latent demand for solar became clear when a subsidy was finally introduced in 2008 for the purchase of solar panels as part of the SDE programme. The total amount of subsidy was exhausted within a day due to overwhelming consumer demand.

Spain: Clear regulation and diffusion from city to city

Whereas the Netherlands showed hardly any growth, and Germany consolidated its world dominance, Spain started its own solar miracle around the turn of the millennium. In this period solar grew from hardly any new installations in 2003-2005 to an explosive growth of new installations from that point on: around 100MW/hr of installed capacity in 2006, 450MW/hr in 2007 and nearly 2700MW/hr in 2008.

Government: Renewable energy appeared on the Spanish policy agenda with the 1997 Electricity Act which set goals for stimulating renewable energy production and reducing fossil-based production. This was consolidated in 2004 (Royal Decree 436/2004) when the Spanish government introduced feed-in tariffs for renewables. Renewable energy producers were allowed to sell their energy surplus to distributors in the Spanish energy market at a price linked to the market price of production (2011a). In 2005, the Spanish government approved the Renewable Energy Plan 2005-2010 (Plan de Energías Renovables) which set out that 30 per cent of Spain's electricity demand should be provided through renewables by 2010 (2005a). In 2007 these policies were broadened to include not only surplus energy but all energy produced (Ministerio de Industria, 2007), and the flexible market-linked tariff was replaced by fixed amounts (RD 661/2007), thus eliminating market risk and incurring high costs for the state (del Río and Mir-Artigues, 2012).

In addition to the national schemes of support, the Spanish provinces and cities played a major role in the diffusion of solar panels. From 2000 onwards both provinces and cities not only supported RE but also made it compulsory through building laws and public procurement procedures. For example, Pamplona, Madrid, and Barcelona made solar heating obligatory for new builds in 2002, and both cities and provinces introduced RE plans (e.g., Malaga Agenda 21 and Andalucian PLEAN in 2003). During this period, there were strong mimetic processes between cities, villages, and large organisations to install solar PV or solar thermal panels on the roofs of schools and public buildings, local swimming pools, hotels, and also, for example, on Real Madrid's stadium. The national government also supported RE and, like Germany, stated clear national goals (12% of energy consumption to be met from renewables by 2010). In 2004 it announced its New Building law ('El Plan de Vivienda') in which all new builds from 2005 onwards were to be equipped with solar

panels. The government's goal was to have 4.2m square metres installed by 2010 and they allocated 680m euros to achieve this goal. In 2007 Spain made its laws even stricter than EU recommendations: for houses more than 15 years old 25% of renovation costs would be subsidized, and all buildings should use solar for water heating.

Industry: As both stimulating subsidies and compulsory measures were driving the solar market, there was fast growth. In the early years, BP was the dominant player, but by 2001 the Spanish firm Isotofón had become the second largest solar panel producer in the world and also companies such as Albengoa, Tsolar, Sisolar and Silikin were increasingly showing growth. Around 2005 in particular, company activities increased sharply, with building companies, installers and panel producers investing, forming partnerships and introducing innovations. Their growth was celebrated: the companies were hailed in the media and in 2006 the Spanish King opened Isotofón's new factory in Malaga. From then on there also seemed to be a race to open the largest solar parc. Near Sevilla a parc supplying 2,500 households was built, BP and Santander collaborated on the biggest solar project in Europe, and in 2006 already an even bigger solar parc was built in Beneixama. Solar parcs became recognized as a viable alternative to traditional investments, luring more capital into the industry.

Professionals: In this period, many stakeholders also invested in education. Provinces such as the Basque country (2001) and Andalucia (2006) rolled out RE education programmes for schools, and this was followed by a national focus on educating children on the environment and RE in 2004. Universities were also involved, developing an all-solar house (University of Madrid). A dedicated solar knowledge centre was built in Puertollana, location of one of Spain's largest solar parcs (2007). In 2008, it was estimated that by 2007 the solar boom had created

200,000 jobs in green companies (El Mundo, 18-05-2008). Because of this strong growth, Ernst & Young (2006) ranked Spain in the top 20 of places to invest in RE, while at the same time a discussion was evolving around the costs of RE.

Public: The adoption of panels was mostly regulation- and subsidy-driven. Neither consumers nor NGOs were very active in the discussions around solar.

(III) Period 2008-2013: After the financial crisis

The last period is very much influenced by the financial crisis of 2008, combined with ever cheaper panel imports from China and South Korea. To protect their emerging industry, solar companies lobbied for EU anti-dumping measures to limit Chinese imports, and a law on this is brought into force in 2013. The Fukushima nuclear disaster of 2011 also colours the scene.

Germany: continuous growth or painful divide?

Since 1990 the German government had been promoting solar, but at this point it was withdrawing support for financial reasons. Although this slowed down demand, it did not kill the market: Germany was still the world's largest PV market. At the same time, however, there was a sharp divide between large energy companies and the panel producers.

Government: The withdrawal of government support had already started before the financial crisis, with amendments to the energy plan (EEG) in 2004 which reduced subsidies slightly, but in 2009 they were cut drastically. A mechanism was brought in to gradually lower the feed-in tariff for new installations, thereby controlling government spending. In 2011 and 2012, the government proposed two more laws that included subsidy reductions. In 2013, the discussions began about stopping subsidies completely, but this has not yet been passed.

Industry: The increasing unpredictability of subsidy policies had caused uncertainty in the German solar energy sector (2005). Both panel producers and large energy companies internationalized when prospects become more uncertain in Germany. After 2004 panel producers started to expand to other countries as feed-in tariffs and sun conditions were (even) more favourable. However, they found it very difficult to survive. Ersol got into financial problems in 2008 and was taken over by Bosch, which stopped operations in 2013. Solon went bankrupt in December 2011 but was rescued by an Indian firm. Conergy filed for bankruptcy in July 2013, and Solarworld is thought unlikely to get through 2014. This means that the entrepreneurial companies that were celebrated in the solar boom went bankrupt when the FIT was decreased, and panel prices were eroded as a result of international competition. In 2010 46% of the solar panels were made in China (while they have only 6% of the world's installed capacity), while Germany share in world production had sunk to 10% but its market represented 36% of total (2013).

This was in contrast to large energy companies that had already started internationalizing before 2004 in anticipation of Germany's nuclear-phase-out plan. The main investments were in wind and storage, but also to a large extent in nuclear plants across Germany's borders. E.ON built up a nuclear power station in Finland (2007) and the UK (2008), while RWE started building one in Belene, Bulgaria (2008), and planned another in the Netherlands (postponed as a result of the economic crisis).

Professionals: Professionals actively tried to influence the political discussion, for example by calling for a dedicated "Energy Minister" and drawing attention to the question of how the big climate catastrophe could be prevented. As the industry developed rapidly, the industry also attracted a high level of specialized consultants

who served both as a vehicle for knowledge diffusion and strengthened 'the voice' of the RE industry.

Public: Throughout these years, the German public was very engaged in 'their' energy transition. This transition had a name, 'die Energiewende', and was a very real part of people's everyday life as neighbours and family shared experiences of their systems, knowledge was shared at schools, etc. Citizens actively aimed to influence political decision-making by campaigning, lobbying and expressing their opinions in the media. After the Fukushima disaster in 2011, for instance, mass demonstrations were organized in the large German cities, attracting 120,000 people, and city centres had to be closed down. Through political consumerism and embargoes, citizens also tried to influence company strategies.

The Netherlands: Growth, despite chop and change policies

Interestingly enough, whereas in Germany and Spain the diffusion of solar stalled after the crisis, this was when diffusion accelerated in the Netherlands.

Government: The 2008 SDE subsidies were capped, and the maximum was determined on a yearly basis, allowing the government to react to changing markets and policy development. That, however, created an uncertain investment climate for companies. In 2009 the scheme was broadened to enable large companies to purchase solar panels, thus increasing demand. In 2011, the subsidy scheme was renamed the SDE+, and the subsidy system was adjusted so that the government promoted projects that required the lowest subsidy per unit of energy produced, with the aim of achieving European RE targets at the least cost to the government. Subsidies for small-scale installations were stopped, but reinstated in 2012-13, after which they were stopped again.

Industry: Although a solid solar industry had developed in Germany and Spain by 2008, the Netherlands had hardly any entrepreneurial activity, although the few start-ups that were present did show growth in this period. Solland Solar, for instance, expected 400% growth in 2009/10, Scheuten invested heavily in production capacity, including in the USA and Asia, and in 2009 these two companies announced a merger. However, during this year the effects of international competition started to take its toll. Instead of realizing the expected growth, Solland Solar had to reduce its workforce by 25%, and the 25-year-old company Econcern filed for bankrupty. In 2010 Solland Solar was bought by an Italian firm, OTB Solar was acquired by the German firm Rath and Rau, and Scheuten filed for bankruptcy. This basically marks the end of the Dutch solar industry. What was then left were the installation companies that imported and installed solar panels. The number of installers saw fast growth from around 2009: according to the Netherlands Statistics Office there were 35 such companies in 2010, 100 in 2011, 460 in 2013 and 968 in 2014.

As in Germany, during this period we can see a divide between small and large companies. Most large energy companies searched for foreign partners and announced take-overs or partnerships (for example, Essent was taken over by German company RWE), and as Dutch politics had not decided against nuclear, but wanted energy production at lowest cost, this period is characterized by a renewed interest in nuclear energy, with the main rationale being to provide "a stable energy base". Both political parties and large energy companies campaigned for this option.

Professionals: The Dutch chop and change policies had meant that some professionals argued that the Netherlands should not support RE, but should look instead for alternatives industries to develop, as the country was too far behind on knowledge and skills, and subsidies would only lead to more imports (2008). In

2011, the consultancy company Roland Berger, in an assignment for World Wildlife Fund concluded that the Netherlands dropped from number 17 to18 as an attractive place in which to invest in renewable energy. Generally, however, experts agreed that the support structure in the Netherlands had increasingly become more favourable for solar diffusion.

Public: The introduction of SDE+ finally unleashed the huge dormant demand in the Dutch market for solar. In 2010 a subsidy for solar panels was announced, prompting 35,000 requests, only 400 of which could be satisfied. In 2012 and 2013 a total of €50m was made available for solar subsidies, and there were over 90,000 requests in this short time frame.

Alongside this interest in solar panels from individuals, the more recent years have shown a boom in local initiatives. Municipalities became a main driver of this trend by starting their own decentralized energy production companies, using solar panels on roofs but also wind turbines and bio gas installations. Citizen collectives started local energy companies, jointly investing in sun and wind and sharing the benefits. Lastly, consumers associations purchased solar panels on a collective basis in initiatives such as '123 solar-energy' of the Dutch association of house owners in cooperation with the Ministry of the Interior. These bottom-up initiatives represented a new trend in the Netherlands (2012), leading to around 300 initiatives by 2012 (Schwencke, 2012).

Spain: From boom to bust

Despite tremendous solar diffusion during the period leading up to the financial crisis, with almost 2700MW/hr in new installations in 2008, the

installation rate dropped back to 500MW/hr in 2009, and 450MW/hr in 2010. This sudden drop led to a great shake-out in the Spanish solar industry.

Government: By the time the crisis started, there was a huge accumulation of state deficit due to the FIT. In combination with crisis-related austerity measures, this resulted in several changes in the support for solar. First, the hours eligible for the feed-in tariff were reduced in 2007 (Royal Decree 661/2007). Second, quotas and reduced feed-in tariffs were introduced in 2008 (Royal Decree 1578/2008), and as the costs of solar support were still rising, new regulations in 2010 limited the duration of support to 25 years instead of a lifetime. In 2012, a new Royal Decree (RDL 1/2012) imposed a moratorium on the generation of solar energy for an indefinite period, which meant that new RE projects could no longer count on feed-in tariffs (2012a). This moratorium further inhibited the growth of the Spanish PV market.

Industry: Whereas before the crisis there had been strong company investment, the subsequent phase brought a marked divide in the industry's development. Large energy companies internationalized and moved out of Spain; large and small solar panel producers first divested and later went bankrupt. The large energy companies typically extended their businesses to countries such as Italy, Australia and the USA that still had FIT in place. For companies that managed and constructed solar plants, such as Abengoa Solar and Fotowatio, this internationalization proved successful. They could use expertise built up in Spain, and use cheap Chinese panels to be competitive worldwide.

TABLE 3. Summary of the cases

	Germany	The Netherlands	Spain
1990-2000	**Clear regulation and an entrepreneurial start** Introduction of the FIT (stimulates self-production and demand) Many start-ups Great demand for RE Public loves RE	**Lobby without result** Strong institutional entrepreneurship/lobby Shell champions RE Introduction of VAMIL (stimulates production) Great demand for sustainable energy	**No activities yet** No real developments Careful adoption of solar thermal
2000-2008	**Grow, grow, grow** Political commitment to 'Energiewende': phase-out of nuclear Boom in solar installations/firms Hollowing out of existing business Anchoring of RE at universities and with professionals and through individual experience	**Lobbying and muddling through** Continuing debate on RE Industry, public and cities lobby for RE support by government Shell abandons RE in 2004 Introduction of SDE(+), MEP (stimulates production) Slow growth of solar start-ups towards 2008	**Clear regulation and city-to-city propagation** Introduction of FIT (stimulate self-production and demand) Many start-ups Diffusion from city to city Little involvement of public/professionals
2008-2013	**Consolidation** Decreasing support leads to: Panel producers going bankrupt Large energy firms leaving the country/internationalizing Market for solar stabilizes (largest in world) Germany becomes importer panels/exporter machinery	**Growth at last?** Lower prices/modest RE support leads to latent demand being activated No solar (RE) industry has been built up, just installers of imported panels The few producers that have developed go bankrupt	**From boom to bust** Decreasing support leads to Small firms and producers going bankrupt Large firms leaving the country/internationalizing Market for solar collapses Lower prices lead to careful new uptake (imported panels)

Large panel producers such as Isofotón, BP Solar, and Siliken reduced production capacity in Spain around 2008 whilst simultaneously trying to extend sales in the international market. However, they soon found they could not compete against Chinese manufacturers. BP Solar stopped its activities in Spain, and Isofotón

and Siliken both filed for insolvency around 2012. Smaller panel producers followed the same strategy, but could not compete and went bankrupt.

It is remarkable to see that, despite this violent shake-out, there seems to have been little resistance in the field. Whereas the Spanish solar associations (ASIF, APPA, AEF, and Anper) did criticize the Spanish government (del Río and Mir-Artigues, 2012), there was little organized resistance in the form of lobbying.

Professionals and public: Professionals and the public also do not seem to have objected greatly to the government reducing its support for solar. Only a few press articles show citizens voicing their opinion on whether or not solar is a good thing for Spain. The few interventions that can be observed are mainly positive, such as consumers being pleased with their solar panels or neighbourhoods starting small solar projects. What is interesting is that, around 2012, Greenpeace became involved in the discussion and promoted the idea that the Spanish people could become independent of the grid, because solar KW/hr prices had come down, and solar had become a viable private investment (grid parity is expected in Spain by 2015). In this period there seems to have been the beginning of a mind-shift, from seeing solar as a 'thing' of the government to regarding it as a good investment opportunity for individuals and communities.

CROSS-CASE COMPARISON AND DISCUSSION

In this section we compare cases and relate our findings to existing theoretical and empirical insights. First, we observe that only in the case of Germany do we see a substantial diffusion of solar panels and a broader field change in the energy industry. However, even this great transition does not seem to have been a true success story as many newly established solar companies have gone bankrupt in

recent years. On top of that, incumbent firms (i.e., large energy companies) have internationalized in order to escape German green policies and continue their 'business as usual', and the costs and disadvantages of the 'Energiewende' have been heavily criticized. Second, we observe that there are no easy answers as to why innovations diffuse and fields change. The cases we have examined have many elements in common, yet have very different outcomes, raising the question of why this should be.

When making comparisons between the experience of the different countries, one obvious explanation for the diffusion of solar would be the subsidized price as a result of the feed-in tariff. After Germany and Spain introduce the FIT, there is a huge surge in entrepreneurial activity and fast market growth, as solar gives a guaranteed return on investment for both companies and individuals. When support is withdrawn, the solar industry then suffers severely. If this were the whole story, it would confirm existing economic and innovation diffusion theories that stress the importance of price (e.g., Rogers 1962). However, our cases paint a more diverse picture. Whereas both the industry and market collapse in Spain, the market in Germany is not much affected and remains the world's number one market for solar panels. Furthermore, in around 2012 when our case narratives stop, solar (PV) reaches grid parity in Europe, yet we see no acceleration in the uptake. We therefore conclude that however price plays a major role in stimulating innovation diffusion, it is not a sufficient condition to explain field change, and that complementary processes are at work.

Another explanation seems that coercive government regulation can enforce diffusion and field change. In Spain and Germany coercive pressures included new building regulations, and in Germany the political decision to phase out nuclear production forced energy companies to alter their strategy and operations. Running

across all three cases are the European EMTs. All these regulations caused clear changes in the solar and broader industry. This conforms to existing theory that argues that coercive pressures are strongest as they can simply not be resisted and have to be adopted, even if firms do not want to do so (Clemens & Douglas, 2006; Devereaux & Zandbergen, 1995; Scott, 2001; Zucker, 1987). But, however strong the direct effect of these regulations may be, there still seems to be ample agency. For instance, while complying to the regulations that apply to German-based operations, large energy companies escape German green policies to start producing their 'dirty' energy elsewhere – energy which is then imported back to Germany. Also, although the Netherlands introduce binding building regulations to support solar (and other RE) and compel companies to invest in RE production, around 2012 there is increasing industry and political support for investment in nuclear rather than RE.

We hence conclude that the relationship between regulative government and industry is a fragile one, as our economies are international and companies footloose. Whereas regulative pressures are effective at forcing rapid changes in behaviour, they seem not to have the ability to change more deeply rooted beliefs about 'how things should be done', and can therefore only lead to field change if complemented by other institutional pressures.

A final explanation could be the involvement of institutional entrepreneurs. In Spain and Germany there are clearly distinguishable entrepreneurs who frame and theorize how renewables are 'the future' for their respective countries. In Germany especially, the early years of development saw many start-ups, and the CEO of Solar World dominated the headlines and even lobbied the European Commission to reduce taxes on RE products. This explanation would confirm existing theory on the role of institutional entrepreneurship and social movements in initiating and realizing field change (Maguire et al., 2004, Sine and Lee, 2009, De Bakker and Den

Hond, 2008a) through processes such as advocacy and lobbying (Oliver and Holzinger, 2008, Klein Woolthuis et al., 2013). However, though institutional entrepreneurship and public interference have influenced developments, they do not offer a sufficient explanation for field change. In the Netherlands, we see the slowest diffusion of solar and not even a start of field change, yet the highest level of social movement and institutional entrepreneurship: small start-ups, NGOs, political parties, CEOs of large companies, industry associations, and the public all tried to influence the RE debate. They went as far as filing 6 law suits against the government over the space of 15 years to challenge existing beliefs and practices, and to frame and theorize new solutions. Despite all these actions, RE did not get on to the Dutch agenda. With Sine and Lee (2009) we conclude that whereas social movement and institutional entrepreneurship is important, these generative institutional forces need to be complemented by favourable regulatory policy.

On superficial reading, the processes also seem to resemble the opportunity bazaar as described by Sine and David (2003) in their case of the American energy industry after the oil crisis. In line with their reasoning, the fast increase in oil prices, from 41$ a barrel in 1990 to 91$ in 2013 (inflation adjusted), increased environmental awareness, and for instance disasters as Fukushima could be framed as jolts that deinstitutionalize existing beliefs, and create entrepreneurial opportunities in the emerging RE industry. Spain and Germany seem to confirm this finding as there is a great upsurge in entrepreneurship though at different moments in time (raising the question which jolt potentially leads to a reaction, why, and with what time lag). However, the Netherlands are subject to exactly the same conditions yet see no entrepreneurship, and nearly all entrepreneurs in Spain, Germany and the Netherlands go bankrupt as a result of decreased government support and international imports, or are taken over by large incumbents. Whereas the 'bazaar'

phenomenon was thus observed in the early stage of solar diffusion in two out of three countries, it does not seem to provide a sufficiently rich explanation for sustained field change. In the later stages, the fields are more and more dominated by large incumbent firms and (inter) national competition and regulation, and ever less by entrepreneurs and their efforts to introduce new business models and frame new solutions.

The interaction between processes

All in all, we conclude that comparing across cases enables us to arrive at a more multi-facetted understanding of the diffusion of novelty and field change than has been presented in earlier studies. Whereas our study does not contradict earlier findings – the importance of for instance price, institutional entrepreneurship, and social movement are confirmed, – it does suggest that institutional and competitive pressures should be studied in interaction to discover how processes of (de)institutionalization evolve. This is in line with Beckert (2010) and Heugens and Lander (2009) who argue that further theorizing on the diffusion of novelty and field change should focus on the interactions between different pressures. Drawing on the successes and failures in our cases, we argue that institutional pressures will only have the effect of influencing innovation diffusion and field change if they occur in conjunction with complementary pressures. Below we develop propositions on how interaction between processes may take shape.

Anchoring loop

The first interactive process that we distinguish is the loop of anchoring by which the innovation becomes more and more deeply rooted in the economy and society. In this loop, the price of the innovation (competitive pressure) is the trigger

for institutional generative pressures: changing beliefs and preferences of the users leading to changing demands on constituents (social movement) and changes in the knowledge and know-how, norms and standards of both professionals and industry (professionalization).

In the case of the German success we observe that RE in general, and solar more specifically, has become anchored in the deeper layers of the social structure. The first step in this process was the creation of artificial prices by introducing the FIT. The consequent guaranteed return on investment created a very fast market response, and solar became popular with the public. The increased interest and demand from the public lured entrepreneurs into the industry, and made existing companies alter their strategies. This led to several simultaneous processes of professionalization and popularization. Companies built up knowledge and know-how on new technologies, 'Hochschulen' and universities developed curricula on renewable technologies, and engineers were given specialist training in handling these new technologies. This gradually spread knowledge, made the innovation the 'state-of-the-art' technology, and altered existing ideas of what are good solutions (professionalization).

At the same time, the public slowly built up a layman's knowledge and experience as solar systems were installed in their houses and experiences were accumulated and exchanged. This strengthened the belief that solar was a good solution for household application and made the public object more to 'old', dirty solutions, and starting a social movement to support their government in making green choices and phasing out nuclear (social movement). We conclude that while 'fast' coercive stimulation through prices can cause immediate reactions in the field, it needs 'slow' social and professional normative pressures to ensure anchoring within the knowledge and belief systems of the field's actors. This is confirmed by the

Spanish case in which processes of professionalization and social movement were not observed: when government support was stopped after 2008, both diffusion and field change came to an abrupt halt as adoption was mainly price driven and not supported by new beliefs or understandings of how 'things should be done'.

Proposition 1: 'Fast' government coercive pressures to stimulate innovation diffusion should be accompanied by 'slow' normative pressures from professionals, industry and the public to anchor the innovation in new knowledge and know-how (professionalization), and experience, beliefs and societal demands (social movement) to provide a solid basis for the adoption of novelty and the realization of field change.

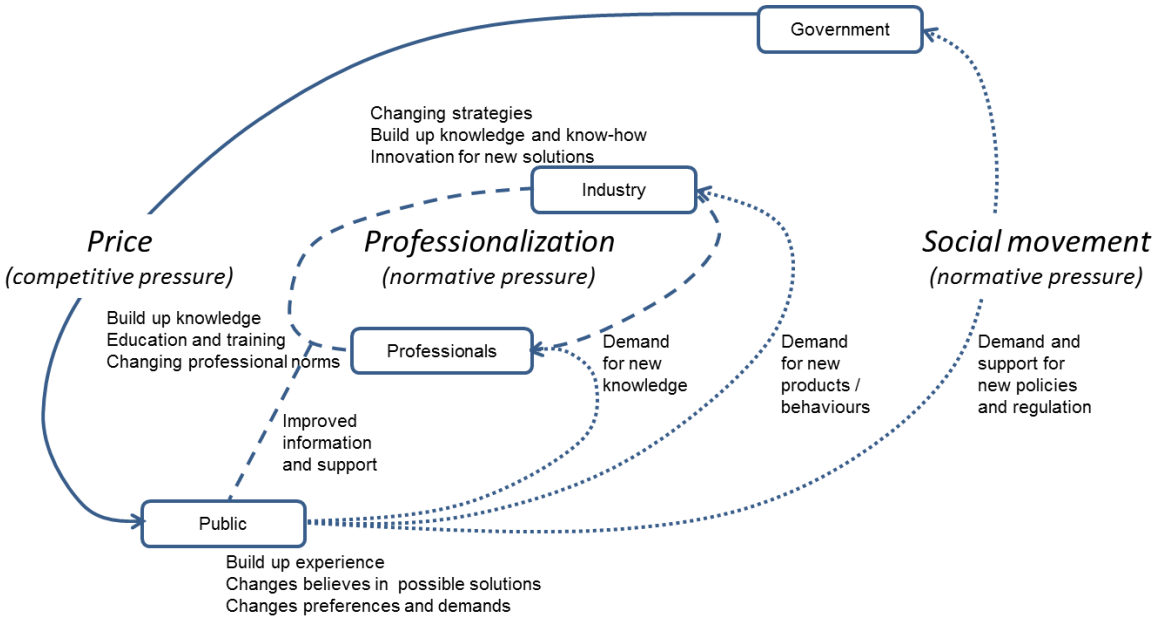

FIGURE 3. Anchoring loop

Politicizing loop

A second loop we distinguish is that of politicizing, or the process by which powerful actors are persuaded to back the innovation, and steer actors within the field towards new beliefs and behaviours. In this loop, institutional

entrepreneurship, as a generative institutional process (normative pressure) is the trigger for competitive and coercive reproductive processes through government regulation (coercive pressure), industry commercialization (competitive pressure) and mimicry (mimetic pressure). Through politicizing field actors place innovation on the agenda of the government, and through favourable regulation choices of the public, professionals and industry become politicized and biased towards the adoption of novelty.

In the Netherlands there was much institutional entrepreneurship, yet little innovation diffusion or field change as the field actors' requests for favourable regulation were not granted, and there were no powerful firms supporting the field's transition to more sustainable energy production. The situation was different in Germany as entrepreneurial actions were backed up by government support, as well as by other powerful actors such as CEOs of large corporations. These powerful actors translated the normative pressures into concrete actions, i.e. through regulation and commercialization. The government translated normative demands into favourable policies, rules and regulations (for example, building regulations), financial support for new knowledge development, and fiscal and other financial measures.

As normative pressures demand innovation from the bottom up (institutional entrepreneurship), and coercive pressures enforce innovation from the top-down (coercion), companies feel there is a solid basis for investments in innovation, capacity build up, knowledge development and expansion, and this results in a process of fast commercialisation of solar: In Germany, we observe entrepreneurial firms show extra-ordinary growth figures and returns, and how adoption is driven by competitive pressures as profitability and market growth.

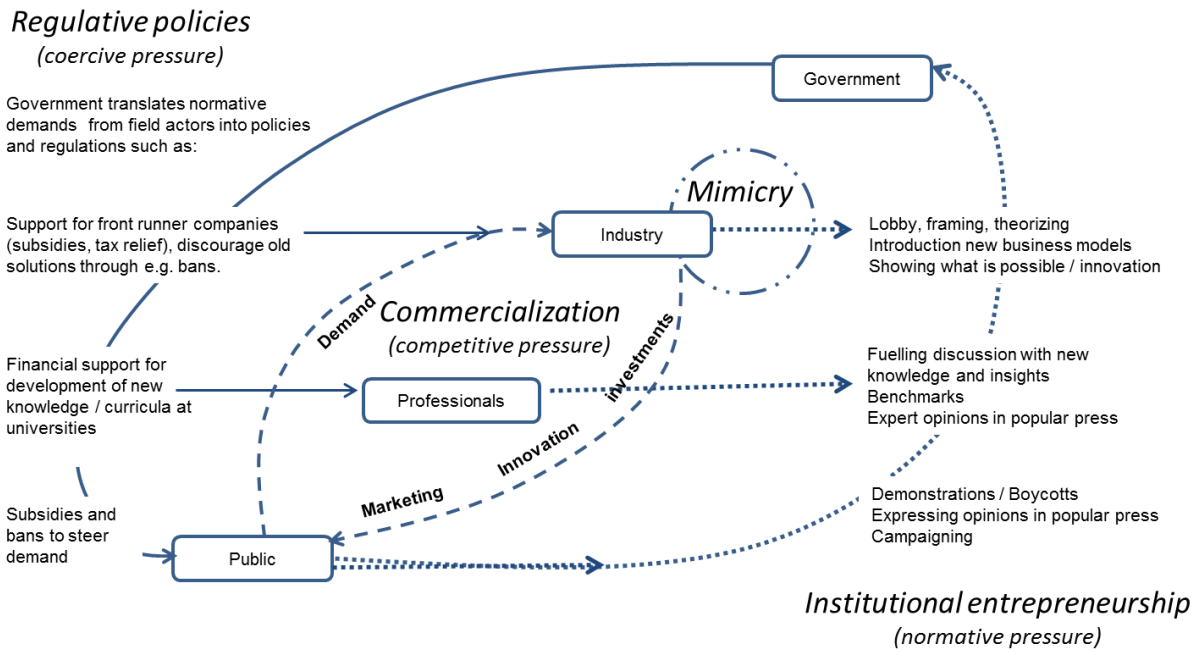

FIGURE 4. Politicizing loop

As front-runner companies show good results, mimicry becomes a driving force for accelerated diffusion of novelty and field change, as more actors, investments, innovations, and improved products enter the field. All in all we conclude that institutional entrepreneurship as the generative institutional process of creating new norms, standards and practices is an important but not a sufficient condition for the diffusion of novelty or field change. We propose that generative institutional processes, should be accompanied by reproductive processes like coercion, commercialization and mimicry to translate institutional demands, into concrete actions and 'things' such as laws, regulations, investments, and products so that the field's actors are steered towards the adoption of new behaviour trough coercion an mimicry.

Proposition 2: Generative normative pressures (institutional entrepreneurship) should be accompanied by reproductive pressures through

favourable regulative policies (coercive pressures) to steer behaviours and stimulate demand, industry commercialization (competitive pressure) to create supply and market new products, and industry mimicry to accelerate developments and create critical mass (mimetic pressure).

Making use of these interactive loops between institutional processes, we enable a richer understanding of the diffusion of novelty and field change. In Germany all these 'loops' were present and functioning, whereas in Spain and the Netherlands only parts of the loops were active. In Spain, for instance, the anchoring loop was only partially functioning. The FIT made the price for solar temporarily low, leading to rapidly changing behaviour (sales), but this was not supported by changes in beliefs or ideas about state-of-the-art solutions (social movement and professionalization). When the subsidy was withdrawn, both innovation diffusion and field change halted. This contrasts with Germany where widespread public support and involvement (social movement) and investment in education and training (professionalization) ensured that both the diffusion of solar panels, and the changes in the broader industry continued.

In the Netherlands, the politicizing loop did not function. Whereas the institutional entrepreneurship process was very strong, this generative process was not followed by reproductive processes: the government did not coerce, and hence the industry did not find any basis for commercialization, and no successful companies arose to trigger mimicry within the field. This was again in contrast to Germany where the government chose to make energy a political rather than a purely economic issue.

CONCLUSION

It is important to increase our understanding of how sustainable innovations diffuse as they can help to minimize the ecological footprint of modern life. However, many sustainable innovations are not immediate winners as new solutions conflict with existing beliefs, preferences and interests. As a result, institutional pressures are important as they can steer actors towards new behaviours, and enable fields to change. Whereas previous studies have illuminated how institutional processes can lead to the diffusion of novelty and field change, these studies mainly focused on single institutional processes and generally excluded the interaction between these processes (Beckert, 2010; Heugens and Lander, 2009) and the role of competitive forces (DiMaggio and Powell, 1983). This study contributes to this field in three ways.

First, on the basis of a literature review we developed a coding scheme that enabled us to break down abstract institutional pressures into concrete actions and reactions of actors. By assigning pressures to actors, it becomes possible to study the influence of various pressures separately and in conjunction with one another. This coding scheme can aid the empirical study of institutional change processes.

Second, by including all institutional and competitive pressures, we are able to do justice to the full theory of DiMaggio and Powell in which both isomorphic changes was explained as a result of both 'the invisible hand' and institutional processes. By looking at all pressures we also address the issue raised by Mizruchi and Fein (1999) that focussing on just one isomorphic process may lead to the failure of not considering that an alternative process might explain the phenomenon observed. By studying institutional processes in conjunction with each other, we

unveil how seemingly decisive processes for the diffusion of novelty and field change, like mimicry or institutional entrepreneurship, are only set in motion if complementary institutional processes precede or follow them. In the case of institutional entrepreneurship this had been addresses by Suddaby (2010) who showed concern for heroification of certain actors, and the lack to include alternative processes that may explain the success of these actors. With Sine and Lee (2009) we conclude that one of these pressures is supportive regulation, but in addition to earlier literature we propose the interactive loops of anchoring and politicizing, in which the process of isomorphic change is described as the result competitive and institutional processes in interaction.

This leads to the third contribution: examining competitive and institutional processes together gives us additional insights into how the interaction between pressures explains the diffusion of novelty and field change (Heugens and Lander, 2009). We conclude that while generative normative processes, such as institutional entrepreneurship and social movement, are important for creating new solution, for instance through for framing and theorizing (Klein Woolthuis 2013) or introducing new business models (Pacheco..), they need to be followed by reproductive coercive, competitive and mimetic processes, such as supportive government regulation, commercialization by front-runner companies, and mimicry in the wider field. In a similar vein, we also contend that whereas coercive pressures, such as price and regulation, can enforce fast innovation diffusion, this diffusion will not sustain nor lead to field change if not followed by slower and more indirect institutionalization processes such as professionalization and social movement.

Limitations and notes for further research

This study is an attempt to provide a richer understanding of the diffusion of novelty and field change by studying the interaction between institutional and competitive pressures towards isomorphic change in three more and less successful longitudinal cases. To be able to do so, use was made of event studies to 'track' developments over time. While this method enables comparison, it also has limitations. As we rely on secondary data from newspaper clippings, we are dependent on what is covered in the media, and have to rely on published source of why actors choose certain behaviours. Whereas use was made of triangulation to verify introduced laws and regulations mentioned in the newspapers on official government websites, in depth knowledge of all specific regulations is limited. Further studies could be improved on these two aspects.

This study developed two propositions on the basis of the analysis and discussion of both existing literature and the longitudinal cases. While these propositions reflect the main findings of this study, it is not exhaustive. Alternative interactive processes may still be recognized, refinements can be made, and there is the challenge to connect the anchoring and politicizing loop. Also, because we focus on the interaction between earlier recognized institutional processes such as professionalization and mimicry, the depth of explanation of the individual processes suffers from the aim to describe how these processes constitute interactive loops towards isomorphic change. All in all the study forms a step towards theorizing on interactive processes leading to the diffusion of novelty and field change, but many questions still remain unsolved.

For instance, in existing literature, jolts are framed as important for de-institutionalization and field change. Yet, in our cases we did identify potential jolts (e.g. Kyoto, Fukushima) but saw limited and very confuse effects in our cases. This raises the question what characteristics a jolt should have to be able to influence a

field, why some jolts do seem to stimulate change and others don't, and for instance what the role is of actors in enacting jolts.

Another puzzle remains the role of prices and competition, and under which conditions competitive forces prevail, and when legitimation becomes a dominant force. Many studies into institutional theory have been done in the public domain (schools, hospitals) and few in early stages of a field's development. Further research could focus more on this interplay between legitimation and market forces in steering companies towards new behaviours.

Overall, we plea for future studies that focus on testing earlier findings by comparing cases or developing methods for quantitative testing. As institutional theory has reached maturity, its insights based on many inspiring success-cases should be tested in failure-cases and larger populations to ensure generalizability of results. This should also lead to increased insight in how to govern the complex interactive processes that can make our economies and societies more sustainable.

ACKNOWLEDGEMENT

This study is executed in collaboration with Hans Berends, Stephan Nunes, Caroline Maier, and Steven Ammerveld of the VU University Amsterdam. We are indebted to them for the great effort they put into method development and data gathering and analysis. We furthermore thank Philipp Tuertscher and Lars Coenen for their helpful comments.

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APPENDIX

Appendix A: Operationalisation of institutional pressures

Coercive pressures are defined as those pressures that have a direct financial impact on field actors, either through stimulation (e.g. subsidies, buycotts) or obligation (e.g. laws, boycotts.

Government: A government can exert pressure by several means. By announcing proposed changes to legislation, it can signal impending changes to companies, and companies can anticipate these laws (Bansal and Roth, 2000). Through policies, laws and bans a government can enforce certain behaviours (Delmas and Toffel, 2004, Frumkin and Galaskiewicz, 2004) (Amran and Siti-Nabiha, 2009, Zucker, 1987), whereas technology-forcing standards can limit the choice for certain technologies, which in turn can bring about new norms (Joosen et al., 2004, Johnstone, 2005). Coercive pressures will only be effective if accompanied by monitoring and enforcement mechanisms. A softer form of coercion is through reporting requirements – for instance, on waste or pollution (Amran and Siti-Nabiha, 2009). Fiscal measures can stimulate investment and create markets for new technologies, whereas tax increases for 'unwanted' products and technologies can help to discourage use of current technologies (Noailly, 2008, Johnstone, 2005). Subsidies function in a similar way, providing financial support to stimulate investment and demand (Joosen et al., 2004).

Industry: Alongside government, large buyers can also enforce certain behaviours. For example, multinational corporations can force certain new behaviours to be adopted – for instance, by threatening to stop buying from companies that do not have specific certification (e.g. Bio) or that do not report on certain environmental standards. On the other hand, large corporations can also

attempt to block progress by filing lawsuits against important constituents – for example, by suing governments for damages as a result of unfavourable regulations.

Public: Finally, consumers, or the general public, can enforce adoption of new models by political consumerism, as seen for instance in buycotts or boycotts. Buycotting refers to the increased buying of particular products by consumers, whereas boycotting refers to abstaining from buying in order to express certain preferences or ethics (de Bakker and den Hond, 2008b, Sharfman et al., 1997, Micheletti, 2003, Greening and Gray, 1994). Through shareholder activism, members of the public can obtain shares in corporations and file shareholder resolutions at a firm's meetings (De Bakker and Den Hond, 2008a) and in that way can directly influence decision-making processes. In the literature, no sources were found referring to how professionals could enforce adoption through coercive means. This leads to the following overview of coercive pressures as actions from the government, industry and public.

TABLE A.1. Coercive actions of Government, Industry and Public

Coercive Government	Coercive Industry	Coercive Public
• Law proposal: Announcement of – and engagement in – the making of a new law (Bansal and Roth, 2000), political discussion on new law, announcement that the law will gradually be made stricter (e.g., reduction in CO_2 emissions) • Policies: Clear government statements about goals and plans, and concrete actions for realization (Delmas and Toffel, 2004, Frumkin and Galaskiewicz, 2004), for instance sketching long-term visions and ambitions (" Netherlands to be energy-neutral by 2030"), promoting entrepreneurship, reducing reliance on fossil fuel • Laws/bans: The system of rules which a particular country or community recognizes as regulating the actions of its members which it may enforce by the imposition of penalties (Amran, A., Siti-Nahiba, A.K., 2009) e.g. government prohibits certain behaviour, rules for companies, (e.g legal requirement on energy companies to buy electricity produced by solar panel owner), law that new-build houses have to be energy-neutral, banning traditional lights etc. • Technology-forcing standards: Binding limits set by government which constrain the choice of type of technologies that can be used, or quantitative limits (Johnstone, 2005; Joosen et al. 2004. e.g. limits on the generation of particular emissions, mandated emission reductions, prescribing catalysator for cars, prescribing a standard for plugs, standardizing labelling for lights, • Fiscal measures: A tax deduction for investing in certain technologies, or tax increase for 'unwanted' product / technology (Johnstone 2005, Noailly, 2008) e.g. money from the government when investing into electric cars, or investing in energy-saving equipment and renewable energy. Or negative incentives: e.g. pay taxes for energy usage • Monitoring and law enforcement: Actions to monitor compliance and punishment if actors are non-compliant, .g. punishing companies for causing environmental damage, penalizing home owners for not having EPC for their house • Subsidies: Financial support to stimulate an investment. (Joosen et al., 2004) e.g. grants for insulation of houses / energy-efficient appliances, R&D subsidies for companies, subsidy for large research project etc • Reporting requirements: The requirement of certain reports from firms (Amran and Siti-Nahiba (2009) e.g. to use lifecycle analyses in evaluating the environmental effects of their production, sustainability reports,	• Contractors/suppliers boycott: Company may be faced with distributor boycotts, Henriques and Sadorsky (1996) e.g. boycott of palm-oil by multinational, large corporations deciding stop purchasing from non BIO certified suppliers • Suing / Lawsuits: Situation in which (organizations within) the industry suits e.g. the government (or other parties) to influence the diffusion rate of the innovation e.g. government poses new industry norms to cut down GHG emissions and industry actors sue government for unjust rules, BP has oil spill but sues government for incorrect supervision	• Political consumerism: Increasing buying (buycott) or abstaining from buying (boycott) to express preferences related to political values, virtues, and ethics. Sharfman, M.; Ellington, R.T.; Meo, M. (1997); De Bakker & Den Hond (2008); Micheletti (2003) Greening, Gray, 1994 e.g. avoiding Nike products, no longer buying them, not buying petrol from BP after spill • Occupation: Making normal operations of actors impossible (can also be virtual), Stolle et al. (2005) e.g. People occupy a building, block acces routes, chain themselves to train tracks, cyber attacks blocking mail / website etc • Shareholder activism: Buying shares and filing shareholder resolutions at a firm's meetings, De Bakker & Den Hond (2003), e.g. activist having shares and influence corporate policies

Mimetic pressures are defined as a reaction to uncertainty: greater adoption and spread of novelty is a trigger for other organisations to model themselves after the front runner companies.

Industry: First, an increase or decrease in the number of innovations is a signal as to the direction in which the front-runners are moving. This can be through companies announcing new products or showing prototypes at tradeshows (Haunschild and Miner, 1997). Also the degree of industry adoption of an innovation (Haunschild and Miner, 1997, Burns and Wholey, 1993). The more firms adopt, the stronger the pressure on others to follow suit. If front runners are very successful, measured in terms of capacity build up (hiring employees) and profitability, this stimulates others to model themselves on this success (Haveman, 1993). The same happens when more prestigious firms adopt a new innovation, or when emerging firms become more prestigious, as this increases the legitimacy and visibility of new solutions (Burns and Wholey, 1993).

DiMaggio and Powell (1983) acknowledge field connectivity as an important predictor of mimetic isomorphism as networks are an important vehicle for exchanging and structuration. Hence, if the degree of industry interconnectedness increases – for example, through interlocking directories or inter-firm partnerships – this will increase mimetic pressures (Galaskiewicz and Burt, 1991) (Palmer et al., 1993, Ramanath, 2009).

Professionals: Professionals can also drive mimetic processes. Through rankings and benchmarking, companies are compared on their sustainability performance (Sustainable top 50, Dow Jones Sustainability Index), for example, and stimulated to take up innovations (Scott, 2008). Homogenization of this kind also takes effect through the spread of management models (Rao and Sivakumar, 1999) such as the cradle to cradle philosophy which spur companies to change. Another

form of influence is through training staff in new models and updating their knowledge base in areas such as new technologies and products (Dimaggio, 1988), and through knowledge-sharing (Benders et al., 2006) via professional networks, conferences and stakeholder meetings, etc.

Government and public: Although mimicry can also take place between governmental agencies (e.g., copying of policies) and within the general public, these are not included in this study. Mimetic pressures between governments are excluded because our focus is on the diffusion within one country and not *between* countries, and mimetic processes within 'the general public' were not coded for methodological reasons. As the study is based on event counts in the media, all events were coded only once to prevent double counts, whereas a focus of mimicry amongst the public would call for measuring how often single 'real' events are referred to in the media.

TABLE A.2 Mimetic actions of industry and professionals

Mimetic industry	Mimetic Professionals
• Degree of industry adoption: Increase - decrease of number of firms adopting innovation (Haunschild, P. R., and Miner, A. S. (1997); Burns and Wholly, (1993) e.g. news on BMW deciding to build electrical car, news on higher percentage of cities adopting LED lights for street lighting • Degree of industry interconnectedness: Increase - decrease of nr of relationships between actors (Galaskiewicz, J., Burt, R.S. (1991); Palmer, D.A., Jennings, P.D., X. Zhou (1993), Ramanath, 2008), e.g. Ties at board level between firms, announcement of partnerships between companies, hiring retired politicians. • Change in firm / industry size (no. of employees): Increase - decrease in the number of employees working in the industry (Haveman, H. A. (1993) e.g. increase of employees in individual firms, news on increase of people working in the industry on field level / lay-off of people in certain industries • Change in firm / industry turnover – profit: Increase - decrease in turnover - profit of individual firms or industry as a whole Rogers, E. M. (1995). e.g. announcement of higher turn-over / profitability of companies in media, bankruptcy. • Change in firm prestige and visibility: Increasing / decreasing reputation and visibility of individual firms or industry as a whole, Burns, L. R., and Wholey, D.R. (1993). e.g. success of sustainable banks after credit crisis, better visibility and prestige • Change in no. of innovations: Increase / decrease of nr of innovations in individual firm or industry as a whole (Haunschild, P. R., and Miner, A. S. (1997) e.g. company announcing new products, announcement of amount of new products in industry	• Rankings, benchmarking: External bodies ranking companies Scott (2008) e.g. Sustainable top 50, ranking most innovative car maker, AEX, Dow Jones. • Training staff: Training of staff to be able to deal with new technology / product, DiMaggio, P. (1988). e.g. consulting companies training their staff in PPP, updating knowledge base in new technologies and products • Providing general and complex highly integrated models, Marketing standard solution that 'standardizes' the approach within a field, (Rao H., Sivakumar, K., (1999) e.g. Consultancy firms that providing "general models" such as Porter's 5 forces model, university professor introducing 'trias energetica' for energy saving • Knowledge sharing: Exchanging professional knowledge to share and deepen knowledge, Benders 2006, e.g. Conferences, seminars, training, etc.

Normative pressures are defined as those pressures that define what is desired or acceptable. These pressures can be exerted by all actors, in different ways.

Government: Governmental agencies can define both technological norms and norms of behaviour. Through voluntary agreements (e.g., public–private partnerships), governments can establish codes of practice or 'green deals' that both governments and companies commit to. This steers industry actions and gives policymakers a way of implementing policy measures that are not legally enforceable (Baggott, 1986). Through public procurement, governments can set an example and help to build knowledge and know-how in the early phases of technology development (Bulkeley and Kern, 2006). They can do this by being a lead user – for instance, installing solar panels on government buildings – thereby signalling to the wider public that this should become the norm. A third route is through certification and normalization; by introducing and helping to diffuse national norms and certificate schemes such as labels for organic produce or energy performance (Vasudeva, 2013), they can help shape the preferences of both firms and consumers. Through awareness campaigns, governments can educate and inform the public (and sometimes industry) or raise awareness of health or environmental issues. This supports the development of new behavioural norms (Bulkeley and Kern, 2006, Johnstone, 2005). Awareness can also be raised by politicians starting a political discussion, i.e. putting certain topics on the political agenda thereby provoking public debate, or making new policy proposals.

Industry: Industries do not only experience normative pressures from their stakeholders, they also contribute to the process of shaping new norms. On the one hand, industries can use advocacy techniques such as lobbying to influence decisions made by the government and other actors (Henriques and Sadorsky, 1996, Oliver and Holzinger, 2008). Companies can either do this individually, or through industry

associations (Delmas and Toffel, 2004, Campbell, 2007) or by forming coalitions (for example, where renewable energy producers form a coalition to provide stronger opposition to the existing regime) (Garud and Karnoe, 2003). A last type of normative pressure from the industry is self-regulation. In this case members of industry install voluntary standards instead of being forced to do so by the state; for example, they set standards on fair practices, product quality or workplace safety. Good examples are the Cradle to Cradle certification processes, and the LEEDS norms (Senge et al., 2008). These industry-based certification systems provide strong technical and behavioural norms that can pave the way for more stringent government regulation.

Professionals: By introducing new norms and standards professionals can create a business for themselves, and contribute to the creation of new technical and behavioural norms in a field (Bansal, 2005). Similar pressures result from the development and publication of new insights and knowledge, such as status reports, market reviews, or special issues in leading journals on socially responsible behaviour (Scott, 2008, Campbell, 2007). Norms are strengthened if publically expressed expert opinions support new development – for instance, where engineers and scientists push for better environmental practices (Matten and Moon, 2006, Sharfman et al., 1997, Radaelli, 2000) – and when knowledge is extensively shared in personal networks, conferences and stakeholder meetings (Van Everdingen and Waarts, 2003). Training and education, for example, through the development of new curricula or in-company training, also contribute to institutionalizing new norms through the process of professionalization (Dimaggio and Powell, 1983, Campbell, 2007).

Public: The role of the public in institutional processes has received much attention. Recent studies have investigated the influence of consumers, citizens and

NGOs on corporations in general, and more specifically on the adoption of sustainable innovations (de Bakker and den Hond, 2008b). First of all, members of the public can express their opinion in regular media and through social media, calling attention to certain topics or expressing dismay at undesirable behaviours. With the rise of social media, particular topics or companies can 'go viral', resulting in a 'shit storm' – a term used by German-speaking media since 2010 to describe any outbreak or public anger on the internet (Greening and Gray, 1994, Rao and Sivakumar, 1999). By introducing alternative business models, activist groups, NGOs and citizens alike can set an example to companies of how things could be done differently (De Bakker & Den Hond, 2008a; Benders et al., 2006). These groups can, for instance, set up fair trade businesses, or start collective wind farms. Attention can also be drawn to new behavioural norms, or to a desired break from old institutions, by organizing campaigns directed at companies (e.g. against Nestlé for its use of palm oil), at consumers or at 'the system' (e.g., the Occupy movement) (Etling et al., 2010; Campbell, 2007; Stolle et al., 2005). This can also be done by disclosure of information – for example, in consumer programs or magazines or through organizations as Greenpeace (Ramanath, 2009, Stolle et al., 2005). Through advocacy and lobbying, the public and NGOs can, just like industry actors, attempt to influence political decisions. They can invite politicians to their meetings, give speeches, and organize social meetings to influence opinions and build towards new norms (Doh and Guay, 2006, Ramanath, 2009). NGOs and companies can also work together in NGO/corporate partnerships to help establish new norms (Senge et al., 2008; De Bakker & Den Hond, 2008a) – the Word Wildlife Fund, for instance, is working with KLM to reduce CO_2 emissions. In the same way, NGOs can team up with governments to establish new norms of behaviour (Ramanath, 2009).

TABLE A.3. Normative actions of all actors

Normative Government	Normative Industry	Normative Public	Normative Professionals
• Voluntary agreements: Where government exercises policy by way of a non-enforceable industry agreements (Baggot (1984); Delmas & Toffel (2004), e.g. A code of practice or green deal that both government and companies sign for voluntarily • Public procurement: Government sets an example by taking action / being lead customer (Bulkeley & Kern (2006) e.g. Local government using renewable energy in municipal buildings, or the City Council buying green cars • Awareness campaigns: Awareness campaigns e.g. through television of other media (Johnstone, 2005); Bulkeley & Kern (2006); e.g. Education campaigns on healthy food, energy conservation, against smoking etc. • Political discussion: Politics putting topic on agenda e.g. political party making policy proposal to 'do something' about energy efficiency, asking critical questions to ruling parties on lack of CO2 reduction etc. • Petition / motion: Forcing politics to take action / position taking e.g. calling minister to responsibility over exploded chemical firm - asking for reassignment for bad supervision • Certification and normalisation: 'shaping	• Advocacy: Attempt to influence decisions made by the government and other actors Henriques and Sadorsky (1996) e.g. DSM choosing sustainability strategy and trying to convince others, company investing in electric car and asking government to provide infrastructure • Industry association membership-action: Action taken by industry associations such as e.g. chamber of commerce (Delmas & Toffel (2004); Campbell (2007) e.g. industry associations stimulate knowledge development and adoption of new technologies and products / processes • Coalition: Industry actors form voluntary coalition to achieve goal (Garud, Karnoe) e.g. industry network to promote export of shared products, company networks to be stronger and fight the status quo • Self-regulation: Members of industry control the regulatory processes themselves instead of being forced by the state Campbell (2007) e.g. setting standards, fair practices, product quality, workplace safety to which industry members are expected to adhere - these precede potential law making	• Public expresses opinion: Pressure from public opinions expressed in newspapers, press and other media (Gray Greening, 1994/ Rao H., Sivakumar, K., (1999), e.g. Shitstorm, twitter, facebook, letters to newspapers, • Introducing alternative business models: Activist groups / NGO's, citizens set example for companies how it can be done differently (De Bakker & Den Hond (2003); J. Benders (2006) e.g. Activists groups organizing fair trade, collective setting up wind farms, inidvidual starts new sort of company. • Campaigns : campaigns with a clear, long-term objective to „right a wrong" - break corporate power (Etling; Campbell (2007); Stolle et al. (2005) e.g. Wedding of the Wedding movement: alcohol-free weddings were organized to make people aware of alcoholism, occupy, social movements, Culture jamming • Revealing information, disclosure People are sent to the "enemy" to spy them (Stolle et al.(2005), Ramanath (2008) e.g. Greenpeace spying on Exxon, Wikileaks to reveal info, disclose unethical behaviour Nike's on facebook, twitter etc., TV programmes questioning ethical behaviour and sustainability claims • Civil disobedience: Not obeying the law (Stolle et al.(2005)e.g. smoke cigarettes in public places even if it is forbidden, ignoring norms • NGO-business partnerships: The cooperation between an activist group and a company (De	• Introducing new norms and standards: Influencing the field with new business models, standards, norms Bansal 2005, e.g. ISO , Certificates, regulated diploma's • Knowledge developmens (reports): Creating objective information from professionals. (physical report/business publication) (Scott (2008), Campbell (2007) e.g Status reports, research, market reviews etc., e.g. McKinsey report on solar power, Harvard Business review special issue on socially responsible corporate behaviour • Knowledge sharing: Sharing of professional knowledge with network Van Everdingen and Waarts (2003) e.g. CEO's interpersonal network , climate conference, expert groups • Expressing expert opinions: professionals, associations, consultancy firms, policy experts, companies etc. that express concerns/opinions (Matten & Moon (2006, Sharfman et al. (1997); Radaelli (2000)); e.g. engineers and scientists that push for better environmental practices, professor / director of Fraunhofer gives opinion • Training / education: Curricula/school training received influence managers' approaches, DiMaggio and Powell 1983, Campbell (2007) e.g. business models that receive most attention during study program , training of NEW professionals, e.g adding solar technology to curriculum

the preferences of firms through the diffusion of norms", Vasudeva, G. (2013), e.g. national norms and certificates: BIO, CE, NEN, EPC etc.	Bakker & Den Hond (2003) e.g. Greenpeace working together with a company to influence their corporate policies. • Lobbying: Attempt to influence political decisions. Doh and Guay, (2006) Ramanath (2008) e.g. Invite politicians to CEO-Meetings, social meetings with politicians to influence their agenda • NGO-Governmental relations: Close engagement between NGO/Government (Ramanath (2008) e.g. RED Cross, a military supporting NGO.

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