Towards a model of wind energy industry development in industrial and emerging economies

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Abstract: Through the development and analysis of four in-depth case studies of the emergence of wind power industries in two industrialised and two emerging economies, the authors develop a model of sustainable energy industry development. The model demonstrates that fundamental economic indicators are insufficient for explaining new industry development. Environmental, institutional and cultural factors idiosyncratic to individual jurisdictions play important roles in the emergence of renewable energy industries in both industrialised and emerging economies. The model makes contributions to institutional and strategic change theories and has implications for policy makers and managers.

Keywords: sustainability; wind power industry; renewable energy; RE; institutional factors; legitimacy; climate change.

Reference to this paper should be made as follows: Espinoza, J.L. and Vredenburg, H. (2010) 'Towards a model of wind energy industry development in industrial and emerging economies', *Global Business and Economics Review*, Vol. 12, No. 3, pp.203–229.

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1 Introduction

The election of Barack Obama to the presidency of the USA signalled a coming shift in energy policies in the USA and around the world toward more sustainable solutions to our energy problems. President Obama's appointment of Dr. Steven Chu, a Nobel prize-winning University of California-Berkeley scientist and strong proponent of renewable energy, further enhanced perceptions around the world that a new dawn for renewable energy was upon us. But what, in reality, is the influence of national institutions and cultural contexts on the development of new sustainable development oriented industries? Many will argue that fundamental economics will prevail and a change in national institutions and culture will have only a fleeting influence on the establishment of new industries such as renewable energy that are more costly than their traditional alternatives. Others, such as economic philosopher Jacobs (1992), have long argued that the state through its institutions and culture indeed sets the 'rules of the game' to reflect society's core values and those rules then allow the business sector through the competitive market to innovate and achieve society's goals. In this article, we will explore this question in detail using qualitative data from four nations drawn from the industrialised and emerging economies.

During the last decades, new industries have emerged claiming a sustainable development character. Organic farming, ecotourism, or eco-buildings can be part of such industries. In the energy sector, sustainable industries, those related to renewable energies, could provide a way out of the emerging impasse between the growing demand for energy and the desire to protect our environment and quality of life (Brown, 2008; Espinoza and Vredenburg, 2010; Hall and Vredenburg, 2003). In addition, it is urgent today to find sustainable energy solutions to combat climate change. However, it is still not quite clear why and how renewable energies are developed within a business environment dominated by fossil fuels and large hydropower projects.

Renewable energy (RE) industries, such as wind power, should be developed expecting to bring together socio-economic growth and environmental protection in both the electricity sector and larger energy systems. Moreover, the emergence of RE industries might represent not only the beginning of a new era of energy production but one of the many steps required to shift toward a new techno-economic paradigm of development (Elliot, 2000; Espinoza and Vredenburg, 2010).

Most of the studies on sustainable development and RE have neglected industry as the level of analysis. For Russo (2003), few studies have identified wind power as a sustainable industry or have used such an industry as the level of analysis. This shift in the unit of analysis is important as it incorporates sustainability into the study of wind power development. Indeed, Russo (2003) found that in locations where natural, social, and economic influences converge, a greater wind energy activity may follow. However, Russo's research analysed a specific jurisdictional context (i.e., the state of California) and no comparison with other contexts is provided. Espinoza and Vredenburg (2010) extended Russo's analysis to a multi-national setting in the developing world and essentially confirmed Russo's findings regarding renewable industry development. This paper considers here whether Russo's findings are consistent *across* industrialised and emerging economies when examined at the national or sub-national regional industry level. Or, we ask, are contextual conditions important enough to be taken into account when analysing sustainable industries?

This article is a multi-case study that analyses the development of the wind power industry and contributes to meet the need for more research at the industry level. In addition, this international comparative study will help us to understand the influence of the different economic, institutional, and socio-cultural contexts over the start-up of sustainable industries like wind power. Finally, this study will open opportunities for further research on how sustainable industries can be a part of sustainable development processes at the macro-level.

Contributions from this paper have to do with institutional theory. This research identifies the key role that both country context and informal institutional factors such as 'institutional entrepreneurs' or champions play in the emergence of a sustainable industry. Another contribution refers to the hypothesis that the networks supporting a sustainable industry are mainly local. Finally, this study is addressing the process from institutional evolution to industry legitimacy to paradigm shift. The need for moving from the organisational to the industry to the system (inter-industry) to the society level is explained as a way to suggest a sustainable path to be followed by jurisdictions or countries.

In summary, through the analysis of the wind power industry, this research seeks to contribute additional knowledge to the current understanding about the development of sustainable energy industries and their implications on sustainability of nations.

2 Literature review

2.1 Sustainable development (s)?

The recognition of the trade-off between continuous economic growth and the sustainability of the environment has led to the argument that our patterns of economic development and social organisation are ecologically unsustainable in the long run (Commoner, 1990; Hart, 1995; Welford, 1995).

In 1987, the United Nations' World Commission on Environment and Development (WCED), known as the Bruntland Commission, published its report "Our Common Future", with an explicit recognition of a global economic-environmental crisis that demands a global response. The commission defined sustainable development as

development that *meets the needs of the present without compromising the ability of future generations to meet their own needs* (WCED, 1987). This idea has been carried forward into subsequent international protocols such as the Kyoto Protocol and the Copenhagen 2009 Convention of the Parties. Thus, the key question of the current global dilemma is how to achieve an economic and equitable development without depleting the earth's resources.

From a managerial point of view, sustainable development seeks to solve the dilemma through incorporating an ecological perspective into business activities (DesJardins, 1998; WCED, 1987; Westley and Vredenburg, 1996). For Stead and Stead (2008), firms can obtain a competitive advantage by developing two types of sustainability strategies: process driven (pollution prevention) or market-driven (product stewardship). Using renewable energies is an example of process-driven sustainability strategies.

In spite of its impact, the WCEDs definition of sustainability is still criticised for being fuzzy, too broad and controversial (Gladwin et al., 1995) as it may depend on 'different contexts' (Vredenburg and Westley, 2002). Moreover, for Fergus and Rowney (2005), the meaning of 'sustainable development' has changed over time and was absorbed into the dominant paradigm of economic growth.

In an effort to obtain a more elaborated definition of sustainability, Gladwin et al. (1995, p.878) suggested that sustainable development is "a process of achieving human development... in an inclusive, connected, equitable, prudent, and secure manner". Each of these factors involves economic, social, ecological, generational, political, and scientific aspects.

Incorporating terms such as 'human development' within the concept of sustainability is something critical for both scholars and organisations. For some scholars, this 'human development' dimension brings a new perspective: the person or individual as the very *end* of development which is opposed to the 'conventional' view of the person as an economic agent (Max-Neef et al., 1991; Sen, 1985). This human dimensional view seeks to contribute with a qualitative variable (i.e., 'quality of life') to the already accepted quantitative variable (e.g., gross domestic product or GDP). Although, economic growth is still important to eradicate poverty, the human development approach is concerned with 'welfare': the possibilities that people have to meet their fundamental human needs (Max-Neef et al., 1991).

Understanding the meaning of sustainability is not easy for organisations either. For Elliot (2000) and Welford (1995), 'business as usual' is still alien to the sustainability of the planet and therefore we cannot rely on established structures, technology and science to bring about real change.

Therefore, sustainability represents a new vision of the world, a new development process that seeks to ensure a high quality of life for current and future generations by creating a synergistic balance between the three 'Es': economy, environment and (social) equity (Daly, 1996; Frankel, 1998; Stead and Stead, 2000; WCED, 1987).

Starik and Rands (1995, p.909) argue that (ecological) sustainability is a critical emerging management concept that has multilevel and multi-system characteristics and that "the achievement of sustainability requires an effective integration of these multiple levels and systems". The shift toward sustainability may start at any of those levels and, since sustainability is a dynamic and integrated process, changes of current practices should occur simultaneously at different levels as well, arriving at the final and more important level: ecological sustainability. In addition, Stead and Stead (2008) argue that

firms that 'stand for sustainability' should develop instrumental value systems to serve the sustainability needs of various stakeholders such as regulators, shareholders, customers, employees, the greater community and the planet itself.

Although, Starik and Rands (1995) do not specifically include industry among their different levels of sustainability, Russo (2003) has suggested that industry is an important level of analysis whose relevance has not been deeply analysed by much of the organisation and natural environment literature. This paper, based on Russo's comment, focuses on the wind power industry that belongs to one specific level (the electric power sector), which is part of a larger system, the energy system.

Energy is considered a key component of development. However, most of the current energy activities are environmentally damaging as conflicting pressures between rising global energy demand for socio-economic development and rising pollution and climate change do exist (Ayres, 2001; EIA/DOE, 2002). Within the energy system as a whole, the electricity sector is highly relevant in the development of nations (Ferguson et al., 2000) and has become essential for the functioning of modern societies (Sawin, 2001). Currently, demand for electricity is growing rapidly, particularly in the developing world, where two billion people do not have access to electricity, most of them living under poverty conditions (EIA/DOE, 2002; World Bank, 2000). Indeed, the rate of electrification is one of the indicators used by international organisations (e.g., the UN or the World Bank) to determine the level of development of countries. As the developing world attempts to achieve levels of economic development approaching those of the industrialised world, the strains on global energy production become apparent. However, the electricity sector, as well as entire energy systems, faces important challenges related to environmental and social impacts of its activities (Espinoza and Vredenburg, 2010).

This research seeks to explore whether the electricity sector can provide long term solutions to socio-economic development without negatively affecting the environment. Can sustainable industries be developed within the power sector?

First of all, it is necessary to define a sustainable industry. Using Starik and Rands's (1995) concept of sustainability, Russo (2003, p.319) defines an (ecologically) sustainable industry as:

> "…a collection of organizations, with a commitment to economic and environmental goals, whose members can exist and flourish (either unchanged or in evolved forms) for lengthy time-frames, in such a manner that the existing and flourishing of other collectivities of entities is permitted at related levels and in related systems"

Based on this definition, Russo (2003) explains that it is possible to look at industries that are on the 'trajectory toward sustainability' and concludes that, when compared to most traditional energy sources (e.g., fossil-fuelled power plants), the RE industry (i.e., solar and wind energy) is moving toward sustainability because of both its lower environmental impacts and its mission-driven nature. In addition, the development of RE industries would help to accomplish some of the principles of biophysically sustainable behaviour suggested by Gladwin et al. (1995) such as regeneration, conservation, or perpetuation.

Similarly, in order to incorporate sustainable development principles into the formulation and implementation of energy policies, the project 'Energy and Sustainable Development in Latin America and the Caribbean', carried out by the Organizacion Latinoamericana de Energía – OLADE, developed energy sustainability indicators, where

the use of RE sources was among the most important ones. Based on such an indicator, an energy system becomes highly sustainable – economically, environmentally, and socially – when it has a high share of renewables in the energy supply (OLADE et al., 1997, 2000).

In summary, the world might be witnessing the emergence of a new energy paradigm and this 21st century may well belong to renewables, just as the 20th century belonged to oil (Brown, 2008; Elliot, 2000).

2.2 New industries, legitimacy and sustainability

In his book *Leadership in Administration*, Selznick (1957) suggests that organisations must change and adapt to a changing society through the embodiment of organisational values, which relate them to the whole society. Later, the concept of institutional isomorphism (Meyer and Rowan, 1977) proposes that, to be successful, an organisation must meet a set of (political/ideological) norms by convergence through imitation. There are three types of isomorphism: mimetic (e.g., imitation or 'benchmarking'), coercive (e.g., regulations), and normative (e.g., professional influence/expertise) (DiMaggio and Powell, 1983; Mintzberg et al., 1998; Scott, 1991). Thus, a firm's action is seen not as a choice among unlimited possibilities determined by internal arrangements, but rather as a choice among a defined set of legitimate options determined by the group of actors composing the firm's organisational field (Hoffman, 1999).

Hoffman (1999) developed a framework for understanding how organisational fields and institutions coevolved and demonstrated that ideas from the old institutional theory about change and interests fit with neo-institutional ideas about isomorphism and resistance to change. Hoffman (1999) also showed that change can emerge suddenly, thrusting institutional players into periods of revolution, where institutional entrepreneurs can be both strategic and opportunistic in order to take advantage of the uncertainty in the institutional order they seek to change (DiMaggio, 1988). In other words, institutional entrepreneurs must break with existing rules and practices associated with the dominant institutional logic and institutionalise the alternative rules or practices they are championing (Garud et al., 2007).

Since firms always face an external environment (Selznick, 1957), or a 'social structure' (Stinchcombe, 1965) that can affect their success, institutionalisation suggests that other than economic contexts should be explored to understand the emergence of organisations and industries. Baden (1998) suggests three types of environmental entrepreneurs who can promote change towards sustainability: for profit ventures that create 'green products'; government officials who create new institutions that foster environmental ends; or public, non-governmental organisations that enable people to cooperatively achieve social and environmental goals.

In addition, Aldrich and Fiol (1994) argue that access to capital, markets, and governmental protection are all partially dependent on the level of legitimacy achieved by an emerging industry. Without legitimacy, firms may have much greater difficulties to survive. There are two dimensions of industry's legitimacy:

1 cognitive or knowledge about the new activity to succeed in an industry

2 socio-political or the value placed on an activity by cultural norms and political authorities (Aldrich and Fiol, 1994).

Similarly, Westley and Vredenburg (1991) have suggested that firms can gain competitive advantage by gaining social legitimisation. In contrast to competitive forces (e.g., Porter, 1980, 1990), institutional forces exert a relatively similar pressure on organisations to comply with institutional rules or practices in exchange for the conferral of legitimacy (DiMaggio and Powell, 1983).

Suchman (1995) incorporates both the strategic dimension and the cognitive/institutional dimension to define legitimacy as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (p.574). Suchman (1995) points out that the question 'what is legitimacy?' often overlaps with the question 'legitimacy for what?'

But, what is the relationship between sustainability and legitimacy? Based on their study of regional networks and the role of individual actors, Jennings and Zandbergen (1995) contributed to institutional theory by incorporating natural constraints on sense making and paradigm construction. Institutional theory helps to understand how consensus is built around the meaning of sustainability and how concepts and practices associated with sustainability are developed, accepted, and spread among organisations. Therefore, the greater the association between the concept of sustainability and essential daily activities of organisations, the more recognised and legitimate the concept becomes among them. Also, the more typified and rationalised the concept of sustainability becomes, the greater the likelihood that some of its components will be legitimated by action in society, including business firms (Jennings and Zandbergen, 1995). For instance, Hoffman (1997, 2000) argues that current environmental concerns originate from a broader system of pressures than merely from government or activism. These new pressures come from insurance companies, investors, communities, the media, consumers, and suppliers. In that sense, Hoffman (2005) explains, for example, how the climate change issue is becoming less environmental and more related to business practices.

3 Data and method

This study sought to understand how the wind energy industry is developed under different contexts. Based on both personal face-to-face interviews and secondary data from Denmark and from the Province of Alberta, Canada, our industrialised jurisdictions, and from Costa Rica and from Ecuador, our emerging economy countries, the research investigated the main factors (e.g., driving forces and barriers) as well as the main actors (or stakeholders) playing a role in the development of wind power projects.

Because of its nature and based on Crotty (1998), this research used case study (based on interviews) as its main method and grounded theory as its methodology. It is also important to point out that the research theoretical perspective is interpretive in nature, which leads to constructionism as the epistemological position of this study.

This research was developed within a specific context of the whole energy system: the electric power sector. The study domain was then the wind-based generation projects that participate or will participate in the (on-grid) power system of selected jurisdictions.

Globally, the wind energy industry is relatively new and small and competes with well established conventional energy industries based on both fossil fuels and large hydropower resources. However, since wind power is a RE technology with a dramatic

growth in the last few years (Brown, 2008), it might represent an important option for countries/regions to move toward a sustainable development path. Therefore, understanding the way a wind energy industry is established under different contexts was considered relevant as a research topic.

This study addresses the following questions:

1 Why/how is the wind power industry emerging in both industrialised economies and developing countries?

2 What theoretical framework may explain the emergence of wind energy industries? Can such a theory be equally applied in North America, Europe, and Latin America in order to explain the same phenomenon?

Based on these questions, Yin's (1994) typology was considered to help in conducting the research. This study would represent an embedded design, with a main unit of analysis (the wind power industry) and some sub-units of analyses within the main unit (the main actors or stakeholders). In this way, opportunities for extensive analysis were available, enhancing the insights. In addition, by using multiple cases, this study primarily focused on literal replication (corroboratory evidence) rather than theoretical replication (contrasting but predictable results) (Yin, 1994).

Since this study was supplemented by grounded theory techniques (i.e., being receptive to new insights emerging), the use of multiple cases also contributed to the process of theory building (as opposed to theory testing). This means that such a process is mainly inductive. Finally, this international comparative work helped to explore the links between the patterns of industry development and the varying institutional, regulatory, and cultural contexts of nations (Porter, 1990; Pettigrew et al., 2001).

In summary, the advantage of using a case study approach in this research was its ability to deal with contextual conditions (Yin, 1994), which can generate a novel theory/model that is empirically valid (Eisenhardt, 1989). However, because a case study could corroborate the researcher's preconceived positions, openness to contrary findings was required. For that, experts in the area of research were asked to offer alternative explanations of the findings.

This research consisted of an exploratory and descriptive four-case study with both national and international generalisation and application. The study focused on investigating wind power projects in Alberta Canada, Denmark, Costa Rica and Ecuador. Denmark was one of the world leaders in wind energy development while Alberta Canada had a modest amount of wind power development; Costa Rica was the Latin American leader in wind power development whereas Ecuador represented a 'typical' Latin American country looking at developing alternative energy projects.

The field research was conducted over an eight year period between July 2001 to June 2009 with repeated follow-up face-to-face interviews to the initial interviews in three of the four jurisdictions (Alberta-Canada, Denmark and Ecuador) and electronic follow-up to the initial face-to-face interviews in Costa Rica. The selected cases were involved in wind power at different stages of development. By the time this research was developed, three cases had wind power projects already working whereas one case was developing its wind farms. The projects themselves were not a controlled variable as the phenomenon of interest was the development of the wind energy industry as a whole.

Selection of jurisdictions to investigate was based on informed choice and considered either operating projects or projects under development. The selection and number of

cases was also determined based on the available resources (e.g., time and money) for the research and by specific repeated travel opportunities and ease of access to relevant organisational actors.

The varied sample strengthened theory building about common elements that may appear in jurisdictions when developing a wind power industry. In order to avoid extensive use in resources and time, every case was analysed for a specific purpose within the overall scope of inquiry. The recognition of the differences among jurisdictions allowed for a number of comparisons to be made in order to explain the development of wind energy industries.

Table 1 Case description

Case	*Description*
Denmark	Industrialised economy
	Although it produces fossil fuels, such an industry is not the main economic activity of the country
	Strong 'conventional' power industry (fossil fuels)
	'Significant' wind power contribution (16% of total generated power)
Alberta, Canada	Industrialised economy
	Fossil fuels producer (oil and gas is the main source of income)
	Strong 'conventional' power industry (fossil fuels: coal and gas)
	'Small' wind power contribution (1% of total generated power)
Costa Rica	Emerging economy
	Produces no fossil fuels
	Renewable-based power industry (hydropower, geothermal, wind)
	'Significant' wind power contribution (4% of total generated power)
Ecuador	Emerging economy
	Oil producer (oil is the main source of income)
	Strong 'conventional' power industry (large hydro + fossil fuels)
	No wind power contribution so far*

Notes: *In October 2007, the San Cristobal wind power project (2.4 MW) started its operations, constituting the first large-scale wind project in Ecuador. This project is sponsored by the UN Development Program (UNDP), in an international collaborative agreement between the local (public) utility Electro-Galapagos and the E-7 Network. Since the project is located in the Galapagos Islands, it is an 'off-grid' (isolated) project and was not considered in this research.

The cases studied in this research had to do with groups of people or organisations (i.e., stakeholders) represented by individual subjects (i.e., managers). Subjects represented both the public sector (e.g., government/regulators) and the private sector (e.g., wind power producers) and were selected because of their direct involvement with the development of wind power projects.

In order to avoid a very broad study, the research focused on wind power projects in which three particular stakeholders were analysed: electric utilities, government regulators, and wind power producers (firms or organisations). When relevant, community leaders and/or representative consumers (e.g., large clients) were considered as the fourth group of stakeholders.

The initial foundation phase of this research was conducted over a 30-month period involving 26 interviews and 22 follow up interviews with 41 subjects from the senior and middle management levels. The follow-up phase of the research was conducted on a yearly basis with a roughly representative proportion of respondents and their organisational successors.

The process of data collection involved three data sources: interviews, literature review, and secondary/documentary. The use of interviews allowed for multiple sources of evidence. The data from interviews was read, coded, analysed, and interpreted repeatedly. Macro and micro level analysis led to the determination of 'meta-codes' at the category level. These categories were included in the research model as presented below.

This research used an 'in-depth interviewing' approach as the primary method of data collection. For that, the study used a standardised semi-structured (open-ended) interview, based on face to face discussions. In some cases, new participants were identified using the 'snowball' technique in order to obtain additional people for the study. An important aspect of the interviews conducted in this project is known as 'elite interviewing', which focuses on a particular type of interviewee (e.g., government officials, senior managers, or community leaders) as they are considered to be influential and well-informed about their organisations (Marshall and Rossman, 2000).

The focus of data analysis was to 'interpret' the data sources through answering the research questions. Data analysis consisted of reviewing/'manipulating' all the evidence through activities such as inspecting, categorising, tabulating, recombining, and so on (Yin, 1994). Data analysis was carefully developed in order to avoid alternative explanations and conclusions at the end of the study.

The interview transcripts were analysed through the categorisation of emergent concepts/ideas and the constant comparison among them to identify common themes (Glaser and Strauss, 1967). This early phase of data analysis facilitated the development of a logic model of analysis (Yin, 1994) and was based on grounded theory, an inductive methodology for discovering/development of theory based on an iterative approach of data collection and concept development about a given phenomenon (Glaser and Strauss, 1967; Strauss and Corbin, 1990).

Categorisation of emerging concepts was based on coding. Coding is an analytic process to fracture, conceptualise, and integrate data in order to build theory (Strauss and Corbin, 1990). The macro and micro analysis was an iterative process of reading, coding, and interpreting the data. Such a process was crucial to determine the final themes or 'super codes' of this study.

The initial phase of data analysis determined emerging topics (textual quotes from each transcript) that led to 'first-order themes' (Sharma and Vredenburg, 1998). This initial analysis was iterative as codes were added and removed over time to observe how new themes emerged. The process arrived at a form of data saturation as no new codes were added by the time the last few transcripts per case were coded.

In this research, first-order codes were identified as 'basic codes' and then listed in a computer file separated by location. In order to decide which theme to retain, the total number of references for each theme (from each jurisdiction) was identified and ranked in a separate file. Codes with only one reference were either integrated into other codes or eliminated (if not relevant to the study). At the end, 41 basic codes were identified and listed. The basic codes were then classified in a higher category level, which was supported by the theoretical frameworks used in this research. This led to obtaining 'second-order themes' (Sharma and Vredenburg, 1998) or 'super codes'.

Table 2 Super codes and basic codes

	Super code	*Examples of basic codes*
1	Country (development) conditions	Country risk; economic crises
		Funds available (financial issues)
		Reliance on conventional sources (e.g., fossil fuels)
		Existing infrastructure (transmission lines)
2	Natural capital	Resource/wind potential (global and/or local winds)
		Data available on winds
		Complement to hydro; diffuse nature of wind power
		High site specificity (difficult to find 'the' place)
3	Technological/innovation aspects	Marginal contribution of wind energy
		Uncertainty about wind energy quality (% penetration)
		Improvements in efficiency/production costs
		Easy installation/short period of construction
		External influence/experience
4	Informal institutional issues/social capital	Country culture (e.g., 'green' reputation)
		Environmental entrepreneurship (personal motivation and risk taking)
		Good relationship with land owners
		Wind manufacturers involvement
		Sharing of good/bad experiences from first projects
5	Institutional/legal framework	Restructure of electricity sector (private participation)
		Market and price guaranteed (e.g., PPAs)
		Energy policy (commitment to RE)
		Long/bureaucratic processes (e.g., construction permits)
		Resistance/fear to change old mentality and practices in the power sector
6	Economic aspects	Wind power is a good business
		Market interest to buy cheaper electricity
		Need for energy; demand growth
		Electricity sector situation (monopoly vs. open market)
7	Environmental and social aspects	Environmental costs are not internalised yet
		Environmental protection, alternative to thermal plants
		Wind power to solve social/economic problems
		Conviction/commitment to renewable energies
8	Climate change issue	External donations and networking
		CDM as a 'positive psychological effect'
		CO2 trading as a 'plus'/additional funds
		High transaction costs (small additional cash flow) and uncertainty about CDMs

Source: Espinoza and Vredenburg (2010)

Throughout a process involving a back and forth strategy of reading, coding, interpreting, and model building, eight super codes were determined comprising the research model, as presented in Espinoza and Vredenburg (2010).

4 Analysis of case studies

Firstly, it is important to explain why the four cases under study were chosen. Denmark, Alberta Canada, Costa Rica, and Ecuador were selected as the contexts to study wind power development because, at the time this research was conducted, each of the cases was experiencing a different level of development of their wind power industries, thus, contributing something new within the overall scope of the research.

Several reasons justified the selection of the Province of Alberta instead of the entire Canadian country. First, in order to make comparisons, the researchers wanted to have the cases as homogeneous as possible in terms of geographic size, population, and so on. Second, under the Canadian Federal regime, Provinces are geographic jurisdictions enjoying considerable political, legal, and economic autonomy. Energy policy in Canada is a specifically Provincial responsibility, not a Federal one. Third, Alberta was an oil-based economy, which was one of the arguments that might play against wind power development. Therefore, this study uses frequently (and interchangeably) the terms jurisdiction/economy as they can apply to both a country and also to a highly decentralised province like Alberta.

This paper focuses on developing a theoretical framework to explain the emergence of wind energy industries regardless of (or in addition to) two interrelated factors: the jurisdiction's (economic) development and the jurisdiction's oil dependence. In other words, although both factors might represent important economic variables explaining wind power development, it was not quite clear if other relevant issues could also contribute to understanding the emergence of a wind power industry in a given context.

Under these circumstances, the idea at the beginning of this research was to find two developed economies and two developing economies in order to explain the same phenomenon. In that sense, this study seeks to extend Espinoza and Vredenburg's (2010) research on the start-up of the wind power industry in the developing world and look at some similarities (or differences) across industrialised and emerging economies when examined at the national or sub-national regional industry level.

To identify an emerging economy, two main criteria were used: the World Bank's Gross National Income (GNI) per capita (per year) and the United Nations Development Program's (UNDP) human development index (HDI), which measures the level of development based on several different variables related to education, income and health (UNDP, 2002). By using both GNI and HDI, Costa Rica and Ecuador were classified as developing (emerging) economies (Espinoza and Vredenburg, 2010) whereas, Alberta Canada and Denmark were considered as developed (industrialised) economies.

In addition, two cases represented oil-based economies whereas the other two had other than oil as their main economic activities. For this study, defining an oil-based economy was straightforward: a jurisdiction whose main economic activity was related to the 'oil industry', which includes fossil fuels in general (oil, coal, and natural gas). The contribution (in percentage) of the oil industry to the country's GDP was considered an appropriate proxy to meet such a definition. Two cases, Alberta and Ecuador, met the definition. Neither Denmark nor Costa Rica had oil-related industries as their main economic activity. A summary of the relevant information from these four economies is presented in Table 3.

Table 3 Basic information from selected jurisdictions

Jurisdiction (country)	*Area* (km^2)	*2005 populat. (million)*	*2005 GNI (US$ per cap)*	*2005 HDI (World ranking)*	*Economy (in terms of GDP)*	*Total energy consumption by source*	*2005 Inst. capacity (% wind power to NIS[1])*
Denmark	43,094	5.4	33,973	0.949 (14)	Services 72%	Oil 41%	
					Industry 25%	Nat. Gas 20%	3,122 MW
					(O&G 1%)	Coal 25%	(16 %)
					Agricult. 3%	Others[2] 14%	
Alberta	661,190	3.1	33,375	0.961 *	Services 60%	Oil 50%	
				(4) *	Industry 38%	Nat. Gas 20%	164 MW
				(*)From Canada	(O&G 20%)	Coal 25%	(1%)
					Agricult. 2%	Hydro 2%	
Costa Rica	51,000	4.3	10,180	0.846 (48)	Services 61%	Oil 69%	
					Industry 30%	Biomass 14%	66 MW
					(O&G 0%)	Hydro 14%	(4%)
					Agricult. 9%	Others[3] 3%	
Ecuador	256,000	13.1	4,341	0.772 (89)	Services 56%	Oil 74%	
					Industry 33%	Biomass 17%	None
					(O&G 15%)	Hydro 7%	
					Agricult.11%		

Source: UNDP (2005); OLADE/SIEE (2005); EWEA (2005); CanWEA (2004) Danish Energy Agency (2005)

With the information from the cases, a preliminary 2 × 2 matrix was constructed based on whether the jurisdiction was an oil-based economy and considering the level of economic development. Four different quadrants were created to represent each of the cases under analysis. In that way, the theoretical sampling of the research was initially developed.

From the matrix (Figure 1), three different conditions were determined in order to explain the emergence of a wind power industry: favourable conditions, potential conditions, and difficult conditions.

Figure 1 Different conditions under which a wind power industry may appear

		Level of development	
		Developed	Developing
Oil-based economy (% of GDP)	Low	**(1) Denmark**	**(3) Costa Rica**
	High	**(2) Alberta (Canada)**	**(4) Ecuador**

Notes: 1 = Favourable conditions; 2–3 = potential conditions; 4 = difficult conditions.

Denmark (quadrant 1) represented favourable conditions to develop a wind power industry. As a developed nation, Denmark possessed the economic resources to invest in governmental programs promoting renewables. Although, the country had a well established oil and gas industry, the contribution from this sector to the whole economy represented about 1% of the Danish GDP and was not as high as in Alberta or Ecuador. This contribution might have some influence on the development of alternative energy industries.

Alberta (quadrant 2) represented an important oil and gas producer, which was certainly a factor to take into account. The oil and gas sector represented more than 20% of the Albertan GDP. This heavy dependence on fossil fuels, based on a cheap and easy access to these non-renewable resources, created a sort of 'carbon lock-in' (Unruh, 2000), which would explain why the province did not have an important wind power industry. However, Alberta (at the Provincial level) and Canada (at the Federal level) seemed to be creating potential conditions (mainly through economic incentives) to grow such an industry. Environmental issues, and particularly the pressures to accomplish the Kyoto Protocol, represented one of the main driving forces behind the government commitment to RE.

The same potential conditions may be inferred from the Costa Rican case (quadrant 3), although for different reasons than in Alberta. Costa Rica was not a developed jurisdiction and lacked sufficient governmental economic resources to promote wind power development. Nevertheless, Costa Rica did not have indigenous sources of fossil fuels to generate electricity and depended almost exclusively on hydropower, which represented a risk for the Costa Rican electricity system particularly during dry seasons. This situation led the country to consider other indigenous sources such as geothermal, wind, or solar energy. The country partially opened the electricity sector to private participation to develop power generation projects. This participation was restricted to investing in RE sources only.

Finally, Ecuador (quadrant 4) represented difficult conditions for the development of a wind power industry. Like Alberta, Ecuador was an oil producer and depended heavily

on fossil fuels, particularly oil derivatives for transportation and power generation. The Ecuadorian oil industry represented about 15% of the country's GDP. In addition, the country did not have the economic resources to invest in R&D or governmental programs to aggressively promote wind power development. And, even though a few wind farms were under study, funding them was perhaps the main problem to start up the development of the Ecuadorian wind power sector.

Based on the analysis done so far, a straightforward question appeared: can Figure 1 explain the emergence of the wind power industry everywhere? The answer was not completely clear. Although, the matrix might explain what happens with the four cases under study, it might not explain why a wind power industry does not appear in other places. In other words, the macro-economic indicators used in the matrix might falsify the model when applied in other contexts. For instance, France could be located in quadrant 1 and yet this country is not a wind power producer like Denmark. Similarly, Central American countries such as Nicaragua or El Salvador might be located in quadrant 3 but they have not developed wind power projects like Costa Rica did.

Therefore, a first conclusion is that Figure 1 might partially explain the start-up (or not) of a wind power industry. Macroeconomics is a necessary but not sufficient condition to explain the phenomenon under study and other factors were required to complement such an explanation. Based on the findings from the case studies, these additional components were related to both project-specific factors and institutional factors as described in Espinoza and Vredenburg's (2010) study.

4.1 Project-specific factors

Project-specific factors refer to individual wind farms and were obtained from the super-code analysis (the research model) described above. Some of the super-codes identified in this research were closely related to Russo's (2003) study on the development of the wind power industry in California. In the end, project economics, natural capital, and social capital were three components or constructs included in the theoretical model developed in this paper. These constructs represented the specific conditions under which the wind power technology was adopted, at the project level, in order to develop the wind power industry in a given jurisdiction (Espinoza and Vredenburg, 2010).

Economic factors had to do with how project developers saw wind power as a 'good business' based on the specific conditions of the electricity sector of each jurisdiction. From the technological perspective, wind power was mature enough (e.g., competitive production costs) to avoid considering such a factor as a variable. Rather, the economic analysis refers to how a wind power project might succeed within a specific jurisdiction. For instance, people's interest in buying cheaper electricity or a country's need for more energy sources were factors considered by wind power developers before starting their projects. Specifically, the jurisdiction's average cost of electricity generation as well as the financial incentives given to wind power producers represented two important variables to consider.

Natural capital refers to both wind as an energy resource and land as a strategic asset. Factors such as wind speed or information about windy areas were mentioned in many interviews. In addition, the issue of geographic location was always present as wind power projects are site specific. Therefore, the place where a project is developed has to have, in addition to good winds and detailed data, a relatively easy access to the national/regional electricity grid (Espinoza and Vredenburg, 2010). It might also be

possible to predict that new searching rounds of windy areas will occur once most of the first 'good places' have been exploited. For instance, Denmark had a well developed wind Atlas with information of thousands of wind turbines already in place. Currently, the country is looking at off-shore wind power development.

In this study, social capital was associated with networks, trust and/or collaborative efforts, not involving (direct) financial transactions and that have helped to develop wind power projects. For instance, social capital could be related to how key (scarce) information was obtained by the different stakeholders of the wind power industry with no payment involved in getting such information. Social capital has also been associated to 'weak ties' (Granovetter, 1973) that some local champions had with outsiders in order to develop wind farms. This was particularly important in the Latin American cases.

4.2 Institutional factors

This research identified two types of institutional factors: formal and informal. This categorisation relies on North's (1990) work that relates formal institutions to legal aspects (policies, laws, and regulations) and informal institutions to cultural or 'taken for granted' issues. It is not easy to demonstrate which type of institutional factors should appear first and perhaps that is not relevant for this research. Rather, it is important to note that the dynamic interaction of both formal and informal institutional factors generates 'industry legitimacy' (Aldrich and Fiol, 1994) that can contribute to explain the emergence of wind power projects.

The interviews from the cases under study showed that formal institutional factors are key elements to promote wind power development. For instance, the Danish legislation established that power utilities had to pay, to the privately owned wind turbines, 85% of the retail local average price of electricity. In Alberta, it was the Provincial government that started promoting wind power through specific laws and development programs. Costa Rica allowed private participation through two specific laws that were the stimulus to starting the development of wind farms. Ecuador, with a new electricity law and particularly with a specific regulation, also encouraged the development of RE projects including wind farms. In all the cases, these laws and regulations sought to guarantee at least three things for wind power producers: a stable (i.e., fixed) price for wind energy, a market, and fair access to the grid.

Informal institutional factors refer to a jurisdiction-specific environmental commitment (e.g., 'green culture') promoting the use of cleaner energy sources, the role of champions/visionary leaders ('environmental entrepreneurs'), or the perception of an 'environmental crisis' (e.g., climate change).

Denmark's environmentalism promoted wind power development after the 1970s oil crisis when several other European countries started developing nuclear energy. Lately, Denmark committed to reduce CO_2 emissions, through various Kyoto mechanisms. Before deregulation occurred in Alberta in the mid 1990s, the role played by environmental entrepreneurs from a few energy companies was critical. These people were not only knowledgeable about the technology but also were able to promote wind energy by convincing the gate-keepers (i.e., governments) that such an energy source was the right choice. Once the electricity market was deregulated, some voluntary collaborative agreements between wind power producers, retailers, and consumers did appear. Governments (both local and Federal) were also part of this group of 'green'

consumers because, like in Denmark, climate change was becoming an important issue encouraging governments to consider alternatives to reduce their GHG emissions.[4]

It is important to note that Costa Rica has a regional reputation of being a 'green country'. This sort of green culture has influenced several industries and activities, including the electricity sector. The country does not 'like' fossil fuels as energy sources and has established a sustainable development path for its power sector. Costa Rica has a long tradition of using its own renewable resources like hydropower, geothermal, and lately, wind power. The Costa Rican wind power industry was started by 'environmental entrepreneurs' from both the government and the private sector, who identified wind power as a good alternative for the country not only from the economic point of view but also from the environmental and social perspectives. In Ecuador, one can also identify several individuals or organisations that were promoting wind power projects. These champions along with some utilities and provincial governments were all pushing to develop wind farms in the country. Enthusiasm, conviction, and environmental commitment were some of the reasons given by these people to explain why they were getting involved in the wind power industry.

4.2.1 Theoretical model

This study has tried to complement Russo's (2003) research and extend Espinoza and Vredenburg's (2010) analysis. The research presented here shows that the jurisdiction specific conditions are very important to explain the development of a sustainable industry in both industrialised and emerging economies.

In addition to the state of the economy (e.g., access to economic resources), latent demand for the product (e.g., need for electricity), and competitive pressures from related industries are also among the factors contributing to a new industry's success (Aldrich and Fiol, 1994; Porter, 1990). Such factors can be categorised as economic factors. However, one of the first findings of this research was that country and project characteristics other than economic factors were necessary to explain the emergence of a sustainable industry.

This research observed that environmental and social factors were also intervening during the establishment of the wind power industry. Moreover, in addition to economic factors, institutional forces were always present to legitimate the new activity. Gaining industry legitimacy is a key component to successfully starting an industry (Aldrich and Fiol, 1994; Espinoza and Vredenburg 2010; Russo, 2003). Specifically, Espinoza and Vredenburg (2010) identified three strategic resources that explain the emergence of the wind power industry: natural capital, social capital, and legitimacy.

4.2.2 Natural capital as a strategic resource

In the cases studied in this research, several organisations showed the characteristic of fitness with their natural environment (Russo, 2003; Mintzberg et al., 1998). These organisations demonstrated a high awareness of the importance of natural (RE) resources for power production as a basis to protect the environment and improve their businesses, increasing at the same time, the portfolio of power sources in the places under analysis.

Having a sustainable power sector might mean that the jurisdiction where that sector operates would have an easier way toward sustainability in the future. Elliot (2000) has mentioned that if a country seriously addresses the issue of developing a sustainable

energy industry then it would become the central location for a major new international business sector. The results of this research support Elliot's point by showing how Denmark is the true world leader in manufacturing wind power turbines. Although not a turbine manufacturer, Costa Rica has also shown that its power sector, based mostly on renewables, is stronger and looks more sustainable than its Central American neighbours. The path toward sustainability would be moving then from the industry (i.e., organisations) to the sector to the country.

4.2.3 Social capital as a strategic resource

The findings of this research demonstrate that wind energy projects tend to concentrate in some geographic areas as wind power is highly site specific. These results are consistent with Russo's (2003) and Espinoza and Vredenburg's (2010) analyses, which noted that having high geographic concentration means generally tight communities and leads one to think that social capital can be developed in those locations. If so, social capital can become a valuable resource for a new industry.

If a sustainable industry is to be established, it is suggested that some contextual stakeholders must first validate the new industry before it can go mainstream (Espinoza and Vredenburg, 2010). In this process of socio-political legitimisation (Aldrich and Fiol, 1994), the participation of key industry-stakeholders, most of them concentrated geographically, is quite important. In the case of the wind power industry, this group of stakeholders includes wind power producers, governments, customers, Non Governmental Organizations (NGOs), investors, electric utilities, and communities. Geographic concentration also has ramifications for those outsiders with whom individuals from the new industry interact. In the cases under analysis, collaboration among stakeholders such as wind power producers, utilities and even local governments was noted.

The research also showed that the social networks, around the projects in each jurisdiction, also had 'weak ties' (Granovetter, 1973), in the form of connections with people outside of the jurisdiction. This connection with key people outside the community was very important to explain the diffusion of wind power technologies, particularly in the Latin American cases.

4.2.4 Legitimacy as a strategic resource

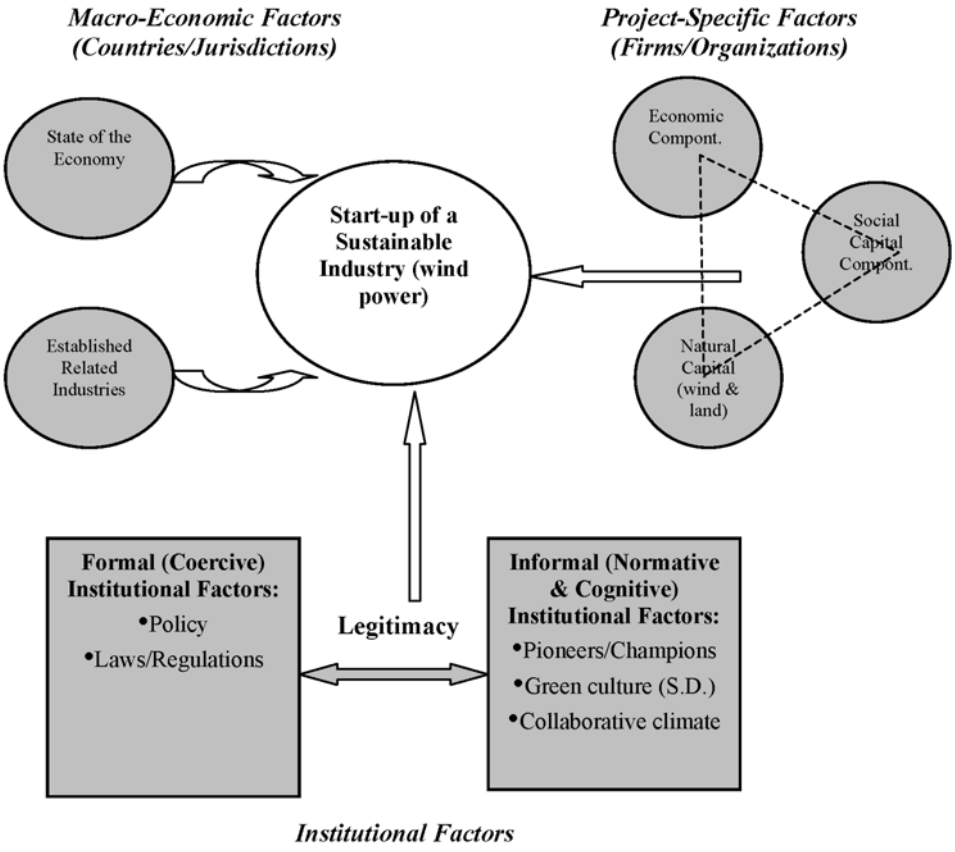
Espinoza and Vredenburg's (2010) study showed that in addition to formal (regulatory) institutional factors, informal factors ('green culture', champions, and so on) are also present, and equally significant, in the emergence of a sustainable industry. These two types of institutional factors can be related to the three institutional pillars (regulative, normative, and cognitive) mentioned by Scott (1991, 1995) and Hoffman (1999). Both formal and informal institutional factors are working together to provide legitimacy to the industry.

Summing up, the model developed by Espinoza and Vredenburg (2010) includes macroeconomics, project-specific factors, and institutional factors (formal and informal) and explains the phenomenon under study (see Figure 2).

All the factors included in the model (Figure 2), are interrelated and their interaction explains how and why the wind power industry emerges. The level of interrelationship seems to depend on each jurisdiction. An important finding is that the formation of new

RE industries is the same in industrial and emerging economies. No qualitative or quantitative differences were found between the two sets of cases.

Figure 2 A model explaining the start-up of a sustainable industry



Source: Espinoza and Vredenburg (2010)

5 Discussion and theoretical contributions

The development of renewable energies is widely seen as important if the world is to move toward sustainable energy systems (Elliot, 2000). RE industries, such as wind power, will be developed by individuals or organisations expecting to bring together socio-economic growth and environmental protection in the electricity sector.

During the last decade, the emergence of the wind power industry has been observed in several regions of North America, Europe, and in some developing countries. This phenomenon might represent not only the beginning of a new era in the power sector but also one of the many steps required to shift toward a new techno-economic paradigm of development. In spite of its relevance, only a few academic studies have analysed the phenomenon focusing on the entire industry instead of either firms or societies. This lack of focus on sustainable industries is a missing level of analysis for those people studying

organisations and the natural environment (Russo, 2003; Espinoza and Vredenburg, 2010).

This article has analysed the development of the wind power industry under different contexts in both industrialised and emerging economies, contributing to meeting the need for more research at the industry level and opening, at the same time, opportunities for further research on how sustainable industries can contribute to sustainability at the macro-level. This study incorporated a set of factors to explain why and how a wind power industry emerges under different contexts. Specifically, the research included macro-economic components, project-specific factors (incorporating sustainable development principles) and institutional factors in order to determine the successful start-up of the new industry.

By emphasising the final acceptance (legitimisation) of some social practice or social goal, institutional theory is useful for describing how organisation activities may, over time, come to contribute to sustainability (Jennings and Zandbergen, 1995). However, the focus on isomorphism of (neo) institutionalism seems to contrast with the reliance on ecosystem diversity (Jennings and Zandbergen, 1995), the resource based view (RBV) in strategic management (i.e., Hart, 1995), or change.

Some authors have located the source of change in the actions of powerful constituents of the relevant field (DiMaggio, 1988; North, 1990). In contrast, Hoffman (1999) showed that change can emerge suddenly pushed by 'institutional entrepreneurs' who can influence the establishment of a new institution. However, Hoffman's (1999) research is not quite clear about how to identify these entrepreneurs and their specific roles. Westley and Vredenburg (1997) have shown the role played by key individuals in bringing about changes in complex networks where a multi-stakeholder decision-making process is required. In addition, Trist (1983) has noted that before meta-problems can be solved, a first (under-organised) stage appears. In this stage, individuals (leaders) are critical for bringing recognition of the joint problem to the attention of stakeholders.

One of the contributions to institutionalism is that this research has identified the key role that 'institutional entrepreneurs' or champions play in both the start-up of the wind power industry and the reconfiguration of the power sector. By relying on their interpersonal skills such as reputation or political influence (Aldrich and Fiol, 1994), champions have been able to create the right conditions to build strong networks to develop the industry. In those networks, champions have challenged the current paradigm of energy production and are offering, at the same time, an alternative paradigm based on renewables. Recognising the role of these visionary leaders is to suggest that, for a sustainable industry to be legitimate, its champions' legitimacy should first exist (Espinoza and Vredenburg, 2010).

Another contribution to institutional theory has to do with 'organisational field' (Hoffman, 1999) or 'domain' (Gray, 1989; Trist, 1983; Westley and Vredenburg, 1997). Both concepts refer to a group of stakeholders or participants who interact with each other to solve a common problem. By examining the current development of wind power industries in different jurisdictions, this research is approaching networks as being built around communities. The findings show that the networks supporting wind power development are mainly local/regional (Espinoza and Vredenburg, 2010). In Denmark, wind farms developed around wind power cooperatives supported by local wind turbine manufacturers. In Alberta, the industry was growing based on a (local) market arrangement among wind power generators, utilities, and customers. In Costa Rica, the wind power industry was centred on ICE, the state monopoly. In Ecuador, even though

there was a national regulatory entity, as the country is going to decentralisation, both provinces' governments and local utilities were becoming the centre of wind power development.

In addition, Jennings and Zandbergen (1995) note that the development of organisational fields around different communities and around different issues related to sustainability may create some diversity. Similarly, Aldrich and Fiol (1994) suggest that a single venture's uniqueness (i.e., according to the RBV) during the emergence of an industry should be counterbalanced with the collective efforts of all players in the new industry to portray the new activity as familiar and trustworthy, if they are to survive as a group. This research is a good example that supports the need for a balance between uniqueness/diversity and isomorphism. Although, the study was addressing the development of the same sustainable industry, each of the cases analysed had different characteristics depending on the jurisdiction's specific conditions. For instance, the ways in which the wind power industry was developed in Alberta was different than those in Denmark, Costa Rica, or Ecuador. Moreover, some managerial practices were also different even in each jurisdiction or country.

Finally, this study corroborates Espinoza and Vredenburg's (2010) findings in the sense that firms/organisations were committed to sustainable development principles (e.g., pollution prevention) but they also showed rational behaviours to justify their operations. The managers who were interviewed mentioned that wind power was not only a valid option to protect the environment (i.e., facing climate change) but also a good business opportunity.

5.1 From emerging sustainable industries to institutional evolution to paradigm shift

This research can be related to institutional evolution by exploring Hoffmann's (1999) ideas about institutional change: the view that regulative, normative, and cognitive institutional pillars are connected and can move from one to another. Since this research sought to explain the development of a sustainable industry under different contexts, each case study could only be approached within one of the four stages suggested by Hoffman (from a questioning of prior institutional beliefs to a regulative institution to a normative institution to a cognitive institution). As far as the countries were different in terms of industry development, each industry should be facing either a different historical stage or a transition from one stage to another. Thus, an important hypothesis appears: the more developed the sustainable industry the higher its legitimacy in a country or region and vice versa. In other words, institutionalisation (i.e., legitimisation) of a sustainable industry can be faster or stronger when it does not face an established unsustainable practice (Espinoza and Vredenburg, 2010).

In the analysis of the wind power industries of Costa Rica and Denmark, this research found that environmentalism had strong roots inside the culture of both countries. In the former, using fossil fuels for power generation was never an established (widely accepted) practice whereas in the latter, its strong environmental commitment has made it possible to develop a more diversified (and sustainable) power sector. On the other hand, both Alberta and Ecuador possessed strong fossil fuel sectors impeding somehow that more environmentally friendly technologies might move into the mainstream. In both case studies, it seems that a process 'de-institutionalisation' (i.e., challenging a fossil

fuel-based economy) should go first before a sustainable energy industry can get successfully established.

From the case studies, the relationship between processes of deinstitutionalisation (at the power-sector level) and paradigm replacement (at the societal level) might be addressed. Alberta was experiencing significant structural changes in its power sectors, moving from a monopolistic structure to a deregulated electricity market where participation of any power source (including wind-based electricity) was possible. Ecuador was involved in a decentralisation process where local (e.g., provincial or municipal) governments had competencies and resources to accomplish development programs including power generation. In both cases, the introduction of alternative and renewable technologies was transforming the power sector by challenging the 'traditional' way to produce electricity.

Deinstitutionalisation represents an important part of shifting to new paradigms (Jennings and Zandbergen, 1995). Some philosophers of science (Burrell and Morgan, 1979; Kuhn, 1970) have argued that the basic assumptions of existing paradigms must be challenged by crises before new paradigms can be adopted. Moreover, Jennings and Zandbergen (1995) hypothesise that each crisis will give rise to new sets of organisational actors who begin to promote alternative paradigms. From a sustainable development perspective, some of the crises, or what Hoffman (1999) calls 'disruptive events', that have begun to challenge the current expansionist paradigm include the 1970s energy crisis, nuclear accidents, and oil spills. Lately, global threats such as climate change are also challenging the way we all live.

It can be concluded from this research that the depth of the changes in the power sector, of which sustainable energy industries are part, will partially depend on how societies perceive/react to crises. In the case of developing countries (Costa Rica and Ecuador), solving their current energy crises was mostly related to socio-economic issues. Wind power was seen as a means to ensure power supply and have a larger portfolio of energy sources. In both cases, improving the environmental conditions was seen as an important yet secondary aspect to consider.

In the developed jurisdictions under analysis, the situation was slightly different as environmental issues were considered at a similar level as economic factors. For instance, during the oil embargo of the 1970s, Denmark moved to develop alternative sources of energy, particularly wind power, rather than resorting to nuclear power. Contrarily, Alberta might not have seen the 1970s crisis as a significant threat to its economy, perhaps because of its huge reserves of fossil fuels. However, some energy players in both Alberta and Denmark are currently seeing climate change as a global threat that might undermine their business. Moreover, the inclusion of renewables in energy firms' businesses appears to be not only a local/regional but a global phenomenon: large energy companies based in Alberta such as TransAlta and Suncor as well as multinationals like Shell and BP, currently have RE divisions.

Through this research, by analysing the emergence of a particular sustainable industry, several aspects related to processes of institutionalisation (deinstitutionalisation) have been addressed. Therefore, it might be hypothesised that a changing power sector, due to the entrance of the wind power industry, could start the deinstitutionalisation of the whole energy system, which would lead to promote a paradigm replacement at the societal level. Since large techno-institutional infrastructures or systems tend to create their own stability, their displacement might come not from within the system, but from exogenous forces (Unruh, 2002). Thus, a sustainable energy industry, which incorporates

new technological, social, and environmental aspects, is seen as an external force pushing to change the established energy system.

The study found that a process of deinstitutionalisation in the power sector went from discourses about sustainability (by entrepreneurs or 'champions'), where the current practices were challenged and the alternatives/opportunities were presented, to policy development (by governments) to technology adoption/diffusion. Only when a 'good reputation' for the new industry was obtained, based on the successful implementation of projects, were the old practices in the power sector questioned and the new activity adopted by key actors of the sector (e.g., utilities, customers, or large energy firms).

Although, this research arrived at the point of analysing jurisdictions with projects under development, it might be argued that after the new industry enjoyed a good reputation, a larger process of institutionalisation would start at the inter-industries level – the whole energy system – and later at the societal level (e.g., Denmark's experience with wind power). Table 4 summarises the ideas mentioned above. Based on Aldrich and Fiol's (1994) work on industry creation, four levels of social context (organisational, intra-industry, inter-industry, and institutional) are presented as progressively broadened sites within which trust, reliability, reputation, and institutional legitimacy, respectively, are built.

Table 4 Development and institutionalisation of a sustainable industry

Level of analysis	*Organisational*	*Industry (sector)*	*Inter-industry (system)*	*Society (institutional)*
Main actor(s)	Champions	Firms/organisations	Other related industries	Communities
	Firms/managers	Customers		Countries
		Policy-makers		
Process	Discourse/vision of sustainability	Policy development	Deinstitutionalisation of 'old' practices	Institutional. of 'new' practices
		Project adoption		
Expected institutional outcome	Trust	Reliability	Reputation	Legitimacy
Example of jurisdictions (wind power)	Ecuador	Alberta	Costa Rica	Denmark

6 Directions for future research

As Table 4 suggests, changes in the power sector, due to the participation of a sustainable industry, may occur in small steps and not as a response of a dramatic paradigmatic shift. This corroborates Jennings and Zandbergen's (1995) argument that paradigmatic changes may occur as the result of the complex interactions of many actors and subsystems rather than from local subsystem development. Moving the power sector toward a more sustainable energy system represents one of many small changes that may shift people and organisations to a new paradigm for sustainability (Jennings and Zandbergen, 1995; Starik and Rands, 1995).

The gradual process of establishing a sustainable industry suggests that building a new paradigm might also be gradual and a result of many interacting forces. For instance, it would be important to study how two or more new technologies (e.g., RE technologies) compete or complement each other to replace the conventional ones under a specific context. Also, it would be interesting to study how several sustainable industries (RE, organic farming, eco-tourism, and so on) interact with each other in terms of paradigm replacement (Espinoza and Vredenburg, 2010).

Whether paradigm replacement is a local culturally-based phenomenon or responds to a more widespread, cumulative process is something partially answered in this paper. This study's findings would be supporting the intermediate position maintained by Jennings and Zandbergen (1995): "enclaves must exist so that the deeper values of the paradigm can be articulated and preserved, but only the spread of these values as part of a larger process similar to modernisation or rationalisation will allow for the shift of a paradigm" (p.1039). For instance, the role played by the 'weak ties' of champions/entrepreneurs in a given jurisdiction is something deserving deeper analysis.

References

Aldrich, H. and Fiol, C.M. (1994) 'Fools in rush? The institutional context of industry creation', *Academy of Management Review*, Vol. 19, No. 4, pp.645–760.

Ayres, R. (2001) 'How economists have misjudged global warming', *World Watch Magazine*, September–October, Vol. 14, No. 5, pp.12–25.

Baden, J. (1998) 'Environmental entrepreneurship: a new shade of green', Bozeman Daily Chronicle, 1 September, available at http://www.free-eco.org (accessed on February 2009).

Brown, L.R. (2008) *Plan B 3.0 Mobilizing to Save Civilization*, Earth Policy Institute-Norton, New York/London.

Burrell, G. and Morgan, G. (1979) *Sociological Paradigms and Organizational Analysis*, Heinemann, London.

Commoner, B. (1990) *Making Peace with the Planet*, Pantheon Books, New York.

Crotty, M. (1998) *The Foundations of Social Research: Meaning and Perspective in the Research Process*, Sage, London.

Daly, H. (1996) *Beyond Growth*, Beacon Press, Boston, MA.

DesJardins, J. (1998) 'Corporate environmental responsibility', *Journal of Business Ethics*, Vol. 17, pp.825–838.

DiMaggio, P. (1988) 'Interest and agency in institutional theory', in Zucker, L.G. (Ed.): *Institutional Patterns and Culture*, pp.3–22, Ballinger Publishing Company, Cambridge, MA.

DiMaggio, P. and Powell, W. (1983) 'The iron cage revisited: institutional isomorphism and collective rationality in the organizational field', *American Sociological Review*, Vol. 48, pp.147–160.

EIA/DOE (2002) 'International Energy Outlook 2002', available at http://www.eia.doe.gov/oiaf/ieo (accessed on December).

Eisenhardt, K. (1989) 'Building theories from case study research', *Academy of Management Review*, Vol. 14, No. 4, pp.532–550.

Elliot, D. (2000) 'Renewable energy and sustainable future', *Futures*, Vol. 32, pp.261–274.

Espinoza, J.L. and Vredenburg, H. (2010) 'The development of renewable energy industries in emerging economies: the role of economic, institutional, and socio-cultural contexts in Latin America', *Int. J. Economics and Business Research*, Vol. 2, Nos. 3/4, pp.245–270.

Fergus, A. and Rowney, J. (2005) 'Sustainable development: epistemological frameworks & an ethic of choice', *Journal of Business Ethics*, Vol. 57, pp.197–207.

Ferguson, R., Wilkinson, W. and Hill, R. (2000) 'Electricity use and economic development', *Energy Policy*, Vol. 28, No. 13, pp.923–934.

Frankel, C. (1998) *In Earth's Company: Business, Environment, and the Challenge of Sustainability*, New Society Publishers, Gabriola Island, BC, Canada.

Garud, R., Hardy, C. and Maguire, S. (2007) 'Institutional entrepreneurship as embedded agency: an introduction to the especial issue', *Organization Studies*, Vol. 28, No. 7, pp.957–969.

Gladwin, T., Kenelly, J. and Krause, T. (1995) 'Shifting paradigms for sustainable development: implications for management theory and research', *Academy of Management Review*, Vol. 20, pp.874–907.

Glaser, B. and Strauss, A. (1967) *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Alpine Press, Chicago, IL.

Granovetter, M. (1973) 'The strength of weak ties', *American Journal of Sociology*, Vol. 78, No. 6, pp.1360–1380.

Gray, B. (1989) *Collaborating: Finding Common Ground for Multipart Problems*, Jossey-Bass, San Francisco.

Hall, J. and Vredenburg, H. (2003) 'The challenges of innovating for sustainable development', *MIT Sloan Management Review*, Fall, pp.61–68.

Hart, S. (1995) 'A natural resource-based-view of the firm', *Academy of Management Review*, Vol. 20, No. 4, pp.986–1014.

Hoffman, A. (1997) *From Heresy to Dogma: An Institutional History of Corporate Environmentalism*, New Lexington Press, San Francisco, CA.

Hoffman, A. (1999) 'Institutional evolution and change: environmentalism and the US chemical industry', *Academy of Management Journal*, Vol. 42, No. 4, pp.351–371.

Hoffman, A. (2000) *Competitive Environmental Strategy: A Guide to the Changing Business Landscape*, Island Press, Washington DC – Covello, CA.

Hoffman, A. (2005) 'Climate change strategy: the business logic behind voluntary greenhouse gas reductions', *California Management Review*, Vol. 47, No. 3, pp.21–46.

Jacobs, J. (1992) *Systems of Survival: A Dialogue on the Moral Foundations of Commerce and Politics*, Random House, New York.

Jennings, P. and Zandbergen, P. (1995) 'Ecologically sustainable organizations: an institutional approach', *Academy of Management Review*, Vol. 20, pp.1015–1052.

Kuhn, T. (1970) *The Structure of Scientific Revolutions*, 2nd ed., University of Chicago, Chicago, IL.

Marshall, C. and Rossman, R. (2000) *Designing Qualitative Research*, 2nd ed., Sage Publications, London.

Max-Neef, M., Elizalde, A. and Hopenhayn, M. (1991) *Human Scale Development: Conception, Application and Further Reflections*, Apex Press, New York.

Meyer, J. and Rowan, B. (1977) 'Institutionalized organizations: formal structure as myth and ceremony', *American Journal of Sociology*, Vol. 83, No. 2, pp.340–363.

Mintzberg, H., Ahlstrand, B. and Lampel, J. (1998) *Strategy Safari*, Free Press, New York.

North, D.C. (1990) *Institutions, Institutional Change and Economic Performance*, University of Cambridge Press, Cambridge, UK.

OLADE, CEPAL, GTZ (1997) *Energía y Desarrollo Sustentable en América Latina y el Caribe: Enfoques Para la Política Energética*, OLADE, Quito, Ecuador.

OLADE, CEPAL, GTZ (2000) *Energía y Desarrollo Sustentable en América Latina y el Caribe: Guía Para la Formulación de Políticas Energéticas*, OLADE, Quito, Ecuador.

Pettigrew, A., Woodman, R. and Cameron, K. (2001) 'Studying organizational change and development: challenges for future research', *Academy of Management Journal*, Vol. 44, No. 4, pp.697–713.

Porter, M. (1980) *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, Free Press, N.Y.

Porter, M. (1990) 'The competitive advantage of nations', *Harvard Business Review*, March/April, pp.73–94.

Russo, M. (2003) 'The emergence of sustainable industries: building on natural capital', *Strategic Management Journal*, Vol. 24, pp.317–331.

Sawin, J. (2001) 'The role of government in the development and diffusion of renewable energy technologies: wind power in the United States, California, Denmark and Germany 1970–2000', PhD thesis at The Fletcher School of Law and Diplomacy.

Scott, W. (1991) 'Unpacking institutional arguments', in Powell, W. and DiMaggio, P. (Eds.): *The New Institutionalism in Organizational Analysis*, University of Chicago Press, Chicago, IL.

Scott, W. (1995) *Institutions and Organizations*, Sage, London.

Selznick, P. (1957) *Leadership in Administration*, Harper & Row, New York.

Sen, A. (1985) 'Cuál es el camino al desarrollo?', *Comercio Exterior*, Vol. 35, No. 10, pp.939–949.

Sharma, S. and Vredenburg, H. (1998) 'Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities', *Strategic Management Journal*, Vol. 19, pp.729–753.

Starik, M. and Rands, G. (1995) 'Weaving an integrated web: multilevel and multisystem perspectives of ecologically sustainable organizations', *Academy of Management Review*, Vol. 20, pp.908–935.

Stead, J. and Stead, E. (2000) 'Eco-enterprise strategy: standing for sustainability', *Journal of Business Ethics*, Vol. 24, pp.313–329.

Stead, J.G. and Stead, W.E. (2008) 'Sustainable strategic management: an evolutionary perspective', *Int. J. Sustainable Strategic Management*, Vol. 1, No. 1, pp.62–81.

Stinchcombe, A. (1965) 'Social structure and organizations', in March, J. (Ed.): *Handbook of Organizations*, Rand McNally, Chicago, IL.

Strauss, A. and Corbin, J. (1990) *Basics of Qualitative Research: Grounded Theory, Procedures and Techniques*, Sage, Newbury Park, CA.

Suchman, M.C. (1995) 'Managing legitimacy: strategic and institutional approaches', *Academy of Management Review*, Vol. 20, No. 3, pp.571–610.

Trist, E. (1983) 'Referent organizations and the development of inter-organizational domains', *Human Relations*, Vol. 36, No. 3, pp.269–284.

UNDP (2005) 'Human Development Report 2005', United Nations Development Program, available at www.undp.org.np/publications/hdr2005/ (accessed on May 2006).

Unruh, G.C. (2000) 'Understanding carbon lock-in', *Energy Policy*, Vol. 28, pp.817–830.

Unruh, G.C. (2002)'Escaping carbon lock-in', *Energy Policy*, Vol. 30, pp.317–325.

Vredenburg, H. and Westley, F. (2002) 'Sustainable development leadership in three contexts: managing for global competitiveness', *Journal of Business Administration*, pp.239–259.

WCED (1987) *Our Common Future, World Commission on Environment and Development*, Oxford University Press, NY.

Welford, R. (1995) *Environmental Strategy and Sustainable Development, The Corporate Challenge for the 21st Century*, Routledge, London and New York.

Westley, F. and Vredenburg, H. (1991) 'Strategic bridging: the collaboration between environmentalist and business in the marketing of green products', *Journal of Applied Behavioral Science*, Vol. 27, No. 1, pp.65–90.

Westley, F. and Vredenburg, H. (1996) 'Sustainability and the corporation. Criteria for aligning economic practice with environmental protection', *Journal of Management Inquiry*, Vol. 5.

Westley, F. and Vredenburg, H. (1997) 'Interorganizational collaboration and the preservation of global biodiversity', *Organization Science*, Vol. 8, No. 4, pp.381–403.

World Bank (2000) *Energy Services for the World's Poor*, Energy Sector Management Assistance Programme-ESMAP (World Bank), Washington, DC.

Yin, R. (1994) *Case Study Research, Design and Methods*, 2nd ed., Sage publications, Newbury Park.

Notes

1 A national interconnected system (NIS) or 'on-grid' system refers to an electricity system interconnected in a given area.

2 It includes biomass and wind energy.

3 It includes geothermal and wind energy.

4 It is important to point out that the climate change issue was more visible in Denmark and Alberta/Canada than in Costa Rica and Ecuador. One of the reasons might be that developed countries, according to the Kyoto Protocol, are obligated to reduce greenhouse gases (GHGs) whereas developing countries are not, for the period 2008–2012.