

PH.D. PROJECT DESCRIPTION

Project Title:	Innovation Partnerships in the Energy Sector
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EXECUTIVE SUMMARY

With the increasing maturity of areas like wind technology, bioenergy and solar energy, and the development of smart grid and emerging technologies, the energy sector is witnessing an increasingly complex multiple stakeholder reality. Furthermore, in accordance with an Innovation Systems perspective the sector is characterized by high interdependence whereby no actors can innovate and commercialize renewable energy technologies in isolation from other actors.

Based on the above, this project analyses the use of innovation partnership to develop and commercialize renewable energy technologies in the energy sector. It analyses the challenges and barriers faced by actors in the sector based on an Innovation Systems perspective by use of Open Innovation and collaborative innovation theory. It is hypothesized that the systemic nature of the sector increases the interdependence, and thereby the need for and uses of innovation partnerships. It is further hypothesized that sector characteristics such as the regulatory levels, as well as asymmetry in many partnerships, will create paradoxes for firms engaging in innovation partnership, thus requiring novel approaches to the structuring and management of partnerships in this sector.

BACKGROUND FOR THE PROJECT

The importance of developing new renewable methods for energy production to replace the traditional, established technologies such as coal, oil and gas is essential to preserving our climate, and thus securing the future of our planet. Therefore innovation and commercialization of renewable energy technologies, and the challenges related thereto, should be better researched and more elaborately understood in the particular context that the energy sector is.

To fully comprehend and embrace to particularities of the energy sector, this project takes an Innovation Systems perspective (Hekkert 2007). This provides a fundamental understanding and appreciation of the complexity and systemic nature of the sector as well as the high interdependence and mutual influence of actors, which characterizes the energy sector (Truffer, Markard et al. 2012) . The Innovation Systems approach is concerned with (inter)actions at both the collective level as well as those on the individual firm/actor level (Hekkert 2007), with the latter being the main focus of this project, while throughout considering the former as the context.

The Innovation Systems approach is useful to understand and analyse the collaborative efforts and learning of actors in a sector in which they cannot develop technologies, products or services singlehandedly, and are unable to subsequently commercialize and implement these in the market without working with and being dependent on other actors. Furthermore the energy sector has a high degree of bureaucracy, with regulation and legal constraints to consider, which has further impact on innovation partnerships and the development of renewable energy technologies, something which the Innovation Systems perspective helps to consider and account for.

The interdependent nature of actors in the energy sector briefly described above means that collaborative innovation and innovation partnerships are a necessity rather than an option. Recent years has seen an increase in research in innovation partnerships (Chesbrough 2003), (Sloane 2011), (Slowinski 2010) following the recognition that innovative products, services and solutions will increasingly be developed in such collaborations, rather than through isolated R&D work in individual organisation. There seems to be a general consensus that increasing innovative output across a range of sectors will involve and require more and better innovation partnerships and collaboration.

A number of models and theories have been developed concerning the design and management of such innovation partnerships, for the most part based on empirical data from the biotech, medical industry and IT (Chesbrough 2003), (Sloane 2011), (Chiesa 1997), (Slowinski 2010). In addition other industries are increasingly making use of innovation partnerships (Chesbrough, Crowther 2006) . However, little research has focussed on the implication of a highly systemic, bureaucratic and interdependent sector, such as the energy sector, on the challenges and barriers which organizations face in their collaborative innovation efforts. It is the aim of this project to analyse and understand what the barriers and challenges related to innovation partnerships in the energy sector are.

To achieve this, the project applies the Innovation Systems perspective alongside the management perspective, mainly drawing on Open Innovation and collaborative innovation theories, to understand the challenges and barriers related to interaction between the numerous actors, which constitute the energy innovation system, as well as exploring the potential solutions.

As such the project merges the macro level understanding of interdependence and systemic nature of the sector and its many actors, the Innovation Systems perspective, with a more micro level analysis of what the challenges and barriers are for these actors when engaging in innovation partnerships in the energy sector to develop and commercialize new renewable energy technologies and how they

overcome them, the management perspective. Finally the project will then relate the “micro-level findings” back to the more macro-level of the Innovation Systems perspective to understand potential implications or changes at this level evolving from the micro-findings in relation to innovation partnerships in the sector. As such, the project seeks to answer a number of questions, among them:

- How do actors in the energy sector utilize, design, structure and manage innovation partnerships to develop and commercialize renewable energy technologies?
- What challenges and barriers do actors face when performing collaborative innovation in the energy sector in development and commercialization of renewable energy technologies?
 - o What processes and practices are used to overcome such challenges and barriers?
- How do the apparent contradictions between on one hand predefined agreements, legal constraints and inflexible conditions and structures, and on the other hand innovation, emergence and uncertainty, influence innovation partnerships and their development and commercialization of renewable energy technologies?
 - o How are these contradictions managed and overcome in a sector with a high level of constraints and red tape?

AIMS OF THE PROJECT

The aim of the project is to research and create new knowledge about the use of as well as the barriers and challenges related to collaborative innovation in the energy sector, what types collaborations are utilized, and what the structures, processes and practices used are. To embrace the complexity and uniqueness of the energy sector the project utilizes an Innovation Systems perspective. It aims to create new knowledge regarding the use of, and the barriers and challenges for innovation partnerships and the solutions related hereto, from organization's perspective based on management theories such as Open Innovation, collaborative innovation and further relevant theories, and relate these findings back to the Innovation Systems perspective to understand potential implications.

This aim is to be reached through analysis and understanding of:

- The use and configuration of innovation partnerships in the energy sector to develop and commercialize renewable energy technologies
- Barriers and challenges for, as well as solutions for these, in innovation partnerships in the energy sector based on the Innovation Systems perspective and management theories
- Internal preconditions for as well as practices and processes related to collaboration in energy companies and in the firms or organizations they partner with in innovation and commercialization efforts

As such, the project will research how organisations in the energy sector collaborate in innovation partnerships, what the barriers, challenges and paradoxes are and how they are/could be overcome.

Based on this research, the project will develop new knowledge regarding innovation partnerships in the energy sector and add to existing knowledge on innovation partnerships and R&D collaboration in an Innovation Systems perspective and will seek to generalize across sectors.

Among the questions answered by the project are:

- When and why do innovation partnerships in the energy sector occur, and what challenges and barriers exist related to developing and commercializing renewable energy technologies?

- How are such challenges and barriers prevented? How are they managed or overcome when they nevertheless occur? Who are involved, when, how and why are decisions made?
- How can collaboration types, structures, processes, management and practices at a management level be developed or adapted to ensure better use of complementary competences in the development and commercialization of renewable energy technologies? And how can these findings similarly be related to an Innovation Systems perspective?

Research Question

Based on the brief description of the framing of the project with an Innovation Systems perspective and the role and relevance of theory on Open Innovation and innovation partnerships, as well as the general importance of improved innovation partnerships in the energy sector for development and commercialization of renewable energy technologies, the research question proposed for this project is the following:

What is the use of innovation partnerships, and challenges and barriers related to these, when developing and commercializing renewable energy technologies?

Definition and Limitation of “Innovation Partnerships”

The focus of the project is on the collaborative development of renewable energy technologies and/or new knowledge related thereto between at least two separate entities, defined as an innovation partnership. This is the process of identifying internal knowledge gaps preventing the development of innovative knowledge or an innovative product, technology or service, and finding an outside partner to complement existing knowledge to bridge such gaps through a collaborative effort, structuring the alliance and managing this (Slowinski 2010) to potentially create incremental as well as radical innovations (Tidd 2009).

In contrast, this project is not concerned with the outsourcing of R&D efforts and acquisition of knowledge. A significant difference between innovation partnerships to traditional outsourcing of innovation is that the partner is not viewed as merely a supplier but as a partner, with significant consideration of the interests of all parties and the interrelationship (Newell, Robertson et al. 2009) , as well as the need for acceptance of uncertainty and development of the partners through and by the partnership (Åkerstrøm 2008).

Chesbrough identifies a number of different roles for companies in innovation partnerships, which may be more or less active (Chesbrough 2003). The focus of this paper is on the active parties, which excludes e.g. passive investors, innovation merchants such as IP companies, innovation marketers that only focus on marketing the finished innovations and innovation one-stop centers that only focus on sale and similar. Neither is the focus on acquisitions of companies and hence their knowledge and expertise as well as the separate acquisition of knowledge (Grant, Baden-Fuller 2003) such as companies funding research performed by a separate organization, license acquisitions, equity investments without real co-development efforts, strategic partnerships without development of new knowledge, products, services or other similar results but simply with goals of joint marketing, sales efforts etc.

The scope is not to study one specific partnership structure. Hence differently structured partnerships are part of the empirical data as for example two (or more) separate entities collaborating, collaborations in or with the goal of a jointly owned entity, temporary organizations or projects, and a number of other potential structures.

METHOD

Being an interdisciplinary field, the project will make use of theories from both open innovation, innovation management, structuring of partnerships strategic alliances, collaboration, actor-network theory and more (to mention a few: (Åkerstrøm 2008), (Baldwin, von Hippel 2010) , (Chesbrough 2003), (Chiesa 1997), (Grant, Baden-Fuller 2003) , (Latour 1999), (Sloane 2011), (Slowinski, Sagal 2003) , (Slowinski 2005), (Tidd 2009)).

The use of an Innovation Systems perspective (Hekkert 2007), (Truffer, Markard et al. 2012) , (Nelson, Nelson 2002) will help analyse, understand and describe the highly systemic, inter-dependent and complex context of the energy sector and its actors. Understanding this is essential to understanding the use of innovation partnerships, the challenges related thereto, their structure, management and related practices.

In lack of theories on innovation partnerships in the energy sector, theories on open innovation, strategic alliances and collaboration will provide a frame of reference as to the structures, management and practices found in the empirical data. It will help understand why and to what effect such aspects are employed and assist in the development of theory, which better describes and explains the implications and consequences of the particular nature of the energy sector on innovation partnerships.

The project will be a mixed methods study of use of and challenges for innovation partnerships as described in order to both study the general sector patterns as well as the critical incidents that occur when several heterogeneous actors are involved in collaborative innovation projects in a complex, systemic sector. These incidents are among others related to: Internal conditions; negotiations, terms and agreements between partners; setting goals and objectives; allocation of resources; solving disputes and disagreements, renegotiating terms and agreements in light of new conditions; management practices; etc. Such incidents are best studied and understood in their context through use of qualitative methods, while the quantitative methods will provide a broader understanding of the use of and types of innovation partnerships in relation to the renewable energy technologies.

Rather than being an ex-post study of events, practices etc., the project will be close to relevant collaborations as they unfold. The Ph.D.-student will perform qualitative interviews with representatives from the parties involved, such as: alliance managers, actors who function as obligatory passage points internally in relevant organisation and in the collaborative efforts and work, top level management and developers of strategy and processes. This will give insight into challenges, issues and paradoxes internally in the organisations and in the collaborative work between organizations. Further the project will involve observatory studies of critical meetings and decision processes separately in organizations, as well as between, the organisations and/or in collaboration projects, study archival data such as strategies, contracts, agreements etc. of relevance to the partnerships and the parties' participation in partnerships.

The project will study a number of collaborations which aim to develop and/or commercialize renewable energy technologies, in the manner described above. These collaborations will be studied as they develop and unfold over time to thoroughly analyse, understand and appreciate all aspects of these. Furthermore, the student will discuss findings and potential suggestions to changes with the parties studied based on the research. By doing so, the project has the opportunity to potentially understand the usability and implications of suggestions as well as gaining deeper insights and confirmations of findings before drawing final conclusions on these and suggesting them as new, or contributions to existing theory.

At the moment the student expects to participate in projects in the following areas: Smart grid, biomass, photovoltaic solar energy, and off shore wind. Further and/or alternative projects will be identified as the project develops and insights are gained. Access to such projects is available through the student's network in the energy sector.

In addition to the study of the empirical data collected, the Ph.D.-student will keep up to date on the study of open innovation, R&D collaboration, innovation in the energy sector and other relevant areas in order to continuously make adaptations and allow influence from the latest relevant knowledge.

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