Sectoral dynamics and technological convergence: an evolutionary analysis of eco-innovation in the automotive sector

We know from evolutionary theory that sectoral characteristics are important to innovation. This paper investigates if sectoral characteristics also are important to eco-innovation, a hitherto under-researched theme. We argue that research into possible sectoral patterns in eco-innovation is key to understanding green industrial dynamics and the greening of the economy. This paper investigates to what degree the economy is greening horizontally (sector-wise). Starting with a sectoral case study, we undertake a longitudinal analysis of the breath and strength of the greening of the automotive sector from 1965 to 2012, focusing on powertrain technologies. The empirical analysis is based on patent data amongst big car producers and focuses on identifying changes in two main aspects: (1) the convergence/divergence of firms’ green strategies and technologies within the automotive sector; and (2) the contribution of alternative key green technological trajectories relative to the dominant design. Our findings indicate that the evolution of relative green patenting has followed a positive, linear growth over the last decades with increasing participation of alternative propulsion technologies and increasing convergence of automakers’ strategies towards a diversified portfolio.
This paper sheds light on some important but underestimated elements of green industrial dynamics: the evolution of firms’ eco-innovation strategies and activities within a sector. While eco-innovation sectoral case studies have taken place before, our analysis is distinct in investigating the rate, direction and extent of eco-innovation in the automotive sector, represented here by the main automakers, in order to identify possibly sectoral-specific patterns in firms’ strategies, as opposed to divergent strategic behaviors, grounded on evolutionary economic theory. We conduct a two-step empirical analysis using patent data from 1965 to 2012. Our findings suggest a process of co-evolution of firms’ strategies and indicate that strong sectoral-specific patterns of eco-innovation are present in this sector from the mid-2000s onwards. For fuel cells technologies, however, we observe the formation of two antagonist patterns. A further econometric analysis is conducted and indicates that the positioning of the firms between these two groups is correlated with the firms' profit margins and the size of firms' patent portfolios.

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Technological Innovation and Beyond: Exploring Public Value of University Inventions Based on Contingent Effectiveness Model

University inventions are traditionally seen as significant input into development of new technologies and innovations in the market as they generate growth and regional development. (REF) Yet, these inventions developed into new technologies can simultaneously create public values such as those that are related with sustainability goals. In this paper, we apply the Contingent Effectiveness Model by Bozeman et.al. (2015) as a framework to consider the effectiveness of technology transfer from university to industry via licensing, and examine what values derive during the commercialization process of university inventions. We define four main values: technological, economic, social and environmental, and place the latter two under the concept of public value. The aim of this paper is to expand the understanding of public value and incorporate it into technology transfer literature. We assign to the concept of public value a measurement tool, thus, making public value a measurable concept. Therefore, this study not only extends conceptual and theoretical considerations of public value (Jørgensen and Bozeman 2007), but it also provides evidence based on collected data. A unique data set from survey of university licensee companies reveals that university inventions that are accomplished technologically, often create added public value, social or environmental, or both.

General information
Sectoral Patterns of Eco-innovation: Theoretical considerations and a study case in the automotive sector

There goes almost thirty years since the World Commission on Environment and Development released the Our Common Future report, more than four decades since the Jay W. Forrester's Institute at MIT launched Limits to Growth, and more than two centuries since Thomas Malthus first published An Essay on the principle of Population, all calling attention to the limits of natural resources, but the humanity – and particularly the Homo economicus – still struggle to acknowledge the limitations of our planet and act upon it. We appear to be locked in a primitive, tribal-oriented mindset, unable to effectively think and act globally. In this perspective, the academic community is still taking the first steps towards the understanding of what a "green" economy - or more widely, a green society - truly means and how to move our whole industries, our habits, and our mindsets in that direction.

The characteristics and dynamics of the Danish energy innovation system in perspective: a patent-based analysis

The characteristics and dynamics of the Danish energy innovation system in perspective

Relations
Projects:
The characteristics and dynamics of the Danish energy innovation system in perspective
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Literature about the relationship between innovation and sustainability has skyrocketed in the last two decades and new terms have appeared. However, only very few bibliometric analyses have reviewed some of these terms (eco-innovation, environmental innovation, green innovation, and sustainable innovation), and they concluded that such terms are mostly interchangeable. These findings surprise in light of the different positions shown in the innovation for sustainability debate. Our bibliometric analysis tracks meanings and communities associated with these four terms and indicates some overlaps, especially between eco-innovation and environmental innovation. However, we found relevant differences of meanings and communities that reflect the different positions in the innovation for sustainability debate.
Eco-innovation Dynamics and Green Economic Change: the role of sectoral-specific patterns
This paper investigates the features of Green Economic Change process at the meso-level, the greening of industries. We posit that, as for "traditional" innovations, it is possible to identify sectoral eco-innovation patterns and that these represent key but neglected factors in the dynamics of green economic evolution. The paper represents early speculative conceptual work. We have posited that, as for "general" innovations, it is possible to identify sectoral eco-innovation patterns and that these represent key but neglected factors in the dynamics of green economic chance. The paper identifies seven specific characteristics of eco-innovation which form the basis for identifying 4 core hypothesis which may explain sectoral heterogeneity and identify likely sectoral eco-innovation leaders.

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Standardization and Green Economic Change - the Case of Energy Efficiency in Buildings
This paper investigates the role of standardization for green economic change using energy efficiency in buildings as a case. Innovation research on standards tends to focus on the competition between competing emerging standards as well as the economic impacts of these. The idea pursued here is rather to analyse longitudinal trends in the standardisation process itself, seeing these as important constituents of modern economic change. The paper traces more specifically changes in the thematic direction of the standardization process over time. The analysis seeks to capture when, where and how energy efficiency becomes an issue in standardization work using buildings as a case. The paper seeks more specifically to investigate the rise of building related standards generally over time as well as in different technical areas and geographic regions.

The hypothesis pursued in this paper is that the rise of the green economy can only take place accompanied by considerable institution formation in the form of standards. In this sense, the presence of standards may be seen as an important indicator on the maturity of the greening of the economy. The paper presents early empirical work and contributes as much to formulating a research agenda and provide methodological clarifications as presenting solid findings. The paper feeds more fundamentally into an evolutionary economic understanding of (green) economic change.

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The evolution of green patenting activity in the automotive sector (1965-2012)

The paper aims to analyze the evolution of eco-innovative activity and strategies in the automotive sector over time. We have chosen to use a patent count methodology tracking the development of selected technologies considered as promising “green technologies” in the automotive sector. Our methodology is based on a normalized Relative Technologic Specialization Index derived from Relative Specialization index, in order to measure the evolution of individual firms’ specialization on the specified technological areas. Our findings show that all the major firms in the automotive industry are diversifying their patent portfolios in response to institutional and demand pressures, as well as new technologic opportunities, in order to generate competitive advantages derived from the introduction of alternative, greener technologies, emerging and becoming more pronounced after the financial crisis in 2008. The analysis demonstrates the current fluid emerging stage of the greening of the economy but also illustrates that eco-innovation is already an important competitive factor.

The Green Economy and Emerging Green Business Models in the Danish Window Industry

Understanding the evolution of eco-innovative activity in the automotive sector: a patent based analysis

The paper aims to analyze the evolution of eco-innovative activity and strategies in the automotive sector over time. We suggest to use a patent count methodology tracking the development of selected technologies considered as promising green technologies? in the automotive sector. The paper contributes to an understanding of the industrial dynamics of the greening of industry and the economy, a theme little analyzed despite the huge and rapidly increasing literature on sustainable development and innovation. Our findings show that all the major firms in the automotive industry are...
diversifying their patent portfolios in order to generate competitive advantages derived from the introduction of eco-innovations, activities emerging in the 1990s and accelerating in scope and radicality in the end zeroes. All the firms are engaging in developing new alternative green trajectories to the existing dominant design, even though there is some variety in the strategic responses of the firm. The main firms within the industry do go green at a fairly similar pace hinting at important horizontal dynamics of the greening of industry, whereas focus has tended to be on the vertical greening dynamics. The analysis demonstrates the current fluid emerging stage of the greening of the economy but also illustrates that eco-innovation is already an important competitive factor globally.

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Where does the green economy grow? The Geography Of Nordic Sustainability Transitions (GONST)
There is no one-size-fits-all approach to greening the growth path of an economy as this depends on place-based policy and institutional settings, level of development, resource endowments and particular environmental pressure points. This research proposal addresses the place-based, context-dependent nature of the shift to green growth in the Nordic countries by asking the question: where does the green economy grow? In addressing this question, we foreground the importance of innovation, new industry formation, and radical industry transformation.

The project is based on a mixed methods approach. Quantitative techniques will be applied to analyse the importance of human capital and technological specialisation for the greening of the economy. Qualitative case studies of Nordic regions will focus on the role of institutions and account for the diversity in Nordic regional green pathways.

Participating regions will benefit from a thorough analysis of current green growth processes and the opportunities for further greening. The project in particular seeks to engage pioneering green growth regions in the case study analysis, and a full work package in the project will be focusing on the possibilities for policy-learning between participating regions. An important element here will be to distinguish between those successful practices that can be transferred between regions, and those which are context dependent.

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Project participant:
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Project
The search for sustainable development and its relation to the dynamic of sectoral innovation systems: An empirical analysis in selected sectors

Department of Management Engineering
Period: 15/12/2012 → 04/07/2016
Number of participants: 6
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