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The relevance of innovation leadership for environmental benefits: A firm-level empirical analysis on French firms

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ABSTRACT

This paper seeks to contribute to the green building debate in economics and management by focusing on environmental innovation and innovation leadership. The latter is the dynamic capability of an innovative firm to seize new innovation opportunities as a result of a proactive investment policy and enhanced innovativeness. The paper defends the thesis according to which firms that are consistently "innovation leaders" are those that encourage environmental innovations. We use French CIS Surveys and employ a Heckman selection estimation method using a sample of 1180 firms to study which different forms of innovation leadership increase the propensity to develop environmental innovations. We find a strong impact of innovation leadership that is measured in a novel way, using innovation persistence. Furthermore, the results show a strong impact of regulations and costs savings as determinants of eco-innovation.

1. Introduction

The year 1972 is notable for economists due to the famous work by Meadows et al., who raised the question of the limits and the (un)sustainability of growth regarding the intensive use of energy in industrial activities. This issue has also cast doubt on the use of strict market measures and shed light on regulatory imperatives (see e.g., [1]). Environmental and climate change concerns have thus come to be ranked highly on the competitive, political and socio-technical agendas of market economies over the last two decades. This context appears to be an opportunity to reconcile economic imperatives and ethico-ecological requirements.

Porter [2] explains that environmental regulation could constitute a competitive advantage between countries (see also [3]). In a 1995 seminal paper, Porter and van der Linde [4] wrote: "companies must start to recognize the environment as a competitive opportunity — not as an annoying cost or a postponable threat" [4, p. 115]. Their argument is consistent with the notion that environmental regulation and competiveness can be positively related. From this perspective, regulation and environmental concerns in a way induce innovation. These innovations are often specific to an institutional and industrial context (and thus to a category of countries) and appear to be profitable in response to specific regulations (see, e.g. [5,6]). Such practices contribute to a new regime of growth sometimes called a "sustainable socio-technical regime" [7].

However, regulatory imperatives imply a clear definition of what is or can be an environmental innovation (also later called an eco-innovation). There are a number of complementary definitions in the literature. In the spirit of Kemp and Arundel [8], Rennings [5] and Rennings and Zwick [9], environmental innovations can be defined as new or modified processes, systems, techniques or products that aim to reduce or eliminate environmental harms. Environmental innovations must be analyzed in the context of the current environment where

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new models of firm performance are evaluated on the basis of green performance and global ecological preservation. Nevertheless, what are the characteristics of the firms implementing environmental innovations?

This paper seeks to contribute to the green building debate in economics and management by focusing on environmental innovations and innovation leadership. This paper defends a thesis according to which firms that are consistently "innovation leaders" are those that encourage environmental innovations in both integrated (later called "cleaner") and end-of-pipe technologies. Here, we define innovation leadership as the dynamic capability of an innovative firm to seize new innovation opportunities due to a proactive investment policy and enhanced innovativeness. For Tuominen et al. [10, p. 497], "innovativeness refers to an organization's capacity to innovate".

Innovation leadership can explain why certain firms can more easily simultaneously enhance industrial and environmental performance. They are able to respond to the evolution of the competitive environment by seizing new innovation opportunities. This joint objective currently seems to be crucial for success in a strong selection environment. We use French CIS Surveys and employ a Heckman [11] two step selection model to determine which different forms of innovation leadership increase the propensity to develop environmental innovations.

The paper intends to discuss the potential contribution of innovation leadership to approach eco-innovations implementation and so the corporate environmental responsibility movement through the relationship between industrial performance and ethico-ecological concerns. The crucial question is whether the firms that are "innovation leaders" are those that implement environmental innovations. The paper is organized as follows: Section 2 presents a theoretical background on environmental innovation and innovation leadership and describes the hypotheses we tested. Section 3 describes the data from the French CIS survey and the variables we employed to conduct our empirical study. Section 4 analyzes and discusses the results and the robustness of the model. Section 5 concludes the paper and sheds light on the limitations that could be addressed in future research.

2. Environmental innovation and innovation leadership: background and hypotheses

The recent development of eco-innovations should be seen as a means of achieving environmental sustainability in the economy as a whole [12]. This is why the theoretical and empirical analysis of the determinants of environmental innovations has recently (since the end of the 1990's) become a research subject. This section provides a brief overview of the main theoretical arguments on the impact of innovation leadership on the firms' capacity to implement environmental innovations with the aim of clearly deriving the empirically testable hypotheses we selected in our study.

2.1. Environmental innovation: definition and theoretical insights

Environmental innovation is a fuzzy concept because the absolute environmental impacts of products are very difficult to measure. It is commonly accepted that environmental innovations are alternative technologies. In this sense, studies made by OECD apply the definition of innovations provided in the latest version of the OSLO manual to eco-innovations and include two additional characteristics. The first considers products, process innovations and other forms of non-technological innovation that have reduced environmental impacts — even if such an effect was not intended. The second includes changes related to social and institutional structures. This means that the environmental benefits of a given innovation can generate changes in the societal context through changes in social norms, cultural values and institutional structures.

This definition therefore goes far beyond the conventional organizational boundaries of the innovator because it also captures the environmental benefits of goods: "the production, assimilation or exploitation of a novelty in products, production processes, services or in management and business methods, which aims, throughout its lifecycle, to prevent or substantially reduce environmental risk, pollution and other negative impacts of resource use (including energy)" [13]. The OECD aligns its definition with what is suggested in the 2010 MEI report: "eco-innovation is innovation that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle" [14].

A crucial point concerning environmental innovation relates to the externality issue. Indeed, this specific type of innovation aims to introduce new processes or products reducing (globally) or avoiding environmental harms, as the academic literature has explained (see *supra*). In this view, environmental innovation is, to a certain degree, similar to a (global) public good. Because they produce positive spillovers both in the innovation and the diffusion phases, eco-innovations imply "double externality problems" [5] that could lead to a reduction in the incentives of firms to invest in environmental innovations. However, owing to the existence of regulation, such innovations also share, to a certain extent, the characteristics of a private good in the sense that firms often have to pay for environmental harms [4].

Interestingly, what seems clear is that this global regulatory perspective can also be seen as an opportunity for firms to gain a competitive first mover advantage. In other words, it is possible to argue for a positive relationship between environmental regulations and firms' competitiveness [15]. And this is especially the case if regulations are stricter compared to other countries (which is the case in France). In fact, these firms gain a "first mover advantage" if other countries take time to adapt to regulation [6]. This idea is reinforced by the Porter and van der Linde hypothesis [4]. Firms that are concerned by environmental issues need to focus their innovation efforts on one direction in order to adapt to the competitive situation.

The question of the determinants of environmental innovations has been discussed for a decade (see, e.g., [16] for an analysis based on environmental patents). For example, Rennings [5] or Belin et al. [17] stated in their studies that if regulation and policy determinants are important for environmental innovations, the latter are also linked to specific demand and supply side determinants.

According to Reenings [5], regulatory incentives constitute a major factor behind the production of what we have

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