

# Do Environment-related technologies strengthen the competitiveness of local systems?

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## Abstract

Environmental innovation is considered one of the key drivers of sustainable development and economic growth. However, we still know very little about the organizational factors underling the development of this category of innovations and their relative competitive effect. In this paper, we focus on regions and we look at the specific effect of environment-related technologies and collaborative environmental inventions on the competitiveness of European regions. In fact, the complex and multidisciplinary nature of environmental innovation is expected to further strengthen the competitive advantage of regions and the strategic significance of geographical proximity. A longitudinal study of 232 European regions over the period 2000-2013 was organized using data from the RegPat, Cambridge Econometrics and Eurostat databases. Our main results confirm the positive effect of environment-related technologies and local collaborative networks on regional competitiveness with significant implications in terms of policy making.

**Keywords:** Environment-related technologies; Environmental innovation; Green innovation; Clean technologies; Competitiveness.

## 1. Introduction

Environmental innovation is receiving increasing attention from scholars and policy makers as key driver in the development of a greener and more competitive economy. The term environmental is used to classify innovation with a positive effect on the environment (Cooke, 2008; Rennings, 2000; Ghisetti and Rennings, 2014). Therefore, it is the effect rather than the content that defines an innovation as green. Due to its unspecific character with respect to the content of the innovation, large part of the literature on innovation has either overlooked the concept or have focused on the policy issues related to the adoption of this kind of innovations (Cainelli et al., 2015). In fact, differently from other types of innovations, whose effect can be directly appropriated by users, environmental innovation generate value for society as whole. Therefore, users side externalities are expected to further slowdown the adoption of this kind of innovation. Differently, little attention has been given to the process through which these innovations are

developed, the resources and competences that contribute to their development, and the competitive effect of those innovations (Tsoutsos and Stamboulis, 2005). This paper attempts to cover part of this gap by focusing on environmental innovation in regions. Therefore, our objective with this paper is to test whether and to which extent environmental innovation and collaborative environmental innovation strengthen the competitiveness of regions and the significance of geographical proximity as distinctive source of competitive advantage. To achieve this objective, we apply panel regressions with time and regional effects using generalized estimating equations on a 11-year dataset of 232 “NUTS2” European regions. The OECD RegPat database is used for measuring environment-related technologies and collaborative networks (De Noni et al., 2017; De Noni et al., 2018). Cambridge Econometrics data are used to operationalize our dependent variable - regional competitiveness and data from Eurostat are further collected to define the control variables more widely assumed by the literature on innovation such as industrial gross value added, R&D expenditure, human capital, population density and employment rate. Our results confirm that environmental innovation contribute to strengthen the competitiveness of regions. Furthermore, we also show that geographical proximity plays as significant as intraregional collaborative environmental innovation positively contribute to the competitiveness of regions. Differently, extra-territorial forms of collaboration negatively impact on the added value generated by the regions. These results, as we shall see, have significant implications in terms of policy making. First, they highlight that much of the externalities generated by environmental innovation are internalized at regional level. Second, they suggest that environmental innovation may widen the competitive gap between competitive regions and lagging beyond regions.

## 2. Methods

NUTS2 (Nomenclature of Territorial Units for Statistics) is used to define the regional level. First, we have to define environmental technologies. For these reasons, patent data are best suited for identifying specifically environment-related technologies. This

identification has been conducted through a search based on the Cooperative Patent Classification (CPC). The CPC system is an extension of the International Patent Classification (IPC) provided by the World Intellectual Patent Office (WIPO) and it has over 200,000 technology classes. The search strategies presented in this paper rely on the CPCY02 classes to the extent possible. We estimated the regression models using the generalized estimating equations (GEE) to control for heterogeneity at the regional level and the existence of any systematic difference across regions due to unobserved effects. Table 1 presents the GEE coefficient estimates for the “gaussian” regression model to explain the drivers of regional productivity growth. We estimated all models, controlling for Year dummies and Country dummies, but the coefficient estimates are not reported due to space constraints.

### 3. Main results and conclusion

Our results confirm that green innovation positively affect regional competitiveness. Differently from what expected, the share of collaborative environmental innovation does not positively contribute to regional competitiveness. However, if the collaboration is disentangled into its constituents, we discover that intraregional collaboration positively affects regional competitiveness whether extra-territorial forms of collaboration impact negatively of the regional added value. Therefore, this confirms that spatial proximity is key strategic resource in the process of environmental innovation. This is probably due to the complex and multidisciplinary nature of this innovation, which relies extensively on face-to-face interaction to share significant cognitive and social cues. Our paper has significant implication in terms of policy making. First, it shows that environmental innovation contributes to strengthen the competitiveness of regions. Therefore, in the distribution of public incentive to support environmental innovation policy makers should consider regional competitiveness. In fact, the risk to contribute to further widening the competitive disadvantage of lagging behind regions. Differently, policy makers should provide stronger incentives to facilitate the transfer of environmental innovation to lagging behind regions. However, they should not only support knowledge transfer, but also knowledge localization and the development of local collaborative networks. Second, it shows that positive externalities generated by environmental innovation tend to stick at regional level. Therefore, regional level may represent the most suitable level for the implementation of environmental strategy. This is the first paper, according to our knowledge, attempting to assess the effect of environmental innovation on regional productiveness and competitiveness. Therefore, lots of work remain to be done. First, in this paper we assessed whether environmental innovation impact positively on regional competitiveness. However, we did not model specifically how environmental innovation lever on regional advantages and how environmental innovation translate into added value and indeed into regional

competitiveness. Further reflection on those issues are indeed required. Second, we measure environmental innovation on the basis of patents classified as environmental. However, patents are only a proxy of the new knowledge produced in the environmental field. It tells us little about whether this knowledge is adopted and to which extent firms in the regions are adopting environmental innovation. Therefore, our analysis should be integrated with indicators related to the adoption of environmental innovation.

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