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The green factor in European manufacturing: a case study of the Spanish ceramic tile industry

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ABSTRACT

This paper analyses how environmental issues have affected and are continuing to affect the evolution of European manufacturing industries based on the example of the Spanish Ceramic Tile Industry (SCTI).[1] The Ceramic Tile Industry (CTI)[2] in Europe became very competitive and innovative in the early 1990s, with the Italian and the Spanish sectors, which are cluster-based, becoming world leaders. However, since 2008, this leadership position is being eroded. We provide an in depth analysis of the SCTI focusing on the influence of new European environmental regulations. The CTI has a major impact on the environment and has been the focus of environmental regulations. We also consider the innovation system and socioeconomic effects of the industry. In order to analyse the relationship between the environmental issues and innovation the empirical part of the paper builds on research on SCTI, including the industry value chain, and the innovation system and how it functions. We take account of the views of industry experts on the SCTI innovation system, its environmental impact and the constraints on the sector.

Current research at the local level suggests that the environmental impacts of the industry are outweighed by its huge contribution to socioeconomic wellbeing. The transition from national environmental legal frameworks towards EU-wide regulation has had a clear effect on both the strategic goals and the management of the industry and the new regulation combined with a more complex international economic scenario is jeopardizing European manufacturing industries. This applies especially to traditional industries. The case study demonstrates that the capacity of the SCTI to adapt to new scenarios will be vital for its future survival and success.

1. Introduction

According to Eurostat[3] about one in ten (9.8%) of EU-27 non-financial business enterprises in 2009, a total of 2 million firms, were in manufacturing. In 2009, the European manufacturing sector employed 31 million people and generated EUR 1400 billion in value added. Some 30%–40% of all employment is in industry – mostly concentrated on districts or clusters.

Nevertheless, manufacturing subsectors include activities with apparent relatively low labour productivity and average personnel costs, such as ceramic tiles production, where the labour productivity (measured as revenue per employee) and average personnel costs in SCTI were in 2010, respectively, 150,000 and 35,000 Euros per employee (data provided by ASCER[4]) Whereas other manufacturing activities show significant higher values for the same indicators in 2010, for instance the European pharmaceutical production show double personnel cost (around 60,000 Euros per

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[1] Spanish Ceramic Tile Industry (SCTI).
[2] Ceramic Tile Industry (CTI).
[3] Source: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Manufacturing_statistics_-_NACE_Rev._2# (downloaded 2012/10/03).
[4] Source: http://www.ascer.es/asociados/ (downloaded 2013/11/08).

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employee), but almost triples the labour productivity (428,000 Euros per employee) (data from Eurostat[5]). So, the manufacturing subsectors with lower productivity and exposed to an international market, like the SCTI, are more vulnerable to the new EU scenario, characterised by an increasing pressure on environmental regulations (CO_2-emission trading scheme, use of the Best Available Techniques, etc.), but playing in the same field that non-EU competitors (often producing their products with environmental standards below EU standards, lower energy prices and perhaps better access to raw materials). This context is provoking debate over the sustainability of the so-called traditional industries in the EU due to the major transformations that are resulting from the process of globalisation and the current economic crisis. These transformations include the increasing demand for resources (especially energy and raw materials) from the world economies, and especially Brazil, Russia, India and China (the BRIC countries); increased public awareness of the diminishing capacity of the environment to assimilate the impacts of human activity; and increased demand for environmental sustainability.

The relationship between industry and the environment is receiving attention from academics, policy makers and companies (Kivimaa and Mickwitz, 2011; López-Gamero et al., 2010; Taddeo et al., 2012; Weber and Rohracher, 2012; Zeng et al., 2010) and the analysis of environmental innovations is a growing research area in both the social and natural sciences (Markard et al., 2012). Environmental innovation can be understood as "all the changes in the product portfolio or in the production processes that tackle sustainability targets, like waste management, eco-efficiency, emissions reduction, recycling, eco-design or any other action implemented by firms to reduce their environmental footprint" (De Marchi, 2012: 615).

Angel and Rock (2005) identify stricter end-market environmental regulation and increased concern among firms over reputation and operating legitimacy as the main drivers of adoption of firm-based environmental standards. De Marchi (2012) highlights environmental innovation is the way that companies integrate concern for the environment into their strategies while consolidating their competitive advantage. The SCTI in Spain is concentrated in certain municipalities in the province of Castellon (Molina-Morales and Martinez-Fernandez, 2004) and overlaps with the Distritual Innovation System (DIS), which combines the perspectives of innovations system and the industrial district. The DIS concept emphasizes the relevance of the territory for the industrial district form, but also other elements of the innovation system (Gabaldón-Estevan et al., 2012). The district approach provides the most suitable framework to study the SCTI in enabling a focus on the innovation system as well as the particularities of industrial agglomerations (Hassink, 2007; Mota and de Castro, 2004).

We analyse the role of environmental issues on the evolution of Europe's traditional industries using the example of the SCTI.

The paper is organised as follows: Section 2 discusses the methodology; Section 3 provides an analysis of the ceramic tile value chain and describes the SCTI innovation system and how it functions. Section 4 discusses the results of the analysis in the context of environmental issues.

2. Methods

The main interest in the current paper is to establish the interactions between the innovation system and the new environmental requirements. To do that the study is based partly on the methodology proposed by Bergek et al. (2008) to analyse the dynamics of the functioning of the system, which includes defining the innovation system in question, identifying its structural components and mapping the innovation system pattern.

To proceed the paper builds and revisits evidence from previous research on the SCTI (Gabaldón-Estevan, 2011) which focuses on the characteristics of the SCTI innovation system and analyse the CTI in the north of the autonomous region of Valencia and the Emilia Romagna region in the north of Italy. And on Gabaldón-Estevan and Hekkert (2013) where the functioning of the SCTI innovation system is presented. Function analysis, a recent development in the innovation system literature (Bergek et al., 2008; Hekkert et al., 2007; Negro and Hekkert, 2008), is grounded on the technological innovation systems and sectoral innovation systems approaches and based on functional analysis (Bergek et al., 2008; Edquist, 1997; Jacobsson and Johnson, 2000). Data availability dictated the methodologies used and qualitative tools were substituted for some of the quantitative parts of Bergek et al.'s model. Section 3 is based partly on the methodology proposed by Bergek et al. (2008) to analyse the dynamics of the functioning of the system, which includes defining the innovation system in question and identifying its structural components (Sections 3.1 and 3.2) and mapping the innovation system pattern (Section 3.3).

3. Results

We summarize the evidence so far. This section is subdivided into three subsections which analyse the ceramic tile value chain (3.1), describe the SCTI innovation system (3.2), and discuss how it operates (3.3). For sections 3.1 and 3.2 we rely on Gabaldón-Estevan (2011) which focuses on the characteristics of the SCTI innovation system and analyse the CTI in the north of the autonomous region of Valencia and the Emilia Romagna region in the north of Italy. In these regions are located the most important ceramic tile clusters in Europe, which have similar problems to accomplish the EU environmental regulations (Minguillón et al., 2013).

Even though the study was mainly focused in SCTI, some data of the Italian ceramic tile cluster were included and analysed, to find out the common problems of the European CTI. To this end, the study involved 24 semi-structured interviews with representatives of the ceramic industrial districts in Italy and Spain. The interviewees included managers from the ceramic, electromechanical or glaze company representatives of employers' and workers' associations; representatives of public institutions specialized in technology or trade; representatives of research institutions conducting R&D for the CTI; and researchers interested in the area. The interviews provided information on the ceramic tile process, on the ceramic tile district, production and dissemination of innovation, the contributors and motivators of innovation, and factors related to global trends in production, the competition and trade.

3.1. The value chain

Fig. 1 depicts the six main elements of the ceramic tile production process. We provide a descriptive analysis of these elements and measure their contribution to the value chain.

The quality (i.e. organic composition) and characteristics (i.e. carbonates content) of the *raw materials* (clay) determine their suitability for ceramic tile production; their final cost is dependent mostly on the distance from their source (the mine) to the plant. There are two main types of clay, red and white, with different iron content. There is poor availability of white clays in both regions and they are imported (mainly from Eastern Europe—Turkey and

[5] Source: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Manufacture_of_pharmaceuticals_statisticsNACE_Rev._2 (downloaded 2013/11/08).

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