Generation and diffusion of innovations in a district learning system: the case of Ink-Jet Printing (IJP)

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Introduction

In spite of the great number of studies and theoretical propositions related to the concept of industrial district (and clusters) from the systemic perspective, the historical evolution of innovation has rarely been considered (Cantner et al. 2010). At regional level, in words of Iammarino (2004), little progress has been made in testing the definition of Regional Systems of Innovation (RIS) on the basis of the importance attributed to localised knowledge generation and diffusion and idiosyncratic learning capabilities.

The word "regions" has many different meanings across scales and disciplines, embracing sub-national and inter-national spaces (Molina-Morales 2001; Herrschel, 2009). A basic premise in the RIS approach is that the innovative performance of a region positively depends on the systemic character of the innovative activities in that region, including external and internal connections. As the term implies, an RIS should therefore be considered as an integrated system that consists of components, relations and attributes, integrating bottom-up and top-down perspectives and tackling also the internal dynamics of regionally embedded social, economic and institutional structures. In this sense Cantner et al. (2010) argues that the concept of the RIS can be enriched by applying social network analysis techniques to empirically investigate forms of interaction within the regional system and across the system borders. These affirmations can be extended to the case of districts and clusters.

From this perspective, this paper investigates the development of innovations in the Castellon Ceramic district and performs a case study analysis on a relevant innovation emerged in the last decade: the Ink Jet Printing (IJP) technology, considering the generation, evolution and diffusion processes. The ceramic tile industry -and particularly the district ceramic of Castellon- is highly dynamic and driven by consumer trends and retailer demands (Escardino 2001; Tortajada et al. 2008). Various print techniques have been used over the years to decorate tiles, mainly using traditional contact printing methods (such as screen, flexo, and rotogravure). Over the last decade innovation in the field of ceramic tile decoration is experiencing an increased dynamic due the introduction of the IJP technology (De Carlo & Montani 2003; Berto 2007; Hutchings 2009; Moreno et al. 2010). The Ceramic district of Castellon has a great protagonism in the generation of this technology, which is part of the "digital revolution in the ceramic industry".

Research focus

The principal objectives of our study are:

- To detect and characterize innovations produced in the Castellon Ceramic district from a historical perspective and as a "learning region";
- To study the specific case of a recent innovation, analyzing the knowledge flows throughout both the *core networks* (links with the local environment) and the *periphery networks*. In this study-case we try to identify, according the evolutionary theories of technological change, three main functional dimensions: 1.*Absorption* of new knowledge for adaptation to local needs, 2. *Generation* of new knowledge, technology and innovation, and 3.*Difussion* of innovation throughout all the "learning system" (Iammarino, 2004).

Methodology

We combined qualitative and quantitative approaches, using network analysis (Wasserman & Faust 1994) and case study (Stake 1995). We have realized a review of the literature applying the LBIO *(Literature-Based Innovation Output)* indicator *(*Kleinknecht 1991; Coombs et al. 1996), together with information provided by patent

databases (Breshi & Lissoni 2004; Barberá et al. 2011) and by carrying out semi-structured interviews. The interviewees were selected for being the principal actors in the generation and development of the IJP technology and other agents whose work had intensively been focused on the issue. In the interviews information was obtained regarding different aspects on the ideas generation, the innovation process and the diffusion of IJP. More specifically our interest was directed to understand innovations' achievement and dissemination in the market and the role of the different agents which participated in the innovation processes, i.e. how innovations were stimulated and diffused in the district and in the sector.

Contributions

This paper aims to acquire a major knowledge about the principal innovations and their characteristics at micro-level in the Ceramic district of Castellon from the perspective of the learning innovation systems combining qualitative and quantitative methodologies.

Note:

We consider the concept of "district", differentiated from the cluster concept. According to Porter *"Clusters are geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, trade associations) in a particular field that compete but also cooperate. Clusters, or critical masses of unusually competitive success in particular business areas, are a striking feature of virtually every national, regional, state and even metropolitan economy, especially in more advanced nations."* (Porter, 1998, p. 197).

"*A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities".* (1998, p. 199).

The Marshallian industrial district can be characterized by the overlapping between the social level and the productive one, where the decisions taken by the local community are affected by the presence of the industry and economic relationships are influenced by the social ones ("industrial atmosphere"). In addition, this productive system is characterised by a widespread division of labour between firms engaged in

complementary activities and an advanced specialisation. The importance of social relationships in industrial districts has been widely detected by Giacomo Becattini, which in his neo-marshallian conception defines the industrial district as a "A socio-geographical entity which is characterized by the active presence of both a community of people and a population of firms in one naturally and historically bounded area'' (Becattini 1990, p. 39). In this definition, as already stressed, the local social system is an integral part of the industrial district itself.

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