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How knowledge links with universities may foster innovation: The case of a science park



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ABSTRACT

The objective of this research is to evaluate how technological knowledge flows from universities may increase innovation by firms located in a science park. We propose that firms with the capacity to acquire and assimilate the knowledge provided by universities, mainly due to being academic spin-offs or having long-term relationships with them, receive more knowledge from universities. We also argue that firms located in central positions inside the local firm-network have access to a complementary source of technical knowledge. Empirical evidence gathered from the Madrid Science Park confirms that having long-term relationships with universities, based on both formal and informal interactions, is the most important means of obtaining technical knowledge from them. We also observed a positive relationship between the technological knowledge obtained from universities and the innovation carried out by firms. Finally, we confirmed that firms with a significant role as intermediaries between other co-located firms have a higher level of innovation even if they are not involved in relationships with the university.

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1. Introduction

It is broadly accepted that, among the different institutions that exist inside science parks, universities and other higher education institutions can provide valuable knowledge and promote innovation among their co-located firms (Lambooy, 2004; Löfsten and Lindelöf, 2005; Mian, 1996; Ritala et al., 2015). Science parks can be understood as loose structures where knowledge spillovers can occur more easily between universities and firms, favouring the creation and exchange of technological knowledge among them (McAdam and McAdam, 2008; Mian, 1997; Montoro-Sánchez et al., 2011).

As a consequence, firms inside parks can improve their innovative capacity by combining their internal knowledge with the knowledge provided by the universities and other co-located firms (Colombo and Delmastro, 2002; Lee et al., 2001). In these locations, firms find it easier to have face-to-face interactions and informal knowledge exchanges (Chan and Lau, 2005; Díez-Vial and Montoro-Sánchez, 2014; Westhead and Batstone, 1998a), and a

trust-based environment is created so that alliances and formal agreements can also be developed (Giarretta, 2014; Löfsten and Lindelöf, 2005).

Nevertheless, not all firms in a science park obtain the same benefit from these local knowledge spillovers (Bakouros et al., 2002; Patton, 2014). Knowledge is not a collective good available to all firms in the science park (Capello, 2009), but rather it depends on the type of relationships and interactions that firms have with other agents, i.e., their knowledge network (Ahuja, 2000; Phelps et al., 2012). How each firm benefits from the science park depends on the agents with whom they have established a relationship (Rubin et al., 2015) and the position that each firm occupies in this knowledge network (Ahuja, 2000; Löfsten and Lindelöf, 2005; Powell et al., 1996), as well as their potential absorptive capacity (Lane and Lubatkin, 1998; Tsai, 2001).

Taking into account these considerations, and focusing our attention on one of the main agents in the context of science parks, the purpose of this research is to assess the role of universities inside the knowledge networks in science parks and their impact on the innovative capacity of the firms located there. By taking into account both a network approach and a firm's absorptive capacity, we try to better understand how knowledge provided by universities can help in improving innovation.

In doing so, we firstly contribute by evaluating local interactions inside science parks using a network approach (Ahuja, 2000; Gnyawali and Madhavan, 2001; Phelps et al., 2012; Zaheer et al.,

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2010). While extensive research has highlighted the importance of local interactions inside science parks (Bakouros et al., 2002; Colombo and Delmastro, 2002; Hansson, 2007; Löfsten and Lindelöf, 2005), little research has been undertaken for evaluating them using a network approach, which has been more typically developed in the fields of geographical and regional economics (Boschma and Ter Wal, 2007; Giuliani and Bell, 2005). The network approach highlights the characteristics of the relationships between different agents and looks at how the networks they form influence their ability to access, transfer, absorb, and apply knowledge between firms. This approach changes the perspective from an autonomous, self-reliant view of a firm's actions and outcomes to one that is essentially relational. Following Phelps et al. (2012), relationships can be seen as knowledge networks where different nodes (individuals or higher level collectives that serve as heterogeneously distributed repositories of knowledge and agents that search for, transmit, and create knowledge) are interconnected by social relationships that enable and constrain the efforts of the nodes to acquire, transfer, and create knowledge (Bell and Zaheer, 2007; Ter Wal and Boschma, 2009).

Secondly, this paper contributes by improving our understanding of the role that a firm's absorptive capacity has regarding the acquisition of the knowledge that firms receive from universities. The empirical evidence is inconclusive about the role of universities as knowledge providers inside science parks; there are arguments about the cost of assimilating the knowledge and technology provided by universities as well as the scarcity of university–firm relationships (Massey et al., 1992; Bakouros et al., 2002). In addition, firms differ in their relative absorptive capacity, that is, in their capacity to identify, analyze, interpret, understand and assimilate the knowledge provided by the network in general, and by the university in particular (Chan and Lau, 2005; Cohen and Levinthal, 1990; Soetanto and van Geenhuizen, 2015). In the context of science parks, the successful acquisition of external knowledge (Lane and Lubatkin, 1998) requires not only a similar knowledge base that allows for a certain degree of mutual understanding among firms and other local institutions (Gilsing et al., 2008; Stadler, Rajwani, and Karaba, 2014), but firms also need to show a higher cognitive proximity to the knowledge provided by specific institutions, in our case the knowledge provided by the university. Specifically, we evaluate how being a university spin-off, establishing formal agreements with a university, or just establishing informal interactions, may foster these knowledge flows.

Thirdly, we take into account the position that each firm has in the local network created by the firms in the science park. Recent studies have pointed out the necessity of creating knowledge networks between firms in driving local innovation (Chan and Lau, 2005; Löfsten and Lindelöf, 2005; Westhead and Batstone, 1998b). In particular, firms with a central position in the network should benefit most from these local knowledge spillovers (Ahuja, 2000; Tsai, 2001). We assume that co-located firms are a complementary source of technical knowledge, in addition to the knowledge provided by the university, and that this can also improve local innovation capacity (Powell et al., 1996).

Finally, empirical evidence has been gathered through in-depth interviews with the managers of 76 firms located in the Madrid Science Park, close to the Autonomous University of Madrid. These interviews allowed us to obtain information about the innovative capacity of the firms and the intensity and type of relationships they have developed in the park. The results show that many of them have developed formal agreements and hold informal meetings that also foster mutual interaction, and that some firms have also been created by researchers, which stimulates the relationships between these firms and the university.

This paper is structured into the following sections: after this

introduction, the second section presents the theoretical framework and the hypotheses proposed. The third part deals with the empirical evidence obtained, explaining the main characteristics of the science park, presenting the measurements of the variables and discussing the main results of the study. Finally, the fourth part presents the conclusions.

2. Universities, local knowledge networks and Innovation

The degree to which a firm has access to external knowledge sources, both tacit and explicit knowledge, affects its ability to exchange and combine this and, consequently, to generate innovation (Kogut and Zander, 1992). In the particular context of science parks, a key factor in explaining the innovative capacity of firms relates to them having access to different external knowledge sources and identifying new ways of combining these knowledge sources (Löfsten and Lindelöf, 2005; Zeng et al., 2010). However, not all types of knowledge are equally easy to exchange. According to the literature on networks, geographic proximity facilitates the exchange of knowledge among firms and between them and other institutions, especially tacit knowledge which is more difficult to share (Bell and Zaheer, 2007; Poudier and John, 1996).

In this regard, most studies consider that there is a high level of tacit knowledge exchange among firms and institutions in geographically concentrated spaces, this generally being considered the main location advantage (Almeida and Kogut, 1999). Therefore, proximity can encourage and facilitate co-located firms sharing tacit knowledge locally (Boschma and Ter Wal, 2007; Giuliani and Bell, 2005). In particular, inside science parks firms can have face-to-face interactions and informal and formal meetings that foster trust and a higher level of knowledge transmission (Chan and Lau, 2005; Levin and Cross, 2004). Being conscious that most of the knowledge shared locally has a high tacit content (Bakouros et al., 2002; Vedovello, 1997), but also recognizing the difficulties associated with making a clear distinction between tacit and explicit knowledge, in this research we look at knowledge as a whole construct. In particular, from among the different organizations and institutions that can provide knowledge inside science parks, we pay special attention to the role of the university as a provider of knowledge and its impact on the innovation capacity of firms.

2.1. The university as a provider of knowledge

Science parks were created with the objective of transferring technology from universities to the adjacent firms within a shared space, with basic research from the university being the main source of knowledge (Acs et al., 1992; Quintas et al., 1992; Westhead and Batstone, 1998a, 1998b). As Oakey (1985) pointed out, the important role played by universities in increasing local development and innovation is a consequence of the American model where some kind of “technological interaction” between universities and local high technology firms takes place.

Under this approach, universities are a valuable source of knowledge as they provide scientific research that firms inside a Science Park can transform into new valuable products, services or processes (Löfsten and Lindelöf, 2005; Rubin et al., 2015; Westhead, 1997). Innovation by firms is the result of proceeding from basic to applied research and then moving on to development and marketing, following a sequential process (Löfsten and Lindelöf, 2005; Phillimore, 1999; Quintas et al., 1992). Nevertheless, universities can provide valuable knowledge not only at the start of a firm's innovation process, but throughout this process (Bakouros et al., 2002; Hansson et al., 2005). Universities possess a rich stock of physical and social capital, as well as the availability of expert

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