How Local Knowledge Networks and Firm Internal Characteristics Evolve Across Time Inside Science Parks

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Abstract In this chapter we analyze how firms' characteristics, along with the network that each firm establishes, evolve through three different periods of time: incubation, growth, and maturity. We observe that as firms stay longer in the park, they have a higher number of direct relationships, and also these relationships tend to be stronger in terms of both frequency and friendship. Nevertheless, this higher level of interactions do not benefit firms in the same way, being the best period for improving innovation, the growth initial period, in which firms have between 3 and 6 years.

Keywords Network evolution · Knowledge exchange · Trust

1 Introduction

The increasingly competitive environment has led to organizational knowledge becoming a dominant source of innovation for firms. The creation, dissemination, and exploitation of knowledge has become critical in explaining competitiveness (Spender and Grant 1996). While some knowledge can be internally developed, it has been broadly demonstrated that a firm's innovative capacity depends strongly on external knowledge sources, such as relationships with universities, networking with competitors and colleagues, or customer involvement, among others (Boschma and Ter Wal 2007; Hansen et al. 2002; Zaheer and Bell 2005). Under the paradigm, the boundaries of the firm are porous, so firms can interact with their environment and either access external sources of information, ideas, and knowledge or create new combinations of knowledge (Expósito-Langa et al. 2011). It has been specially observed in high-technology industries, where firms can expand their learning

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capacity and improve their innovative capacity by combining external and internal knowledge.

In this context, science parks can be considered as an environment that is conducive to innovation as they provide the physical and social infrastructures that stimulate the creation and dissemination of new knowledge (Hansson et al. 2005). In particular, science parks encourage partnerships between the universities, the firms, and the management of park itself that improve their learning abilities and capacity for innovation (McAdam and McAdam 2008). The development of knowledge networks inside parks among these different agents has been proved to be particularly important for a firm's innovative capacity (Chan and Lau 2005; Löfsten and Lindelöf 2005).

However, there is little research about how these geographically bounded networks created inside park evolve across time and, in particular, how firms and support institutions foster a nurturing environment for new business start-ups but also lead to the subsequent development of growth-oriented firms. Local knowledge generated collectively tends to evolve over the time a firm remains in the park, so the benefits of the park are highly correlated to the evolution of the local network among colocated firms, as well as the internal characteristics of the firms involved (Ahuja et al. 2012; Phelps et al. 2012).

So, some parks launch incubation programs where firms can only take part for two or three years, it being considered that firms should graduate after that period. Under this approach, the park helps its firms gaining access to marketing and technical and managerial knowledge, as well as many other resources, but once firms learn how to successfully commercialize an innovation, they must leave (Allen and Mccluskey 1990; Rothaermel and Thursby 2005). Conversely, other parks allow firms to stay for as many years as they wish, using the argument that they can benefit from the local network during their long stay. However, there are certain doubts about how long a firm should stay in a park, receiving support and enjoying of local knowledge, as there could be a limit to benefit from local innovation (Clarysse et al. 2005).

The objective of this research is to analyze the role of the science parks as knowledge enablers across time, evaluating both the evolution of the internal characteristics of the firms and the network locally developed. We mainly adopt an evolutionary perspective (Balland 2012), in which network changes are analyzed under the light of network structural mechanisms (endogenous forces) (Powell et al. 1996; Soda et al. 2004) and firm-level behavior (Ahuja et al. 2012).

Empirical evidence has been gathered in Madrid Science Park, Spain. The aim of the Madrid Science Park is to promote research, development, and innovation, running a business development unit designed to support the creation and development of technology-based businesses, as well as to transfer knowledge and technology, and technology development units, which provide high-level scientific services to public and private research groups. There are no exit policies, which allow us to obtain information about firms in different periods of time, from those that has just established to those that had been more than 10 years established there. Moreover, firms have entered in the park in different periods of their development; almost 40% of the firms entered in the park when they had 5 or more years since their foundation.

This variability in their age of entrance in the park allow us to better understand the effect of the time in the park, without being so influenced by the natural growth of the firm from youth to maturity.

2 Local Knowledge Inside the Park and Time

2.1 Knowledge Networks Inside Parks

In understanding how science parks can promote knowledge flows and innovation, it is necessary to firstly consider the geographic concentration of firms and institutions that foster knowledge externalities. These localized knowledge externalities are created by informal relationships and face-to-face interactions: firms and other institutions can establish relationships, providing each other with personal contacts and technical advice (Bakouros et al. 2002; Löfsten and Lindelöf 2005; Mian 1996). According to this view, informal contacts allow knowledge to be shared between park members, while outsiders are excluded, since they are not in the local community (Vedovello 1997).

Nevertheless, the physical concentration of firms from the same sector is not enough to explain strong local innovation, and it is also necessary to consider institutional, cognitive, and social proximity (Boschma 2005). Compared to other agglomerated spaces, inside science park firms are not assumed to have basic common knowledge, language, and procedures (Díez-Vial and Montoro-Sánchez 2014). In this sense, inside park firms do not have to share the same industry, so they may lack of similar background. In this context, the entrepreneurial orientation can be considered a key element which helps to develop similar routines and practices and managerial philosophies, knowledge bases, and firm behaviors (Carayannis et al. 2006; Walter et al. 2006).

Moreover, this regional collective learning is based on basic common knowledge, language, and procedures among proximate firms as well as on relationships based on trust and reciprocity that facilitate mutual understanding and communication (Lawson et al. 1999). In science parks, three main relationships can be identified: those among colocated firms, those related to universities or any other higher education institutes, and those promoted by the park's management team. Inside parks, this reciprocity and trust among colocated firms do not evolve in the same way as firms are not assumed to be for long periods of time, being observed that firms tend to be reluctant to share information and ideas with other colocated firms or local institutions (Bakouros et al. 2002; Westhead and Batstone 1998b).

The university-firm relationship has been the most extensively researched topic, as most of the science parks were created with the objective of transferring technology from universities to firms (Quintas et al. 1992; Westhead and Batstone 1998b). In the case of firms located in science parks, the empirical evidence tends to confirm a higher level of interaction between firms in the park and the universities compared with firms outside the park (Felsenstein 1994). However, it has frequently been

observed that these local interactions between firms and universities to be successful need either the development of personal and informal interactions (Bakouros et al. 2002; Colombo and Delmastro 2002; Vedovello 1997) or previous experience in dealing with scientific knowledge (Cohen et al. 2002; Díez-Vial and Fernandez-Olmos 2014).

Another kind of relationship, inside the park, relates to a park's management team. The management team may act as a bridging institution, providing firms with technical and business services and connecting outside agents to the local network. It is the function of being actively involved in the transfer of technology and business skills, as well as training for firms (Chan and Lau 2005; Westhead and Batstone 1998b). Moreover, there is an extensive network of ties with firms within the park and external agents. As a result, firms that establish links with the park can enjoy the knowledge spillovers available from all these sources (McEvily and Zaheer 1999).

But along with the source of the knowledge, recent contributions on the transfer and creation of local knowledge have shifted their attention to the characteristics of each firm (Morrison and Rabellotti 2009; Ter Wal and Boschma 2009). Inside a cluster, each firm establishes its relationships with others, and differences emerge between one firm and another in the knowledge externalities they can enjoy but also they can provide (Shaver and Flyer 2000). As a result, the internal characteristics that firms have inside the local network play a fundamental role in the creation and diffusion of knowledge and in local learning dynamics (Hervás-Oliver and Albors-Garrigós 2007). Knowledge is only available to firms that establish ties with other firms and institutions inside the local network. However, they also need to have the internal capacity to absorb this knowledge contributing to the development of local knowledge spillovers. In this more selective approach, formal relationships with partners and providers, but also informal interactions based on friendship and professional encounters, might function as channels through which knowledge is exchanged (Eisingerich et al. 2010; Owen-Smith and Powell 2004).

2.2 The Role of Time on the Knowledge Network of the Park

From a dynamic perspective, it has been observed that networks evolve over time and that this evolution is determined by a path-dependent process, as previous links condition the development of future ones (Balland et al. 2016). In particular, the formation of new relationships inside a network tends to follow a preferential attachment logic which reflects the tendency of firms with a central position to become more central over time, attracting new firms to their direct network (Powell et al. 2005).

A central position in the network implies that firms have many direct contacts with whom to exchange knowledge and access to a broader range of technical, managerial, and marketing knowledge, so they can complement their own knowledge and experience with that of their connected firms (Powell et al. 1996). Firms in central positions also tend to generate more visibility, status, and power, inside the

network, which makes it easier for them to obtain institutional support and resources such as money, technology, machinery, or public funds (Gulati and Gargiulo 1999). When a new firm enters the park, it tends to establish links with the firms already located there, ideally with firms in central positions inside the network. If firms increase their direct relationships, they will benefit from moving into more central positions or being able to consolidate them (Powell et al. 2005).

Moreover, as firms increase the time they have spent in the park, they not only increase the number of relationships but also tend to reinforce these relationships by increasing the level of trust, commitment, and a certain emotional attachment (Ahuja et al. 2012). Firms need time to increase the strength of their relationships. Following Gulati (1995), firms repeating interactions with other colocated firms tend to develop trust, and this induces them to behave loyally, therefore reducing the mutual fear that others will act opportunistically. In this sense, it has been observed that networks tend to evolve toward triadic closure structures, where the main actors are all connected (Balland et al. 2016). Firms tend to reinforce their local relationships with frequent visits to and meetings with other firms, or informal encounters, and with personal proximity, which increases the willingness of firms to share knowledge (Molina-Morales and Martínez-Fernández 2009). In this environment, the risk of opportunism is reduced, firms tend to find more opportunities and time for knowledge transfer, and there is a feeling of reliability and positive expectations about future relations (Levin and Cross 2004; Phelps et al. 2012).

Nevertheless, the evolution of the network not only depends on endogenous factors but also on exogenous ones, as it is the behavior of the firms and institutions that configure the network. In particular, firms' characteristics and the differences among them have an impact on the evolution of local networks and facilitate or not the creation and development of local externalities inside the park (Brass et al. 2004; Demirkan and Demirkan 2012). It has been broadly considered that better firms would contribute most to create local externalities, while worse firms would benefit most (McEvily and Zaheer 1999; Shaver and Flyer 2000). These firms' characteristics also affect their willingness and involvement in the local network. Often, what is best for the network is best also for the firm (Morrison and Rabellotti 2009). This is the case of internal R&D investments of the firms locally involved, or their innovative capacity, that conditionate both the firms' capacity to absorb external knowledge and their contribution to develop a valuable local knowledge network.

R&D investments, firms' capacity to develop new products and process, and entrepreneurial orientation contribute to increasing a firm's capacity to recognize and assimilate external knowledge from the local network. As firms learn from their own R&D investments, and previous innovative experiences, they also develop their ability to understand external knowledge developed in the park (Cassiman and Veugelers 2006; Löfsten and Lindelöf 2005). Nevertheless, firms can develop their absorptive capacity if there is first a knowledge network available. In this sense, it is necessary to consider not only each firm's R&D and innovative capacity but also the R&D and innovative capacity of the other firms. That is, as firms invest in improving their own innovative capacity, firms from the network do it too (Lee et al. 2001). Additionally, the ability to transform in-park knowledge into profitable products and

services depends, among other capabilities, on the capacity of the entrepreneur to identify, assimilate, and exploit opportunities arising from that knowledge, or, in other words, from their entrepreneurial capacity (Clarysse et al. 2005; Gedajlovic et al. 2013). So firms who are better able to recognize opportunities, and have extensive relationship experience, will have a greater entrepreneurial capacity to identify, understand, capture, and assimilate these local knowledge flows embedded in their network. As firms spend more time in the park, with other firms that are also investing in their R&D and innovative capacity, they would all benefit from the presence of high local innovators (Canina et al. 2005; Shaver and Flyer 2000). As a consequence, time would have a positive effect on firms' innovations, as long as the firms that are also in the park are investing in creating new products or processes.

3 The Science Park of Madrid: A Case Study

We study knowledge flows and firms' characteristics in the context of the Madrid Science Park, Spain, (*Parque Científico de Madrid*, PCM). The Madrid Science Park is a nonprofit foundation created in 2001 by the Autonomous University of Madrid and the Complutense University of Madrid. To obtain the data, we gathered information using structured interviews with managers at firms located in the park. The number of firms established and operating during this period was 94. We obtained complete information about our variables from 76 firms, representing 81% of the total information about the network. In any case, all relevant actors were interviewed and non-response bias was controlled.

3.1 Time in the Park

In part due to this terminological confusion about parks—research park, technology park, innovation center, science park incubator, etc. (Löfsten and Lindelöf 2005)—and variety of objectives that each one establish (Westhead and Batstone 1998a, b), it is not easy to identify relevant time frames that can take into account the expected evolution of firms inside parks. In this sense, this paper contributes by identifying relevant time frames for the evolution of the network inside parks.

For instance, many parks are mainly incubators, which are designed to allow a short stay of the new ventures. Incubation periods are expected to be short; after then firms are given an incentive to leave through exit graduation programs or exit policies that encourage them to move away from the incubators (Allen and Mccluskey 1990; Clarysse et al. 2005).

Nevertheless, most science parks are not only incubators but also facilitators of business development, so there is no exit policy and firms can remain in the park as long as they consider it beneficial to their business. In fact, Rothaermel and Thursby (2005) have found that firms staying longer in an incubator tend to generate

significantly higher revenues. In the case of Spanish science parks, and following the definition of the Spanish Science and Technology Parks Association (*Asociación de Parques Científicos y Tecnológicos de España*, APTE), science parks are projects generally associated with a physical space that (1) maintains formal and operational links with universities, research centers, and other higher education institutions; (2) is designed to encourage the formation and growth of knowledge-based companies; and (3) has a stable management that promotes technology transfer and innovation among businesses and organizations using the park.

Taking into account these considerations and following to Rothaermel and Thursby (2005), in this study we have established three broad time frames: (1) from 0 to less than 3 years in the park, (2) 3 to 6 years, and (3) more than 6 years. The first period, from 0 to less than 3 years in the park, can be considered an incubation period, as firms have just arrived in the park, and they are generally trying to commercialize new products. The length established for this first incubation period is a conservative estimate, as most firms are expected to complete this stage in at most 2 years, and firms in incubators not graduating in 2 years can even be considered a failure. After it, we have split the post-incubator stage into two periods, establishing the sixth year as the cutoff point for differentiating them: the growth period (3 to 6 years), during which in theory firms tend to develop new local relationships and consolidate the existing ones, and the maturity period (more than 6 years), when firms have extensive experience in the local network as well as in launching new products in the market.

3.2 Firms' Characteristics

We have evaluated the characteristics of the firm first in terms of innovative capacity. We have measured the innovative capacity of firms by their capacity to creating and introducing new products or services and to adopting new technologies (Zaheer and Bell 2005). More precisely, following the Community Innovation Survey, we have measured innovation as the launch of new products or services that are new to the firm and new products or services that are not only new for the firm but also for the market. Similarly, we have measured innovation in processes for manufacturing or providing these products and services, which are new for the firm, called process innovation. We also have measured R&D investments to take into account not only firms' internal R&D investment but also their absorptive capacity, based on the assumption that existing knowledge influences their ability to understand and integrate new knowledge (Cassiman and Veugelers 2006).

As it can be observed in Table 1, firms tend to be more innovative in the growth stage, when firms have spent between 3 and 6 years in the park. Firms develop more products, new for the firm or also new to the market, while also they introduce new processes in this intermediate stage. In a similar way, firms invest more on R&D in this second stage. Comparing the incubation period (less than 3 years) with the growth period (3–6 years), we observe that firms increase in all these measurements, as expected. As firms consolidate their activities in the industry, they tend to invest

Table 1 Firms' characteristics

Variables	Time in the park			
	Total	Incubation (*<3 years*)	Growth (*3–6 years*)	Maturity (*>6 years*)
Radical product innovation				
Mean	4.026	3.535	5.545	1.6
Median	2	1	2	2
Std. dev.	12.007	6.131	17.318	1.454
Incremental product innovation				
Mean	9	7.857	12.545	3.333
Median	4	4	3	4
Std. dev.	24.001	12.231	34.520	2.663
Process innovation				
Mean	1.052	1.071	1.212	0.666
Median	0	0	0	0
Std. dev.	2.371	2.478	2.701	1.175
R&D expenditures				
Mean	237,622.6	67,664.29	366,288.3	291,083.3
Median	65,000	15,300	97,250	90,000
Std. dev.	625,318.1	117,301.7	883,759.7	405,224.4
Entrepreneurial orientation				
Mean	5.622	5.854	5.189	4.75
Median	5.888	6.166	5.25	4.75
Std. dev.	1.203	1.569	1.525	1.666
N	76	28	33	15

on new R&D investments and also are able to successfully commercialize their products and introduce new procedures. Nevertheless, when firms reach a maturity stage (they spend more than 6 years in the park), these variables are reduced.

These data offer interesting results for the length of stay of a firm inside a park and how this may affect the development of a valuable knowledge network. In early stages, firms are taking important investments that can contribute both to transfer valuable knowledge among firms inside the park and to better understand the knowledge provided by others. Nevertheless, networks among firms that have spent a long period in the park seem to be less conducive to create local knowledge spillovers.

In Table 1 we also present the evolution of the entrepreneurial orientation of firms across time in the park. What it can be observed is that firms just arrived to the park have a slighter lower entrepreneurial orientation than those in the growth stage, but in the mature stage, this level is lowest. Again, these results may indicate that after a long period in the park, firms are less proactive to identify, understand, capture, and assimilate these local knowledge flows embedded in their network, because their skill in identifying new business opportunities, their ambition, and risk-taking propensity tend to be lower.

3.3 Network Characteristics

In this research we measure the knowledge network using a widely used methodology: social network analysis (SNA) (Borgatti et al. 2002). SNA measures knowledge flows among firms, as well as different aspects of the one-to-one relationships that firms establish with different agents. These kinds of relational data were collected through a "roster recall" method: each firm was presented with a complete list (roster) of the other firms and institutions in the science park, and they were asked about their relationship with each other (Giuliani and Bell 2005; Ter Wal and Boschma 2009). As a consequence, we measured each variable by creating a matrix in which each cell contains information about the relationship between each pair of organizations. In our research we have information for 76 firms, but these firms have developed links with other firms surveyed but providing incomplete data (2 firms) with firms not surveyed (41) and with 9 institutions. As a consequence, for each variable we construct a 128 × 128 matrix where cell *ij* represents any characteristic of the relationship between organization *i* and organization *j*.

To measure knowledge sharing among organizations in the science park, and based on previous literature (Bell and Zaheer 2007; Boschma and Ter Wal 2007; Giuliani and Bell 2005; Hansen 1999; McEvily and Zaheer 1999; Molina-Morales and Expósito-langa 2012; Morrison 2008), we asked each manager to indicate the organizations from which they had received different kinds of knowledge over the last 2 years: "From which of the local organizations mentioned in the roster have you received technical knowledge such as advice about new production processes, product development, or more efficient machinery?" (0, no knowledge exchange; 1, very low intensity and frequency; to 7, very high intensity and frequency).

In Table 2 we present the main data about the evolution of each firm direct network, according with the time they have spent in the park. First, we have measured the degree, which measures the number of direct knowledge linkages that each node has with others in the network. Also, we have measured betweenness, which is the extent to which a particular organization lies between the various other organizations. It evaluates the role that firms may play as "broker," connecting different colocated firms in the science park (Chan and Liebowitz 2006). In this sense, betweenness takes into account all the relationships created inside the park and not only those directly established by each firm. With these two measures, degree and betweenness, we try to understand the position of the firm simply in terms of the structure of the network, without considering the type of relationships (Ahuja 2000; Freeman 1979).

The results of these variables indicate that as firms spend more time in the park, they develop a higher number of direct relationships: firms begin in the park with 4.035 relationships, evolve to 6.181 in the growth one, and after 6 years they have 6.866. Firms prefer to establish relationships with firms that have already built relationships with many others. In doing so, they can benefit from the higher status and power of those with many connections. Nevertheless, betweenness does not behave in the same way: it takes a value of 4.065 in the incubation stage, increases to

Table 2 Network Characteristics

Variables	Time in the park			
	Total	Incubation (*<3 years*)	Growth (*3–6 years*)	Maturity (*>6 years*)
Degree-direct relations				
Mean	5.526	4.035	6.181	6.866
Median	5	4	6	7
Std. dev.	3.594	2.741	3.273	4.778
Betweenness				
Mean	7.217	4.065	10.217	6.5
Median	4	2	6	4
Std. dev.	9.845	6.774	12.237	6.842
Strength tie				
Mean	4.471	3.828	4.859	4.819
Median	4.350	3.342	4.469	5.375
Std. dev.	2.578	2.816	2.424	2.362
Diversity of activities				
Mean	0.404	0.173	0.298	0.311
Median	0.5	0	0.375	0.375
Std. dev.	0.277	0.224	0.250	0.299
N	76	28	33	15

10.217 in the growth stage, and finally drops to 6.5 in the maturity stage. It is in the growth stage that firms have a more active role as broker in the local network. It seems as if the number of direct relationships increases, but its capacity to control and connect firms does not evolve in the same way.

To measure the relational aspect of the local network, we measure the strength of these knowledge relationships inside the science park. Following previous studies, we measure the strength of the relationships by considering the frequency of the interaction among firms and their degree of friendship (Hansen 1999; Reagans and Mcevily 2003). In particular we asked them the two following questions: "How close/friendly do you feel to the organizations mentioned in the roster?" (7 Likert scale) and "How frequently do you have contact with the organizations mentioned in the roster (conferences, informal encounters in meetings, formal or commercial relations, etc.)" (7 Likert scale). Once we calculated these data for each node, we calculate the mean value of each of these variables, dividing by the number of knowledge relationships that the firm has developed. In doing so, we try to measure the strength of each relationship, avoiding that the higher the number of relationships, the higher will be the strength of them. As expected, as firms spend more time in the park, the strength of their relationship tends to increase.

Finally, we measure the diversity in the ego network of each firm, in relation to the industries involved. Inside the science park, firms can undertake either of these activities: information technology and communication, environment and renewable energy, life sciences and chemical, nanotechnology, new materials and engineering, and other sectors and support services. Measuring these data for each firm, we

calculate the degree of diversity in the ego network of each firm. We followed the heterogeneity measurement of Blau, as follows:

$$H = 1 - \sum_{k} P_K^2$$

where P_k gives the proportion of alters that fall in each activity K.

We observed that the diversity tends to increase in the mean value across time, but in terms of mean value, there is the same level of diversity in the growth and in the mature stages. We have included those variables because it is considered that a certain degree of diversity is positive, as a source of new ideas and technologies (Boschma and Iammarino 2009). Firms that come from different knowledge bases can widen one's perspective, enhancing creative thinking and providing opportunities for new combinations of knowledge across various knowledge domains (Wuyts and Dutta 2014). Nevertheless, in the case of science parks, the benefits of diversity seem to be lower than specialization. Differently from what occurs in clusters, in science parks host firms belong to different industries, with whom they do not necessarily have commercial relationships or that are competitors. Inside park firms are usually highly innovative and in many cases they are developing a new product or a new process, having a high entrepreneurial perspective. In this condition, firms that are linked with their local partners, within their same activity, can benefit from sharing investments and sophisticated equipment (Mian 1996). Technology-intensive industries are heavily reliant on R&D resources, and this dependence fosters a mutual exchange of knowledge.

Also, a high specialization of relationships inside the park fosters the development of an accumulated sector-specific knowledge that can help firms to make better decisions and to better estimate the innovative potential of new products and ideas (Grimaldi and Grandi 2005; Schwartz and Hornych 2008). In this sense, firms need a certain overlap of competencies, markets, and knowledge, to be able to incorporate new knowledge. Firms need a mutual understanding to absorb knowledge from others, in order to recognize, assimilate, and exploit it, with the goal of creating new products or processes (Cohen and Levinthal 1990).

4 Conclusions and Implications

In this research we have taken into account both firms' characteristics and the network structure that each firm established across three different periods of time: incubation, when the firm has spent less than 3 years in the park; growth stage, when the firm has stayed between 3 and 6 years; and maturity that includes firms that have spent more than 6 years in the park. Firms' characteristics are measured in terms of R&D expenditures, innovative capacity, and entrepreneurial orientation. Except for entrepreneurial orientation, in all cases firms that are in the growth stages present the highest values of these variables. Taking into account these data, a first implication

for managers can be identified: the best firms to establish a network inside a park are those that have been there between 3 and 6 years. These are the firms that can contribute most to develop local knowledge spillovers that would benefit other firms.

When considering the network characteristics, we observe that firms with longer stages have a higher number of direct relationships, and also these relationships tend to be stronger in terms of both frequency and friendship. But firms develop their highest broker position in the growth stage. It seems that, again, firms in the growth stage are the best to establish relationships with others: they not only are better internally but also enjoy of a brokerage position that save time and efforts. Nevertheless, it could be considered that firms in the mature stage also benefit from a friendlier environment that foster mutual trust and the exchange of ideas. Also, since firms in mature stages have more direct contacts with firms belonging to different industries, they may develop a variety of ideas, information, and contacts that can help firms in improving their own innovative capacity.

There is also a clear recommendation for both managers and policy makers: after 6 years the benefits of belonging to the park are harder to be identified. Firms in mature stages have a lower capacity to innovate and entrepreneurial orientation. Belonging to the park provides several benefits for firms such as sharing machinery, procedures, and installations or improving their legitimacy. But above them all, locations inside science parks have recently been valued for giving access to valuable sources of knowledge. In this research we have focused on the knowledge network internally developed, using as a unit of analysis the firm and its local network. Future research could take into account the firms' ego network, studying its implications for both managers and policy makers.

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