

# CAPACITY OF ANDALUSIAN INNOVATIVE COMPANIES FOR COOPERATION: TYPOLOGY AND NETWORKS

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Several researchers and institutions argue that, in the current situation of economic and financial crisis (OECD, 2009b; UE, 2010; Huertas and Salas, 2012; Pérez, 2011, 2012), the conditions for growth must focus on boosting innovation, among other issues. The effects of this innovation will depend on how it is disseminated to the rest of the business fabric (Boschma, 2009, 2005; Ceci and Iubatti, 2012; Boggio and Dematteis, 2002; Rezzónico and Muñoz, 2009). In this context, it has been proved that few times are companies able to innovate individually (Cooke and Morgan, 1993, 1998; Fernández de Lucio, 2009; Jordá and Ruíz, 2012) and that the introduction of new products or processes into the market depends on their ability to establish links with external agents. Thus, innovation must be understood as a process with connections and feedbacks between different agents. Through this process, knowledge is created, transferred and applied with the aim of providing society and economy with a real added value (OECD, 2009a; Krüger, 2000; Koschatzky and Sternberg, 2000).

This conception of innovation as an open system of relationships (Chesbrough, 2012) requires that the company focuses on its essential capacities, outsourcing those which are not crucial for its competitiveness. That is why the main reason for a company to cooperate is to gain access to a valuable knowledge and develop the capacities which it lacks. This is one of the strategies used by companies to organise their innovative activity and, at the same time, a necessary condition for its competitiveness (Kantis, et al. 2005). However, to acquire knowledge through cooperation, they need to have their own basis, suitable resources and certain skills that are only obtained if activities of research, development and others related to innovation processes have been internally undertaken before (Cohen and Levinthal, 1990; Chaston and Scott, 2012).

At the same time, relationships between different agents play a key role in the development of a territory (Noguera and Esparcia, 2008). The lack of cooperation could be an obstacle to the transmission of knowledge, especially in an area such as Andalusia where low-tech small and medium sized enterprises are predominant. Meanwhile, on the contrary,

network participation can contribute to the dissemination of innovation, favouring the territory competitiveness and dynamism (Nieto, 2010; Martínez Puche, 2012). For its part, the territory plays a key role as a generating and favouring agent for cooperation relationships. In this sense, there is a wide range of information infrastructures and organisational structures (Méndez, et al., 2010; Ondategui, 2006) that generate and transfer knowledge to the territory. These agents are universities (Hewitt-Dundas, 2013), technology centres, research institutes and science parks, which generate and contain stock of knowledge. This knowledge applies to the business fabric and turns these institutions into differentiating and mobilising horizontal agents for all the territory under their influence.

With the suitable environment and the resources to acquire and adapt knowledge, innovative companies regard cooperation agreements as an essential way to: a) reduce financial costs and time derived from innovation activities (Acosta and Modrego, 2001; Miotti and Sachwald, 2003; Nieto and Santamarina, 2006) and, at the same time, b) improve and acquire competences and capacities for the development of innovation processes (Steensma, 1996; Sakakibara, 1997; Edwards et al., 2011).

There is a wide range of ways (as much as agents) to organise cooperation relationships. However, they can be divided into and distinguished between (Koschatzky, 2002 and Cooke and Morgan, 1998): 1.- Relationships with other production and service companies: certain firms, mainly high-tech, cooperate and, at the same time, compete against its partners. These links are based on the complexity of the innovation processes, the unequal distribution of resources among agents (Quintana and Benavides, 2004) and the numerous capacities needed to materialise and introduce innovations into the market; 2.- Relationships with research, transfer and consultancy institutions: collaboration with the university (Azagra et al. 2006) and public research centres is considered the connection with science. These links are especially beneficial for both agents. On the one hand, scientific institutions provide guidance for private research in order to improve and create technologies which are more complex and difficult to imitate. They help companies to design strategies avoiding highly expensive projects and facilitate access to technologies that they do not master. Therefore, they meet part of the needs of the firms with regards to R&D (mainly on their initial processes). On the other hand, private agents provide an important source of income to acquire instruments, hire researchers,... Furthermore, they are the connecting channel with the fast and changing market which puts real value on innovations.

Based on these theoretical arguments, the objectives set are: a.- to detect distinguishing features of the companies of the Andalusian innovative fabric capable of reaching cooperation agreements from those which do not acquire knowledge this way; b.- to make known the geographical scope of the cooperation networks of the Andalusian innovative companies in order to estimate the connectivity with the immediate environment and/or the capacity to relate to entities from other territories to acquire external knowledge; c.- to identify and explain the existence of a typology of Andalusian Innovative Companies (*EIA, Empresas Innovadoras Andaluzas*) according to cooperation relationships based on structural, sectorial and territorial features, the provision of resources, experience in R&D and the characteristics of the cooperating agents.

When conducting the study, the main difficulty to deal with is the non-existence of suitable official statistical sources which provide the necessary information to analyse the coop-

eration relations of the *EIA*. In this case, the adopted solution was to obtain information directly from a wide process of surveys conducted during the first quarter of 2012. A representative sample of 263 Andalusian innovative companies-establishments was surveyed (through a stratified sampling of the Directory of Andalusian Innovative Companies -*Directorio de Empresas Innovadoras Andaluzas*-, created by Andalusian Geographical Studies -“*Estudios Geográficos Andaluces*”-). Out of the 263, 181 firms were identified as reaching agreements for cooperation on innovation.

The variables used in the study are: 1.- *Details of the Andalusian Innovative Company surveyed* which include structural features (sector of activity, location, location in Science and Technology Park, invoicing, internationalisation, type of capital); aspects directly related to the innovative activity (effort, type of innovation activity, type of product, technological results, technology market); internal resources on which they maintain their essential capacities –human, organisational and physical-. 2.- *Details of the cooperating partners*: type of institution (companies of capital goods, engineering and advanced services, universities and other public research centres) and location; importance that active projects have for the development of innovation processes. 3.- *Andalusian Knowledge Agents*: out of the 232 Agents of the Andalusian Register, a database of their own has been created to link each of them to their municipal code and, from there, to the location of the *EIA*. There are distinctions between: knowledge generating agents, technological and knowledge areas, entities directed to the application and transfer and entities supporting the management and dissemination of knowledge.

With this complex information, the work has been carried out in several stages. In the first stage, the analysis unit used was the 263 Andalusian innovative companies of the initial sample so as to identify the structural and innovation differences between those with cooperation agreements and those without them. In a second stage, the information used has been the one related to the cooperating partners (344 agents) of the 181 *EIA* with agreements. The reason is that it was necessary to classify/ codify them according to type and location to detect the types of networks (each of them has been given a code) established by the *EIA*. With all these, a new database including those 181 cases has been generated. All variables described above have been linked to the aforementioned database.

Thus, with this new database and in order to identify the existence of a typology of Andalusian innovative companies on the basis of their cooperation relationships, a mixed procedure of cluster analysis (Elías and César, 2007), widely validated and used by the research group “*Estudios Geográficos Andaluces*” (Jordá-Borrell and González, 2009; Lucendo, 2007, 2009; Lucendo and González, 2012) has been performed. It combines the analysis of hierarchical clustering and the analysis of k-means. The first procedure is characterised by the development of a group structure starting with the distance between individuals, which is represented graphically by a classification tree (dendrogram). From the study of this, the necessary information about the number of cluster that can be formed is obtained. By analysing the dendrogram, the existence of 5 groups of companies was clearly identified. However this method does not offer a table with the partition of the group of companies for each belonging cluster and the characterisation of each kind (with the average value of the clustering formed around the centroid), according to the variables used for this grouping. To obtain this infor-

mation, an analysis of k-means is performed as a non-hierarchical method of classification of individuals in k cluster, where k is the number of groups (5, in this case).

The results of the research show that, in the search, acquisition and incorporation of external knowledge relevant to undertake innovation activities and with the need to improve competencies and capacities, 68.8% of the *EIA* participate in cooperation networks which are mainly limited to the regional level. Furthermore, they are shaped with Andalusian knowledge generating agents (43% with universities and 20% with other research institutions).

Indeed, coinciding with the contributions of Fernández de Lucio, 2009; Edwards, et al., 2011; Buesa and Navarro, 2001, among other studies, there are a series of differentiating features regarding size, location, sector of activity, internationalisation and innovation effort among companies of the Andalusian innovative fabric which cooperate and those which do not participate in these links. A general characterisation of this last group is: belonging to a sector of production dominated by the providers, being located in a medium city, making low investment in innovation activities and being a creator of improved products. On the contrary, cooperating *EIA*, which are big invoicing firms from sectors based on science, are more involved in innovation activities, generate a greater volume of new products for the company and the market, are located in big metropolitan areas and are internationalised.

The experience and trajectory in innovation activities are another key requirement to reach cooperation agreements and gain access to a complex knowledge which is lacking since the internal development and the inclusion of external knowledge are complementary mechanisms in the innovative performance of the companies. Hence, and coinciding with the conclusions of the studies by Cassiman, 2009; Cassiman and Veugelers, 2006; Ceci and Iubatti, 2012, conducting the internal research increases the capacities to integrate into networks at the same level as other cooperating partners. In this way, the type of cooperation network (geographical scope and the type of scientific or corporate partner) which makes up the *EIA* is determined by the innovation activities which the company undertakes. 78.3% of the *EIA* which conduct basic research cooperate with the university and public research institutions (*OPI*, *Organismo Público de Investigación*), while those which undertake engineering (50.7%) and technologic development (28.6%) projects are the ones which create business-to-business networks.

In Andalusia, the geographical proximity between agents is a key element to facilitate knowledge transmission. However, the geographical area of action of the network (when it is only made up of private companies) expands and non-European countries (from North America, South America and Asia) cooperate with the Andalusian companies (23% of the collaborating firms). It must not be forgotten that private companies which are partners of the *EIA* still represent 59% from Andalusia, 17% from the rest of Spain and only 1% from Europe. Therefore, Andalusian innovative companies do not relate much with international entities under the umbrella of cooperation. Besides, provided that they do so, they constitute simple networks with a single agent located abroad.

A significant fact to highlight is that there are no cases of *EIA* in rural areas with agreements signed with other companies (they only take part in networks with public agents). Therefore, it can be understood that they do not have enough capacity or accessibility to perform joint actions with other firms. Thus, the agreements are only public under a whole institutional framework which promotes them through promotion programmes and they develop

with the drive of different interface structures. On the other hand, for nearly two decades, medium cities have been opening the relational space to establish cooperating links with Spanish and European firms.

Moreover, the density of the companies (cooperating advanced services) in large cities, along with a greater concentration of Andalusian knowledge agents, encourage the generation of cooperation links, turning into a localised geographical phenomenon, based on the proximity and homogeneity of knowledge (Martínez Puche, 2012; Méndez et al. 2010; Ondategui, 2006). In this way, it is in urban agglomerations where the favourable environment to sustain synergies which makes knowledge dissemination easier is created. This way, the integration into networks with other territories (Jordá and Ruiz, 2012) which provide the path for the integration into international processes is stimulated.

Likewise, the cluster analysis has highlighted the existence of an *EIA* typology, according to the cooperation relationships whose differentiation between groups is determined by: a.- internal variables of the company directly related to innovation (investment, activity and product), b.- type of network to which they belong according to the geographical area of action c.- geographical proximity to the Andalusian knowledge agents and other entities which make formal and informal relationships easier.

The results reveal that 48% of the Andalusian innovative companies take part in networks limited to the regional area but play roles and have different capacities in their cooperation relationships. In this sense, the roles of group 1 and group 2 make a contrast. The first one is made up of firms of Andalusian capital with small cooperation capacity, linked to public research institutions in simple regional networks generated with the support of transfer agents. For them, the small investment in innovation of the small enterprises of engineering and technological adaptation reduces their relational capacity to reaching cooperation agreements with university research and advanced service groups. However, these are firms which benefit from the resources available on the territory so that they can make improvements in their products. The scope of acquisition and absorption of knowledge is based on geographical proximity.

This behaviour is different from that of the big internationalised companies (through technology purchase channels to their parent companies abroad) with experience in R&D and capacity to cooperate with other firms and public research institutions (*OPI*) in Andalusia. In spite of not devoting a high investment effort in innovation, they are companies which boost and promote cooperation among Andalusian agents through consolidated and lasting agreements with nearby research institutions (universities). Therefore, these *EIA* are, in many cases, the ones which contribute to the funding and orientation of research conducted in the nearby universities. This fact responds to a linkage strategy with the territory by means of researchers' training and knowledge exchange through constant formal and informal relationships (inclusion of researchers in the *EIA*). Thus, a lasting network for regional knowledge dissemination is created.

On the other hand, 49.6% of the *EIA* have capacities to take part in projects of major importance with business partners (group 4) and to create multiple networks of state scope with the aim of generating technology (group 5). The cooperation capacity of the first, located in Technology Parks, is accompanied by a considerable economic effort in innovation (15.25%). They are companies of great importance regarding the percentage of skilled

workers and, above all, the demand generated on the rest of auxiliary companies. The importance of their projects and the linking and identification of technology areas contribute to create consolidated and specialised fields from the sectorial point of view. According to the data analysed, it could be asserted that in the cases of the Parks in Málaga, Seville and Granada, there are strong functional connections with the universities located within these cities. These institutions are encouraging the growth of companies based on knowledge and specialised advanced services to satisfy the demand of other nearby companies. These three cases of Science and Technology Parks are the ones which seem to be achieving their aims regarding the organisation and boost of relationships between business agents and research institutions. The rest of Andalusian science and technology spaces still seem to be far away regarding the stimulation and management of knowledge relationships between universities, institutions, companies and markets.

Likewise, according to the results that Cassiman and Veugelers, 2006, had obtained in other regions for the science based firms in agglomerations, the accumulation of knowledge and experience empowers them to establish cooperation connections out of Andalusia (state level). These, along with the cases of medium cities in Seville (food agriculture), make the dissemination of knowledge in Andalusia easier. The aforementioned knowledge had been acquired from the outside through the creation of networks with national and regional institutions. Its medium-high economic effort in innovation activities has been channelled into the generation of technology. This dynamic requires human capital (Cecci and Iubatti, 2012) involved in its innovation processes and joint interaction of all technical, organisational and strategic resources among others. This way, the accumulation and movement of knowledge in the territory, the skilled workforce and the use of experimental technology qualify them to find their way into the technology selling markets.

It must be highlighted that only 2.2% (group 3) of the Andalusian innovative companies have, exceptionally, a great capacity and trajectory in cooperation. They are the generators of multiple and mixed networks which favour the connections and exchange of knowledge between laboratories and nearby research centres and others located abroad.

All in all, although the percentage of *EIA* with established cooperation agreements for innovation is high, these must improve their capacities to create networks of a higher complexity and diverse geographical scope which will allow them to gain access to, acquire and absorb complex knowledge. Half of the existing networks are still limited to the regional area and there is always a public research institution involved. In order to diversify the type of networks with the involvement of different agents and diverse geographical areas which provide value, based on the wide literature review and the result of this work, improvements of two essential aspects for innovative companies and the territory have to be made. On the one hand, they must increase the innovation effort since, in order to detect the worth and importance of external knowledge, it is necessary to have a basis and previous skills which would improve human, technical and organisational capacities. On the other hand, they must introduce themselves into the international channels as internationalised firms are the ones which drive and stimulate relationships between public research institutions and the rest of the Andalusian innovative business fabric.