Industrial Clusters, Innovation and Universities – The Role of the University in a Textile Cluster

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Abstract

The main purpose of this paper is to contribute to the discussion about the role played by universities in the traditional industrial clusters, as a result of the changing situation of the competitive environment. To achieve this objective, our work makes a study of an industrial cluster for a so-called traditional sector with serious problems of competitiveness. The study results show how the cluster has changed the redeployment of its relational capital, becoming more important the relationship between the companies of the cluster and the University. This is caused by the search of a greater product differentiation, through processes of innovation and product improvement in which the University plays an important role.

Keywords: *university-industry relations, innovation, industrial cluster, textile industry.*

1. Introduction

For many years industrial clusters have played an important part in the industrial growth of many countries. The companies operating in these clusters have benefited from the presence of a series of external, non-commercial inter-dependencies (Storper y Scott, 1989; Storper, 1992) in order to successfully meet the challenges of the market place. However, in recent years, the international competitive panorama has undergone an intense and sudden transformation, particularly in terms of new competitors, technology and markets.

These changes and their repercussions have had a great impact on the majority of industrial clusters, especially those considered to be traditional or *low-tech*. Many of these clusters now find themselves in a critical situation (Onida et al., 1992; Harrison, 1994; Passaro, 1994; Alberti, 2006). Faced with these new circumstances, the role that local institutions play in helping clusters to adapt to the new situation is taking on an ever greater importance. In the context of this research, we consider local institutions to be those that are locally based (both private and public) and which offer collective support to companies within the cluster. These local institutions may be universities, professional training centers, research institutes, industrial policy agencies, technical assistance organizations or business and professional associations. These institutions are important agencies within territorial networks as they provide specific knowledge gained through their position as intermediaries (Baum and Oliver, 1992; McEvily and Zaheer, 1999). Local institutions often have a diverse circle of contacts external to the cluster, but at the same time are close to the firms themselves, which means that they can explore and transfer information and knowledge from outside to within the network.

In summary, the intermediary position of local institutions facilitates the acquisition of new capacities through the gathering and diffusion of knowledge (Molina-Morales et al, 2002). Local institutions also reduce the costs related to the search for external sources of knowledge, which is of great importance for the companies within the cluster. In maintaining an extensive network of links, these intermediaries generate search economies (Molina-Morales, 2005).Moreover, due to the fact that local institutions interact with many of the companies in the cluster they witness a wide variety of solutions to organization and management problems. From the range of experience acquired from observing how problems have been solved, local institutions, in their role as intermediaries, can compile and pass on capacities and solutions. In effect, local institutions facilitate business innovation through access to information and resources, which in turn allows firms to acquire new capacities and strengthen existing ones (McEvily and Zaheer, 1999).

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However, it is important to distinguish between universities and public research organizations on one hand, and business associations and chambers of commerce on the other, as they perform different roles when acting as intermediaries between firms in the cluster and external networks (Belussi and Sedita, 2009), as we will see in this work.There has been a great deal of theoretical and empirical literature studying the collaborations between universities and industry. These studies have generally shown that the main motive for these collaborations has been the possibility of accessing new knowledge along with increasing the internal capacity of businesses (Hagedoorn et al., 2000). On one hand, the literature on innovation has often focused on the relationships between various types of *spillovers* and cooperation in R+D in which the university is seen as a generator and member of innovation projects. On the other hand, the literature on management or strategy has focused mainly on internal factors of the company in order to determine their propensity to collaborate with the university, including factors such as size, age and R+D intensity of the company.

These studies also indicate that the most extended and used of the university's knowledge is related to technology (Klevorick et al., 1995). It has been suggested that the technological capacity of a firm (measured as investment in internal R+D) is directly associated to their consideration of the university as a source of knowledge for innovation (Mohnen and Hoareau, 2003; Laursen and Salter, 2004). However, in the literature, the idea that size of firm is a determinant factor in possible collaboration has received little support. While some studies have reported a positive relationship (Bayona et al, 2002;. Miotti and Sachwald, 2003), others (Abramovsky et al, 2009) have found no significant association. Whichever the case, the influence of *spillovers* – especially those derived from scientific agencies – generally shows positive results (Belderbos et al, 2004).

Laursen and Salter (2004) and Fontana et al. (2006) suggest that when companies open up to their business environment, it tends to have a significant effect on the probability of them interacting with universities. Bercovitz and Feldman (2007), when exploring how innovation strategy influences the level of commitment a company may have with university research, found that the companies with more wide ranging exploratory research strategies spend a larger proportion of their resources on research projects with universities, and these projects tend to be part of a long term relationship.

In the particular case of industrial clusters, the action of a university is conditioned by the context in which it is found. There are important differences between traditional *low-tech* clusters and sectors that are more technology oriented or *high-tech*. And thus, while in this second area, universities are usually leading institutions in processes of innovation and improvement (Gertler, 2010), in traditional clusters, their role is not so evident (Belussi and Sedita, 2009).However, in spite the general view of the positive effects of university collaborations, there is not unanimous agreement on their value, especially in times of radical external change. In the literature there is evidence of cases where support institutions and organizations have failed to detect imminent changes (Glasmeier, 1991), acting more as barriers instead of agents of change. Therefore, it is important to have a clear idea of the role of universities in the adaptation of traditional or *low-tech* clusters to changes in the competitive context (Belussi and Sedita, 2009; Gertler, 2010).

The objective of this present work is to contribute to the debate on the role played by universities in helping companies located in traditional clusters to adapt to these radical external changes. To be more specific, with this work we aim to analyze the role of the university in the adaptation to the new competitive panorama of an industrial cluster from the textile sector, one of the manufacturing areas most affected by globalization (Sammarra and Belussi, 2006). With this in mind we proposed the use of the methodology used by Yin (Yin, 1989) to analyze the influence of a School of Engineering in the adaptation of the Valencian textile cluster to changes caused by the massive influx of Asian products after the free-market changes of January, 2005.
The paper is structured as follows: firstly, we present the main characteristics of the cluster under study; following this, we show the results obtained; and then we describe the general implications of the work; and finally, we discuss any limitations to the work and propose future lines of research.

2. Case study

2.1. The Valencian textile cluster

The textile industry is a diverse and heterogeneous sector, covering a wide range of production activities. These activities range from production of fiber to manufacture of clothing garments and other final products for the consumer. Each of these stages has its own particular characteristics. We are dealing with a sector which, according to the classification of the Cooperation and Economic Development Organization (CEDO), is defined as having weak demand and low technological content, characterized by labor intensive production processes, especially in final product elaboration Currently, the textile sector in developed countries is facing an unprecedented crisis in which firms are dealing with critical challenges and changes. How they respond will decide their future competitiveness and even their survival.

Although there have been several different reasons for this situation, the determining factor is generally considered to be the increase in competition from Asian countries after the GATT Uruguay conference agreement of 1993, which allowed the progressive elimination of the Multi-fiber Agreement leading up to the complete liberalization of textile manufacturing markets on January 1, 2005. Before this agreement was reached, analysts identified a certain geographical pattern, in which countries with the lowest labor costs performed the manufacturing procedures with the least added value, generally the start of the value chain, while the more developed countries concentrated on production and distribution of finished products (OCDE, 2004). However, this scenario has changed recently with the appearance of a collection of countries that are creating powerful agglomerations of textile firms capable of developing the entire textile process and with the capacity to supply a wide range of products to developed countries at very low prices.

The consequences of these developments are visible in the Spanish textile sector, where we have seen large-scale closures of firms in recent years, resulting in huge losses, as well as a decrease in coverage rate, as can be seen in Table 1.

Insert table (1) about here

The Spanish textile sector is made up mainly of small and medium sized, family run companies. Although the industry is distributed throughout the country, the greatest concentrations of firms are found along the Mediterranean coast, above all in the Valencia and Cataluña regions, with other areas, such as Castilla la Mancha, Andalucía and Galicia, also having a significant textile presence. These types of concentrations correspond strongly with clusters or industrial districts as identified by Boix and Galletto (2008), constituting 31.5% of the sector as a whole. To be exact, there are 53 industrial textile districts in Spain, which are generally considered to have specialties in which knowledge is little used in their activities.

The Valencian textile industry is found mainly in the north of Alicante province and the south of Valencia province and represents a classic cluster or district structure. The principal products are home textiles, although the production in the sector known as *technical textiles* has grown rapidly in recent years. Table 2 shows the deceleration process taking place in this cluster in relation to levels of employment and production.

Insert table (2) about here

The data obtained shows a significant reduction in production, employment and export levels between 2003 and 2008, with negative growth values. For many companies, the working situation has reached breaking point as they cannot compete with imported products in terms of prices, due to the low labor costs in Asian countries compared to those in Europe. Companies in Asia can generally keep their machines running for longer and often enjoy state subsidies. All of this is driving strong changes in company strategy and production organization. Many firms are changing away from low cost, labor intensive mass production toward a new model based on flexibility, quality, design and the search for added value in all phases of the production cycle, as we will show later in the paper.

2.2. The Alcoy campus of the Polytechnic University of Valencia

The Alcoy campus of UPV began life as the Real Fábrica de Paños de Alcoy (RFPA), which, during the second half of the eighteenth century and first decade of the nineteenth century, embarked on a period of renovation and industrialization, offering contracts to foreign technicians and experts in textile dying machinery. Moreover, this organism developed the policy of sending representatives to distant places to gather knowledge on textile innovation and machinery which they could then introduce in Alcoy.

The second decade of the nineteenth century was a turbulent time in the Spanish textile industry, a time which saw wide-scale protests by workers against the introduction of the new machinery that was replacing many of the manual workers. These events, allied to the fact that Alcoy industry was not technologically up-to-date, in spite of the efforts of the RFPA, meant that it became necessary to train technicians who, after theoretical and practical preparation, were able to competently manage the various sections of a mechanized textile factory.
This initiative was confirmed in the session of October 29, 1828, of the Real Fábrica in which it was agreed to create and maintain, at their expense, industrial training courses which would be called Artistic-Scientific Training, known at the time as "Escuela de la Bolla", after the old trade union hall of the founding entity. This project came to fruition without problems or delay and the courses were started the following year. A plan of four academic areas was developed in which the following subjects were taught: reading, writing and accounting in the first group; arithmetic and algebra in the second; geometry, mechanics, physics and geometric design applied to arts in the third; and finally chemistry in the fourth. The duration of the Artistic-Scientific Training course was five years. Later, in 1953, there was a Royal Decree (RD) to create three technical training centers and Alcoy was one of these.

The center gained official status and was named "Elementary Industrial School", receiving subsidies from state, municipal and industrial funds. From that time, state funding gradually increased, becoming the principal source of money. The RD of August 30, 1862 created different qualifications, the first of which covered chemistry and the second mechanics. These types of schools were soon super-ceded by other types of center, but Alcoy was committed to the school and it became the only technical training center of its type.
The RD of August 17, 1901 radically reformed superior studies and the center changed its name from Elementary Industrial School to Superior Industrial School. It began to offer courses under this name at the beginning of the 1902-03 academic year, specializing in mechanical, chemical and electrical engineering. Further specialties of manufacturing and textile were added by RD on January 10, 1902, followed by technical drawing in 1907.

In 1910, the Industrial School was established after the merger of the Superior School and Elementary School (which had been more focused on art and trades).
There were several more reforms and various name changes until the RD of July 22, 1942 introduced changes in the study and teaching plans and the University became known as School of Industrial Expertise. In 1964, after another name change, it became the "School of Industrial Technical Engineering".
In 1972, the school was integrated into the Polytechnic University of Valencia and the name became the "University School of Industrial Technical Engineering". Since 1983, the school has offered five degrees: Chemical Engineering; Mechanical Engineering; Electrical Engineering; Textile Engineering; and Electronic Engineering.

When the LRU came into force in 1986, The University acquired a new internal structure in which the school was divided into departments or faculties. Due to the new structure and the singularity that Textile Engineering represented within UPV, the headquarters for Textile and Paper Engineering were located in Alcoy. Since 1991, this department has offered Doctorate courses (3rd cycle).

In the 1993/1994 academic year, the Telecommunications Technical Engineering degree was initiated. Later, in the 1994/1995 academic year, the 2nd cycle degree of Industrial Organization Superior Engineer was added, which meant the School became the "Superior" Alcoy University School. Because of this, on July 19, 1994, the Inter-University Council approved the new status and the institution gained the name that it currently bears, "Escuela Politécnica Superior de Alcoy (EPSA)" or Alcoy Superior Polytechnic School as stated in DOGV number 2423 of January 9, 1995.In the 1995/1996 academic year, as well as the qualifications already mentioned (all with new study plans since 1993/1994), a new degree, Industrial Design Technical Engineering was added. In 1997/1998, the Business Administration and Management degree was introduced. These additions were followed by Materials Engineering in 1999/2000 and Technical Computer Engineering in 2001/2002. Finally, in 2007-08 the Textile Engineering Master's degree was introduced which was given a quality seal of approval by the Ministry of Education.

Currently, the University is in the process of European convergence, and in the Alcoy campus the University offers six degree courses and one Master's degree adapted to the criteria of the Espacio Europeo de Educación Superior (EEES). At the research level, there are 160 researchers integrated into groups or research centers, who generated 1.300.000€ for R+D projects in 2008.

3. Analysis of the collaboration between the University and the companies in the cluster

Traditional industrial clusters are now facing a serious reduction in their competitiveness, and it is no longer enough to merely have an agglomeration of firms to achieve growth. It is now necessary that clusters modify their traditional patterns of working and their defining principles. These changes are particularly necessary in how production is organized and in relationships external to the cluster (Sabel, 2004; Biggiero, 2006; Zeitlin, 2006; Chiarvesio et al., 2010). In this context, the key element has become the relationship between training, innovation, efficiency and market expansion (Belussi et al., 2003). To be more precise, clusters must develop what Humphrey and Schmitz (2002) call *upgrading*. These authors identified four types of strategies that firms can develop: improvements in processes; product; functioning; and inter-sector relationships.

The simplest areas to improve are those of processes and product, which consist, respectively, of the most effective transformation of raw materials to finished product through reorganization of production systems or introduction of new technology; and a change in focus towards more sophisticated products with high unit prices. These ways of improving are, according to Sammarra y Belussi (2006), common in many clusters or industrial districts and can be achieved through adaptive learning and innovation. However, although these strategies may improve competitiveness in the short to medium term, similar action in the future on the part of emerging countries will again threaten those clusters that have only developed strategies focused on these two types of improvements.

For this reason Humphrey and Schmitz (2002) proposed two other more complex types of possible improvement that would allow firms, especially in the manufacturing sector, to reduce the vulnerability created by the production specialization of the cluster when facing new competition from countries with developing economies (Giuliani et al., 2005). These are functional improvements and inter-sector improvements. Functional improvement refers to companies assuming new functions of greater value in the production chain, such as R+D, design and marketing, and the abandonment of existing low value activities. Inter-sector improvement refers to cluster companies reaching for new sectors. The collective action of these two improvement strategies has been called the fast lane toward competitiveness. Whereas focusing on reducing costs and consequently prices is considered to be the slower way to achieve competitiveness (Sammarra and Belussi, 2006).

In order to achieve competitiveness quickly, the companies within an industrial cluster must search for new opportunities to improve and renew their capacities, especially those related to innovation, and it is in this area that collaboration between universities and companies can play a major role. If we analyze the evolution of collaborations between companies in the cluster and the university in recent years (Table 3), we can see how collaboration related to innovation (contracts and agreements for R+D and technical support) between the University and companies has increased dramatically compared to collaboration unrelated to innovation (general services, testing, training, etc.). However, it is important to point out that university-company collaboration has suffered due to the financial crisis that began at the end of 2007, and we can see a clear decrease in 2008. This decrease did not last long and there were clear signs of recovery in 2009.

Insert table (3) about here

Figure 1 shows the increase in R+D collaboration between firms and the University that took place just before the liberalization of the markets in January, 2005, and this trend continued until the second half of 2006, at which point it began to stabilize. At the end of 2007, the first effects of the crisis were felt, although this could be seen more clearly in 2008, when the negative impact of the crisis on University-company collaboration became much more appreciable. However, this trend toward a decrease in collaboration quickly faded and during 2009 recovered to the levels seen in 2006 and 2007

Insert figure (1) about here

Finally, if we break down R+D collaboration into technical support, contracts and agreements (Figure 2), we can see that technical support activities, which are related to strategies to help in the search for improvements in processes in products, were the first to be adopted by cluster companies in their collaborations with the University. However, from 2005 onwards, there was an increase in activities related to R+D, which is to say those where companies were looking for functional and inter-sector improvements as proposed by Humphrey and Schmitz (2002) as a third option. With this type of collaboration the objective was to achieve sustainable increases in competitiveness, as companies took on new higher added value functions, such as R+D or design.

Insert figure (2) about here

To summarize, the first response by companies in the cluster to the new situation was to try to compete with products from emerging economies by improving processes and products. Process improvements were aimed at increasing efficiency in production activities by reducing production costs. However, although this type of improvement allowed companies increase their competitiveness a little, these cluster companies were still at a real disadvantage. This is due to the extremely low labor costs in countries with emerging economies, as well as the fact their costs continue to fall as their production technology and organization improves.
Moreover, improvements in products have allowed companies to employ strategies whereby they placed their products in higher quality markets. However, if countries with developing economies continue to improve the quality of their products, there is a risk in the future that they too will enter these markets, once again threatening the competitiveness of companies from developed countries.

For reasons such as this, this type of strategy does not generate sustainable competitive advantages in the mid to long term. Thus, we saw from 2005 onwards a change in trends concerning strategies. Initiatives concerned with technical support began to decline and there was an increase in collaborations designed to gain competitive advantages mainly through innovation. This increase has occurred for two main reasons. Firstly, local companies have approached the University to help them improve their innovation capacity and to thus achieve sustainable competitive advantages. Secondly, research groups from the University have actively sought collaborations with companies on research programs promoted by the administration at both regional and national level. In fact, if we analyze in more detail University-company collaborations, we can see a proliferation of joint programs in which collaboration networks involving companies and the University or technical institutes, such as those promoted by IMPIVA (Instituto de la Mediana y Pequeña Empresa Valenciana), which are designed to support R+D and innovation development in local companies.

We can also see an increasing amount of collaboration between the University and the Instituto Tecnológico del Textil (AITEX), Although perhaps not at an institutional level, there are collaborations involving researchers from both institutions in joint projects and programs. There is also a clear fall in collaborations around the beginning of the current crisis, but this trend was reversed with some recovery taking place in 2009.

4. Conclusions

Faced with these changes in the textile sector, companies in the cluster have been forced to change their strategies in order to adapt and survive. In particular there has been a change from strategies designed to reduce costs to strategies designed to differentiate the company both in terms of products and services. In order to achieve this it has been necessary to establish links and carry out collaborations with the University.

The results of this study show that, in terms of redistribution of capital, relationships between the University and companies are becoming increasingly important, and there is a clear increase in the amount of collaboration at the R+D level. Highlights of this trend include lines of research between leading companies in the cluster and the University, along with participation in collective research contracts and projects between the University and the rest of the agents in the cluster in order to improve competitiveness and differentiate cluster companies in these times of fierce competition and globalization in the sector.

We wish to underline the fact that all of this has also led to a change in the role of the University within the cluster, in which it has become a key element in enabling a flow of information between agents in the cluster, acting as a link both internally and also to external networks, allowing access to new non-redundant information.

This research work has certain limitations that we wish to mention. Firstly, although the case study allowed us to understand in detail the characteristics of the companies in the cluster and their relationship with the network as a whole, there may be some bias due to the singular nature of the cluster in question which in turn restricts our capacity to generalize our results. Secondly, we have used a mainly qualitative approach, and so the data and values obtained would be reinforced by a later quantitative work. Finally, this work has focused on the specific role of the University as a driver of innovation in the period of dramatic change brought about by the liberalization of the international textile markets, but there are other implications which may affect other local institutions such as technology institutes. Therefore, it would be interesting to study the function that other agents of change within the cluster territory may have and how these may relate to the University.

As a line of future research we propose to study more deeply the innovative function of the University, analyzing in greater detail its involvement in the changes produced in relationships with other agents in the cluster. With this mind, we aim to study the cluster's OTRI network and its principal research groups, as well as the possible interactions with other institutions both inside and outside the cluster. We also plan to study the repercussions of the changes that have been made on the results of the companies in the cluster (in economic and innovation terms).

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Table 1. Development of Spanish textile sector.

	2003	2004	2005	2006	2007	2008
No. of companies	7.200	6.850	6.350	6.100	5.900	5.500
Employment (x1000)	257,5	243,3	223,2	206,0	196,5	182,3
Production (million €)	13.258	12.750	11.650	11.415	11.350	10.390
Added value (million €)	5.700	5.500	5.020	4.920	4.900	4.470
Imports (million €)	9431	10.031	11.011	12.336	13.383	13.281
Exports (million €)	6.437	6.627	6.659	7.356	7.814	8.005
Balance of trade (mill. €)	-2.994	-3.404	-4.352	-4.980	-5.569	-5.276
Coverage rate (%)	68,2	66,1	60,5	59,6	58,4	60,3
Export effort	46,5	48,8	54,3	62,4	66,2	73,2
Import penetration	56,2	59,7	66,9	74,1	77,2	82,2

Source: generated by the authors from *Centro de información textil y de la confección (*CITYC) data

Table 2. Development of Valencian textile cluster

Indicator	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Employment	43.000	40.300	38.150	36.625	35.620	32.100
Production (million €)	2.475	2.360	2.220	2.150	2.050	1.825
Added value (million €)	1.045	1.000	950	900	850	775
Exports (million €)	911	850	774	779	767	680
Imports (million €)	789	870	854	945	955	846

Source: *Asociación de Empresarios Textiles de la Comunidad Valenciana (ATEVAL)*

Table 3. Collaboration between companies in the cluster and the University

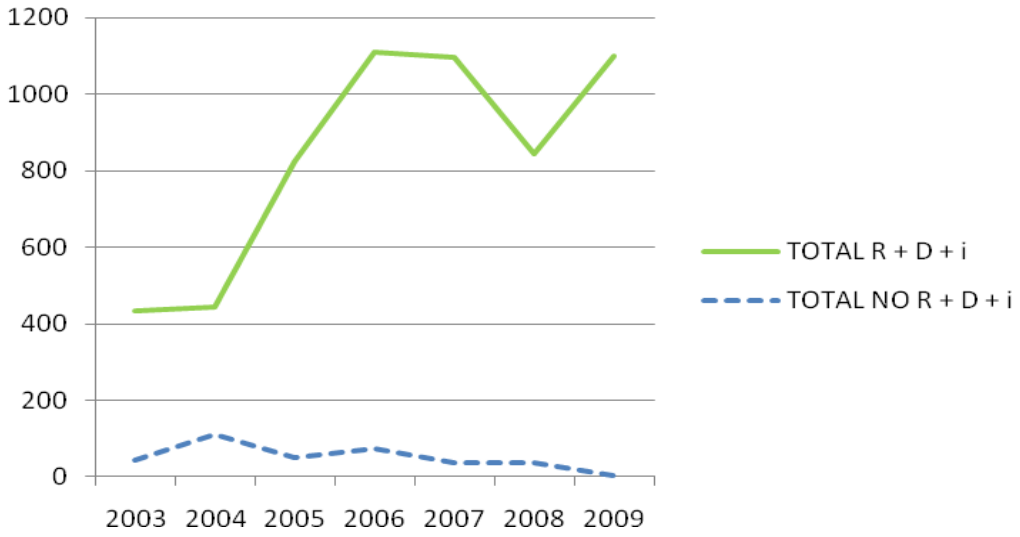
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Contracts and Agreements of R + D [1]	77	119	76	361	625	313	472
Technological Support	357	326	747	750	471	530	628
TOTAL R+D	434	445	823	1111	1096	843	1100
Testing services	15	24	14	38	8	19	4
Others[2]	28	88	37	37	29	19	0
TOTAL NO R+D	43	112	51	75	37	38	4
TOTAL	**449**	**469**	**837**	**1149**	**1.133**	**881**	**1.104**

[1]Value of contracts and agreements signed for R & D

[2] Other activities, contracts, agreements or subsidized training courses

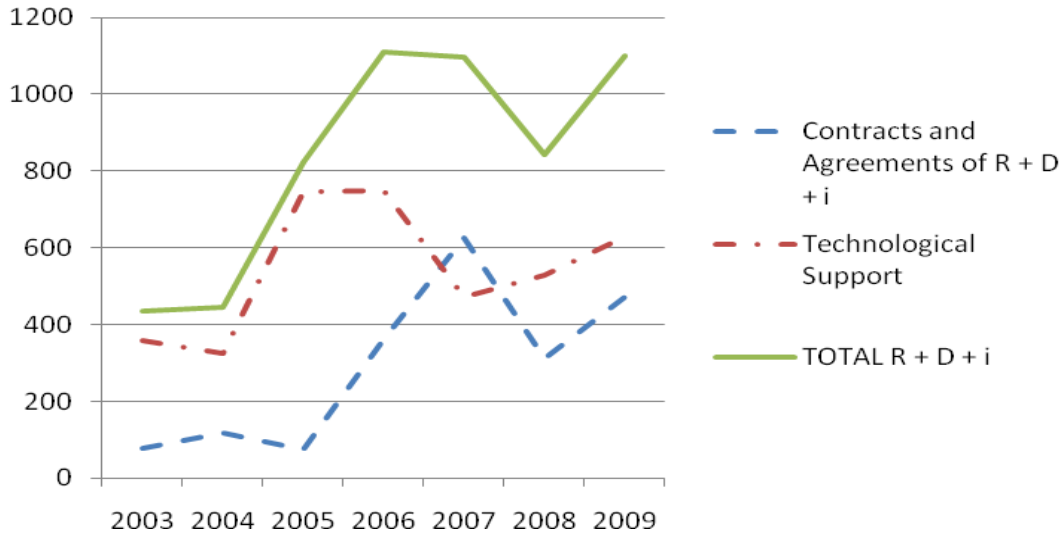
Source: Centro de Apoyo a la Innovación, la Investigación y la Transferencia de Tecnología (CTT) of the Universitat Politècnica de València

Figure 1. R+D collaboration between firms and the University



Source: Centro de Apoyo a la Innovación, la Investigación y la Transferencia de Tecnología (CTT) of the Universitat Politècnica de València

Figure 2. R+D collaboration between firms and the University (by parts)



Source: Centro de Apoyo a la Innovación, la Investigación y la Transferencia de Tecnología (CTT) of the Universitat Politècnica de València