



**STATE OF THE ART REPORT ON
UNIVERSITY-INDUSTRY CO-OPERATION AT
REGIONAL LEVEL:
The Region of Valencia**

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1 Background

In economies that are based on knowledge (OECD, 1996), the role of universities comprises three main functions: **knowledge production**, particularly through R&D activities, **knowledge transmission**, through the training and the publication of research results, and **knowledge transfer**, by providing solutions to the specific problems of social and economic agents. The first two functions are the classic responsibilities of any higher education institution; the last has come about as the result of the relationships of universities with the economy and the employment. Since the 1970s, universities have become increasingly aware of the importance of the third function, leading to a new university model known as the "modern university" (OECD, 1999).

The new university model involves direction of training and research activities towards the search for solution the social, economic and political problems, and pays more attention to the employment prospects of its students than the classical university. The third function of universities has transformed them into institutions with a strong service component directed towards the community, and support for local and regional development strategies (Fontela, 1994). In this sense, as Etzkowitz et al. (2000) point out, the role of knowledge, and the role that universities – as producers and transmitters of that knowledge, in innovation has become increasingly important. Universities have become sources of as both knowledge and human capital for new knowledge-based start-up companies.

The generation of new knowledge, technological advances and innovation, which are determinants of economic growth, are strongly tied to territory. This means that actions oriented to promoting innovation processes are relevant in a regional dimension, leading to the concept of Regional Innovation Systems (RIS). Autio (1998) provides a definition of a RIS as a social system made up of interacting subsystems with

particularities based on: (i) the dependent path followed by the institutions that constitute the system; (ii) the specificities of its framework; and (iii) its systematic features, what implies that, to understand such a system, all its elements and the interactions among them, have to be taken into consideration.

Universities and firms are the key elements of a RIS. The quantity and quality of their relationships and the existence of a co-ordinating regional policy for research and development (R&D), innovation and learning procedures to properly articulate the system, constitute a so-called “learning region” (Landabaso, Oughton and Morgan, 1999).

The relationships between universities and firms are not straightforward, since the main interest of firms focuses on problems and situations that require immediate attention (Sparks and Lesser, 1995), whilst academics tend to adopt a longer term perspective. Firms actively search external resources (customers, suppliers, etc.) for specific competencies related to their needs, in a bid to achieve tangible results in a short time frame (Santoro and Chakrabarti, 1999). Nonetheless, and in spite of certain cultural and structural incompatibilities between universities and firms, it is evident that there are some firms with significant scientific knowledge and absorptive capability and medium term technological strategies. These firms, which may require the support of scientific partners to speed up the development of their new products and processes, are mainly in science-based sectors, where innovation is strongly dependent on advances in scientific knowledge.

Analysis of university-industry relationships at regional level, therefore, is important; it is one of the main factors affecting the performance of RIS, which is what we want to emphasize in this study. The main aim of our study is to analyse the current state of university-industry co-operation in different European regions, with an especial

emphasis on the practices being developed by universities in areas such as teaching, the labour market, R&D and the setting up of start-up or spin-off companies based on technology and/or knowledge developed in universities.

This report emphasizes the socio-economic and geographic features of each region, the interactions and relations among the actors within them, the mechanisms for promotion and management and, finally, the legal-political framework that supports university-industry co-operation.

The study is organized as follows. Chapter 2 describes the socio-economic and geographic features of the region. Chapter 3 offers an overview about the state-of-the-art in terms of university-industry relationships, identifying and describing the main actors and the relationships among them. Quantitative and qualitative approaches are used in examining training and labour market requirements, interactions between universities and enterprises and how they are organized, and the entrepreneurial actions associated with the development of new firms based on university research results. Chapter 4 describes the innovation policies drafted and implemented at national and regional levels, and discusses tools to enhance co-operation between universities and firms. Finally, Chapter 5 provides conclusions and a description of the main strengths and weaknesses of regional university-industry co-operation.

2 Socioeconomic structure of the region

The Region of Valencia is one of the 17 Spanish autonomous regions. Located between Catalonia and the Region of Murcia, the Valencian territory is about 400 km by 60 km, and is on the Mediterranean Sea coast. It includes three provinces, which are, from north to south, Castellon, Valencia and Alicante (see Figure 2.1). It has an area of some 23,000 km², which represents 4.6% of Spain's territory. In 2004, its population accounted for more than 4.5 million inhabitants, 10.5% of the country's population and has a high demographic density compared to the Spanish average (195 inhabitants per km² compared to the national average of 85 inhabitants per km²). The region has traditionally been the target of internal migration, and in recent years there has been a significant influx of foreign immigrants. Between 1994 and 2003 a positive migratory balance of 21.0% was recorded¹.

Figure 2.1. The Region of Valencia.



¹ INE: Statistics of Residence Variations.

Government system

The Region of Valencia was constituted in 1982 by an Autonomy Statute passed by the Spanish Parliament, which was reformed in 2006. The Valencian Statute of Autonomy established the general guidelines for its political and administrative organization and the self-governing empowerment rules. There are three different levels of public authorities that coexist and interact in the region: the central administration, the regional administration and the local administration, this last includes the provincial and municipal levels.

The way that responsibilities are shared among the three different administrative levels in the region is not clearly defined. In most cases they are joint even in areas where responsibility has been conferred on a specific administration on exclusive terms. One example of this is foreign trade, which, in theory, is the exclusive responsibility of the central administration, but in reality is managed jointly with the regional administration, which develops its own promotional policies. Table 2.1 presents an outline of how responsibilities are shared among the different administrations. The degree of responsibility of the administration for each area is indicated by the 'intensity of the shading in the table. As can be seen, with the exception of social security and some public services such as airport infrastructure and telecommunications, most public responsibilities are, to a greater or lesser extent, shared by more than one administration.

Table 2.1. Shared Responsibilities

Area	Central Administration	Regional Administration	Local Administration
Public Services			
• Roads			
• Rail Transport			
• Airport Infrastructure			
• Seaports			
• Telecommunications			
Economy			
• Economic Development			
• Fiscal Policy			
Education			
Research and Development			
Health and Welfare			
Social Security			
Culture			

Regional economy

In the context of the European Union (EU), the Region of Valencia can be regarded as a peripheral region (OECD, 1997). In 2003, the participation of the Region of Valencia in the national economy was slightly below its demographic weight. In terms of GDP, it represented 9.7% of the Spanish economy. As Table 2.2 shows, in 2003, Valencian GDP per capita was over 16,000 euros, slightly below the national average. The Region's GDP per capita index compared to that for the whole of Spain, increased up to 2001 (95.3%); by 2003 it had decreased around 2.5 points (92.8%), showing no significant variation in the degree of convergence. However, there was clear convergence in the context of the EU-15: GDP per capita in the Region of Valencia increased from 53.9% of European GDP in 1995 to 64.8% in 2003.

Table 2.2. GDP per capita at market prices in the Region of Valencia and Spain (euros)

	1995	1997	1999	2001	2003
15-Member EU	19,023	19,911	21,783	23,905	24,950
Spain	10,820	12,456	14,064	15,904	17,434
Region of Valencia	10,269	11,780	13,386	15,155	16,175
Region of Valencia /15-Member EU	53.9%	59.2%	61.4%	63.4%	64.8%
Region of Valencia /Spain	94.9%	94.6%	95.2%	95.3%	92.8%

Source: Eurostat. National Institute of Statistics, 2004. Social Indicators. Income

Regional productive structure and sector specialization

In terms of the participation of the major productive sectors in total Gross Added Value (GAV), the economic structure of the Region of Valencia, similar to most developed economies, has moved towards a tertiary economy (see Table 2.3). In 2002, the GAV structure of the Region of Valencia was broadly similar to that for Spain, although industry and construction accounted for a greater share (21.0% and 9.2% respectively) compared to the national figures (18.9% and 8.6% respectively), while the relative share of the primary and energy sectors was lower.

Table 2.3. GVA Sectoral Distribution in the Valencian Region and Spain

	Region of Valencia		Spain	
	1986	2002	1986	2002
Primary Sector	5.6	2.9	5.9	4.2
Energy	4.9	2.8	6.3	4.0
Industry	28.3	21.0	24.6	18.9
Construction	5.8	9.2	6.9	8.6
Services	55.4	64.0	56.3	64.2

Source: National Institute of Statistics, Regional Accounts of Spain

In the Region of Valencia, the **primary sector** is relatively small and basically consists of agricultural exports, especially citrus fruit. The **energy sector** mainly consists of the production of electricity from thermo-nuclear, fuel oil and, to a lesser extent, hydraulic sources. Traditionally the Region of Valencia has been dependent for its energy supply on other regions (almost 50% of its total electricity consumption comes from other regions).

The **industry sector** includes a number of traditional low-medium technology sectors such as ceramic tiles, furniture, textiles, etc. A productive structure of small and medium-sized companies (SMEs) and the importance of exports are characteristic of these sectors, as is their location in industrial districts. There are a small number of companies in the knowledge-intensive sectors (pharmaceuticals, electronics, ICT, etc.) and despite the quite considerable number of innovative companies in the Region, degree of innovation intensity is fairly low since activities are directed towards the

acquisition of machinery and equipment rather than to development of internal R&D activities. This is due to the absence of knowledge-intensive and high-technology oriented firms in the region (a more detailed description of the regional specialized sectors is provided in Chapter 3).

Construction and buildings has grown considerably over the last 20 years as a result of demand for more housing, public projects aimed at improving infrastructure and communications, and investment in tourism infrastructure. Finally, the **service sector** includes a number of different sub-sectors with a long tradition in the region, transportation and trade being the most relevant.

The region's foreign trade is important to the national economy. In 2002, regional exports represented 12.8% of the national total. Despite a reduction in the traditionally positive trade balance of the Region of Valencia - around 15.4% in 1992 (De Miguel, 1996), the Region's export/import rate compares favourably with Spain's: in 2002 the Region of Valencia was 121.0%, well above the national average of 75.7%².

Human capital and technology resources

An economy's output depends, among other factors, on the number of people employed. The labour force participation rate in the Region of Valencia in 2004 was 58.6% and the employment rate was 52.1%. Both these percentages were two points above the national average. The rate of unemployment in the Valencian Region was 11.1%, slightly higher than the Spanish rate.

The structure of employment by economic sector, and its evolution in recent years, is presented in Table 2.4. In 2004 primary sector accounted for 4.2% of employment, construction 13.4%, industry and energy 21.3% and the service sector for approximately 61.1% of employment.

² Data from "Situación Económica de la Comunidad Valenciana". Economic Regional Notes. ICO (2004).

Table 2.4. Employment by economic sectors in the Region of Valencia

Sector	1996		2004		Growth 1996-2004
	No. employees ¹	Structure	No. employees ¹	Structure	
Primary Sector	81.9	6.2%	81.4	4.2%	-0.6%
Industry (energy sector included)	342.6	26.1%	416.2	21.3%	21.5%
Construction	128.4	9.8%	262.2	13.4%	104.2%
Services	761.1	57.9%	1,193.8	61.1%	56.9%
Total	1,314.0	100.0%	1,953.7	100.0%	48.7%

(1) Thousand of people

Source: National Institute of Statistics. Survey of the Labour Force Participation

Table 2.5 presents some indicators describing the economic and technology assets of the Region of Valencia. The proportion of the population aged between 25 and 34 with higher education qualifications increased from 18.0% in 1992 to 30.2% in 2002. This 2002 value is similar to the average for all OECD countries (29.0% in 2002)³, but lower than the level for Spain (36.7%). The percentage of the region's population with tertiary education between 25 and 64 years old was 20.7% compared to 24.4% in Spain.

In terms of innovation indicators, expenditure by Valencian firms was about 1.2% of GDP in 2003, 20% lower than the national level (1.5%). On the other hand, in 2003, applications for high-technology patents submitted to the European Patent Office (EPO) by the Valencian applicants (4.3 applications per million people in the labour force) were above the national level (3.6), but regional employment indicators in high-technology manufacturing and service sectors were lower. This contradiction can perhaps explained by the important role of the public sector in the Region of Valencia in R&D activities and in applications for high technology patents.

According to the indicators included in the European Innovation Scoreboard (EIS) in 2003, the relative positioning of the Region of Valencia in Spain (RNSII) –sixth among 17 regions – was lower than would be expected based on its socioeconomic structure (4/17). This position, in combination with the weak position of Spanish R&D

³ OECD 2005. (www.oecd.org/edu/eag2005).

in the European framework, implies that 61.2% of European regions are better placed in terms of competition than the Region of Valencia (106/172).

Table 2.5. Human Capital and Technology Resources

	2003	
	R. V.	Spain
Population (25-34 years old) with tertiary education (% of total population)**	30.2%	36.7%
Population (25-64 years old) with tertiary education (% of total population)**	20.7%	24.4%
Labour force participation rate with tertiary education**	78.8%	78.4%
Labour force participation rate (25-34 years old) with tertiary education**	30.2%	36.7%
Expenditures in innovation (% GDP)	1.2	1.5
N° high tech patents applied for the EPO (per million labour force)	4.3	3.6
Employment in high tech manufacturing sectors (% of total)	3.4	5.4
Employment in high tech services (% of total)	1.6	2.5
Gross Value Added in high technology manufacturing sectors (% of the industry GVA)*	21.0%	34.9%
Gross Value Added in high technology services (% of total GVA)*	11.7%	-
RNSII (Regional National Summary Innovation Index)	92	-
RRSII (Regional Revealed Summary Innovation Index)	70	-
Ranking Spanish Regions (RNSII)	6/17	-

* Data refer to 2001. ** Data refer to 2002.

Source: Science and Technology Statistics in Eurostat, EIS, Valencian Institute of Statistics (IVE) and National Institute of Statistics (INE).

R&D resources

Table 2.6 presents internal R&D expenditure in the Region of Valencia, which was 0.87% of regional GDP in 2003. In spite of a significant increase in recent years, Valencian companies account for a small share of total R&D expenditure. In 2003, firm participation in total regional R&D expenditure was 30.0%, whilst universities spent 47.0%. This structure of R&D expenditure diverges widely from the total for Spain, where 60.0% of R&D expenditure was accounted for by firms and 32% by universities.

Table 2.6. R&D and Innovation Resources

	2003	
	CV	Spain
R&D expenditures (% GDP)	0.87	1.10
R&D expenditures performed by (% of GDP):		
Firms	0.30	0.60
Government	0.10	0.17
Universities	0.47	0.32
N° R&D researchers (by thousand active population)	4.10	4.80
N° R&D researchers (by thousand active population):		
Firms	0.96	1.50
Government	0.52	0.80
Universities	2.58	2.50

Source: *Science and Technology, Statistics in Eurostat, EIS and INE.*

This structural imbalance is even more pronounced when we compare with the OECD average,⁴ where R&D expenditure performed by firms (1.4% of the GDP) was 62.0% of total R&D expenditure in 2002, whilst the university share was 18.0% (0.41% of the GDP).

Numbers of researchers, shown in Table 2.6, follows a similar pattern, with expenditure in R&D being related to the numbers of researchers in the universities.

To sum up, it can be said that the Region of Valencia has low scientific knowledge absorptive capacity (Azagra-Caro et al., 2006) based on the indicators discussed above, particularly in terms of business investment in R&D activities and innovation, labour force participation with tertiary education and development of manufacturing sectors and high-technology services.

⁴ Statistics OECD: Main Science and Technology Indicators: Plus Research and Development Statistics 2004.

3 Characteristics of University-Industry co-operation in the region

This chapter aims to identify and describe the main regional actors involved in the university-industry cooperation, and the relationships among them, and to present an overview of the state of university-industry collaboration.

3.1 Description of actors

3.1.1 Public research system

Within the public R&D system in the Region of Valencia there are a number of universities and R&D centres belonging to national (Spanish National Research Council -CSIC) or regional administrations (specialized centres in areas such as health, agriculture and environment). In 2003, public R&D sector accounted for 65.0% of total regional R&D expenditure and employed 75.6% of researchers in the region (INE, 2003).

Universities

The Valencian higher education system is made up of five public and two private universities. Four of these universities are located in the city of Valencia; two in Alicante and one in Castellon, and with the exception of the University of Valencia, were established in the last 35 years (see Table 3.1).

In 2004, the total number of students enrolled in first and second cycle studies in Valencian universities was 142,000. An additional 7,000 were enrolled in PhD studies. The academic staff comprised some 10,000 teachers (one per 14 students).

In 2002, the total budget for the public universities was about 839 million euros (1.23% of the Region's GDP or about 5,900 euros per student). In 2002, about 100 million euros was allocated to research activities (wages and other personnel

expenditure not included): 21.0% of R&D was funded by the private sector and 79.0% by the public sector.

Table 3.1. Universities in the Region of Valencia: 2004^(a)

	UA	UJI	UMH	UPV	UV	UCH	UCV	Total
Foundation year	1979	1991	1997	1971	1499	2000	2004	-
Character ^(b)	1	1	1	1	1	2	2	-
Number of students	27,957	13,179	9,771	35,450	46,488	6,715	2,522	142,082
% of students in total students	20%	9%	7%	25%	33%	5%	2%	100%
PhD students	1,115	425	470	1,827	2,848	88	0	6,773
Number of teachers	1,870	844	963	2,577	3,183	461	227	10,125
Total budget (million €)*	156.5	86.2	75.8	241.6	278.9	-	-	839.0
R&D budget ^(c) (million €)*	6.7	5.6	8.3	31.3	46.2	-	-	98.1
% from public sources*	-	89.3%	79.5%	65.1%	86.1%	-	-	78.6%
% from private sources*	-	10.7%	20.5%	34.9%	13.9%	-	-	21.4%

(a) UA: Universidad de Alicante, UJI: Universidad Jaume I de Castellón, UMH: Universidad Miguel Hernández, UPV: Universidad Politécnica de Valencia, UV: Universitat de València, UCH: Universidad Cardenal Herrera, UCV: Universidad Católica de Valencia.

(b) Character: (1) Public, (2) Private

(c) Personnel expenses not included

* Data refer to year 2002.

Source: Ministerio de Educación y Ciencia. Avance 2004-2005. CRUE: La Universidad Española en cifras, 2004.

As already mentioned, the higher education sector in the Region of Valencia has an important presence in the RIS, accounting for 54.0% of total R&D expenditure and employing 63.0% of total researchers. Its evolution in the last 17 years is shown in Table 3.2. It can be seen that R&D expenditure as a proportion of GDP has increased fivefold, and the number of researchers is ten times higher. This growth is mainly due to the “dynamization” of academic staff towards R&D activities: the proportion of academic staff involved in research activities has increased from 14.2% in 1987 to 52.4% in 2003. It should be pointed out that this evolution is the more remarkable since the human resources of universities also increased based on the education demands from a rapidly growing number of students. It is clear that the support provided by the Law of Science and the National R&D Plan for R&D projects and Technology Transfer Offices (TTO), in addition to provision of salary increments for university staff based on their scientific production (“sexenios”) have been key factors in this significant advance.

Table 3.2. Research evolution in the Valencian Universities

	1987	1997	2003
R&D expenditure/GDP (%)	0.10	0.33	0.47
Number of teachers	3,956	6,535	10,125
Researchers (FTE)	521	2,579	5,300
% Researchers/Teachers	14.2	39.5	52.4

Source: INE(2003). *El Sistema Universitario Español: Libro Blanco, 2006.*

Public research centres in the region

Public R&D centres in the Region of Valencia include centres dependent on the central government and those dependent on the regional administration (Generalitat Valenciana). In 2003, both types together carried out 11.5% of total R&D expenditures and employed 13.0% of researchers in the Region of Valencia.

Centres dependent on central government are integrated in the Spanish National Research Council (CSIC). CSIC has 10 R&D institutes located in the Region of Valencia. Six are mixed centres and are managed jointly with universities in the Region of Valencia; one is jointly managed by CSIC, University of Valencia and Generalitat Valenciana (local government). Table 3.3 shows location and scientific-technological specialization of these centres.

Table 3.3. CSIC institutes in the Region of Valencia.

Name	Province	Scientific-technical area	Type
Instituto de Acuicultura Torre de la Sal	Castellon	Natural resources	Own
Instituto de Agroquímica y Tecnología de Alimentos	Valencia	Science and food technologies, agrarian sciences and natural resources	Own
Instituto de Biología Molecular y Celular de Plantas “Primo Yúfera”	Valencia	Biology and biomedicine	Mixed
Instituto de Biomedicina de Valencia	Valencia	Biology and biomedicine	Own
Instituto de Física Corpuscular	Valencia	Science and Physic Technologies	Mixed
Instituto de Gestión de la Innovación y el Conocimiento	Valencia	Humanities and Social Sciences	Mixed
Instituto de Historia de la Ciencia y Documentación “López Piñero”	Valencia	Humanities and Social Sciences	Mixed
Instituto de Neurociencias	Alicante	Biology and biomedicine	Mixed
Instituto de Tecnología Química	Valencia	Science and chemical technologies	Mixed
Centro de Investigaciones sobre Desertificación	Valencia	Natural resources and environment	Mixed

Source: Own elaboration

In 2004, the total number of R&D personnel in CSIC centres in the Region of Valencia was 568, most of whom were researchers (fellows included), representing more than 10.0% of the overall personnel of CSIC in Spain.

In 2004, the budget for CSIC centres in the Region of Valencia was about 30 million euros, 38.0% of which was allocated to institutes researching in “Biology and Biomedicine” and 37.0% to institutes working on “Food Technology” and “Natural Resources”. Most funding comes from the national public administration (80.0%), 14.0% comes from abroad, 3.0% from national companies and 2.0% from the regional administration (“Informe del Alto Consejo Consultivo de la Generalitat Valenciana”, 2005).

Centres dependent on the regional administration (Generalitat Valenciana) and their scientific-technological area include:

- Instituto Valenciano de Investigaciones Agrarias (IVIA): Agriculture and Natural Resources.
- Fundación Instituto Valenciano de Infertilidad: Health
- Fundación Oftalmológica del Mediterráneo: Health.
- Fundación Valenciana de Investigaciones Biomédicas (Prince Felipe centre): Biology and Biomedicine.
- Centro de Estudios Ambientales del Mediterráneo (CEAM): Environment
- Instituto Valenciano de Investigaciones Económicas: Social Sciences.

In 2004, the number of personnel in research centres attached to the regional administration increased to 549, 50.0% of them researchers. The budget allocated to these centres is about 40 million euros, with Health and Agriculture receiving the largest shares. In general, the funding is made up as follows: 82.0% from the regional administration, 12.0% from the national administration, 3.0% from international

institutions, and the remaining 3.0% from national companies and private institutions (Informe del Alto Consejo Consultivo de la Generalitat Valenciana, 2005).

3.1.2 Business sector

In 2004, there were about 300,000 firms in the Region of Valencia representing 10.7% of all Spanish enterprises. Average firm size in the Region of Valencia is quite similar to that in Spain as a whole: 99.1% of firms employ less than 50 employees. Manufacturing companies in the Region of Valencia represented 10.0% of total manufacturing Spanish firms and contributed 21.0% to regional GAV. Manufacturing industries in the Region of Valencia include a high proportion of labour-intensive sub-sectors; there are very few companies involved in the high technology and knowledge-intensive sectors: High-technology⁵ firms generate 8.0% of industrial GAV, compared to low-technology companies, which generate 65.0%. Table 3.4 shows the contribution of the different sectors to industrial GAV and regional employment.

⁵ Sectors considered as high technology are: high technology manufacturing sectors: pharmaceuticals, office machinery and hardware, electronic components, radios, TV and communications, medical instruments, precision instruments, optical, and aeronautics; Medium-High technology manufacturing sectors: chemicals (excl. pharmaceuticals), machinery and equipment, machinery and electrical devices, cars, other transport; High technology services sectors: telecommunications, data processing activities, R&D.

Table 3.4. Gross added value and employment in Valencian companies.

Industry	1996		1998		2000		2002	
	GAV ⁽¹⁾	Employ ⁽²⁾	GAV ⁽¹⁾	Employ ⁽²⁾	GAV ⁽¹⁾	Employ ⁽²⁾	GAV ⁽¹⁾	Employ ⁽²⁾
Industry	9,313,522	349.1	10,598,921	377.7	11,564,593	399.9	11,993,356	404.7
Food products, beverages and tobacco	1,126,930	42.1	1,192,798	42.6	1,235,118	44.2	1,270,396	43.5
Textile, leather and footwear	1,606,282	88.5	1,809,059	97.0	1,835,739	96.5	1,724,645	92.1
Wood and cork	396,554	16.9	457,285	18.6	533,213	22.3	478,036	22.1
Paper, publishing and printing	520,182	18.7	596,019	20.0	687,749	21.9	804,782	23.5
Chemical industry	495,417	7.7	547,909	8.5	605,702	8.9	680,182	10.5
Rubber and plastic	426,119	11.8	481,182	12.6	575,830	14.3	640,570	15.5
Other non-metallic mineral products	1,496,144	42.7	1,780,307	45.4	2,109,276	52.4	2,220,027	52.9
Basic metals and fabricated metal products	945,687	39.8	1,067,375	43.6	1,137,522	44.8	1,321,960	49.0
Machinery and equipment N.E.C	422,570	16.2	475,201	17.8	511,006	19.2	627,601	21.3
Electrical and optical equipment	332,285	10.7	352,717	11.4	402,325	12.5	411,184	12.3
Transport equipment	783,835	19.0	943,966	20.5	846,427	20.9	785,659	23.3
Manufacturing N.E.C	761,517	35.0	895,103	39.7	1,084,686	42.0	1,028,314	38.7

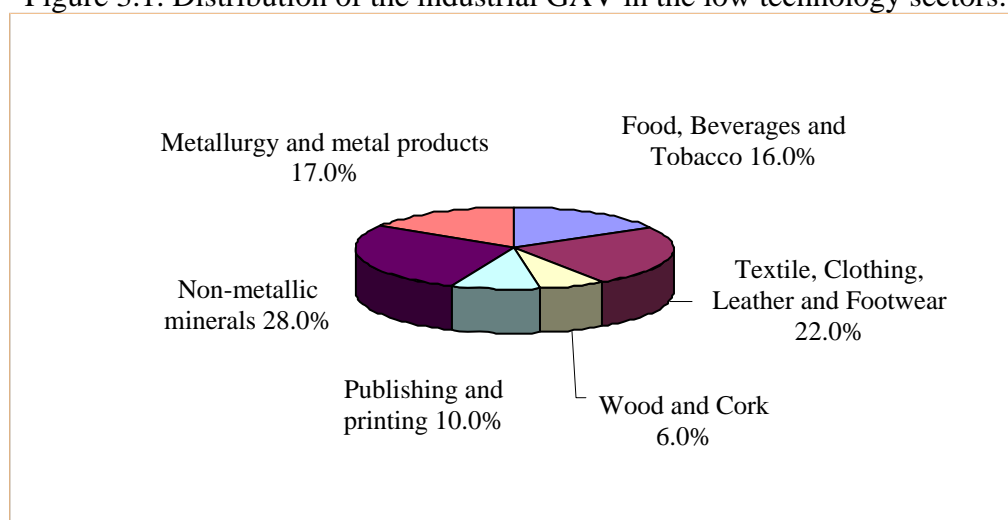
(1) Thousand euros

(2) Thousand employees

Source: INE (2004), Spanish Regional Accounts

For the last year for which data are available, among the low-technology sectors, the greatest contributor to industrial GAV is “non-metallic mineral products” (mainly ceramic tiles and paving), which represented 28.0% (Figure 3.1), followed by “textile, clothing, leather and footwear” (22.0%), with the lowest contributor being the “publishing and printing” (10.0%) and “wood and cork” sectors (6.0%).

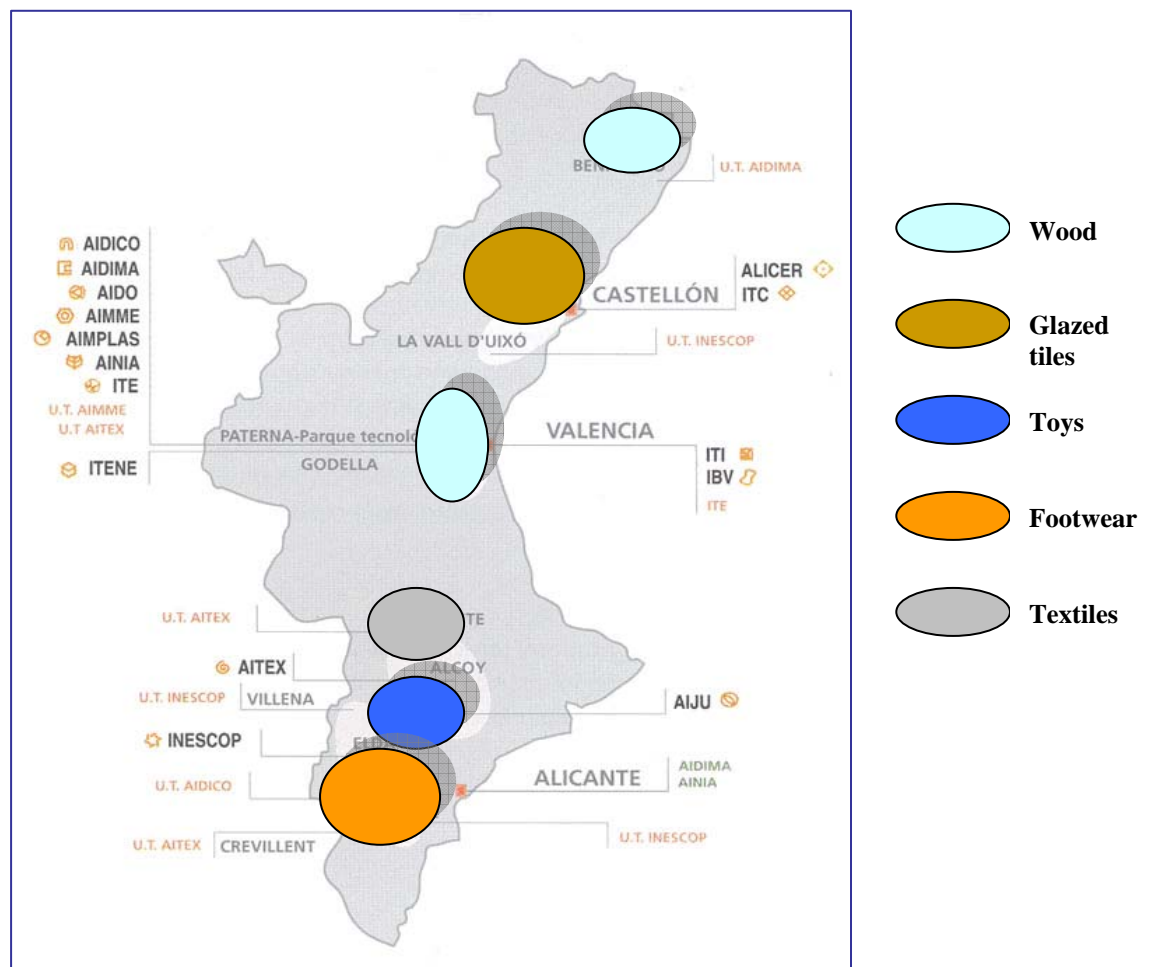
Figure 3.1. Distribution of the industrial GAV in the low technology sectors:



Source: INE(2004), Spanish Regional Accounts

Most of the firms in the low-technology sectors tend to be located together in the industrial districts of the Region of Valencia (Figure 3.2). Technology Institutes and European Innovation Centres have been established following this pattern to provide industrial districts with advanced services relating to technology and entrepreneurship. Figure 3.2 depicts location and a description of them is provided in section 3.1.3.

Figure 3.2. Map of the industrial districts in the Region of Valencia



A high proportion of total Spanish output is concentrated in the industrial districts in the Region of Valencia, making this region a leader at national level in these industries. Table 3.5 presents the share of the Region of Valencia in total Spanish production for selected industries.

Table 3.5. Relative position of the Valencian districts in the Spanish ones (percentages)

	Footwear	Toys	Glazed Tiles	Wood	Textiles
% Reg. Valencia/Spain	65%*	48%	92%	26%	17%

*based on number of employees in 2004.

Source: INE(2003).

According to the information provided by INE from its Survey of Technology Innovation 2003 (see Table 3.6), the number of innovative companies (EIN) in the Region of Valencia represented 12.3% of total innovative companies in Spain, which is 1.6 points higher than the proportion of total Valencian firms with respect to total Spanish firms.

Table 3.6. Some innovative indicators in the Region of Valencia and Spain.

2003	Region of Valencia	Spain	R.Valencia/Spain
Number of companies involved in innovation	2,912	23,721	12.3%
Expenditure in innovation (thousand euros)	647,824	11,198,505	5.8%
Innovation intensity of innovative firms (Innovation expenditure/turnover)	2.3	1.9	--
Percentage of turnover due to new products in innovative firms	19.1	16.3	--

Source: INE and Survey of Technology Innovation 2003.

However, innovative effort measured as expenditure on innovation in the Region of Valencia accounts for only 5.8% of total expenditure on innovation by Spanish companies, broadly a half of the Region's contribution to the national GVA (9.7%). The lower share of innovation expenditure by companies in the Region of Valencia compared to Spain is entirely due to the scarcity of companies in the region with over 250 employees. However, data on innovative intensity show that Valencian EIN invested a higher percentage of their turnover in innovation, probably due to turnover from new products for Valencian EIN being three points higher than for Spanish EIN.

The business sector in the Region of Valencia was responsible for 35.0% of R&D expenditures and employed 24.0% of researchers. Although in both relative and absolute terms these values are low, it should be noted that R&D expenditure has grown rapidly in the last 15 years, with the proportion of private sector R&D expenditure as a

percentage of regional GDP increasing from 0.15% in 1988 to 0.30% in 2003 (INE, 2003).

Table 3.7 presents some indicators for diffusion and use of information and communication technologies (ICT) in the Region of Valencia. On average, use of ICTs is lower than the national level. In 2003, the percentage of Valencian companies with access to the Internet was 86.1% and 42.1% of companies had a website. Percentages for the whole of Spain were one and three points higher respectively.

Table 3.7. Diffusion of Information and Communication Technology in firms.

	Reg. Valencia	Spain
% Firms with access to the Internet (2003)	86.1	87.4
% Firms with broadband access to the Internet ¹ (2003)	78.1	81.2
% Firms with access to the Internet and with a web site ¹ (2003)	42.1	45.5

(1) Percentage of firms with Internet access

Source: INE, 2003. Survey of the use of ICT and Electronic Commerce, 2003. Survey of Information Technology at Home, 2004

3.1.3 Technology and Innovation Centres (CIT)

CIT are private institutions that receive public sponsorship. Their objective is to enhance innovation in firms by providing infrastructure and services in areas such as cooperative R&D, technical consultancy, information and documentation, laboratory tests and quality certification. The network of Technology Institutes (TI) has been promoted and supported by IMPIVA since the mid 1980s. The current network includes 14 TI, which employ a total of around 900 people and provide the infrastructure supporting industrial innovation in the region. TI are dependent on sector-based associations of companies at national level, although there is a majority of firms in the Valencia Region's industrial districts. Table 3.8 provides a list of all TI in the Region of Valencia.

Table 3.8. Technology and Innovation centres in the Region of Valencia.

Name	Location	Year of foundation
Instituto Tecnológico del Calzado (INESCOP)	Elda (Alicante)	1971
Instituto Tecnológico de Cerámica (AICE)	Castellon	1984
Instituto Tecnológico Textil (AITEX)	Alcoy (Alicante)	1985
Instituto Tecnológico del Juguete (AIJU)	Ibi (Alicante)	1986
Instituto Tecnológico Metalmecánico (AIMME)	Paterna (Valencia)	1987
Instituto Tecnológico Agroalimentario (AINIA)	Paterna (Valencia)	1987
Instituto Tecnológico de Óptica (AIDO)	Paterna (Valencia)	1988
Instituto Tecnológico del Mueble y Afines (AIDIMA)	Paterna (Valencia)	1989
Instituto Tecnológico del Plástico (AIMPLAS)	Paterna (Valencia)	1990
Instituto de Biomecánica de Valencia (IBV)	Paterna (Valencia)	1990
Instituto Tecnológico de Materiales de Construcción (AIDICO)	Paterna (Valencia)	1991
Instituto Tecnológico de Informática (ITI)	Valencia	1994
Instituto Tecnológico del Envase y Embalaje (ITENE)	Paterna (Valencia)	1994
Instituto de Tecnología Eléctrica (ITE)	Valencia	1995

Source: Own elaboration

In 2004 about 7,000 firms were affiliated to TI Associations and over 14,000 made use of their services. 60.0% of companies that use the services of TI are located in the Region of Valencia, the remaining 40.0% being spread across the other Spanish regions.

Table 3.9 presents a list of some of the activities developed by the network of TI in 2004.

Table 3.9. Some activities of the Network of TI in the Region of Valencia, 2004.

Activity	Nº of projects/services	Nº of firms
R&D projects	1,173	1,700
Technical services	285,558	7,937
Technical consultancy	166,212	6,930

Source: Informe Alto Consejo Consultivo de la Generalitat Valenciana, 2005.

Of the total number of R&D projects developed, 54.0% were funded by contracts with firms and 46.0% by public funds. “Technical services” includes tests and laboratory analysis (82%); 88.0% of “Technology consultancy” includes supply of information and technical documentation, and ongoing or occasional “tailored” consultancy.

In 2004, the total budget available to the network of TI was about 70 million euros, 48.0% of it from the private sector (3.0% from association fees and 45.0% from the sale of services), and 52.0% from the public sector (mainly regional government) (Informe del Alto Consejo Consultivo de la Generalitat Valenciana, 2005).

3.1.4 Business Innovation Centres (BIC)

In the Region of Valencia, there are four European BIC, whose aim is to promote and diversify innovation activities throughout the region. They were established as non-profit associations sponsored by universities, companies, regional and local administrations, and other social regional agents. Their activities focus on giving advice on the setting up of new innovation companies, and facilitating relationships with other centres that support innovation activities, and with the public (administration) and financial systems. For some new companies, they manage their facilities.

Table 3.10. BIC in the Region of Valencia

Name	Foundation
European Business Innovation Centre of Alcoy	1989
European Business Innovation Centre of Castellon	1997
European Business Innovation Centre of Elche	1990
European Business Innovation Centre of Valencia	1991

Source: Own elaboration

In 2004, the BIC were responsible for 450 company plans, of which only 65.0% came to fruition. Of these 65%, 153 resulted in companies with more than 300 employees and account for around 8 million euros; [35.0% were established within BIC facilities (Informe del Alto Consejo Consultivo de la Generalitat Valenciana, 2005).

3.2 Training and the labour market

In the Region of Valencia the higher education system contributes to the learning process, the acquisition of competencies and insertion into the labour market, through formal and non-formal training.

Formal university training provides students with degrees that enable them to undertake professional jobs. University degrees are structured in three levels: the *first level* provides a “medium degree” diploma (ISCED 5B); the *second level* provides a “high degree” diploma (ISCED 5A); and the *third level*, which is aimed at research training, provides a doctoral – PhD - degree (ISCED 6).

Non-formal training, also referred to as “post-graduate courses” is specific to each university and is aimed at providing lifelong learning. Courses carry specific university diplomas, which, unlike the qualifications obtained through formal training courses, are not officially recognized awards. Non-formal training includes three categories: *master*, *expert* and *specialist*, which are related to the content and length of the study programmes.

As referred to in the previous section, the Valencian higher education system includes seven universities with 142,000 students, enrolled in first and second cycle studies (9.7% of the Spanish university population), and provides 223 study programmes for a total of 110 different degree qualifications (see Table 3.11). An additional 6,773 students are enrolled in 286 PhD programmes; thus, the Region of Valencia accounts for 11.0% of all PhD students in Spain and 12.0% of doctoral programmes (CRUE, 2004).

Table 3.11. Distribution of university students by level and knowledge area, 2004

Knowledge area	1 st and 2 nd cycles	PhD
Nº of students	142,082	6,773
Humanities	9.5%	23.0%
Natural sciences	7.6%	13.0%
Social sciences	42.5%	26.0%
Technical sciences	32.4%	22.0%
Medical sciences	8.0%	15.0%

Source: Ministry of Education and Science. Advance 2004-2005.

The area that was in highest demand in 2004 in the first and second cycles was Social Sciences. 42.5% of the students were enrolled in Social Sciences, which in five out of the seven Valencian universities, accounted for more than 50.0% of the student population. Technical training was undertaken by 32.4% of the students, mostly at the Technical University of Valencia (82.0%). Social Sciences is also the most popular doctoral programme, although to a lesser extent than for the first and second cycle degrees and the trend for Technical studies is also similar. However, in terms of the percentage of students in each level, Humanities, Natural Sciences, and Medical

Sciences areas recorded higher numbers for PhD studies than for first degree courses (first and second cycle studies).

Non-formal training differs widely among universities since they are free to design their own programmes. The Valencian Higher Education System offered a total of 323 postgraduate programmes, enrolling 7,720 students. 46.0% of these programmes were *masters* with 36.0% of students, 30.0% were *specialist* programmes with 40.0% of students, and 24.0% were *expert* programmes with 24.0% of students. Concerning distribution by knowledge areas, the majority of postgraduate students in the Valencian university system were enrolled in Social Science courses (57.0%). It should be pointed out that there is no funding provided for non-formal training, which has to be paid for by the students themselves, although firms, private institutions or the public administration sometimes offer grants and scholarships. This encourages universities to collaborate with other regional agents when organizing their non-formal training programmes. The universities are responsible for providing the basic infrastructure, such as classrooms, labs, administration services, etc., for these courses.

Access to the labour market and regional employment

As explained in Section 2, the percentage of the population in the Region of Valencia with a university degree has increased significantly in recent years. As a result, competition for high value-added jobs has also increased, which has motivated universities to conduct studies on the employability of their graduates, identifying the challenges faced by their graduates when they enter the labour market, and assessing the match between education programmes and labour market requirements.

In the 1990s, Valencian universities launched various programmes designed to help their graduates to enter the labour market, seeing this as a strategic objective of university policy. Actions are generally developed and managed by specialist offices

within the universities – except in the case of the Universities of Alicante, Valencia and Cardenal Herrera, where this task is performed by the respective university-industry foundations. The information obtained from these programmes is very valuable, from both an institutional and a social point of view. Firstly, it acts as a basic reference for university planning, assessment and innovation; secondly, it is the basis for the information and advice available to students and graduates; thirdly, knowing more about how graduates gain entry to the labour market is invaluable for the design and implementation of actions to improving relations between universities, companies and society in general. A wide range of mechanisms has been proposed to implement such policy:

a) *Work experience as part of a degree course (internship)*. Undergraduates who have successfully completed half of their degree programme may enrol in four month practice programmes in companies (internship) with the option to extend for a further four months. Students receive wages during this period and receive fundamental supplementary training, in the form of work experience. –For some degree courses at some universities a period of work experience is compulsory. These practice programmes allow undergraduates to apply the knowledge they have acquired at university, and make personal and professional contacts with colleagues in the host company and in other companies with which there are businesses relationships. These contacts can often prove invaluable in gaining employment after graduation.

Table 3.12 provides information regarding the numbers of students enrolled in company practice programmes in the academic year 2003/2004. Over 24,000 students from all universities in the Region of Valencia participated in these types of programmes, which is 17.2% of all university students. If we look jointly at the percentage of students participating annually in in-company practice programmes, and

the length of university studies, it can be concluded that, with the exception of the universities of Alicante, Valencia and Cardenal Herrera, where percentages are between 50.0% and 60.0%, the proportion of students that undertake work experience in the course of their degrees is near 100.0%. The breakdown by areas of knowledge shows the relationship between the academic specialization of universities and the proportion of students participating in work experience programmes.

Table 3.12. Students enrolled into in-company practicing programmes

	UA	UJI	UMH	UPV	UV	UCH	UCV	VU System
Total	3,891	2,921	2,121	7,843	6,052	1,047	532	24,407
% in the total of students	14.0%	22.7%	21.7%	22.7%	13.0%	15.6%	21.1%	17.2%
Humanities	3.0%	7.0%	2.0%	3.0%	23.0%	-	-	9.0%
Natural Sc.	5.0%	2.0%	12.0%	3.0%	8.0%	-	-	5.0%
Social Sc.	53.0%	67.0%	15.0%	9.0%	53.0%	73.0%	100.0%	37.0%
Engineering	18.0%	24.0%	24.0%	85.0%	4.0%	2.0%	-	38.0%
Health Sc.	21.0%	0.0%	47.0%	0.0%	12.0%	25.0%	-	11.0%
Total areas	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Own elaboration from the information provided by the universities.

b) *Career guidance to graduates.* All universities in the Region of Valencia provide career guidance to their graduates by offering lectures or on-line training courses that teach students how to construct a CV and how to apply for and behave in job interviews. Graduates are also offered support and consultancy related to the setting up of companies, designed to promote self-employment.

c) *Labour exchange.* Universities act as intermediaries to help graduates enter the labour market, through the creation of data bases to coordinate job offers and help graduates to locate opportunities that match their skills and ambitions. Universities also help graduates to find employment by organizing special events, such as on-campus company presentations, forums, conferences, and so on, which often lead to job offers and highlight company criteria in relation to the skills and knowledge required for particular jobs.

d) *Collaboration agreements with public and private bodies.* Universities collaborate with the national and regional employment offices (Instituto Nacional de

Empleo and Servicio Valenciano de Empleo y Formacion) and the regional network of European Business Innovation Centres (Centros Europeos de Empresas Innovadoras – CEEI). Similarly, universities participate in public initiatives to enhance employment opportunities for young people and to allow new graduates to participate in European programmes, such as the Leonardo da Vinci Programme.

e) *Labour market observatories*. Labour market characteristics and their evolution are studied and analysed by the universities' labour market observatories in order to assess employment opportunities related to the degrees offered by universities, to analyse demand for university graduates and to adjust university course offerings to suit the requirements of the labour market.

3.3 Innovation and territory: An approach to university-industry cooperation

In recent years, Valencian universities have made considerable efforts to strengthen their “third mission”, i.e. cooperation with the socioeconomic environment. Actions such as the introduction of interface structures and the development of instruments designed to promote university-industry relationships, i.e. the setting up of a structured supply of technology transfer services and the promotion of external relationships, have been part of these efforts.

a) *Interface structures*. With regard to interface structures, all publicly-owned Valencian universities have TTOs to manage their university-industry relationships. The TTOs were set up in 1989 in the three oldest universities, and in 1996 and 1997 respectively for the two more recently founded universities. TTOs channel the management of university-industry relationships, and in some cases – for example, three of the universities in the Region of Valencia, they are also responsible for managing university research activities.

The data presented in Table 3.13 illustrate the relative importance of university-industry co-operation in the Region of Valencia compared to all public universities in Spain. It can be seen that income from R&D contracts and from competitive research, as a percentage of the total university budget, is higher for Valencian universities than for Spanish universities as a whole. Support provided by TTOs to their universities is also slightly higher in the Region of Valencia.

Table 3.13. University-Industry relations in the universities of the Region of Valencia.

Data for 2002	TTO Budget (% University Budget)	Income from R&D (% University Budget)	Income from Competitive Research (% University Budget)
Valencian Universities	0.33	3.74	8.43
Spanish Universities	0.11	3.24	7.34

Source: CRUE, Academic, productive and financial information regarding Spanish public universities. 2002. University indicators – academic year 2002/2003. Annual Report of the OTRI network and own sources

At the same time, the resources allocated by Valencian universities to TTOs have almost doubled in the last five years, mainly due increased expenditure on permanent staff. This is an indicator of universities' keenness to promote development of applied results from their research, by means of knowledge and technology transfer.

The activities of TTOs in Valencian universities are mainly related to the Region of Valencia: about 55.0% of their working time is spent on building and managing relationships at regional level; 25.0% at national level; and less than 20.0% is devoted to international businesses.

All universities in the Region of Valencia describe their technology offerings on their websites. Although there is rather a lack of homogeneity and presentations are not always well structure, the use of key words identifies areas of interest and active research groups.

b) *Promotion of own technology and external relationships.* Universities each have their own promotion mechanisms for their technology and external relationships. These

mechanisms operate at two levels: the institutional, which is the responsibility of the vice-chancellor of each university; and the operative, which is managed by the different interface structures and TTOs.

Among the programmes designed to promote university-developed technology, we would highlight the Technical University of Valencia's (UPV) INNOVA Programme. This programme, with an annual budget of 600,000 euros, considers research groups as promotional agents and provides funds for specific activities designed and carried out by researchers to promote their own technology, for programmes involving specialized technological managers and promoters.

In addition to these instruments, which are specific to each university, there are other instruments that involve the cooperation of all universities or universities and socioeconomic agents. All universities in the Region of Valencia are members of the Association of Valencian Universities for the Promotion of Research, Development and Innovation (RUVID). This Association allows universities to diffuse their initiatives, resources, capabilities and R&D results jointly. The Centre for Innovation Linkages of Spain's Mediterranean Region (CENEMES) is a similar well-established initiative for the joint promotion of innovation and technology. CENEMES, set up and coordinated by the University of Alicante, aims to enhance cooperation among universities and to provide support for transnational technology transfer. Finally universities have agreements with the Valencian Institute for SMEs (IMPIVA) and with the Regional Network of Technological Institutes (REDIT) to collaborate on R&D, technology transfer and development of innovation enhancing activities.

With regard to the collaboration mechanisms set up to promote the transfer of knowledge to stakeholders, Table 3.14 shows that "technological support and consultancy services" and "R&D contracts" are the most commonly used instruments.

In general, in the period 2000-2004, a positive trend can be observed for these instruments, with the exception of “training under specific demand”, which has shown a decrease since 2002.

Table 3.14. University-industry relationships by kind of activities.

Instruments-Total Activity	2000	2001	2002	2003	2004
R&D contracts	433	439	529	592	641
Technological support and consultancy services	1,409	2,029	2,128	2,045	2,250
Patent licences	7	7	26	12	12
New companies start-ups	1	6	6	3	7
Training under specific demand	30	42	48	34	35

Source: Own elaboration from the information provided by the Valencian universities

When analysing the role of regional actors in university-industry relationships by type of activity (Table 3.15) it can be seen that regional actors demands were mainly for “R&D contracting”, “technology support and consultancy services” and “training under specific demand”. Demand for “patent licences” and “support for starting up new companies” was much smaller.

Table 3.15. University-industry relationships. Share of regional actors

	2000	2001	2002	2003	2004
R&D Contracts	62.0%	61.0%	59.0%	63.0%	63.0%
Technology support & consultancy services	45.0%	31.0%	34.0%	52.0%	53.0%
Patent licences	14.0%	14.0%	11.0%	0.0%	17.0%
New companies start-ups	100.0%	33.0%	33.0%	33.0%	29.0%
Training under specific demand	80.0%	79.0%	52.0%	65.0%	51.0%

Source: Own elaboration from information provided by Valencian universities

We have analysed how universities deal with the regional dimension of their R&D strategies. However, it is necessary for them to co-operate with external agents to carry out these strategies. Thus, Valencian universities become involved in a wide range of joint R&D actions with external agents. Table 3.16 presents the main actions and actors involved.

Table 3.16. R&D actions jointly undertaken by universities and external agents.

Action	Type of external agent				
	Public Research Institutes	Universities	Public Regional Administration	Business Associations	Individual Companies
Research institutes					
Interuniversity institutes					
Technological and R&D institutes					
R&D departments					
Certification laboratories					
Business incubators					

Source: Own elaboration from information provided by Valencian universities

In terms of importance and number of joint projects undertaken by universities with external agents, the most relevant actions are *Research Institutes* and *Technological and R&D Institutes*. Research Institutes are the result of projects jointly undertaken with national Public Research Institutes and they are basically science-oriented. In the case of *Technological and R&D Institutes*, the agents involved are, in all cases, business associations and the Regional Administration where collaboration is directed to regional socioeconomic objectives, although scientific research still plays an important role. A third type of action, although less significant in terms of numbers, is *Inter-university Institutes*, which articulate joint efforts by two or more universities in the region.

Other types of joint research projects, involving *R&D Departments*, *Certification Laboratories* and *Business Incubators*, are largely aimed at meeting the needs of businesses. In the case of *R&D Departments*, research projects generally involve individual companies which make use of the R&D potential of a particular research group to set up a joint collaboration. The criteria for *Certification Laboratories* are similar to those for technological institutes, but their purposes are more limited. They involve associations of small companies, generally from the region, and receive support from the Regional Administration. University *Business Incubators* have been set up in

collaboration with some of the regional BIC and are dependent on the Regional Administration. They provide support to the companies that are set up at the university.

In addition to these structures and instruments, Valencian universities are developing other cooperative mechanisms to enhance the applied value of their R&D activities through the establishment of science parks and spin-off programmes. The establishment of science parks on university campuses is seen as a priority, and an effort designed to achieve good levels of R&D cooperation between the universities and regional industries is currently under way.

In 2000 the Technical City of Innovation was established at UPV, and scientific parks in public universities are being promoted by the Spanish Ministry of Education and Science with support from the European Fund for Regional Development (EFRD). Each of these parks is expected to host an incubator. Further details of entrepreneurial activities in universities are provided in Section 3.4.

The Region of Valencia also hosts a Technology Park (València Parc Tecnològic), which was promoted by IMPIVA as one of the first technology parks to be implemented in Spain in the mid 1980s to co-locate research centres, and R&D intensive manufacturing and service activities. The Technology Park, located in Paterna –eight km from Valencia, has an area of 100 ha and opened in 1990, and currently concentrates nine TI, one BIC, several Business Schools belonging to the Chamber of Commerce of Valencia, and some technology-advanced manufacturing and service companies. Since 1994 management of the Technology Park has been the responsibility of SEPIVA, a society belonging to the Regional Government.

3.3.1 Quantifying the cooperation

There are some indicators that give information related to how much the offering of universities in the Region of Valencia are matching regional needs, e.g. among the

private funds obtained by universities from R&D those from within the region represent the biggest share. However, Table 3.17 shows that, in 2004, R&D contracting with universities by traditional industries was very low since the majority is not engaged in knowledge-intensive activities and therefore their demand for R&D is small. Only ceramics was really relevant.

Table 3.17. University-private sector R&D contracts in 2004. Distribution by industries

	UA	UJI	UMH	UPV	UV	Total
Private contracts (thousand euros)	1,751.2	1,842.9	1,569.2	13,826.9	4,106.2	23,091.3
Socioeconomic Area	%	%	%	%	%	%
Agriculture	0.0	0.0	0.1	2.2	0.7	1.4
Industries of extraction	0.2	1.5	1.3	0.2	0.0	0.4
Food, beverages and tobacco	0.5	0.2	0.6	2.1	4.9	2.2
Textile, clothing, leather and footwear	0.0	0.0	0.4	0.2	0.0	0.2
Wood products	0.0	1.0	0.0	0.1	0.0	0.2
Chemical industry(*)	7.6	34.2	18.0	13.6	6.1	13.8
Rubber and plastic products	2.4	0.1	0.4	0.2	0.1	0.4
Non-metallic mineral products (ceramic)	2.6	17.1	0.0	0.8	0.9	2.2
Metal products (except machinery and equipment)	0.0	0.0	0.0	1.3	0.0	0.8
Machinery and mechanical equipment	0.0	2.2	0.0	2.0	3.1	1.9
Electrical equipment, instruments and Electronics	0.3	0.0	9.3	2.9	2.1	2.8
Transport equipment	2.5	1.0	0.8	16.0	0.6	10.0
Energy and water	16.6	0.0	4.1	4.0	1.5	4.2
Construction	16.0	9.0	7.1	17.1	3.5	13.3
Information and communication technology (ITC)	8.5	0.0	0.1	4.9	2.2	4.0
R&D services	3.3	0.6	0.2	0.8	12.3	3.0
Other services to firms	10.4	2.2	1.6	16.3	6.6	12.0
Rest of services	13.4	10.9	9.7	5.9	48.4	14.7
Health and veterinary services, social services	0.0	0.0	2.2	0.4	1.1	0.6
Tourism (hotel and catering, travel etc.)	0.2	0.0	0.0	0.0	0.1	0.0
Technological institutes (R&D)	2.6	13.9	0.3	7.1	1.2	5.8
Others (**)	12.9	6.3	43.8	1.7	4.6	6.3

(*) Refined petroleum included.

(**) This group includes companies, entities and individuals not belonging to any of the other groups, or not classified.

Source: Own elaboration from information provided by Valencian universities

With regard to the geographical area related to contracts for R&D with Valencian universities, Table 3.18 shows that most R&D projects (70.0% of the total) involved regional contractors.

Table 3.18. R&D contracts by public and private entities and geographic area

Year	Businesses and Private Entities			Public Administration		
	Regional	National	International	Regional	National	International
2000	2,824	961	81	411	154	20
2001	2,731	958	64	500	115	21
2002	2,162	1,767	87	302	266	31
2003	3,151	1,079	151	456	256	23
2004	3,648	1,172	187	569	213	38

Source: Own elaboration from information provided by Valencian universities

Although universities are concerned with meeting regional needs, some stated that most of their research activity is related to topics considered as priorities in competitive calls for tender from the regional government. However, these topics try to give priority to regional issues.

3.4 Entrepreneurship in universities

In the last 20 years, the Spanish university system in general and the Valencian university system in particular, have developed the traditional missions of teaching and research. Since the passing of the University Reform Act (LRU) in 1983, universities made efforts to strengthen their research activity, and in the following decade the promotion of technology transfer became a relevant activity. Recently, the role of universities in promoting start up of innovative firms to apply the technology results from university research activity has been emphasized, so called spin-off activity. This is adding a new dimension to the process of knowledge and technology transfer from university to society.

Programmes in the Valencian public universities to enhance new firm start-ups are shown in Table 3.19. They started in 1992 with the IDEAS programme in the UPV. Other universities launched their own programmes after 1999.

Table 3.19. Start-up programmes by Valencian universities.

University	Name of the Programme	Year
U. de Alicante	Centro de Creación de Empresas (GIPE)	1999
U. Jaume I de Castellon	Foro Jovellanos de Fomento Empresarial	1999
U. Miguel Hernandez de Elche	Programa de Emprendedores Universitarios	2000
U. Politecnica de Valencia	Programa IDEAS	1992
U. de Valencia	Fundación Universitat Empresa - ADEIT	2002

Source: Own elaboration from information provided by Valencian universities

Most of these start up programmes suffer from budget shortages and their development is precarious. Frequently, they depend on funding from local and regional development agencies, as well as from national or European programmes, which has greatly increased the amount of administrative work involved. Facilities, staff, budget and organization in start up programmes differs among universities. In some cases they are dependent on the chancellor (rector) or vice-chancellor (vice-rector). In other cases they are the responsibility of university foundations or associations involving public and private actors.

The number of staff employed by universities to carry out start-up programmes is usually no more than two, although there is generally an external network of experts who provide consultancy and technical support. The budgets for this activity are frequently less than 100,000 euros. Thus, universities often enter into agreements with other institutions, and request support from public administration programmes to enhance entrepreneurship, which are generally open to all potential entrepreneurs, regardless of origin or technological opportunity.

In spite of the fact that university initiatives oriented to supporting the start up of new firms are not homogeneous there is some degree of convergence. They are seen as a key element in the knowledge and technology transfer process through the development of start up and spin-off companies, and as a way of providing students

with support in the transition from higher education to the labour market through self-employment. Most entrepreneurship enhancing programmes are aimed at:

- Diffusing throughout the university community the benefits of entrepreneurship and innovation;
- Promoting entrepreneurship, especially among students and researchers;
- Identifying business projects from members of the university community;
- Offering technical and logistic support to start-up companies;
- Making the transfer of research results effective through the creation of innovative technology based firms.

Entrepreneurship programmes in universities in the Region of Valencia are still in their infancy. As Table 3.14 shows, there have been 23 spin-offs originating from Valencian universities based on their research in the period 2000-2004. At the same time, projects that are not the outcome of university research results or whose promoters were not members of the university staff, have also been developed with support from the universities' entrepreneurship enhancement programmes. It should be noted that R&D-based entrepreneurship among the university community involves a cultural change and, hence, time commitments and continuous attention.

4 Innovation policy

4.1. Level of regional de-centralization

In the current political climate, a renewed interest in regionalism almost in all EU countries can be observed. This interest has provoked the regionalization and de-centralization of state power resulting in what has become known as the “Regions of Europe”. De-centralization allows the adjustment of policies to meet the local reality towards which they are oriented, to maximize its possible impact. In this sense, the regional and local authorities take on an active role in the enhancement and promotion of innovation and regional development.

During the last 25 years, Spain has undergone a fast and deep process of de-centralization; its Constitution established the so-called “State of the Autonomies”, by which Spanish regions acquired quasi-federal legal status allowing them to undertake important responsibilities and thus embrace more power and resources. Since the 1980s, a delicate equilibrium has been established among the transferred competencies, the non-transferable competencies (those reserved solely to the central administration), the shared competencies, etc. This situation becomes even more complex when competencies are shared and their management is transferred between different levels of the administration, which makes identification of the legal titleholder rather difficult. In this context, it could be said that the level of autonomy in Spain is high in all regions, and particularly in Andalusia, Canary Islands, Region of Valencia, Catalonia, Galicia, Navarra and the Basque Country.

The statute of autonomy includes the promotion of innovation and R&D as exclusive competences in the regions, although they must be shared and coordinated with the National Administration (Nieto, 2003). This situation has resulted in the rather

peculiar situation that 17 R&D and innovation policies have been developed in addition to those of a general character, established by the National State.

A brief description of the distribution of competencies among the different public administrations in the Region of Valencia was provided in the section on “Governmental Systems” in Chapter 2.

4.2. Main characteristics of the national/regional innovation policies

Within this context, Spanish innovation policy follows a “multilevel model”, developed and managed by traditional institutional actors at national and European level, and agents and authorities at regional level. This model promoted by the EU emphasizes the crucial role of the regional dimension in promoting innovation and embedding it in the European Research Space.⁶

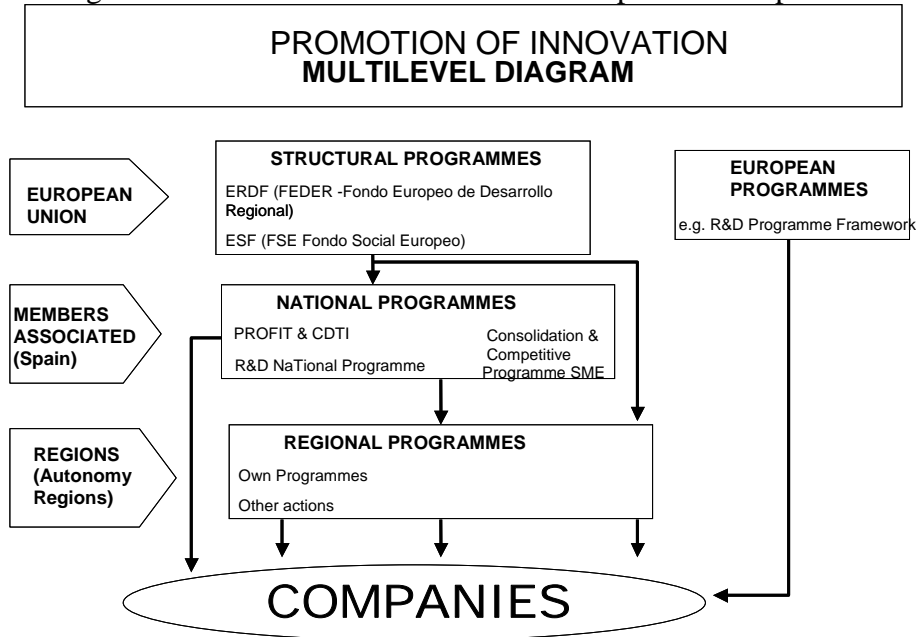
The model for the Region of Valencia is depicted in Figure 4.1. The promotion of innovation activities reaches enterprises through a complex and sequential process in which regions, as the administrations closest to the companies, act as managers and performers, not only of their own programmes, but also of those from supranational administrations (following the principle of subsidiary), and even some national level actions.

The application of this model for innovation policy in Spain, results in sub-national measures of support to companies (actions taken at the regional and local level) being in the majority, representing 70.9% of all measures⁷, which, when if they are compared with France, where 98.0% of the support actions to companies were adopted from the Central Administration (Más, 2005), gives an idea of the degree of de-centralization that exists.

⁶European Commission (2001a) [COM/2001 549 Final] and European Commission (2001b) 60-005 and the Resolution of the European Council on November 16th 2000.

⁷ The most prominent EU investments in objective 1 region are distributed both in national and regional actions.

Figure 4.1: Multilevel model of innovation policies in Spain.



As Figure 4.1 shows, the multilevel model integrates three levels of action European, national and regional (Más, 2005). The actions taken by the *EU* that affect the Spanish system of science and technology are those related to Structural Funds (ERDF and ESF) and the various European Framework Programmes.

At *state level*, the most significant actions in Spanish science and technology policy are: The National Plan for Scientific Research and Technological Innovation (R&D&I National Plan)⁸ of the Ministry of Science and Education; the Promotion of Technical Research Programme (PROFIT) of the Ministry of Industry; Tourism and Trade (MITYC); Ingenio 2010 Programme from the Presidential Ministry; and, at a lower level, the Plan for Consolidation and Competitiveness of SMEs from the Ministry of Industry, Tourism and Trade.

The National R&D Plan adopted in 1988, set the priorities for action and use of available resources, along with the integration of R&D actions for the productive sectors, research institutions and universities. The economic aims of the National Plan

⁸ Prior to 2000, it was known as the: National Plan of Scientific Research and Technological Development (National Plan of R+D).

were made possible by the provision of financial guidelines for national R&D. The goal of these actions was the promotion of applied and basic research and the enhancement of coordinated actions and relations between universities, public research institutions and enterprises.

The MITYC influences on industrial innovation and carries out the technological policy. Its instruments, such as PROFIT, are designed to provide incentives for technological developments by enterprises through the establishment of advanced technologies in subsidized projects, and the promotion of the competitiveness in Spanish Industry to improve the quality of its products.

The Ingenio 2010 Programme is an initiative of the Spanish Government launched in 2005 in answer to the Lisbon Strategy. This programme is intended to involve the State, enterprises, the universities and other Public Research institutions, whose objective is to reduce the economic gap between Spain and other EU countries. The philosophy on which this programme is based is that R&D&i investment is key to maintaining and increasing growth and productivity and improving the welfare state. It involves three instruments: CENIT, which aims to increase public and private R&D&i cooperation; CONSOLIDER which is a strategy designed to achieve research excellence through increased cooperation among researchers and to train research groups; and AVANZ@, which will work on achieving the European average in Information Society indicators.

At *regional level*, the actions are encompassed by the Valencian Region's innovation policy which was established in the mid 1980s. Initially, the Region of Valencia developed a technology policy adapted to the socioeconomic characteristics of its territory (Fernández de Lucio et al., 2001). The model of this policy was based on the promotion of an institutional infrastructure aimed at providing "real services" (advanced

services) to enterprises. A basic component of this strategy was the promotion of the TI Network, the integration of public/private agents, and the horizontal/vertical coordination of various economic and institutional actors. In 1993 a Technological Plan was established which incorporated a number of different programmes (technological development, new industrial activities, R&D precompetitive, etc) to remain in force until 1997 (Más, 2005). Since then, the actions it promoted have been integrated into the Valencian Science and Technology Plan.

One of the distinctive aspects of the Valencian technological policy is the clear differentiation between the role of the administration and industrial control, and the specific actions to promote, reinforce and coordinate the regional technological policies. These functions were assigned to the Institute of the Medium and Small Industry of Valencia (IMPIVA), which was established as a public enterprise created by the Law of the Valencian Parliament in 1984.

In terms of the budget destined for the promotion of industrial innovation, Table 4.1 shows the evolution of the IMPIVA budget for the period 1984-2004, in terms of sources of funds (own funds, funds co-financed by the European Union and from the Central Administration). It should be noted that there is a lack of homogeneity of information, and in the 20 years of IMPIVA's existence, this institution has assumed (or abandoned) some responsibilities and functions (i.e. energy saving and efficiency during the period 1994-2002) which has had an impact on both the global budget managed by the Institute, and the actions developed.

However, the information available allows us to conclude that from the 979 million euros that IMPIVA has managed in the period considered, the proportion denoted as own funds provided by the Valencian Government constituted less than half (45.4%) of the total. There has been a reduction in the size of the budget provided by regional

government. Table 4.1 also shows that the management ability of IMPIVA and ability to get supra-regional funding has not been as good as might have been hoped. This indicates that there is a risk of dependency on funds coming from third parties and presents a possible problem for policy making, and actions and programmes specifically adapted to the needs of an industrial structure that takes accounts of the particularities of the Region of Valencia.

Table 4.1. IMPIVA's budget base on the source of funds, 1984-2004.

Year	GV Funds		GV Co financed		EU Co financed		Initiative SME-PCCP		TOTAL	
	Mill. €	%	Mill. €	%	Mill. €	%	Mill. €	%	Mill. €	%
1984-1989	75.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0	100.0
1990-1995	165.0	61.9	40.4	15.2	61.1	22.9	0.0	0.0	266.5	100.0
1996-2001	139.0	33.9	45.9	11.2	116.9	28.5	108.2	26.4	410.0	100.0
2002-2004	65.3	28.7	21.3	9.4	54.3	23.9	86.6	38.1	227.5	100.0
TOTAL	444.3	45.4	107.6	11.0	232.3	23.7	194.8	19.9	979.0	100.0

Source: IMPIVA. *Economic Reports*.

With respect to science policy, the Valencian Plan of Science and Technology, designed in the mid 1990s was set up to create and promote a science and technology policy capable of reaching the most advanced regions at national and European level, in terms of public and private investment; however, between 1995 and 1998, this Plan did not contribute any additional finance or a defined strategy.

In 2000 the Science and Technology Office was established and launched the Valencian Plan of Scientific Research, Technological Development and Innovation (PVIDI). This new Plan substituted for and integrated all previous plans (Generalitat Valenciana, 2001), taking as reference the national and European programmes of science and technology. A rearrangement of the Valencian Government eliminated this Office at the end of 2001. In 2004 the macro regional government of Enterprise, Universities and Science was created, with the aim of establishing a policy of science and innovation that would take account of the context of Valencian industry and coordinate the actors involved in technological and scientific issues. To this end, plans

for sector competitiveness, Scientific and Technological Parks and the creation of Technology-based enterprises are being promoted.

4.2.1 Policy instruments to enhance university-industry cooperation

As described above, the Valencian innovation policy includes actions endorsed by different administrations (European, national, regional). The situation related to university-industry cooperation is similar. Several instruments coexist at the European level with others proposed by the national administrations and yet others from the regional authorities.

At *European level* the main instrument used to promote university-industry cooperation is the Framework Programmes supporting R&D projects. This instrument, through the consortia created to conduct the R&D projects, enhances the relationships between the agents that create the knowledge (universities and research centres), the agents that create and transfer the technology (engineering companies, consultancies, technological institutes, etc) and the producers of goods and services. The take up of this instrument to reinforce the ties between universities and enterprises is low in the Region of Valencia due to the predominance of SMEs with low levels of absorptive capacity and a focus on traditional sectors which are not dependent on scientific advances.

At *state level* a milestone in university-industry relationship was the approval in 1983 of the University Reform Law (LRU) which, among other things, stated that the faculty should undertake training and research and contribute to socioeconomic development. Furthermore, this law allowed the university to collaborate with other actors in the Innovation System. This law was overtaken by the Organic University Law (LOU) in 2001, which essentially retained its principles.

Based on the LRU and the Law of Promotion and General Coordination of Scientific and Technical Research in 1986 (the Science Law), the National R&D Plan has promoted several structures and instruments for the support of university-industry relationships. Since 1989, under the framework of the first National R&D Plan, TTOs were launched with the aim of promoting and organizing cooperation between universities and research centres, taking account of the socioeconomic environment. Recently, financial support has been provided by the Central Administration to the Scientific Parks as a new structure of university-enterprise relationships.

In parallel with promotion and support of these structures, the National R&D Plan has used a variety of instruments to promote cooperation between universities and enterprises. In some cases these are new instruments, such as the Programme for Stimulus of Research Results Transfer (PETRI), which enhances demand for research project results from universities and public R&D centres. In other cases, the National R&D Plan has strengthened already existing instruments, such as Co-financed projects, managed by the Industrial Technological Development Centre (CDTI), oriented to financing enterprises' research initiatives whose results are not directly commercializable and carry a high technical risk. These initiatives are carried out in collaboration with universities, public research centres and/or innovation and technology centres.

Under the Ingenio 2010 framework, the CENIT actions have started-up with the objective of increasing public and private industrial research cooperation in R&D&i through the co-financing of 50.0% of the National Strategic Consortia of Technological Research. To facilitate implementation of this instrument risk capital funds will be set up to promote the generation and consolidation of technological enterprises.

At regional level, the instruments for the promotion of university-industry cooperation are embedded in the Valencian Plan for Scientific Research, Technological Development and Innovation (PVIDI) managed some cases by IMPIVA and in other cases by the Regional Government of Enterprise, University and Science. Among those managed by IMPIVA we highlight the following:

- *Technological Research and Development Programme*, whose objective is to support Industrial Research and Technological Development projects oriented to generate or develop new products or productive processes with improved technical specifications or properties to those in the market; feasibility studies prior to research activities; and projects developed in collaboration with universities and research centres, thereby maximizing the associated grant.
- *Programme for the Creation of Technology Based Enterprises* which supports the establishment and development of technology based firms to enlarge and diversify companies in the Region of Valencia with new productive and service activities based on new technologies and specialized knowledge.

Besides these programmes offering direct support to enterprises, there are other subsidy programmes providing support to Valencian entrepreneurs, such as the BIC and the Technological Institutes of the IMPIVA Network located across the region. These programmes establish some objectives that define eligible actions and allowable costs, on which grants are calculated.

Among the instruments for the promotion of university-industry cooperation managed by the Regional Government of Enterprise, University and Science, the *NOEMI Environment (New Business Opportunities through Research)* initiative should be highlighted. This initiative aims to develop actions to promote the transfer of Science and High Technology for practical and commercial use, and to facilitate progress among

Valencian companies. Under this framework initiative the new *GESTA Action Plan (Generation of Solutions for High Technology)*⁹ is putting in place the following objectives:

- To stimulate the creation of enterprises by inventors, scientists and technologists who can develop market opportunities from their research results;
- To stimulate technological innovation among SMEs through the incorporation of scientific-technical original principles for producing and commercializing new products;
- To encourage the generation and protection of the intellectual property rights in the form of patents to promote the technological leadership of the Valencian companies;
- To encourage business R&D&i, particularly among the SMEs, for the progress and protection of the economic interests of the Region of Valencia;
- To increase the commercialization of technological innovation through cooperative R&D&i among Valencian enterprises with the collaboration of the Regional Government.

In addition, all universities have a TTO to organize and manage their relations with the socioeconomic environment, develop their research activity and provide innovation support through the application of the instruments described in Chapter 3 to increase the use of patents and licences and the creation of technology based firms.

⁹ <http://www.noemigva.es/gesta/index.php>

5. Concluding remarks: Strengths and weaknesses of University-Industry cooperation in the Region of Valencia

Valencian universities have made considerable efforts to strengthen their so called “third mission”. These efforts have involved implementing actions including the introduction of interface structures (TTO) and instruments designed to promote university-industry collaboration.

From a quantitative point of view, university-industry relationships have become more relevant, although high value added interactions are not predominant. From a qualitative perspective, most actions concern technological support and consultancy rather than R&D activities, patent licensing or new firm creation. Furthermore, most of these actions involve regional rather than national or international actors. Participation of traditional sectors in R&D contracting is relatively low compared to other industries in the Region (among traditional sectors only firms related to the ceramics industrial district are significantly active in R&D contracting with universities). However, these industrial sectors are generally not knowledge-intensive and, therefore, demand for R&D is quite low.

Since 2000 all Valencian universities have been offering programmes to foster new firm start-up¹⁰. Universities have begun to assume a role in the generation of innovative technology-based firms based on university research, as a new approach to knowledge and technology transfer. Broadly speaking, the results from these programmes are still modest. In any case, it should be remembered that these approaches involve cultural changes to the university system, which require constant attention to be accurately developed and consolidated. Universities have also begun to set up their own Science Parks.

¹⁰ The UPV started its programme for the new firm creation in 1992.

5.1 Strengths and weaknesses

Based on the description and analysis of the current situation related to university-industry relationships, the strengths and weaknesses in the Region of Valencia are presented in Tables 5.1 and 5.2.

From the point of view of the legal and institutional framework, it should be noted that the Region of Valencia has been in the leading group of Spanish regions for designing and putting into practice policies to support technological innovation.

The role of national and regional bodies in the development of interface structures to enable, facilitate and encourage co-operation between industry and university, should be emphasized. The network of TI has been active in promoting and upgrading innovative strategies in traditional sectors to increase absorptive capability for knowledge and technology. This is one of the competitive advantages of the Region of Valencia, since these Institutes specialize in the productive activities in which the region has a leading position. However, it is important that efforts made to consolidated a policy to enhance knowledge-based entrepreneurship and science and technology parks development as a way to diversify the productive base of the Region and articulate the Region's innovation system should be increased.

One of the main strengths of the Region of Valencia is its higher education system. Valencian universities have a good scientific level and appropriate territorial distribution throughout the Region. However, they are not offering formal training programmes that answer the specific need of economic regional agents and that are oriented to providing university students with entrepreneurial skills. However, work practice in companies as part of university training is being encouraged and entry of students into the labour market is receiving more attention.

Structural features such as company-size and sectors in the productive fabric of the Region of Valencia are relevant in explaining the weak relationships between the public R&D system, and especially universities, and companies, and the fact that these relationships are mainly related to technical consultancy and support rather than to R&D or technology transfer by means of patents and licences.

The creation of spin-offs to diffuse the results of R&D activities by the public system needs to be encouraged in the Region of Valencia, and should be a major focus of new innovation policies to foster the diversification of Valencian industries and enhance further development of new high value added science and technology oriented activities.

Table 5.1. Main weaknesses of the U-I co-operation in the Region of Valencia.

- The small size of firms and the low absorptive capacity make it problematic to set up R&D units inside the firms, which does not favour the development of strategies based on technological innovation.
- Firms employ a small number of university graduates, and human and financial resources devoted to technological innovation processes are scarce, i.e. poor technological innovation culture.
- Most Valencian firms belong to supplier-dependent sectors. Knowledge intensive and highly R&D demanding activities, such as biotechnology, ICT and new materials, have a weak position in the industrial structure of the Region, which results in a poor demand for R&D.
- The interaction among universities, and technology and business centres and other companies is infrequent.
- Training of human resources by universities does not fit firms' demands and does not encourage an entrepreneurial culture.
- There are structural barriers to design and development of training programmes taking into account societal needs.
- Relationships between universities and private sector are mainly oriented to technological and service support. More complex use of research results by means of patents and licences is not well developed.
- The development of spin-offs to diffuse and apply research results from the public R&D system is poor.
- Incentives for university staff to develop knowledge transfer functions other than promotions and external assessments ("sexenios") are few.
- The Valencian R&D Plan has not designed actions that clearly promote strategic lines concerning financial and R&D support to emerging economic sectors. Their action mechanisms are inadequate and their funding is poor.
- Instruments for funding innovation and new industry projects (risk capital, issued capital, etc.) are not well developed.

Table 5.2 Main strengths of the U-I co-operation in the Region of Valencia.

- The university system offers quantity, diversity and quality of teaching activities, which enables a large majority of students to receive a university education in their own province.
- Universities offer some non-formal training programmes answering specific social needs.
- Universities have developed experience in fostering in-company work experience for students (internships) and in facilitating labour market insertion. Many firms actively participate in these practices.
- Universities have highly qualified personnel involved in basic and applied research, with considerable national and international reach.
- The public R&D system has grown considerably, especially in the higher education sector, and has achieved a high degree of articulation with the productive system.
- Universities have the capacity to provide support and consultancy services to firms and have a long tradition in the development of joint R&D actions with external agents.
- There is a willingness to collaborate with the socioeconomic environment. TTOs employ highly qualified staff with experience in the management of university-industry relationships and knowledge transfer.
- Universities have an active presence in regional, national and international knowledge transfer networks.
- The Region of Valencia has a network of technology centres related to the most important industries in the Region. By using their services firms can improve their innovation strategies and become more technology and knowledge oriented.
- The support of the regional and national public bodies for the development of interface structures, such as TTOs, incubators and Scientific Parks, facilitates and enhances university-industry co-operation.
- There are a number of very innovative firms in technology and non-technology areas even in the traditional sectors.

5.2 Proposals for implementation

In the last 20 years, the administration and the universities have initiated important efforts to promote the cooperation university- industry cooperation. These efforts have contributed that these relationships in the Region of Valencia gaining a certain notoriety at national level. There has been noticeable quantitative development of university- industry cooperation, which is receiving a high level of acceptance from the academic community. However, this type of cooperation faces some problems since most enterprises in the region are not engaged in knowledge-intensive activities and therefore demand for R&D is weak.

It will be necessary to promote actions in which university-industry cooperation is not the main aim. University-industry cooperation should be seen as an instrument to promote the changes necessary to foster a knowledge-society in which science and technology are the key to development.

Proposals for actions should be guided by regional demand for knowledge rather than the supply of R&D. Firms' absorptive capacities must be improved to allow diversification of the productive structure to knowledge-intensive sectors, and to increase the articulation of the RIS.

In order to improve the absorptive capacity of firms, the following actions are proposed:

- To introduce more creativity into basic education programmes to foster curiosity and initiative in children.
- To improve the match between formal and non-formal university training and societal needs.
- To study in depth universities' policies relating to graduate access to the labour market.

- To reconsider the role of TIs through programmes to promote joint participation of TIs and universities in defining training in specific subjects related to particular sectors.

In order to diversify the productive structure to include knowledge-intensive sectors, the following actions are proposed:

- To promote among university students competencies related to entrepreneurship, team working, leadership, responsibility, decision making, and so on.
- To favour the creation of technology-based companies, especially spin-offs. Proposals should be assessed according to the curriculum and their social impact.
- To stimulate the creation of instruments related to risk capital and issued capital.
- To promote the technological environment through the tertiary sector to diffuse the knowledge created by universities.

In order to improve articulation of the Valencian RIS, the following actions are proposed:

- To favour collaborations among the different actors in the system, in particular between universities and TIs.
- To promote the spread of science and technology from universities and TIs.
- To adapt universities' interface structures to current reality and guide the development of new structures such as science parks.

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