



RIP-WATCH

ANALYSIS OF THE REGIONAL DIMENSIONS OF INVESTMENT IN RESEARCH

CASE STUDY REGIONAL REPORT: ANDALUSIA (SPAIN)

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Case Study Regional Report on the Regional Dimensions of Investment in Research

OBJECTIVE

The main objective of this regional case study report is to provide a better understanding of the structural techno-economic characteristics of the analysed European region, to present the key factors conducive to increased investment in R&D and to identify key R&D policy challenges the region is facing.

BACKGROUND

In partnership with DG Research, the Institute of Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) has been implementing a watching brief on policy developments aimed at promoting both private and public investment in R&D (RIP-WATCH). A stated aim of this policy watch activity is to take stock of developments aimed at increasing investments in R&D in the European regions.

In the design phase of the activity, a typology of the European regions was produced. A balanced mix of twenty regions was selected from each of the nine identified regional types representing fifteen member states of the European Union.

COVERED REGIONS

Phase 1		Phase 2	
1. Andalusia (ES)	2. Catalonia (ES)	11. Bavaria (DE)	12. Corsica (FR)
3. Carinthia (AT)	4. Crete (EL)	13. Emilia-Romagna (IT)	14. Etelä-Suomi (FI)
5. Dél-Dunántúl (HU)	6. Jihozápad (CZ)	15. Balearic Islands (ES)	16. Lorraine (FR)
7. Norte (PT)	8. Sicily (IT)	17. Midi-Pyrénées (FR)	18. Saxony (DE)
9. Styria (AT)	10. Wielkopolskie (PL)	19. Scotland (UK)	20. Västsverige (SE)

THE REPORTS

The regional reports are structured according to the following two interrelated dimensions of regional techno-economic systems:

- **Regional knowledge base**, including the research, technological development and innovation (RTDI) infrastructure, human resources, RTDI efforts and outcomes and knowledge transmission mechanisms in the region
- **Regional economic structure**, including the productive structure, regional clusters and networks, international position and financial capacities and instruments

Each report examines these dimensions from two points of view: their current state as reflected in a selected set of regional indicators and their policy context (i.e. policy framework, actors, objectives and instruments).

In addition to the regional case study reports, a **synthesis report** will be produced that combines and interprets the information contained in the case study reports, presents the strengths and weaknesses of the regions covered and the factors that determined the trajectories of development of their R&D and innovation capacities, and discusses the main R&D and innovation challenges identified.

JRC-IPTS launched the first phase of the activity in June 2006 with the contribution of the ERAWATCH Network. The work has been undertaken between June and December 2006 by a project team led by LOGOTECH S.A. (EL) with the participation of iDeTra (ES), IKU Innovation Research Centre (HU), Institute of Fundamental Technological Sciences of the Polish Academy of Sciences (PL); Instituto de Estudos Sociais e Economicos (PT), Joanneum Research InTeReg (AT), Nomisma (IT), Poznan University of Economics (PL), Technology Centre of the Czech Academy of Sciences (CZ), The Bigger Splash (ES) and Transdanubian Institute of Centre of Regional Studies of Hungarian Academy of Sciences (HU).

A first set of ten regional case study reports is now available on the ERAWATCH web-site at <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=intService.home>

The second phase of the activity was launched in December 2006. A second set of ten regional case study reports and a synthesis report are expected to be available on the ERAWATCH web-site by October 2007.

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Annex 1: Definition of policy mix typology

Annex 2: Description of key indicators used in the summary graphs

Annex 3: Tables and Figures

Abbreviations

MC	Management Committee
PM	Project Management
ToR	Terms of reference
ANBERD	Analytical Business Enterprise Research and Development Database
BERD	Expenditure on R&D in the business enterprise sector
EPO	European Patent Office
GBAORD	Government budget appropriations or outlays for R&D
GDP	Gross domestic product
GERD	Gross domestic expenditure on R&D
GUF	General university funds
HERD	Expenditure on R&D in the higher education sector
ISIC	International standard industrial classification
IPTS	Institute for Prospective Technological Studies, Seville, Spain
NACE	Statistical classification of economic activities in the European Community
N.E.C.	Not elsewhere classified
PPP	Purchasing power parity

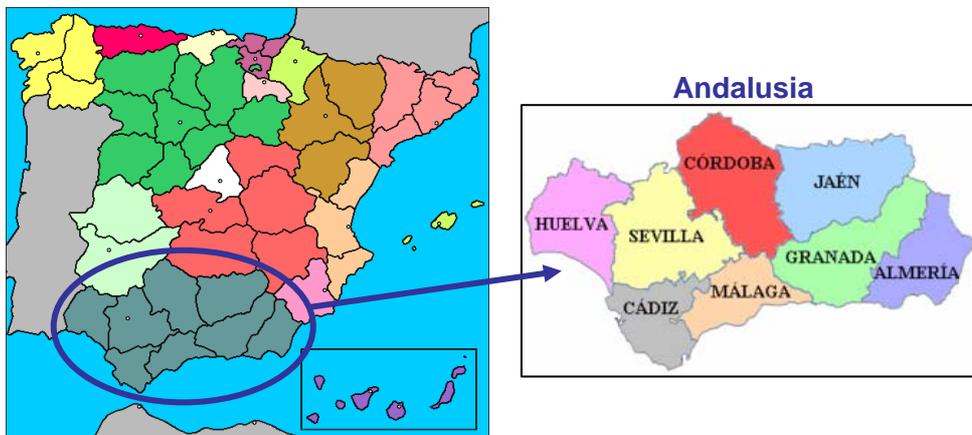
1 Introduction

The Spanish Constitution of 1978 identifies 17 regions in Spain: 15 *autonomous communities* and 2 *autonomous cities* (Ceuta and Melilla). In addition, Spain is divided into fifty *provinces*. Formerly of greater importance, since the arrival of the autonomous community system the provinces have had fewer powers. They are still used as electoral districts, in postal addresses, in phone codes, and as geographical references.

Andalusia (in Spanish: *Andalucía*) is one of Spain's autonomous communities. It is the most populated (with more than 7 million people out of Spain's 42 million inhabitants) and the second largest of the seventeen. Its capital is Seville. The Andalusian population is distributed unevenly, being concentrated in the main cities of the region.

Andalusia is bounded to the north by Extremadura and Castile-La Mancha (also autonomous communities); to the east by Murcia and the Mediterranean Sea; to the west by Portugal and the Atlantic Ocean (south-west); to the south by the Mediterranean Sea (south-east) and the Atlantic Ocean (south-west), linked at the southernmost point by the Strait of Gibraltar separating Spain from Morocco. The British colony of Gibraltar at the south shares its three-quarter-mile land border with the Andalusian province of Cádiz.

The region is divided into eight provinces named after their capital cities: Córdoba (the capital has more than 300 000 inhabitants), Jaén (the capital has more than 100 000 inhabitants), Granada (255 000), Almería (155 000), Málaga (522 000), Seville (683 000), Cádiz (154 000) and Huelva (142 000).



Andalusia's contribution to Spanish GDP is equal to around 14%, while its contribution to national GERD is around 10%. However, general indicators of Andalusian RTDI are showing a positive trend. Especially significant is the increase in regional BERD, from 5.2% of total regional expenditure in R&D in 2002 to 6.4% in 2004. Business expenditure on innovation has also increased, from 6.2% in 2002 to 9.5% in 2004.

The regional economy is based on SMEs, many of which (around 70%) are of very small size (0-1 employees), especially in the services sector, the most important economic activity in the region. Other important sectors are agri-food and the aerospace auxiliary equipment industry. The ICT sector is expanding rapidly in the region, especially around Málaga, and is one of the most RTDI-intensive sectors in Andalusia.

2 Regional knowledge base

There is a wide dispersion in RTDI intensity among the Spanish regions, but none has reached the European average of 2% of GDP. Although the gap in RTDI intensity among the regions has narrowed in the last decade, the concentration of efforts in certain regions is still considered a key feature of the Spanish system. Three regions are the most significant ones within the Spanish RTDI scene, in terms of human and material resources for RTDI: the Region of Madrid, Catalonia and the Basque Country. Andalusia has become a region of particular interest due to the evolution of these indicators and recent achievements for some of them.

Indicator	Region of Madrid	Catalonia	Basque Country	Andalusia
RTDI as % of GRP	1.80	1.37	1,42	0.80
Total expenditure on RTDI (€ million)	2 500	2 100	780	880
% of regional expenditure in total national expenditure on RTDI	27.4	23.6	8.7	10
Number of TBFs (technology-based firms)	660	1,300	540	230
% of TBFs in the national total number	17.5	35.5	14.2	6
Total expenditure on RTDI by enterprises (€ million)	1 300	1 300	610	310
Number of employees within R&D (FTE)	39 500	36 600	12 300	17 000
% of FTE in the national total number	24.4	22.6	7.6	10.5

(Rounded figures) – Source: most recent data published by the National Statistics Institute, INE. Figures correspond to year 2004. Source for % of GRP: official document of the Ingenio 2010 Programme.

2.1 Description of the regional knowledge base

2.1.1 Regional knowledge creation capacity

The Andalusian RTDI system has shown a notable increase in the human and material resources devoted to R&D over the last fifteen years, although this has not been enough for it to reach the Spanish national or regional averages that can be used as references. Andalusian RTDI expenditure as a proportion of GRP (0.80% in 2004) is not remarkable in comparison with the percentage of GRP that other Spanish regions allocate to RTDI activities, although the budget in absolute figures (€880 million in 2004) puts it in fifth place when compared to the regional RTDI expenditures of all Spanish regions.

RTDI expenditure (€ million) (Rounded figures)				
	2001	2002	2003	2004
Andalusia	538	588	903	883
Spain	6 227	7 192	8 213	8 946

According to National Statistics Institute (INE) data, in 2003 Andalusia spent €903 million on RTDI, representing 11% of total national RTDI expenditure. The Andalusian RTDI budget then decreased by €20.3 million in the period from 2003 to 2004, a 2.2% drop. Nevertheless, in the period 2002-2003, the Andalusian RTDI budget had been increased by 54% as a result of implementation of the Master Plan for Innovation and Technological Development in Andalusia (Pladit), the main core of which was executed in 2003. In 2004, no funds were available from Pladit and funds from the Plan for Innovation and the Modernisation of Andalusia 2005-2010 (PIMA) had not yet been released.

The main economic sectors in the region carrying out RTDI activities are the agri-food, mechanical engineering and aerospace auxiliary equipment industries and ICT (in relation to its active participation in RTDI supporting programmes).

□ **Regional public RTDI structure: universities and public research organisations**

The **university system** in Andalusia has undergone fundamental changes over the last two decades, both at academic level and in relation to RTDI activities. According to the most recent data from the National Statistics Institute (INE), more than 44% of regional expenditure on RTDI is carried out by universities (0.34% of GRP). Their total expenditure on RTDI in 2004 was more than €390 million. The number of researchers working within universities in 2004 was more than 17 200, over 59% of the total for the region (the European Union average share of researchers working in universities is around 25%). This demonstrates the main role that universities play in the Andalusian RTDI system.

The university system in Andalusia grew tremendously during the period covered by the Andalusian Plan for Research (PAI 1990-2003), which is described in Section 2. In the last 15 years, four universities have been created (apart from the International University of Andalusia) and more than 100 000 new students have been registered. In 2002, university students in Andalusia represented 21% of the total for Spain. This growth has made it necessary to assign most of the funds received to the resources needed to cope with the new universities and students.

At present, there are 10 public universities in Andalusia.

- Academic performance. In 2003, they integrated almost 16 000 lecturers, more than 230 000 students, which represents 18% of Spanish university students, and about 6 400 PhDs. 27% of higher education students are enrolled in technical and scientific studies, and 23% in health sciences studies.
- RTDI activities. Most of their RTDI activities are related to fundamental research, representing 56% of total expenditure. Applied research represents only 44%, and innovation 10%.¹

The largest Andalusian universities are the **University of Seville**, which has 57 000 students, more than 4 000 lecturers and about 3 130 PhDs; and the **University of Málaga**, with 34 500 students and about 2 000 lecturers. In the former, the research groups from the Industrial Engineering School working in the aerospace sector are especially significant, accounting for more than 550 different groups, 2 360 researchers and 36 requested patents in 2004. Since 2001, the University of Seville's rate of grant holders working in research has increased by 42% (350 in 2004 as against 250 in 2001) and patent applications by 200% (36 patent applications in 2004 as against 12 in 2001).

At the University of Málaga R&D activities within the ICT sector, together with important technology centres, parks and enterprises in the area are especially significant.

¹ Rounded-up figures.

According to the SCI (Science Creation Index) and the ICYT (Spanish Science and Technology Index - *Índice Español de Ciencia y Tecnología*), the numbers of scientific publications produced by Andalusian universities between 1996 and 2001² were:

Years	1996	1997	1998	1999	2000	2001
Andalusia (SCI)	2 300	2 400	2 650	2 950	2 850	3 050
Spain (SCI)	17 250	18 200	19 700	20 900	20 800	21 500
Andalusia (ICYT)	700	750	700	600	800	650
Spain (ICYT)	5 500	5 700	5 700	5 350	5 250	4 850

(Rounded figures)

In 2001-2003, 45% of all publications produced by Andalusian universities related to the life and agricultural sciences, followed by technological sciences with 28% of the total. Andalusian publications represented around 15% of the total number of Spanish publications in national journals, and 13% of the total Spanish publications in international journals, occupying third place in the Spanish regional scoreboard.

In general, Andalusia produced almost 13% of national scientific citations in the SCI from 2001 to 2003 (over 9 500 of the more than 78 000 Spanish documents cited), taking third place at national level. Seville and Granada achieved more than 60% of the total, followed by Málaga and Córdoba (with 25%).

On the other hand, in 2001, 16% of all patents submitted to the Spanish Patent and Trademarks Office (OEPM) by Andalusian organisations/researchers (579) were from universities, according to the OEPM. Furthermore, Andalusian universities applied for 11% of all patents submitted to the European Patent Office (EPO) by Andalusian organisations/researchers (164), according to the EPO. Universities in Andalusia are the third largest source of patents in the region, behind individual inventors (who applied for 60% of the patents coming from Andalusia in 2001) and private firms (which applied for 20%).

In 2004 the ratio of patent submissions per inhabitant in Andalusia (37) was one of the lowest in Spain, and way below the national average (71). That year the OEPM approved 143 Andalusian patents out of the 273 submitted, almost 9% of the total for Spain and 31 more than in 2003. However, this “success ratio”³ is also lower than the national average (which is 57%).

There are also several **public research organisations** in Andalusia which represent more than 20% of the public RTDI effort in the region, although the size and performance of each of them varies widely.

- Belonging to the Regional Government: the “Scientific IT Centre of Andalusia” (CICA – *Centro Informático Científico de Andalucía*), dealing with information and communication technologies (ICTs),⁴ the “Institute for Research and Training in Agriculture, Fisheries, Food and Ecological Production” (IFAPA - *Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica*), which is an autonomous organisation carrying out research, technology transfer and training for the agricultural, fisheries and food sectors,⁵ and the Experimental Animal Health Centre (CEASA).⁶

² More recent data has not been found.

³ Patents approved as a proportion of patents submitted.

⁴ www.cica.es.

⁵ www.juntadeandalucia.es/innovacioncienciayempresa/ifapa/servlet/FrontController?action=Static&url=queEsIFAPA.html&ec=default.

⁶ www.uco.es/webuco/ceasa/.

- Belonging to the Spanish National Research Council (CSIC), which has 39 research institutes throughout the region, some examples: the IGS (Oils Institute of Seville),⁷ the López Neyra Institute of Parasitology and Biomedicine⁸ and the Andalusian Marine Sciences Institute (ICMAN).⁹

□ **Regional private RTDI structure: private firms**

Andalusian BERD has grown in recent years, but the number of enterprises which innovate in-house to improve their competitiveness is way below the European average.

BERD evolution (€million)									
	1996	1997	1998	1999	2000	2001	2002	2003	2004
Andalusia	101	95	152	139	179	150	203	344	313
Andalusia % RTDI expenditure	26.66	24.03	32.67	29.27	33.05	27.90	34.73	38.19	35.44
Spain	1 904	2 015	2 509	2 647	3 120	3 312	3 943	4 459	4 890
Spain % RTDI expenditure	49.45	49.90	53.21	53.00	54.56	53.20	54.82	54.3	54.66

(Rounded figures)

Studies by the National Statistics Institute show that Andalusian companies contribute 0.34% of Andalusian GRP, perform around 35% of Andalusian RTDI activities, and employ more than 4 300 researchers (around 20% of the Andalusian total). Total expenditure by enterprises in Andalusia in 2004 was more than €313 million, which shows a reduction in the RTDI budget to 0.28% of GRP, although in the rest of the Spanish regions enterprises' RTDI financial efforts increased to 0.61% of GNP. This was a consequence of the end of Pladit in 2003.

According to the Enterprises Central Directory (DIRCE), which belongs to the INE, more than 99% of Andalusian firms are SMEs, and only 17% of them do not belong to the services sector.

It has already been stated that the main economic sectors carrying out RTDI activities in the region are the agri-food, mechanical engineering and aerospace auxiliary equipment industries and ICT. Examples of firms with high RTDI capacities within each of these sectors are:

- **Puleva Biotech**,¹⁰ established in 2000 and part of the Ebro-Puleva Group, Spain's largest agri-food business. It is a company devoted to research into and development and commercialisation of new products based on natural ingredients with health-related benefits. Thirty out of seventy employees in the company hold a PhD degree and more than 60 are directly involved in R&D and innovation activities.
- **EADS-CASA**¹¹ is the leader in Spain's aerospace industry, having 7 000 people working at seven sites located in Madrid and Andalusia. Its present field of operations covers the design, production, marketing of and product support for its own products, as well as a broad spectrum of international joint operations (Airbus, Eurofighter, Airbus Military and Arianespace). In each of these international operations, a joint company has been established to direct overall programme management. In 1999, CASA joined EADS.
- **Abengoa**¹² is a big Andalusian technology company applying innovative solutions for sustainable development in the infrastructure, environment and energy sectors.

⁷ www.ig.csic.es/.

⁸ www.ipb.csic.es/index_ingles.html.

⁹ www.icman.csic.es/.

¹⁰ www.pulevabiotech.es/pb/home.jsp.

¹¹ www.casa.eads.net/.

¹² www.abengoa.com/.

According to the 2005 EU Industrial R&D Investment Scoreboard, it belongs to the top 350 most innovative European companies and is the 8th Spanish company with the highest BERD. Telvent is Abengoa's ICT company, which occupies a leading position in Spain.

Andalusian private firms accounted for 23% of all patents submitted to the OEPM by Andalusian organisations/researchers in 2001, and 26% of the patents submitted to the EPO by Andalusian organisations/researchers.

The Andalusian private sector generates very low demand for the scientific and technological work done mainly by universities and science and technology centres, as a consequence of the nature of the entrepreneurial fabric, which is mainly composed of SMEs in non-technology-intensive sectors such as services or agri-food (this is reflected in a lower BERD). For this reason, some new interface bodies, such as the Offices for the Transfer of Research Results (OTRIS), the Southern Europe Innovation Relay Centre – Ceseand, the Andalusian Innovation and Technology Transfer Centre and the Science and Technology Parks (STPs), have been established in recent years in order to link up the available science and technology supply with the firms' needs and demands. (These interface bodies are explained in the following chapters.)

□ **Other regional RTDI structures**

Andalusia has about 41 **Research and Technology Centres**, semi-public entities most of which have a dual role as instruments for transferring knowledge to society and RTDI centres, and several **Science and Technology Parks (STPs)** (explained in the following sub-sections).

One of the largest Andalusian research centres is the **Andalusian Centre for Innovation and ICT (CITIC)**,¹³ located in the STP of Andalusia (in Málaga). It is a non-profit organisation created in 2002 by leading private companies from the ICT sector, and it belongs to the national Network of Innovation and Technology Centres of the Ministry of Education and Science. It has a very active role as an R&D performer in ICT and as a technology transfer agent at regional and national level.

2.1.2 Region knowledge diffusion capacity

The principal interface organisations in the region are:

- **Offices for the Transfer of Research Results (OTRIs).** At present there are 18 OTRIs in Andalusia, 9 of them belonging to universities, with a staff of 71 researchers, and the other 9 to other research organisations. Their mission is to promote and facilitate cooperation among researchers and enterprises in their R&D activities and transfer of the results to the markets and society.
- **Southern Europe Innovation Relay Centre - Ceseand.**¹⁴ This is one of the 71 existing European Innovation Relay Centres (IRCs) with the objective of international knowledge transfer.

IRC staff (a total of nearly 1 000) are experienced specialists with backgrounds in business, industry and research. To date, they have facilitated more than 1 000 transnational transfers of technology. Ceseand is financed by the EC (50%) and regional funds provided by the following Andalusian public partners:

¹³ www.citic.es.

¹⁴ In Spanish: *Centro de Enlace Sur Europa-Andalucía (Ceseand)* - www.ceseand.cica.es/index_en.php.

- **Andalusian Innovation and Development Agency (IDEA)**, dedicated to economic development, project financing and technological infrastructure in Andalusia. It is the coordinator of the Ceseand project.
- **Andalusian Innovation and Technology Transfer Centre (Citandalucía)** as a partner. Its main contribution is as a technology adviser and performer since it is the Andalusian governmental agency responsible for innovation and technology transfer.
- **Andalusian Institute of Technology (IAT)**. Promotes and carries out technological projects, stimulating industrial innovation processes and the incorporation of new technologies in business.
- **Canaries Technological Institute (ITC)** as a partner.

Ceseand's results in 2005: 20 transnational technology transfer agreements were signed, namely 8 technical cooperation agreements, 7 commercial agreements with technical assistance, 1 production agreement, 3 licence agreements/patent sales, and 1 joint venture.

- **Andalusian Innovation and Technology Transfer Centre** (*Centro de Innovación y Transferencia de Tecnología de Andalucía - Citandalucía*).¹⁵ It is a public enterprise partner of Ceseand and manager of the Andalusian Research Results Transfer Network (RATRI) and the Andalusian Technology and Innovation Network (Raitec). Citandalucía promotes and facilitates the matching of R&D efforts to the real demands of the entrepreneurial sector and the detection of new business opportunities for potential new firms.
 - **RATRI**¹⁶ has as its main objective disseminating information about R&D results and facilitating technology transfer to society, but it also helps Andalusian firms to find European partners, to cooperate with technology-based firms and university spin-offs, etc.
 - **Raitec**¹⁷ has as its main objective informing the Andalusian productive system about the innovative actions developed. The principal innovation agents are: Science and Technology Parks, innovation and technology centres, calibration laboratories, European Enterprise and Innovation Centres (CEIs), regional and local development agencies, technology-based firms (TBFs), etc.
- **The F. de Paula Rojas Andalusian Association for Research and Industrial Cooperation (AICIA)**¹⁸ is a non-profit public-interest association sponsored by private companies (79%) and public funds. Its goals are to guide and promote industrial research, with an emphasis on publication and dissemination of results, to promote technological progress in Andalusia, and to help improve the professional training of Andalusian engineers. AICIA was born from the initiative of a group of professors at the Seville Engineering School.
- **Science and Technology Parks (STPs)** are private non-profit entities, very regional-oriented, which make a very important contribution as intermediaries between RTDI centres and enterprises, facilitating interaction between the scientific and technological scenes and acting as a mechanism for the dissemination and generalisation of innovation processes.

¹⁵ www.citandalucia.com/citaeng/.

¹⁶ www.ratri.es.

¹⁷ www.raitec.es.

¹⁸ http://www.aicia.es/principal_e.htm.

Science and Technology Parks in Andalusia are associated at regional level through the Andalusian Network of Technological Sites (RETA, *Red de Espacios Tecnológicos de Andalucía*). It was created in 2005 as an entrepreneurial non-profit association promoted by the Regional Government. Members are considered regional technological agents by the Regional Ministry of Innovation, Science and Enterprise, which is also a member through the Andalusian Innovation and Development Agency (IDEA), the Andalusian Technology Corporation and IFAPA (Institute for Research and Training in Agriculture, Fisheries, Food and Ecological Production).

Some significant examples of Science and Technology Parks in Andalusia are:

- **STP of Andalusia, PTA**¹⁹ (in Málaga), which in 1997 had 51 firms and currently has more than 375 firms and more than 8 500 employees specialised in ICT. It is expected to be the embryo for the future Málaga Valley, the European version of Silicon Valley.
- **STP Cartuja 93**²⁰ (in Seville), with R&D organisations in several fields such as biotechnology, ICT and energy. It is financed by the national (34%), regional (51%) and local governments. Currently this technology park has 24 RTDI centres, 2 innovation and technology centres, 291 firms, 1 business incubator and 11 455 employees, 21% of whom are involved in RTDI.
- **STP of Health Sciences**²¹ (in Granada), with more than 41 firms.

These group together 35% of the Spanish enterprises located in Technology Parks (a total of about 700 enterprises).

In addition to the above, two Science and Technology Parks are in the process of being created:

- **Aeropolis**, for the Andalusian aerospace auxiliary equipment industry. This STP is managed by the Regional Ministry of Innovation, Science and Enterprise through the Andalusian Innovation and Development Agency (IDEA). It will be strategically located next to Seville airport and the new EADS-CASA factory in Seville.
- **Innovation and Technology Park of Almería (PITA)**, with private and public investment from the Regional Government. It is specialised in the sectors auxiliary to intensive agriculture.

2.1.3 Regional knowledge absorption capacity

The shares of the Andalusian labour force participating in public lifelong learning programmes compared with the Spanish averages can be used as an indicator of the region's knowledge absorption capacity. The following table shows these proportions, distinguishing between the employed labour force and the unemployed.

It can be observed that the values for Andalusia are lower than the averages for Spain as a whole. In any event, the rates are very low at both national and regional levels, especially in the labour force aged between 25 and 35 years. On the other hand, it is noticeable that rates are higher for the unemployed than for those with a job. Developing and assuring lifelong learning has systematically been identified in the Trend Chart Annual Reports as one of the main challenges of RTDI systems in Spain.

¹⁹ www.pta.es.

²⁰ www.cartuja93.es/index.jsp.

²¹ www.ptsggranada.com/en/default.jsp.

	Total labour force: 25 to 64 years		Employed: 25 to 64 years		Unemployed: 25 to 64 years	
Spain	Rate of participation in public lifelong learning programmes: 4.3%	Of which aged between 25 and 35 years: 7.2%	Rate of participation in public lifelong learning programmes: 3.7%	Of which aged between 25 and 35 years: 6.1%	Rate of participation in public lifelong learning programmes: 9.1%	Of which aged between 25 and 35 years: 14.4%
Andalusia	Rate of participation in public lifelong learning programmes: 3.8%	Of which aged between 25 and 35 years: 6.4%	Rate of participation in public lifelong learning programmes: 3.2%	Of which aged between 25 and 35 years: 5.0%	Rate of participation in public lifelong learning programmes: 6.8%	Of which aged between 25 and 35 years: 11.9%

2.2 Policy context

2.2.1 Policy framework and actors

The Spanish Constitution of 1978 established the maximum competences that could be taken over by the regions in Spain and the general framework for the interaction between them and the National Government. These are then enshrined and spelled out in the Statutes of Autonomy, the regional governmental laws.

Nowadays, competences related to R&D are shared between the Andalusian Government and the State. The Andalusian Statute of Autonomy of 1981 establishes that, subject to the Spanish Constitution, the Regional Government has exclusive competence for managing the regional scientific heritage and institutions. The Spanish Constitution establishes that the State has exclusive competence for the general promotion and coordination of scientific and technical research.

A new Andalusian Statute of Autonomy has recently been approved by the Andalusian Parliament and is now being processed by the national legislative bodies. It gives further details on the competences of the Regional Government in relation to R&D and innovation:

- The Regional Government has exclusive competence in relation to its centres and research structures and the projects it finances, including: deciding on the directions to be taken by research, monitoring and evaluating projects, managing and accrediting the centres and structures in Andalusia, regulating and managing grants and financial aid allocated by the Regional Government, regulating and training the researchers and support personnel, and disseminating science and transferring the results.
- The Regional Government also has the competence to coordinate Andalusian centres and research structures.
- Criteria for collaboration between the Regional and National Governments in relation to R&D and innovation policies will be established. Systems for the participation of the Regional Government in shaping policies related to these issues within the European Union and other international institutions are also envisaged.

The National Government has developed a global RTDI strategic plan, the Spanish National Plan for Scientific Research, Development and Technological Innovation 2004-2007. Its aims are to boost the standards of Spanish science and technology and the human resources devoted to RTDI (both in the public and the private sector), as well as improving researchers' careers; strengthen Spanish science and technology in the international sphere; make major investments in infrastructure; and improve the role of basic research in society by publicising

the importance of its new findings. This instrument also aims to coordinate interregional science and technology cohesion through the participation of the Regional Governments in the Interministerial Commission on Science and Technology (CICYT), the governmental body in charge of the design, planning, coordination and monitoring of national R&D policies. Regional governments have competence for innovation and usually each regional government develops its own innovation policy framework.

The Andalusian case is quite different; this region has pioneered the development of regional R&D policy (the Andalusian Plan for Research (PAI)) and, like all Spanish regional governments, has developed several of its own innovation policies, such as the Master Plan for Innovation and Technological Development in Andalusia (Pladit).

Since 1990, the PAI has been the main tool in Andalusia for the promotion and coordination of regional research policy. The Plan was structured in three phases. In April 1990 the first phase, PAI I 1990-1993, was launched, followed by PAI II 1994-1999 and PAI III 2000-2003. This initiative was one of the first regional research plans in Spain and its total budget was about €900 million (€108 million for the first two phases and €839 million for the last one).

PAI I originated from an Andalusian RTDI situation analysis, which detected the following problems:

- A very low level of quality in the RTDI system.
- Andalusian RTDI administrative management was very slow and bureaucratic.
- There was a very low level of RTDI social sensitivity and there was also a very low level of private involvement in research activities.

This type of analysis has been repeated from phase to phase, always identifying these as some of the most serious endemic weaknesses of the Andalusian RTDI system. The conclusions were the same even in the ex post analysis after the end of the last PAI, in 2003, during the design stage of the replacement policy, PAIDI.

The three PAI phases had very similar objectives in order to correct those weaknesses:

- Prioritising RTDI lines.
- Increasing public and private budgets for RTDI activities, exceeding the Spanish average expenditure on RTDI, and reaching 0.5% of Andalusian GRP. Improving private involvement.
- Promoting Andalusian participation in international RTDI projects.
- Improving and making the existing research groups more competitive, improving the Andalusian basic scientific infrastructure and simplifying RTDI administrative management processes.

During the three phases of the PAI, the number of research groups grew from 800 identified in 1989, of which 75 (9.4%) were classified as highly competitive, to 1 833 (an increase of 129%) identified in 2002, of which 511 (25.3%) were classed as highly competitive. In 1987, the average scientific production per research group was equal to 2.4 publications in international media; in 2002 it was equal to 3.6 per group per year. The number of PhDs working in those research groups increased by 105% since 1990, reaching 8 300 in 2002.

In 2000, the PAI was supplemented with Pladit, the first Andalusian policy for technological development and innovation, which ended in 2004.

RTDI regional policies in Andalusia are managed by the Regional Government, the **Junta de Andalucía**. Until 2005:

- The regional plan for R&D was managed by the **General Directorate of Universities**, which belonged to the Regional Ministry of Education (*Consejería de Educación*). This regional plan was the Andalusian Plan for Research (PAI).
- The regional plan for innovation was managed by the **Regional Ministry of Employment and Technological Development** (*Consejería de Empleo y Desarrollo Tecnológico*). This regional plan was the Master Plan for Innovation and Technological Development in Andalusia (Pladit).

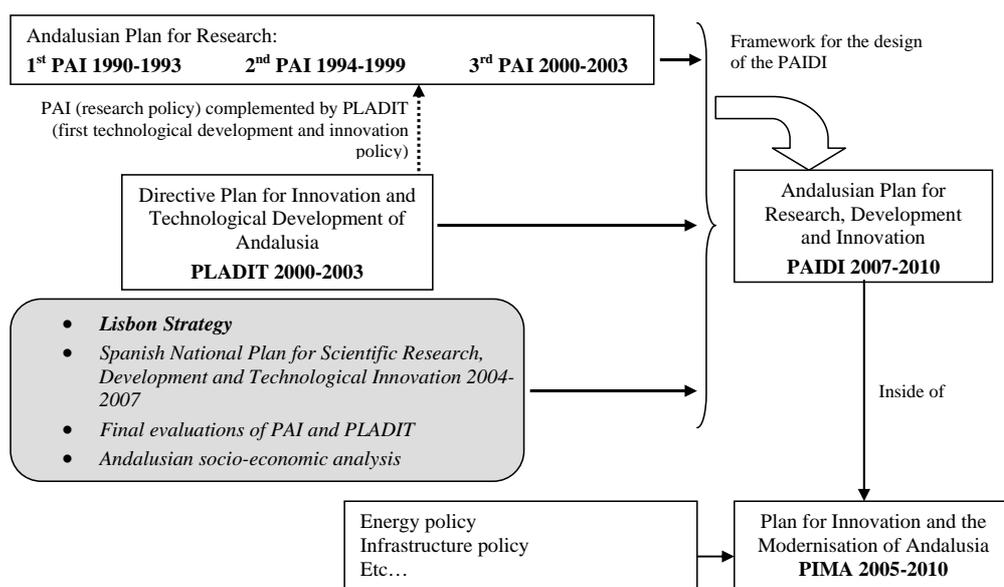
In 2005, with a new term of office of the Regional Government, a new department was created for the integral management of RTDI policies: the **Regional Ministry of Innovation, Science and Enterprise** (*Consejería de Innovación, Ciencia y Empresa*). It took over all regional competences in relation to RTDI, starting the process of integrating all related instruments and public policies. It merged the old Regional Ministry of Employment and Technological Development with the General Directorate of Universities, which no longer belongs to the Regional Ministry of Education. The Regional Ministry of Innovation, Science and Enterprise is in charge of the design and management of the Plan for Innovation and the Modernisation of Andalusia 2005-2010 (PIMA).

The PAI and Pladit came to an end in 2004 and were replaced by the Plan for Innovation and the Modernisation of Andalusia 2005-2010 (PIMA). The main novelty of PIMA was the integration of R&D and innovation policies with other policies related to regional development (i.e. regional energy plans). RTDI activities within PIMA are covered by the Andalusian Plan for Research, Development and Innovation (PAIDI), which is expected to be approved by the end of 2006 for the period 2007-2010.

PIMA was designed with the aim of reinforcing the medium- and long-term socio-economic growth of the region. It identifies the promotion of knowledge and entrepreneurship as strategic objectives, together with sustainability, the environment, energy, and extension of the information society, and it plans 286 actions grouped in 31 strategic areas, with 82 objectives and 6 priorities. The most significant ones (in relation to their budget) are those dealing with promoting the knowledge industry and universities (more than €2 600 million) and entrepreneurial promotion (more than €1 800 million). The other priorities are sustainability, the environment and energy (€560 million), the information society (€482 million), equal digital opportunities (€93 million), and e-administration (€55 million). Inside PIMA a new Plan has been drawn up to continue developing the Andalusian RTDI system, once the PAI and Pladit have ended. This is the Andalusian Plan for Research, Development and Innovation (PAIDI).

PIMA, the Lisbon Strategy, the Spanish National Plan for Scientific Research, Development and Technological Innovation 2004-2007 and the results of the final evaluations of the PAI and Pladit structured the framework in which PAIDI was designed. By the end of 2006, the new PAIDI is expected to be approved for the period 2007-2010.

Other important actions planned by PIMA in relation to RTDI are: creating a technological corporation for quality in research, implementing a plan of incentives for professionals in universities, setting up the Andalusian Support Centre for Industrial Design (*Centro Andaluz de Apoyo al Diseño Industrial*), implementing a programme to attract prestigious researchers in strategic sectors and facilitate access to the Internet and digital public services for families, and creating the Technological Corporation of Andalusia (*Corporación Tecnológica Andaluza*), involving the most innovative companies in the region, research groups, financial entities and the regional administration. This body will finance efforts to achieve excellence in research meeting the real needs of the productive sectors.



□ Main actors involved in the design, management and coordination of RTDI

Each region in Spain has its own agency for the implementation of regional RTDI policies. They are usually totally public and report to the regional and even the European authorities. In Andalusia this agency is the **Andalusian Innovation and Development Agency (IDEA)**, which belongs to the Regional Ministry of Innovation, Science and Enterprise. It was previously called the Institute for the Promotion of Andalusia (*Instituto de Fomento de Andalucía*, IFA).

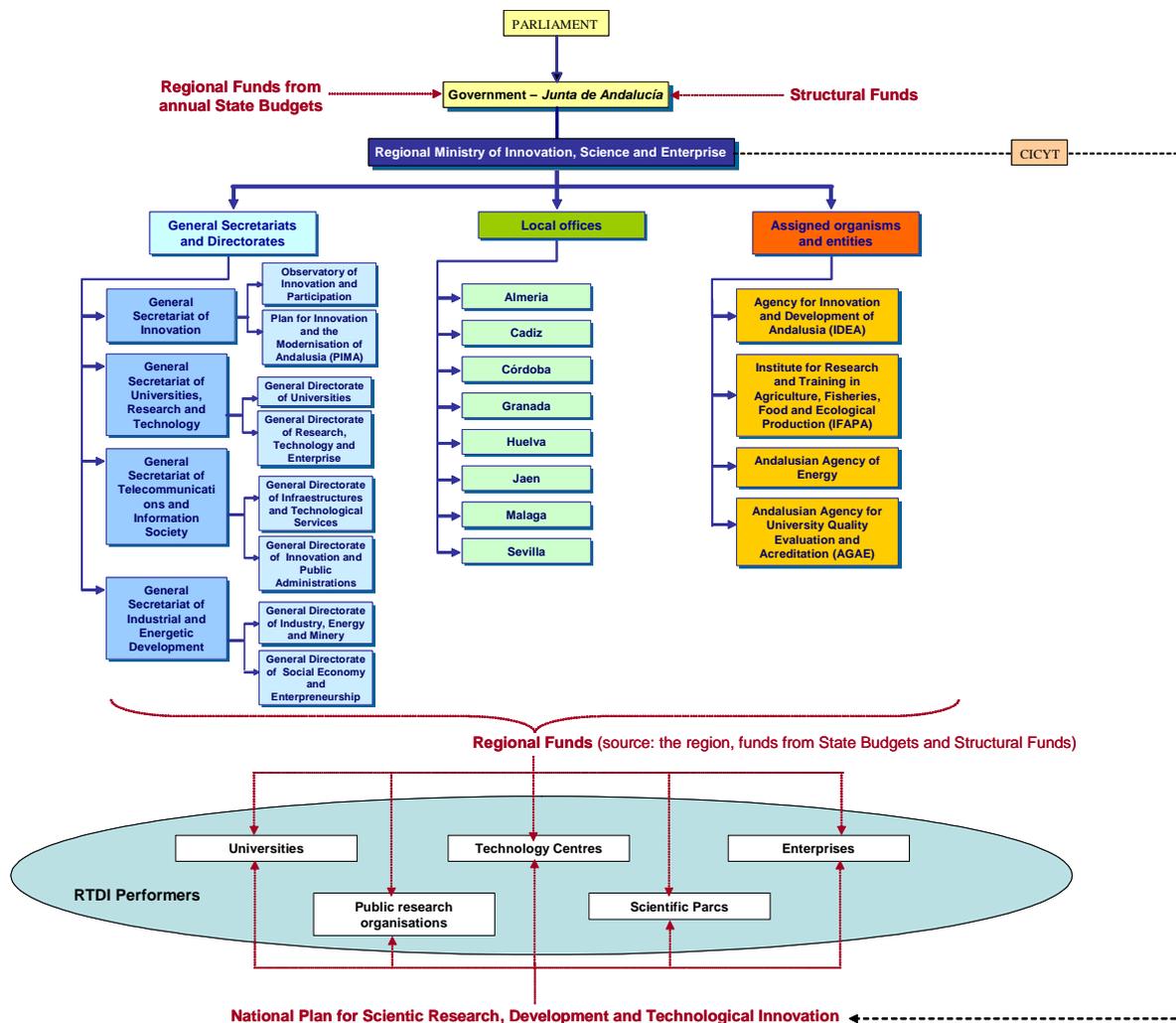
IDEA has been appointed by the Regional Government as the instrument implementing policies for the promotion and economic and social development of Andalusia, under the aegis of the Regional Ministry of Innovation, Science and Enterprise. Its mission is to contribute to the economic and social development of the region, offering the best services to Andalusian companies, employers and the Regional Government, and promoting the spirit of enterprise, innovation and cooperation within the science-technology-business system and the competitiveness of the regional production structure.

In March 2006, IDEA signed an agreement with the Centre for the Development of Industrial Technology (CDTI) under the Ministry of Industry, Tourism and Trade with the objective of cooperating in dissemination, promotion and technology transfer activities in order to help Andalusian companies to increase their technological profile.

The Regional Ministry of Innovation, Science and Enterprise also participates in the advisory bodies of CICYT (the Interministerial Commission on Science and Technology) in charge of the formulation and management of the Spanish National Plan for Scientific Research, Development and Technological Innovation 2004-2007.

Since 2004, the regional governments in Spain are not only represented in the advisory bodies of CICYT; they also participate actively in CICYT's Working Groups for drawing up the Spanish National Plan for Scientific Research, Development and Technological Innovation. On the other hand, a Sectoral Conference of regional ministries with competence in R&D and innovation has recently been created so that the autonomous communities can participate in the implementation of the programmes managed by the Ministry of Education and Science (MEC). Furthermore, specific agreements between the MEC and the regional governments are being signed for mutual collaboration in science and technology, and for the coordinated development of the priorities identified in the national and regional RTDI plans. These facts show how the

regions are playing an increasingly important role in the national RTDI governing structures. Together with the regions of Madrid, Catalonia, Valencia and the Basque Country, Andalusia exercises a significant influence in this area.



The figure shows the breakdown of competences in relation to RTDI in Andalusia and the sources of public funds for RTDI activities (lines in brown):

- **Regional funds from the annual regional budgets.**
- **Regional funds from annual State budgets.**
- **The Spanish National Plan for Scientific Research, Development and Technological Innovation.** In 2004, Andalusian participation in this plan represented almost 12% of the total aid granted under the plan. This percentage is almost equal to the result between 2001 and 2003, but much higher than the participation in previous phases of the national plan. On the other hand, the participation of Andalusia in the 6th European Framework Programme represented only 5% of the Spanish total in 2004. Furthermore, total participation in the 6th Framework Programme was slightly lower than the result for FP5 (falling from 5.5% for 1999-2002 to 5.4% for 2003-2005).
- **EU Structural Funds.** According to the Regional Government's Chamber of Accounts, Andalusia has been allocated 30.2% of the total Structural Funds available for Spain for the period 2000-2006. More information on this source is given in Section 3.

Public research organisations and the universities also play a role in the design, management and coordination of the Andalusian RTDI system, acting as consultative bodies.

2.2.2 Policy objectives and instruments

Andalusia began to develop its RTDI competences relatively soon after the approval of its Statute and the constitution of its first Government in 1982. The Science Policy Programme was created in 1984; this was the predecessor of the PAI. In 1987, a year after approval of the Law on the Promotion and General Coordination of Scientific and Technical Research (Science Law), which forms the basis of the current Spanish RTDI system, the Interdepartmental Commission on Science and Technology was created and the PAI was established as an instrument for the promotion and coordination of RTDI processes.

From the first quarter of the year 2000, the focus of Spanish policy on science and technology started to shift from an RTDI orientation towards an innovation orientation by following an integrative approach defined in terms of goals and initiatives.

Current Andalusian RTDI policy is outlined in the Andalusian Plan for Research, Development and Innovation 2007-2010 (PAIDI), which is expected to be approved at the end of 2006. It integrates in one coordinated plan research, development and innovation, which had been addressed by different regional plans in the past, as has been shown in previous sections. In 2007 there will be a mid-term evaluation, and periodic revisions are programmed during the whole period covered by the plan.

The main objectives of PAIDI are:

- Devising an evaluation model for analysing the extent to which the policy objectives are achieved.
- Participating actively in the elaboration of the Spanish National Plan for Scientific Research, Development and Technological Innovation, through the established cooperation bodies, in order to ensure that it is consistent with Andalusian interests and to coordinate PAIDI with the National Plan.
- Promoting the participation of Andalusian research groups and organisations in programmes under the Spanish National Plan for Scientific Research, Development and Technological Innovation and participating in the European Framework Programme.
- Promoting cooperation within the Andalusian RTDI and productive systems, and within public and private organisations, for research, development and the application of new technologies and processes to improve quality and competitiveness.
- Promoting the creation of new technology-based firms (NTBFs) and the economic, social and cultural utilisation of the knowledge base built up by the RTDI system.

At present, the main policy instruments of the Andalusian RTDI system are the programmes and actions under PAIDI.

The overall policy mix which is affecting Andalusia is described below. **It is noticeable that many of the instruments are new both at national level** (with the Spanish National Plan for Scientific Research, Development and Technological Innovation 2004-2007 and the Ingenio 2010 Programme) **and at regional level** (with the new PAIDI).

Improving innovation and R&D governance

The Centre for the Development of Industrial Technology (CDTI), which belongs to the Ministry of Industry, Tourism and Trade but has been structured independently so that it can respond flexibly and rapidly to challenges, has been consolidated as a fundamental engine for encouraging RTDI by Spanish business.

Another instrument which is having considerable influence in all Spanish regions is the Spanish National Plan for Scientific Research, Development and Technological Innovation 2004-2007, which is seeking to achieve regional cohesion in RTDI in Spain. In 2004, Andalusian participation in this plan represented almost 12% of the total aid granted through it. Andalusian participation in the National Plan was also very extensive in previous phases (Spanish National Plan for Scientific Research, Development and Technological Innovation 2000-2003).

The Andalusian Regional Government has designed PAIDI, the Andalusian regional instrument to improve Andalusian RTDI activities, in such a way as to move them closer to the Lisbon Objectives. The aim is to enhance scientific and technological excellence by establishing quality standards and procedures through the Programme for Quality in Research. Under this programme, PAIDI will give selective financial support to basic science projects that show the potential to be competitive at international level and offer strategic interest for Andalusia. Detailed information about the programmes that go to make up PAIDI is not yet available.

The integration of RTD and innovation management within a single department of the Regional Government, the **Regional Ministry of Innovation, Science and Enterprise**, is also a relevant issue in relation to the improvement of RTDI governance. It has already been discussed.

Creating an innovation- and entrepreneur-friendly environment

As has been previously explained, and according to the Regional Government's Chamber of Accounts,²² Andalusia was assigned 30.2% of the total EU Structural Funds available for Spain over the period 2000-2006. According to this entity, the Structural Funds financed 45% of the investments carried out by the Regional Government from 1994 to 1999 (more recent statistics are not yet available). Many of these funds were used for the construction of infrastructures affecting the entrepreneurial environment (i.e. the construction of Science and Technology Parks).

Specific measures have been adopted to reduce technological gaps between regions and consolidate the information society by means of the national **Avanza Programme 2006-2010** (within the Ingenio Programme), which will earmark €1 197 million for developing all aspects of ICT including infrastructures. The Ministry of Industry, Tourism and Trade is signing agreements with all regional governments for the implementation of the Avanza Programme.

By means of different instruments such as the **Neotec Programme** and the **Fund of Funds within the CENIT Programme**,²³ the CDTI gives financial support in the form of venture capital for the creation of new technology-based firms (NTBFs). It also gives financial assistance to companies with the technical capacity to undertake projects involving research, development or technological innovation. The CDTI offers loans with a zero rate of interest and long-term amortisation to these companies. It only backs projects that are technically and economically viable, but does not demand bank guarantees (**venture capital**). The financing provided by the CDTI basically comes from the CDTI's own resources and from the European Regional Development Fund (ERDF). The CDTI's total budget for financing projects has grown from €125 million in 1996 to €227 million in 2002.

²² www.cuentas.es/ccuentas/accesible/junta.htm.

²³ The Ministry of Industry, Tourism and Trade has assigned the management of the CENIT Programme to the CDTI. It belongs to the Ingenio 2010 Programme.

At regional level, PAIDI includes the Programme for the creation and consolidation of NTBFs, university spin-offs, public research centres and other technological sites, which will be spelled out once PAIDI has been approved. Further regional instruments are:

Andalusian Global Grant (Subvención Global de Andalucía, SGA)

The objective of this scheme is to promote Andalusian enterprises, mainly SMEs, through financial aid for investments in fixed assets, aid for industrial modernisation and the Young Enterprise programme for the creation of new enterprises. Specific aid measures for R&D and innovation projects are implemented within this programme.

The scheme is managed by the Andalusian Innovation and Development Agency (IDEA) and partly financed by the EU Structural Funds. In the period 1994-1999, more than €310 million was spent, almost €230 million coming from the Structural Funds. Data for the period 2000-2006 is not yet available. It is thought that the scheme will be renewed after 2007.

Incentives for the Promotion of Innovation and Entrepreneurial Development

These include four strategic sections: enterprise creation, modernisation, competitive cooperation and RTDI. The scheme includes the Plan for the Competitiveness and Consolidation of SMEs (PCCP) and the Campus Programme, focused on NTBFs created from universities (spin-offs). The Campus Programme is supplemented by the Atlantis Programme, focused on NTBFs in general.

The scheme is managed by the Andalusian Innovation and Development Agency (IDEA). It was approved for the period 2005-2006, and is likely to be continued in 2007. It is also partly financed by the EU Structural Funds.

Developing human capital

Several national programmes have been established to reinforce human potential in enterprises and provide long-term professional careers for researchers: the Torres Quevedo Programme, which for 2006 has a budget of €25 million; Juan de la Cierva and Ramón y Cajal, with €45.32 million respectively; and the I3 Programme.

The promotion of scientific and technological excellence by means of the selection of researchers based on quality criteria, suitable stimulation and mobility in the system so as to optimise resources are the main objectives of the Programme for the development of Human Capital, which is included in PAIDI. This Programme's actions will be worked out in greater detail once PAIDI has been approved.

Networking, co-location and clustering measures

The creation of specific frameworks for cooperation among enterprises and between them and research organisations are priorities that will be developed, once PAIDI is approved, by means of its Programme for cooperative research projects among public research organisations, firms, Science and Technology Centres and RTDI agents and by means of the Programme for the creation and consolidation of NTBFs, university spin-offs, public research centres and other technological sites. But, currently, the main instruments for promoting the creation of strategic consortiums for technical research are the CENIT Programme at national level and the European Framework Programme at European level (53 firms took part in 2004, 6.5% of Spanish total participation).

Science and Technology Parks are also a very useful clustering measure, which has already been commented upon.

Knowledge and technology transfer to enterprises

With the aim of improving the competitiveness of SMEs through innovation, programmes such as the PCCP²⁴ (financed with EU Structural Funds managed at regional level) and national programmes designed to promote the incorporation of experienced researchers into enterprises (such as the abovementioned Torres Quevedo Programme) have been established. Within the Spanish National Plan for Scientific Research, Development and Technological Innovation 2004-2007, the Programme for the promotion of technical research for individual scientific and technological projects of a strategic nature has been set up with the objective of giving financial support to scientific projects involving high technological and entrepreneurial risks and comprising interrelated R&D&I activities aimed at integrating science and technology workers, promoting technology transfer and enhancing the technological capacity of enterprises.

At regional level, similar actions are planned under PAIDI by means of the Programme for the promotion of entrepreneurial RTDI, but further information about PAIDI programmes is not yet available.

The creation of intermediary organisations such as Technology Centres has already been described as one of the most important instruments for knowledge and technology transfer to enterprises.

Research cooperation between public research organisations and the private sector

Promoting **cooperation** between public research organisations and the private sector has always been a priority of the Spanish Government. Recently, the CENIT Programme has adopted as its main objective boosting public and private cooperation on R&D matters. The National Strategic Consortia (CENIT), which are to be financed equally by the public and private sectors, will bring about an increase in research and development expenditures of possibly up to €1 000 million over the next five years. CENIT will give priority to proposals with financial backing from one or more of the autonomous communities.

PAIDI has taken this aspect into account in its future Programme for cooperative research projects among public research organisations, firms, Science and Technology Centres and RTDI agents.

Supporting public research

The Spanish Government supports public research through the abovementioned Spanish National Plan for Scientific Research, Development and Technological Innovation 2004-2007 and through more specifically designed instruments such as the new Consolider Programme, which for 2006 has funding amounting to €35 million (€150 million budgeted for the next 5 years) for financing high-level public research groups. PAIDI will promote public research, as the PAI did in the past, with the Programme for supporting research groups, but detailed information about PAIDI programmes is not yet available.

Financial incentives for R&D in the private sector

Tax incentives for R&D and innovation can be considered the most important public measure in Spain for promoting technological innovation in enterprises. They take the form of deductions from Corporation Tax or Social Security contributions for researchers within enterprises. No

²⁴ Plan for the Competitiveness and Consolidation of SMEs.

conditions in terms of research fields or company size/sector have to be fulfilled in order to be eligible for these deductions. They are furthermore compatible with any financial support for R&D, although there are limits for combined deductions from Corporation Tax due to social and labour issues related to R&D activities. The tax treatment of R&D in Spain is considered one of the most advanced in Europe.

Exhibit 1: RTDI policy mix affecting the region

Policy areas	Policy objectives and instruments at EU level affecting the region	Policy objectives and instruments at national level affecting the region	Policy objectives and instruments at regional level
Improving innovation and R&D governance		<p>Consolidate the Centre for the Development of Industrial Technology (CDTI) as the fundamental engine for encouraging RTDI by Spanish businesses. The CDTI belongs to the Ministry of Industry, Tourism and Trade, but has been structured independently to enable it to respond flexibly and rapidly.</p> <p>Seek regional cohesion in RTDI in Spain (Instrument: Spanish National Plan for Scientific Research, Development and Technological Innovation 2004-2007).</p>	<p>Improve Andalusian RTDI activities and bring them closer to Lisbon Agenda (Instrument: PAIDI).</p> <p>Enhance scientific and technological excellence by establishing quality standards and procedures (Instrument: Programme for Quality in Research within PAIDI).</p>
Creating an innovation- and entrepreneur-friendly environment	Use of EU Structural Funds for RTDI facilities.	<p>Specific measures for reducing technological gaps between regions – consolidating the information society (Instrument: Avanza Programme).</p> <p>Support the creation and consolidation of technology-based enterprises: venture capital (Instruments: Neotec Programme and CENIT's Fund of Funds).</p>	<p>Add the innovation component to the RTDI regional plan (merging the PAI and Pladit into the new PAIDI).</p> <p>Favouring NTBFs, spin-offs and Science and Technology Parks (Instrument: Programme for the creation and consolidation of NTBFs, university spin-offs, public research centres and other technological sites within PAIDI).</p>
Developing human capital		<p>Reinforce human potential in enterprises (Instrument: Torres Quevedo Programme).</p> <p>Provide long-term professional careers for</p>	<p>Promote scientific and technological excellence through the selection of researchers based on quality criteria, suitable stimulation and mobility in</p>

Policy areas	Policy objectives and instruments at EU level affecting the region	Policy objectives and instruments at national level affecting the region	Policy objectives and instruments at regional level
		researchers in Spain (Instrument: Juan de la Cierva, Ramón y Cajal and I3 Programmes).	the system so as to optimise resources (Instrument: Programme for the development of Human Capital within PAIDI).
Networking, co-location and clustering measures	Collaboration in R&D projects (Instrument: European Framework Programme).	Creation of National Strategic Consortia for Technical Research (Instrument: CENIT Programme).	Create specific frameworks for collaboration between enterprises and research organisations (Instruments: Programme for cooperative research projects among public research organisations, firms, Science and Technology Centres and RTDI agents and Programme for the creation and consolidation of NTBFs, university spin-offs, public research centres and other technological sites within PAIDI).
Knowledge and technology transfer to enterprises	Improve the competitiveness of SMEs (Instrument: PCCP Programme, financed with EU Structural Funds).	Promote the incorporation of experienced researchers into enterprises (Instrument: Torres Quevedo Programme). Create specific frameworks for collaboration between enterprises and research organisations (Instrument: Programme for the promotion of technical research for individual scientific and technological projects of a strategic nature).	Stimulate RTDI activities by the private sector (Instrument: Programme for the promotion of entrepreneurial RTDI within PAIDI).
Research cooperation between public research organisations and the private sector	Collaboration for RTDI projects (Instrument: European Framework Programme).	Creation of National Strategic Consortia for Technical Research (Instrument: CENIT Programme).	Create specific frameworks for collaboration between enterprises and research organisations (Instrument: Programme for cooperative research

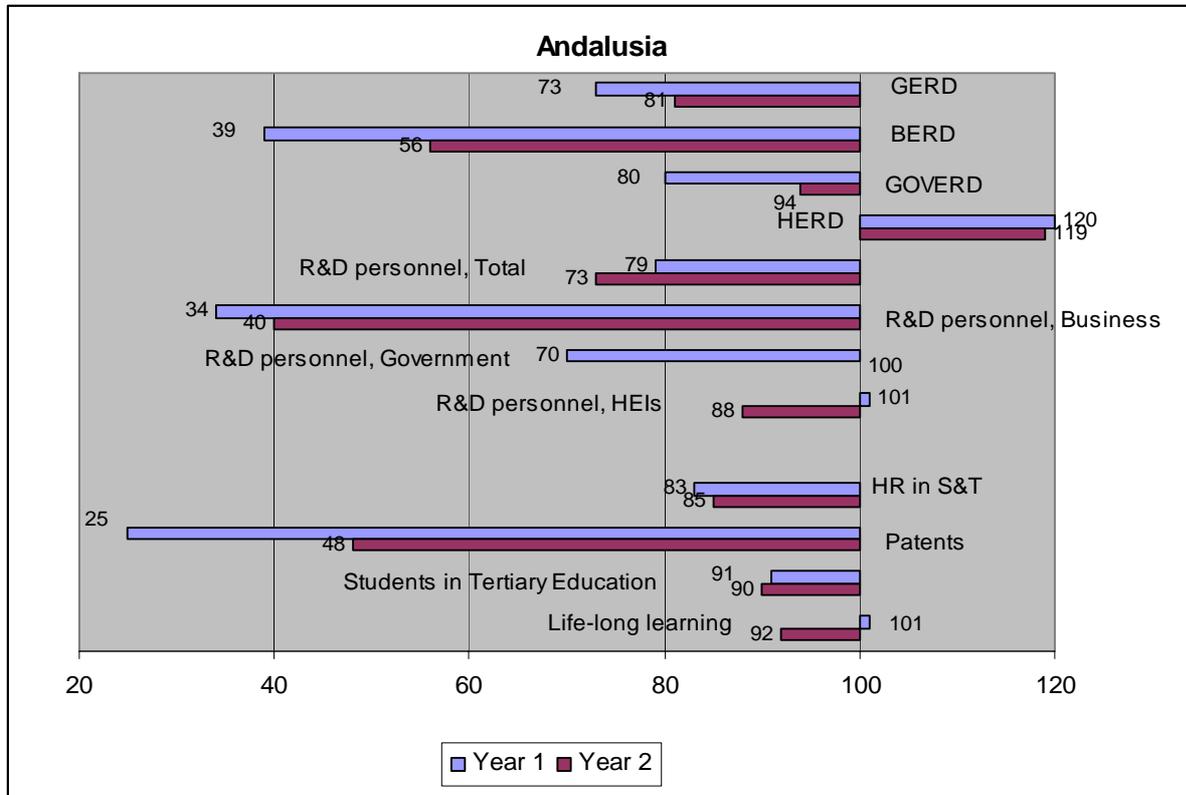
Policy areas	Policy objectives and instruments at EU level affecting the region	Policy objectives and instruments at national level affecting the region	Policy objectives and instruments at regional level
			projects among public research organisations, firms, Science and Technology Centres and RTDI agents within PAIDI).
Supporting public research	Financial support for RTDI projects (Instrument: European Framework Programme).	Specific actions for high-level public research (Instrument: Consolider Programme).	Financial support for competitive research groups (Instrument: Programme for supporting research groups within PAIDI).
Financial incentives for R&D in the private sector	-	Tax treatment of RTDI activities.	-

2.2.3 Conclusions

The following table and graph provide a comparison between the economic situation of Andalusia in 1995 and in 2004. In general the situation has improved during this period, but much remains to be done. The greatest efforts to place Andalusia in a better position within its environment have been implemented in the last few years and might not be reflected in the current situation. The most significant impacts of these new policies will be registered in the years to come.

	1995	2004
Total intramural R&D expenditure as a percentage of GDP (Index; Country = 100)		
GERD	73	81
BERD	39	56
GOVERD	80	94
HERD	120	119
PNPERD	-	.
R&D personnel as a percentage of total employment (Index, Country = 100)		
Total	79	73
Business	34	40
Government	70	100
Higher education	101	88
Private non-profit	-	
Human Resources in S&T as a percentage of labour force		
Total	83	85
Patent applications at EPO per million inhabitants (Index, Country = 100)		
Total	25	48
Students in tertiary education (ISCED 5+6) per thousand inhabitants (Index, Country = 100)		
Total	91	90
Lifelong learning: participation of adults aged 25-64 in education and training as a percentage of population (Index, Country = 100)		
Total	101	92

Summary Graph 1: Key indicators of the development of Andalusia's knowledge base in comparison with Spain



Source: Eurostat

Note: See Annex 2 for explanation of indicators

3 Regional economic structure

The economic environment in which RTDI activities take place needs to be analysed in order to achieve an accurate overview of the socioeconomic position of the region. Although it will be described in detail in Section 3.1, the main figures are introduced here in order to facilitate understanding of the overall picture.

□ Productive structure

- 99.93% of Andalusian enterprises in 2003 were SMEs.
- Andalusian companies represent 15% of the total number of Spanish companies.
- The services sector is the main sector in the Andalusian economy.

□ Regional clusters and networks

- Establishment of economic clusters has been recognised as a weakness by the Regional Government.
- Some sectors have already shown some clustering: aerospace, agri-food, health.

□ International position and FDI

- External trade in Andalusia has been growing rapidly in recent years.
- Fishery products, minerals, metals and oils are the most exported goods.
- FDI has grown by 18% from 2003 to 2004.

□ Financial capacities and instruments

- The Regional Government budget has been growing steadily since 1996.
- In 2006 the budget managed by the Regional Government was over €27 000 million.
- In 2007 the budget will be over €29 000 million.

3.1 Description of the economic structure

3.1.1 Characteristics of the productive structure of the region's economy

Spanish and Andalusian GDPs have been growing steadily since Spain joined the European Union (1986), but they have not yet reached the European average. At present, Andalusian GRP has reached 60% of the average European GDP, while Spanish GDP has reached 81%. In the overall results, Andalusia is also increasing its share of the national GDP, reaching 14.3% in 2005. The Andalusian economy keeps registering solid growth; however, growth was slightly lower in 2005.

As stated in the introduction, the Andalusian economy is based on the services sector. Nevertheless, the annual growth in GRP by sector shows that the services sector grew by almost 3% in 2004, while agriculture grew by 6%, industry by 2.3% and construction by more than 7%. This could indicate a slight trend towards establishing a new balance within the productive system, although further analysis is required:

- Agriculture will gain weight in the Andalusian productive system only by means of "technological agriculture" (biotechnologies, new or enhanced products, advanced agricultural techniques, etc.).

- The growth of the construction sector has been very significant at national level in the last ten years, but it is considered to be inflated and analysts are talking about a “construction bubble”. The expected trend is that the growth of the sector will stagnate during the coming years, until the market is normalised.

In 2000, there were more than 400 000 companies in Andalusia, 31.8% more than in 1996. The number of companies reveals that the Andalusian economy is based on the tertiary sector: 81% of companies carry on their business in the service sector, 9.3% in industry and 9.4% in construction. However, from 1996 to 2000, services companies lost about two percentage points of weight in the structure. When comparing the number of Andalusian companies with the overall national numbers, it can be observed that Andalusia has a lower enterprise density than Spain as a whole: 57 companies per 1 000 inhabitants in Andalusia versus 71 in Spain. A clear majority of the companies established in Andalusia, 69% in 2000, are of very small size (0 or 1 employees) and 21% have from 2 to 5 employees. The difference between sectors of activity is noteworthy: typical companies in the industry and the construction sectors are larger than those found in the services sector.

The number of companies that belong to advanced technology sectors grew by more than 6% during 2004, almost one point higher than the figure for Spain. There are almost 9 000 companies nowadays, representing almost 11% of the total number of Spanish companies in these sectors. Over one third of these companies (34.4%) are classed in the information and communication technologies sector, which has grown more strongly in Andalusia than at national level, by 17% against 13%.

An aspect that reflects the technology gap between the regional, national and European situations is investment in R&D. While in Andalusia only €880 million was invested in R&D in 2004 (0.80% of GRP), in Spain this percentage reached up to 1.07% of GDP, both lower than the European average (2%) and much lower than the figures for countries like Finland, Japan, Germany or the US. If the R&D activities carried out in the public sector or in universities are subtracted from those figures, the gap grows dramatically.

During 2004, unemployment fell more quickly in Andalusia than at national level and within the reference economies (i.e. the EU-15). A historic maximum of almost 3 million employees (183 000 more than in 2003) was reached, representing more than 20% of the employment generated in Spain, and 13% of the European results. Taking into account the share of the population of Andalusia within the Spanish total (15.4%) and the European Union (1.7%), the results for Andalusia are better than those of the reference economies.

In overall terms, the growth in the employed population has been more than 5%, higher than the Spanish (3.9%) and European (0.5%) percentages. Correspondingly, overall unemployment fell by more than 5%, much faster than the Spanish total (-1.3%). This placed the unemployment rate at 17%, while the Spanish rate was 11%.

It is noteworthy that this growth in employment has been recorded only in non-agricultural sectors (with 5.8%, 1.6 points over the national average), and within the population with secondary or higher education, which represented 72% of the total workers in Andalusia during 2004. It is also significant that this increment has been higher in women (almost 7%), in the private sector (more than 12%) and in full-time contracts (4.3%).

Productivity has been highlighted by the Organisation for Economic Cooperation and Development as one of the key issues to be tackled both in Spain and in Andalusia in order to improve the convergence process among the European economies. Although some progress has been registered, Andalusia still lags behind both Spain and the European Union averages.

In 2004, while Andalusia achieved €36 660 pps (purchasing power parity), the figure for Spain was €38 940 and those for the EU-15 and EU-25 were €44 910 and €42 024 respectively.

In the industrial sector the increase in terms of productivity can be evaluated by the ratio between turnover and worked hours. Using this indicator, the productivity increase accumulated between 1993 and 2003 in Andalusia reaches 78.8%. Taking a look at this figure it can be stated that big advances have been achieved in terms of productivity convergence with the European Union, but since the starting points were so far apart, much remains to be done.

3.1.2 Systemic characteristics of the region. Regional clusters and networks.

Although there is a very low level of clustering in the Andalusian economy, it has been identified by the public authorities as an important tool for boosting the competitiveness of Andalusian companies. Some efforts have therefore been made by successive Regional Governments to develop an efficient cluster system, but few positive results have so far been achieved.

Some concentrations of industries active in the same sector can be found throughout Andalusia, but there are very few interactions among them and hence little gain in competitiveness. These “incipient clusters” are mostly related to the food and beverage industries, and some can be found in, for example, furniture, shoe making, natural stone and the leather industry. Most of these sectors are related to traditional activities with a low R&D potential.

Accordingly, two different situations can be found: clusters already established and producing efficient synergies, and projected clusters that are still to be started but have strong potential.

The aeronautic industry established in Andalusia has registered remarkable growth in the last few years. Comparing the current situation with 2001, there are 65% more companies established, generating a 61.3% higher turnover and creating 46% more jobs. This makes Andalusia the second largest region for the sector in Spain, behind Madrid. In 2005 this sector reached a turnover high of €798.8 million, 23.8% more than that registered in 2004. In addition, the National and Regional Governments have signed an agreement to create a new Technology Centre: the Aerospace Advanced Technology Centre in Seville (Aeropolis, which has been presented in Section 2).

Many enterprises have been established around the Science and Technology Parks created in the region. This is true of the Health Sciences Technology Park in Granada, where more than 40 enterprises with different activities (surgical equipment, analysis, etc.), but all of them health-related, are taking advantage of their proximity. Some of these clusters have already been created but others are still being built, such as the Olive Grove Technology Park in Jaén, the Naval and Automobile Technology Park in Cádiz and the Agricultural Technology Park in Almería (PITA, which has been presented in Section 2).

As referred to in previous sections, an initiative by the Málaga local authorities in collaboration with the Regional Government and the private sector plans to set up a major technology centre for information society technologies called Club Málaga Valley e27. This centre, popularly known as the “European Silicon Valley”, aims to establish Málaga and Spain as one of the world’s largest technology clusters.

Tourism is noteworthy as one of the region’s main activities. In this sector there is a high level of networking, both horizontal (i.e. hotel management associations, transport associations, restaurant/food associations) and vertical (e.g. Association of Tourism Entrepreneurs of the Costa del Sol).

3.1.3 Regional economy in the international context

During 2005, Andalusia gave new impetus to its economic relationships with foreign countries, showing on the one hand a significant increase in commercial interchanges, and on the other a high influx of foreign capital as investment, in a national environment that is suffering a decline in this kind of investment.

Total external trade (sum of imports and exports) reached in 2005 a historic high of more than €31 000 million, an increase of 16% compared to the previous year. This is accounted for by the growth of both exports and, more importantly, imports. However the external trade balance (exports minus imports) is still negative: more than -€3 000 million (2.6% of GRP), although lower than the national value (8.6% of GDP).

Historically, the most exported Andalusian goods have been related to food products, with minerals, metals and oils gaining in importance. In the last year the most exported products were those coming from the refinement of petroleum (11% of total exports), olive oil (8.2%), stainless steel (6.8%) and ships (6.6%).

Since data was first available, Andalusia has always shown a positive balance in external investments (foreign investments in Andalusia minus Andalusian investments abroad). This balance reached about €270 million in 2004. This is in contrast to the national situation, where the outflow of investments exceeds the inflow by more than €28 800 million. Total foreign direct investment (FDI) in Andalusia during 2004 was €296 million, 18% higher than what was registered in 2003, in a scenario where the national FDI growth was almost zero.

Regarding the use of these investments, behaviour has varied widely between sectors. While construction and services registered a large increase in foreign investments, the industrial and primary sectors suffered a big fall. In absolute terms, the highest volume of foreign investment, almost 93%, was concentrated in services, the values for commerce and the hotel industry being particularly remarkable.

3.1.4 Capacities and instruments of the financial market

According to the National Statistics Institute (INE), public expenditure in R&D in Andalusia represented 64% of the total in 2004, and BERD 36%. Of the total public expenditure in R&D, public administrations and public research organisations accounted for 20%, and universities 44%. These percentages have been similar for the past five years.

One of the main sources of these funds is the Spanish National Plan for Scientific Research, Development and Technological Innovation. In 2004, Andalusia's participation in this plan gave it almost a 12% share of the total aid granted through the plan. On the other hand, the participation of Andalusia in the 6th European Framework Programme represented only 5% of the Spanish total in 2004.

The EU Structural Funds provide another main source of funds. According to the Regional Government's Chamber of Accounts, Andalusia has been assigned 30.2% of the total Structural Funds available for Spain for the period 2000-2006 (more than €54 million). According to this entity, the Structural Funds financed 45% of the investments carried out by the Regional Government from 1994 to 1999 (more recent figures are not yet available).

Andalusia has been included in the list of Objective 1 Regions within the European Union. This made the region a recipient of Structural and Cohesion Funds in the period 2000-2006. Andalusia will continue to be an Objective 1 Region in the next period (2007-2013), so these funds will still be available then. More than €31 million has been assigned to Spain from the

Structural Funds for this period, more or less 50% of the funds allocated from 2000 to 2006. It is considered that this will be the last period in which the region will be a recipient of Structural Funds.

The Regional Government of Andalusia (*Junta de Andalucía*) is an autonomous government with the responsibilities and obligations set out in the Spanish Constitution and the Statute of Autonomy (*Estatuto de Autonomía*), which is currently being reformed (see Section 3.2.1 below). The Regional Government's total budget was over €27 000 million in 2006 and has been growing at a very steady rate since 1986, when the total budget was only €3 180 million. It is estimated that this trend will continue in the years ahead. If so, in 2007 the budget will be over €29 000 million, which will place Andalusia, along with Madrid, Catalonia and Valencia, among the four regional governments with the highest budgets.

Andalusia received only 3% of the total amount of venture capital investments in Spain in 2005, according to the Report of the Spanish National Association of Venture Capital Entities (ASCRI).²⁵ Within the Spanish environment, Andalusia has fallen from first position among the Spanish autonomous communities in this kind of investments in 1996 (26%) to seventh place in 2003 (1.4%). There are only six venture capital entities located in Andalusia, while more than one hundred can be found in Spain, and most of them were set up through public initiatives by the Regional Government or savings banks. Another seven entities established outside Andalusia provide some funds for investments in this region.

The total venture capital funds portfolio in Andalusia amounted to €184 million in 2004, 3% higher than that registered in 2003, but still only representing about 3% of the national total. While 85% of the portfolio is invested in enterprises in the process of expanding, only 8% is dedicated to enterprises in the start-up phases (seed capital funds). The sector with the biggest share of these funds is the hotel and leisure industry (48.8%), followed by consumer products (18.8%), other services (10.7%) and construction (6.5%). The chemical and computer industries received only 5.7% and 5.3% of venture capital funds invested in Andalusia, and other sectors with future potential, such as biotechnologies, energy, robotics and communications, received hardly any of these funds.

3.2 Policy context

3.2.1 Governance structure and actors

In Andalusia, there are three levels of public authorities, each one with different responsibilities: the National Government, the Regional Government (*Junta de Andalucía*) and local administrations (Town Councils).

The distribution of powers among these three administrations is established by two legal documents, the Spanish Constitution of 1978 and the Statute of Autonomy of Andalusia, as already mentioned. This last law was approved in December 1981 and has proved its effectiveness in the significant growth and development of Andalusian society over the last 25 years. In May 2006 a new Statute of Autonomy was approved in the Regional Parliament and is now awaiting approval by the National Parliament. In this new law, the Andalusian Government has tried to deepen the level of self-government, increasing its powers as much as possible within the Spanish Constitution. This has also been done in many other regions in Spain which are involved in similar processes.

The Spanish state structure, established by the Constitution, involves the decentralisation of many ruling responsibilities from the Central Government to the Autonomous Communities (or

²⁵ <http://www.ascricri.org/ascricri/ascricriweb.nsf>.

Regional Governments). This affects RTDI activities directly, since policies in this field are steered largely by these regional authorities.

As explained in Sections 2.2.1 (Policy framework and actors) and 2.2.2 (Policy objectives and instruments), the construction and implementation of the RTDI policy framework in Andalusia is shared by the National Government and the Regional Government.

The level of decentralisation in Spain has been growing since the approval of the statutes of autonomy for the different regions. The maximum competences are established in the Spanish Constitution of 1978, but the development of these laws of regional self-government has driven a continuous process of transfer of responsibilities to the different regions that has lasted many years. In addition, the new statutes that are being approved in the regional parliaments (and then approved by the national legislative bodies) constitute a further step towards a highly decentralised state.

In the Andalusian Statute of Autonomy of 1981 many competences are exclusively reserved for the Regional Government (i.e. regional elections, forest management, hydraulic resources, energy production, trade and industry councils, tourism promotion, health, education) and some are shared (such as R&D policies).

Andalusia has the same structure as a modern democracy: the population elects the parliament (109 representatives), which appoints a President, giving him the responsibility to form a Government. This process is completely independent from the National Government elections.

The Andalusian Parliament is the centre of political decisions. The executive thus has to count on the confidence of this body, which is responsible for keeping a permanent check on Government activities. On the other hand, the legislative power resides with the Parliament, whose laws are only subject to the Constitution and the Statute of Autonomy. The Parliament is also in charge of approving the annual general budgets of the region.

3.2.2 Policy objectives and instruments

Within the framework of the objectives set by the European Council in Lisbon, Andalusia adopts as a fundamental basis for its development stimulation of the entrepreneurial culture and activities. The entrepreneurial spirit is the main source of competitiveness, economic growth and employment. In accordance with these principles, the Regional Government has developed its annual budget for 2006, aiming to achieve the following objectives:

- Promote entrepreneurial culture among the different sections of the population;
- Support entrepreneurial and innovative individuals and projects;
- Encourage and develop the Andalusian social economy;
- Promote innovation, consolidation and modernisation of industrial structures.

In this sphere some initiatives were launched by the Regional Government in 2006, such as the “Andalucía Emprende” awards and fairs. It will also try to include the innovation and entrepreneurial culture in the education system from primary schools to universities. There are also some actions focused on the young sections of the population, such as the programme “Practiquemos”, which includes 200 practice contracts for young people in enterprises, to implement innovation projects and develop entrepreneurial initiatives.

The Regional Government has highlighted as a strategic objective direct support for entrepreneurs in different initiatives and backing this up with the creation and development of a

regional support network with 22 new centres for the incubation of businesses in the rural environment and 8 for industrial development.

Industrial development is promoted by the Regional Government along four lines:

- Training, organisation, quality and design
- Cooperation
- Internationalisation and alliances
- Financing.

One of the most important actions in this line of activity is the adoption of a programme to help the creation of new technology-based firms by means of seed capital.

When asked about the most important regional instruments for promoting economic activities, the regional authorities pointed to PIMA and the Campus and Atlantis programmes.

The Campus programme was created by the Regional Government's Innovation, Science and Enterprise Council with the aim of supporting the creation of technology-based firms using the results of research carried out by Andalusian universities. Already 16 new enterprises have been created up until March 2006 through this programme, and 25 more are planned before the end of the year. This programme has a budget of €3 million.

The Atlantis programme, with an annual budget of €6 million, is aimed at promoting the creation of new innovative enterprises in Andalusia. The objectives are to attract, boost and finance the establishment in Andalusia of innovative firms from other parts of Spain in order to make this region an important reference point at national level for this kind of enterprise. Last year more than 500 projects were submitted and are now being evaluated.

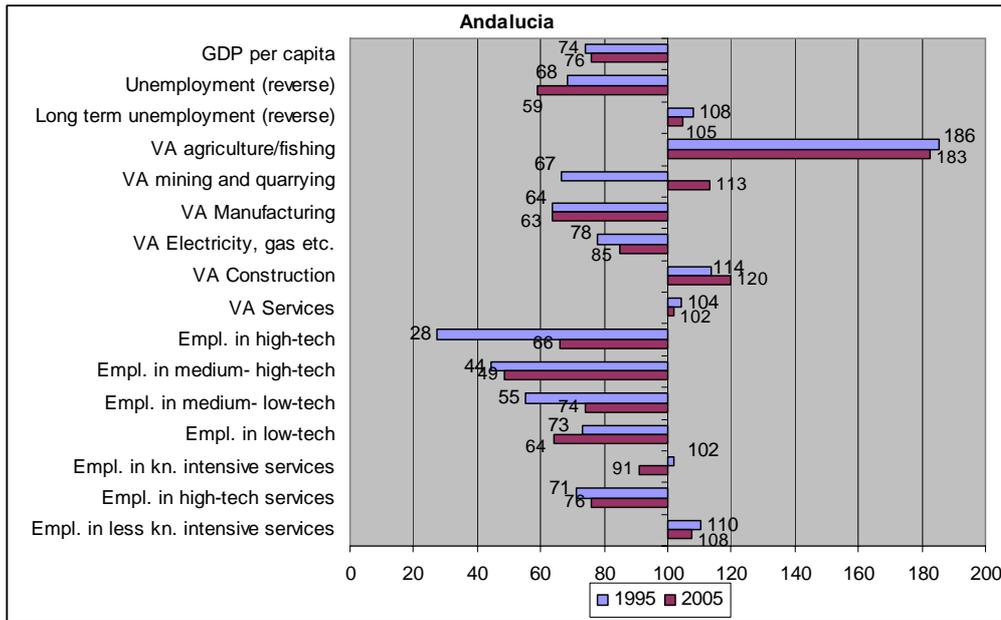
PIMA also includes some actions to promote innovation in Andalusian enterprises. The main priorities of the actions gathered under this programme are:

- Creation of new enterprises
- Modernisation of enterprises
- Competitive cooperation
- Research, development and innovation.

3.3 Conclusions

In the following graph a comparison is made between the economic situation of Andalusia in 1995 and in 2005. Again, in general the situation has improved during this period, but much remains to be done. The greatest efforts have been made in the last few years and might not be reflected in the present situation. The major impacts of these new policies will be registered in the years to come.

Summary Graph 2: Key indicators of Andalusia's economic structure and development - comparison with Spain



Source: Eurostat

Note: GDP data 1995 2003, unemployment data 1995-2001, VA data 1995-2003

Note: See Annex 2 for explanation of indicators

Exhibit 2: Effects of policies complementary to RTDI instruments on R&D and innovation capacity in the region

Policy areas	Policies complementary to RTDI instruments affecting policy area*	Effects on R&D and innovation capacity of the region
Improving innovation and R&D governance	New Regulations implementing the General Subsidies Act, to include measures which speed up and simplify procedures for the grant of financial aid.	Access to financial aid, including RTDI funding, will be easier.
Creating an innovation- and entrepreneur-friendly environment	Supporting the creation and development of new technology-based firms (NTBFs) (Instrument: Neotec Programme). Regional Programmes Campus and Atlantis.	The establishment of new high-tech companies should be easier and cheaper.
Developing human capital	Organic Universities Act. Financing of lifelong training in private companies (Instrument: Forcem).	More and better prepared researchers will be available. Workers will be more aware of technological advances.
Networking, co-location and clustering measures		
Knowledge and technology transfer to enterprises	Tax treatment of innovation. Financing of lifelong training in ICT in private companies (Instrument: Forcem).	Private companies will increase their demand for new technologies. Companies will implement ICTs more easily and cheaply.

Policy areas	Policies complementary to RTDI instruments affecting policy area*	Effects on R&D and innovation capacity of the region
Research cooperation between public research organisations and the private sector		
Supporting public research	<p>Organic Universities Act.</p> <p>A new Agencies Act, to include measures enabling public research centres to convert into agencies, giving them greater flexibility in the management of their resources.</p>	<p>The Universities Act will include improving mobility of researchers and achieving a proper teaching/research balance.</p> <p>Public research centres, when converted to public agencies, will have more freedom to contract new personnel and buy equipment, and will therefore be able to participate in more RTDI projects.</p>
Financial incentives for R&D in the private sector	<p>Tax treatment of investments in:</p> <ul style="list-style-type: none"> - environmental activities - ICT in SMEs - internationalisation of markets. 	

4 Conclusions

4.1 Assessment of the research and innovation system

It has been stated in Section 2 that the Andalusian RTDI system has enjoyed a notable increase in human and material resources in the last fifteen years, although it still lags far behind the European and Spanish averages. The evolution of the Andalusian RTDI system is similar to that of other systems (i.e. the productive system). Because of the weak position of these systems in Andalusia in the early 1990s, the significant improvements made since then have not been enough to overcome the gap existing with the Spanish average and with other regions that started from more advantageous positions.

4.1.1 SWOT analysis of the Andalusian RTDI system: main weaknesses and strengths and systemic characteristics in the development of innovation in the region

When asked whether they thought that Andalusian RTDI activity was in line with the technological potential of the region or not, most regional authorities and entities involved in RTDI²⁶ considered that it was below that potential.

The technological potential of a region can be estimated on the following bases:

1. Investments in RTDI

- Positive. Although still lower than the Spanish and European averages, **Andalusian GERD and BERD have risen steadily since 1995** (see annexed tables and figures). In 2004, Andalusia's contribution to the Spanish Objective 1 regions' GERD was equal to 29%, while its contribution to those regions' GDP was 25%.

Although there are still major challenges to be faced, the Regional Government has implemented some instruments that have achieved a positive general impact on the Andalusian RTDI system, as will be assessed in Section 4.2.

- Negative. Andalusia's contribution to Spanish GDP is equal to around 14%, while its contribution to national GERD is around 10%. Furthermore, the data and the discussion in Sections 2 and 3 show that the **regional RTDI capacity is largely influenced by public funds**. In 2004, the total regional expenditure on R&D and innovation was 2.2% lower than in 2003, while in Spain it increased by almost 9% and Objective 1 regions experienced an average increase of 6.4%. This was due to the fact that funds within Pladit had been spent in previous years (mainly 2003) and funds scheduled in PIMA/PAIDI had not yet been released. This transition period in the main regional public RTDI plans caused a temporary dip in the general upward trend in regional GERD.

BERD in 2004 was also impacted by this period, as shown by the data in Section 2. However, **Andalusian BERD is very low**, far behind the national and, especially, European averages.

- Further analysis. **Most regional public expenditure on R&D is focused on universities**, which in 2004 accounted for 45% of total GERD in Andalusia and 31% at

²⁶ For the preparation of this study, a survey was carried out among a statistical sample of key RTDI actors in the region, both RTDI performers and regional authorities involved in management of the regional RTDI plans and instruments. The results were then compared with our own conclusions and knowledge of the region.

national level (see Section 2). This is somewhat positive, since it is facilitating the emergence of high-quality knowledge creation centres in the region that **can improve the overall attitude towards RTDI**. However, it also has a negative side due to the **lack of interaction between public research and the private sector**, which is a systemic particularity not only of Andalusia but of the whole country. Section 2 shows that major efforts to create intermediary or bridge mechanisms have been set in place in the last five years. These are being intensified at both national and regional levels (i.e. with national initiatives such as the CENIT Programme and **the creation of Technology Parks and Centres sponsored by the Regional Government and coordinated through networks** such as RATRI and Raitec).

2. Human resources dedicated to RDTI activities

- Positive. The **availability of higher-education students with scientific and technological degrees** is considered one of the main strengths of the Andalusian RTDI system by relevant public authorities in the region. As can be seen from the annexed tables and figures, the growth of R&D personnel in Andalusia has been similar to that in Spain, having doubled between 1995 and 2004.
- Negative. In 2004, RTD personnel represented 5.3% of Andalusia's active population, while the national average is 8.3% and the data for the EU-25 was around 10% in 2003. Furthermore, the average expenditure by researchers in Andalusia was around €96 000, while the average for Spain is around €120 000 and in the EU-15 around €180 000.
- Further analysis. While in industrialised countries researchers represent more or less half of all RTD personnel (57% for the EU-25 in 2003), in 2004 in Spain they represented more than 60% and in Andalusia more than 70%. This difference can be accounted for by the fact that researchers may be less involved in technical research activities (which means that more researchers are needed) or that researchers may be engaged in less highly qualified tasks.

3. Scientific and technological publications, as an indirect measure of the quality of RDTI efforts

- Negative. Data in Section 2 shows **Andalusia's low contribution in terms of scientific and technological publications, especially patents**, which is considered one of the main weaknesses of the Andalusian RTDI system by relevant public authorities.
- Positive. Although the number of patents coming from Andalusia is still much lower than other European regions, there has been a significant increase between 2003 (7% of Spanish patents approved by the OEPM²⁷) and 2004 (8.7%).

4. Capacity for adopting and exporting knowledge and technology

- Negative. There is no **mature entrepreneurial market and culture**, and this can be seen in some indicators such as the **lack of venture capital, seed capital and funds for the creation and consolidation of TBFs**, which is also considered one of the main weaknesses of the Andalusian RTDI system by relevant public authorities. However, Sections 2 and 3 show that some efforts are being made in order to overcome this

²⁷ Spanish Patents and Trade Marks Office.

situation, at both national (i.e. the Neotec Programme) and regional levels (i.e. the Campus Programme).

On the other hand, the final evaluations of the results of the Third Andalusian Plan for Research (PAI 2000-2003) and the Master Plan for Innovation and Technological Development in Andalusia (Pladit 2000-2003) identify as two of the main weaknesses of the RTDI Andalusian system the **lack of science and technology priorities that are relevant to the region and the lack of knowledge specialisation in general**, but especially knowledge based on the socio-economic needs and/or strengths of the region. An exception to this could be the creation of Technology Parks in order to concentrate RTDI efforts on some of the main economic sectors in the region; these are usually located in the provinces with higher activity in the sector addressed by the park (i.e. PITA in Almería, the STP in Malaga and CITIC and Aeropolis in Seville).

- Further analysis. Sections 2 and 3 indicate that the **Andalusian private sector generates a low level of demand for the science and technology supply** available in the region, **coming mainly from universities and science and technology centres, as a consequence of the nature of the entrepreneurial fabric**, which is mainly composed of SMEs in non-technology-intensive sectors such as services.

However, the scientific community in Andalusia seems very active and capable of achieving better performance than could be expected from the system when analysing economic aspects in relation to national averages. Furthermore, data shows a trend towards improving quality and productivity, although this trend is not followed by all areas and groups, which illustrates the fragmentation of the system. It is also concluded from all data analysed that the most significant weaknesses are in technological development and innovation, rather than in research.

4.1.2 Knowledge specialisation and economic specialisation

Traditionally, the Andalusian RTDI system has focused on research rather than on technological development and innovation.²⁸ Improving and sustaining economic growth has always been a key objective in Andalusia, but until very recently the direct relationship between the RTDI system and the productive system had not been identified. Knowledge specialisation in the region therefore did not take into account the reality of Andalusia's economic specialisation. Furthermore, **the historical need to develop and consolidate higher education in the region has probably worsened this secondary position of the RTDI system-productive system relationship**, since the quality of higher education is linked to the research activities carried out within universities. Information given in Sections 2 and 3 reflects this situation.

The Andalusian RTDI system is nowadays shifting the focus from fundamental research (mainly carried out by universities in the region) **to technological development and innovation** (more effectively achieved within Science and Technology Centres and Parks and enterprises). This trend has had a direct impact on the design of PAIDI.

Within this framework, information and communication technologies (ICTs) are gaining weight as the technologies with higher potential for achieving innovation within the services sector, the largest economic sector in the region. An example of the trend to match R&D to the region's productive system is the creation of Technology Centres specialised in ICTs (i.e. CICA²⁹ and

²⁸ Until the year 2000 there was no regional plan for TDI. The first one was Pladit, as explained in Section 2.

²⁹ CICA (Scientific IT Centre of Andalusia – *Centro Informático Científico de Andalucía*): www.cica.es.

CITIC³⁰, described in Section 2). Among other things these centres are promoting innovation in the tourism sector. Furthermore, the International Tourism Centre of Andalusia³¹ (CINTA) has recently been inaugurated in Marbella with the objectives of promoting the tourism sector and improving the products and services it offers and their commercialisation.

This trend is being reinforced by the entrepreneurial sector:

- The importance of Abengoa and Telvent as the most outstanding innovative Andalusian enterprise (also significant at national and European levels) has already been mentioned.
- Section 3 showed that 35% of technology-based firms (TBFs) in Andalusia belonged to the ICT sector, a rate that has grown throughout the last five years.
- Section 3 also showed that the ICT sector has grown more quickly in Andalusia than at national level, with an annual increase of 17% against 13%.

Another relevant example is the aerospace industry. With EADS-CASA and a wide group of companies from the auxiliary equipment industries, this sector in Andalusia represents more than 25% of the added value created at national level by the aerospace industry (higher than in 2002, when it was 23% of the national total). The Aeropolis science and technology park has been presented in sections 2 and 3; it is a new initiative to create links among these industries and between them and universities and research and technology centres working in the sector. However, there are research groups with long traditions in this sector, such as groups from the Industrial Engineering School of the University of Seville.

The agricultural sector is one example of traditional parallelism between regional R&D activity and the productive system. Andalusia is one of the largest producers of agricultural and fishery products in Spain and, although nowadays it is not the most important economic sector in the region, it has huge historical importance. Figures in Section 2 show that life sciences and agri-food figure among the main scientific areas covered by the key R&D performers in Andalusia, a trend which is currently being reinforced with the creation of organisations such as IFAPA and PITA (described in Sections 2 and 3). This area provides around 45% of R&D results in the region.³²

On the other hand, RTDI for the agricultural and fisheries sector is still considered a priority by PAIDI, which plans to continue the efforts made under previous policies (i.e. reinforcing IFAPA).

Andalusia has great potential for increasing R&D investment that would contribute to economic growth and regional prosperity. The coming 10 years will prove critical for the emergence of the identified positive trends.

Exhibit 3: Matching of knowledge and economic specialisation

³⁰ CITIC (Andalusian Centre for Innovation and Information and Communication Technologies - *Centro Andaluz de Innovación y Tecnologías de la Información y las Comunicaciones*): www.citic.es.

³¹ www.infotu.com/marbella/cintaex.htm.

³² By results is meant publications and patents.

Knowledge production in the region	Related economic sectors	Specialisation of the region's economy	Conclusions
<p>Agricultural technologies</p> <ul style="list-style-type: none"> ▪ Intensive production ▪ Species improvement and protection ▪ Food quality management 	Agriculture and fisheries	<p>Intensive agriculture and fisheries</p> <p>Olive oil industry</p>	<p>Technological capabilities for intensive agriculture and fisheries have been extensively developed in the last ten years. This trend is being reinforced for the future in close connection with these productive sectors. In relation to olive oil, technology for quality assurance is being developed, although links with the productive sector need to be improved.</p> <p>There are more than 100 research groups in the area.</p>
<p>Life and health sciences</p> <ul style="list-style-type: none"> ▪ Biotechnology ▪ Biomedicine 	<p>Horizontal</p> <p>Agriculture and fisheries</p> <p>Industry</p> <p>Medicine</p>	<p>Agriculture and fisheries</p> <p>Food & beverage</p> <p>Basic industry</p>	<p>There are biotech capabilities and agri-food and aquaculture specialisation, but limited links between the two.</p> <p>There are more around 500 research groups in the area.</p>
<p>Mechanical engineering</p> <p>Electronics</p>	Aerospace	<p>Aerospace auxiliary equipment industry</p> <p>Engineering</p>	<p>Attempts are being made to strengthen links through the creation of Science and Technology Parks.</p> <p>There are around 300 research groups in the area.</p>
ICT	<p>Horizontal</p> <p>Services</p> <p>e-business</p>	<p>Tourism</p> <p>Real estate</p> <p>Commerce</p>	<p>Knowledge production within ICT is growing significantly, and it is the first time there is a real attempt to focus this production on the region's economy and enterprises, especially within the tourism sector.</p> <p>There are around 100 research groups in the area.</p>

4.2 Assessment of policies

It has already been mentioned that the final evaluations of the Third Andalusian Plan for Research (PAI 2000-2003) and the Master Plan for Innovation and Technological Development in Andalusia (Pladit 2000-2003) were carried out recently in order to design the new Andalusian Plan for Research, Development and Innovation for the following four years, PAIDI 2007 – 2010.

Since 1990, the PAI has been the main tool in Andalusia for programming regional research policy. Pladit was the first attempt in the region to incorporate innovation into the regional knowledge system and take into consideration the influence of R&D and the importance of innovation for the sustainable growth of Andalusia. PAIDI gives further impetus to this trend, integrating research, development and innovation in the same policy, merging and renewing the objectives of the former PAI and Pladit.

This is therefore a very good occasion to assess the efficiency and coherence of RTDI-related policies in Andalusia.

As already mentioned, the PAI was focused on supporting the creation of research groups and organisations. This has brought about tangible and intangible benefits for the region, mainly increasing skilled human and material resources for R&D. Nevertheless, some of the objectives of the consecutive PAIs³³ have been only partially achieved: objectives related to the coordination of the Plan, objectively establishing scientific priorities, ensuring the excellence of research, creating critical mass and linking public research with the productive system. The coordination problems have led to a lack of well-established programmes and calls, delays in payments, insufficient maintenance and exploitation of databases for monitoring and evaluating programmes and a lack of fundamental information on the real dimension and advances of the PAI. In relation to the integration of the entrepreneurial sector, the PAI did not develop specific tools and instruments for this purpose, nor did it define a scientific policy for enterprises that identified strategic areas for technological development and innovation.

Furthermore, it has prompted the proliferation and dispersion of small research groups, institutes and centres without well-structured evaluation criteria, encouraged by the possibility of public financial aid. In Andalusia research institutes and centres are not competitive enough, owing to the lack of specific regulations and procedures for their creation and consolidation. Overcoming this situation is one of the objectives of PAIDI, through which new entities such as the Andalusian Quality Evaluation Agency (AAECA) have been recently created. It is too early to appraise the effectiveness of these initiatives.

However, the PAI has been one of the main factors contributing to the creation of a scientific community in Andalusia, as well as to establishing a proper balance between education and research in universities. The PAI has also created the embryo of an information system including an inventory of public research resources in the region. Finally, the PAI has laid the basis for consolidating the Andalusian RTDI system in terms of scientific and technological excellence.

On the other hand, the level of achievement of the objectives of Pladit is described in the final official evaluation of the Plan as *medium-high*:

- Objectives in relation to the creation of technological infrastructures for innovation and the incorporation of information and communication technologies in enterprises have been achieved successfully, although they represent only a first step forward.
- Less success has been achieved in the attainment of objectives related to the creation of entrepreneurial funds and networks.

The regional authorities point to the high participation in the Spanish National Plan for Scientific Research, Development and Technological Innovation as one of the main successes of the regional RTDI system, which is confirmed by data in Section 2. They also identify as a very positive trend the evolution of BERD, which increased from 5.2% in 2002 compared with the total for Spain to 6.4% in 2004. Business expenditure on innovation has followed a similar

³³ PAI I 1990-1993, PAI II 1994-1999 and PAI III 2000-2003.

trend, increasing from 6.2% in 2002 to 9.5% in 2004. This growth has been achieved mainly through the participation of enterprises in supporting regional and national programmes.

4.3 The knowledge economy: challenges and trends

The main challenges for the Andalusian RTDI system have been highlighted in Sections 4.1 and 4.2. On the other hand, the regional authorities interviewed have identified four main challenges facing the Andalusian RTDI system:

- The improvement of financing mechanisms and RTD human resources, financing university-enterprise projects, promoting private RTDI and launching technological marketing programmes in order to attract technological investments;
- The internationalisation of RTDI activities in Andalusia (i.e. improving participation in the European Framework Programme);
- Promoting technological infrastructures in the region;
- Facilitating the creation of technology-based firms (TBFs).

The following table summarises the initiatives being carried out or launched at national and regional levels in order to overcome these challenges. These initiatives will determine the main trends in the Andalusian RTDI system in the following ten years.

Especially relevant are the following:

- The Ingenio 2010 Programme at national level, which includes the CENIT Programme (a major initiative aimed at stimulating the growth of private clustered RTD) and the Consolider Programme (for supporting high-level research groups);
- PAIDI at regional level, continuing the financial efforts of the past PAIs and Pladit, as already described.

These programmes are ambitious initiatives to overcome mainly the low level of internal investment in R&D and innovation and the low BERD. Initiatives to overcome the lack of human resources and the lack of a mature entrepreneurial market and culture (i.e. to increase the supply of seed and venture capital) are, on the other hand, still very timid, both at national and regional levels. Programmes launched at national level dealing with human resources for RTDI are failing to assure long-term careers.³⁴ This is becoming a critical problem for the RTDI systems in Spain, with experienced researchers feeling disappointed and leaving the country.

4.3.1 Good policy practices and unresolved issues

In our opinion one of the best policy practices in Andalusia is the systematic ex ante and ex post evaluation of policies. The design of all regional policies relating to RTDI is based on the evaluation of completed plans and of the Andalusian RTDI system, carried out by independent panels of experts representing the different interests (academia, private sector, etc.). These evaluations are compiled in well-structured documents which are made public. Furthermore, they consider not only the last plans, but also previous ones which may be relevant to the studies, as well as converging plans (i.e. analysing the three phases of the PAI together with Pladit for designing PAIDI). This tradition differs from the general situation in Spain, where a policy evaluation system was developed for the first time in 2004 and is now being implemented.

³⁴ The Torres Quevedo, Ramón y Cajal, Juan de la Cierva and I3 Programmes combined.

However, the capacity of the new policies to overcome the weaknesses and challenges identified in these evaluations is limited. This explains the fact that, for example, the analysis after the three phases of the PAI came to almost the same conclusions (as explained in Section 2), which were repeated during the design of the new PAIDI.

The framework established by the new PAI and PAIDI, for the period up to 2010, seems promising, with serious efforts planned in relation to technological innovation and the integration of the RTDI system in one policy and under one regional ministry. The interest in knowledge specialisation and creation of critical mass is also important. Finally, these tendencies go hand-in-hand with the substantial efforts being made at national level to implement the Lisbon strategy. Therefore, the coming years are going to be critical for ascertaining whether there is a real chance for productive R&D and innovation, both at national and regional levels.

Exhibit 4: Strengths and weaknesses of the regional innovation system

	Strengths	Weaknesses
<i>Knowledge creation capacity</i>	GERD and BERD have increased steadily since 1995.	Regional RTDI capacity is mainly public. BERD is still very low compared to national and European averages.
<i>Knowledge dissemination capacity</i>	Andalusia has a powerful network of entities involved in technology transfer, some of them with substantial support from businesses (i.e. some technology parks and technology centres).	Andalusian contributions to scientific and technological publications, especially patents, are still very low.
<i>Knowledge absorption capacity</i>	There is a plentiful supply of higher-education students with scientific and technological degrees (although there seems to be a downward trend at national level). The new plans that will be implemented in the years ahead have identified entrepreneurial promotion funds as strategic targets.	The private sector generates low demand for the available science and technology supply, mainly as a consequence of the nature of the entrepreneurial fabric. There is a lack of venture capital, seed capital and funds for the creation of TBFs.
<i>Interactions of main actors</i>	New clusters have been set up in the last decade (i.e. aeronautics, health, food), and some are being established. In addition, the creation and development of these clusters has been identified by regional authorities as an issue to be improved in the near future.	Historically, Andalusia has seen a very low clustering level.
<i>RTDI governance capacity</i>	Regional Government is highly independent of national authorities. In the new Statute of	The high level of independence from the national authorities could be a problem when

	Strengths	Weaknesses
	Autonomy, most RTDI policy responsibilities are assigned exclusively to the Regional Government.	coordinating national and regional RTDI initiatives.

Exhibit 5: Identification of policy challenges

Policy challenge	Corroborating indicator	Inducement mechanisms <i>[all measures taken at regional or national level to meet the challenge are described]</i>	Effective approaches <i>[only measures which appear to make a significant contribution to facing the challenge are presented]</i>
Low internal investment in R&D and innovation	<ul style="list-style-type: none"> • Low GERD 	<ul style="list-style-type: none"> • National initiatives to implement the Lisbon Strategy (Ingenio 2010). 	The Spanish Government commitment to increase the national public budget for RTDI by at least a 25% every year, which is supporting initiatives such as the CENIT Programme. Some public research organisations in Andalusia are also benefiting from this initiative (not only private companies such as Telvent), for example CITIC.
Insufficient research and innovation capacity of enterprises	<ul style="list-style-type: none"> • Concentration of expenditure on R&D in the public sector. • Low BERD 	<ul style="list-style-type: none"> • National initiatives to implement the Lisbon Strategy (Ingenio 2010). 	The national CENIT Programme gives financial support to ambitious long-term industry-driven research projects. Telvent (belonging to Abengoa) is already participating in this programme.
Lack of human resources and of critical mass in relevant areas	<ul style="list-style-type: none"> • Proliferation and dispersion of small research groups, institutes and centres. • Priority areas of science and technology not identified in the regional policies. 	<ul style="list-style-type: none"> • Establishment of quality standards for the evaluation of financial aid for research groups and organisations (regional measure within PAIDI). • Programmes for improving the opportunities for professional careers in RTDI (at national level). 	Too early for appraisal of the results of PAIDI, although it still lacks a clear identification of strategic areas of science and technology. The structure of programmes at national level for human resources in RTDI has been improved with the Spanish National Plan for Scientific Research, Development and Technological Innovation 2004-2007, but it still lacks powerful actions for long-term careers.
Lack of a mature entrepreneurial market and culture	<ul style="list-style-type: none"> • Lack of venture capital companies at national and regional level. • Low demand for VC. 	<ul style="list-style-type: none"> • Creation of VC funds and other supporting initiatives for NTBFs, at national and regional levels. 	Timid approaches at both national and regional levels. This will still be a challenge in the future.

Policy challenge	Corroborating indicator	Inducement mechanisms <i>[all measures taken at regional or national level to meet the challenge are described]</i>	Effective approaches <i>[only measures which appear to make a significant contribution to facing the challenge are presented]</i>
Insufficient matching of R&D capabilities with the regional economy	<ul style="list-style-type: none"> • Research policies framed and managed independently of technological development and innovation policies. • Research, technological development and innovation policies with very different focuses. 	<ul style="list-style-type: none"> • Merging RTDI policies into PAIDI. • Local support schemes: Science and Technology Parks, Technology Transfer agents, etc. 	It is too early to evaluate the success of PAIDI in facing this challenge, although it will have to be reinforced in future, since PAIDI only lasts for three years and it starts from a very basic situation.

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Annexes

Annex 1: Definition of policy mix typology

- **Improving innovation and R&D governance capacity.** Technical assistance-type funding used by public authorities, regional agencies and public-private partnerships in developing and improving policies and strategies in support of R&D investments and innovation. This could include changes in the organisation of decision making, national and regional forecasting, measures for improving evaluation, etc.
- **Creating an innovation- and entrepreneur-friendly environment.** This category covers a wide range of actions which seek to improve the overall environment in which enterprises, universities and research organisations innovate. This includes the following measures:
 - Promoting an entrepreneurial and innovation culture in the private sector by undertaking awareness initiatives and changing regulations and disincentives that discourage entrepreneurship;
 - Regulations and initiatives addressing intellectual property rights either by improving legislation dealing with cases where the results of public or collaborative research are commercialised or by covering protection costs;
 - Direct or indirect support for spin-offs and new technology-based firms (NTBFs). Direct support includes public financial schemes such as pre-seed and first stage capital, while indirect measures include funding of incubators, training related to entrepreneurship, etc.
- **Developing human capital.** This category includes measures aimed at upgrading human resources in R&D and innovation-related activities, such as helping science and technology graduates to follow research and innovation-oriented careers; training researchers in enterprises or research centres; intra- and inter-national mobility of scientists; curriculum development in higher education aimed at developing science and technology; orientated under- and post-graduate courses, etc.
- **Networking, co-location and clustering measures.** Policies under this category focus on remedying deficiencies in innovation systems by promoting cooperation, networking and interaction. Measures promoting co-location of industrial and scientific organisations (e.g. innovation poles), funding for cluster infrastructure and technology- and innovation-oriented activities and support for innovation networking (e.g. information exchange clubs) are some of the possible measures in this category.
- **Knowledge and technology transfer to industry.** This category includes policies directly or indirectly supporting knowledge and technology transfer from universities and public research organisations and commercialisation of public research results. Direct support includes aid schemes for utilising technology-related services or for implementing projects transferring technology from the public or private sector to the private sector. Indirect policies include developing infrastructures facilitating technology transfer such as technology parks, innovation centres, university liaison and transfer offices.

- **Research cooperation between public research organisations and the private sector.** Measures supporting collaborative research projects and development of common research infrastructures (for use by private and public sector) are included.
- **Supporting public research.** Measures under this category include:
 - Public investments in research infrastructure and direct funding of public R&D, e.g. setting up new infrastructures or supporting centres of excellence;
 - Grants for R&D projects implemented in universities and other public research organisations;
 - Regulatory changes and incentives for universities and other public research organisations which encourage the commercialisation of research results and collaboration with industry.
- **Financial incentives for R&D in the private sector.** Two main categories of measures are included:
 - **Direct and indirect financial incentives for R&D in the private sector.** Direct measures include direct public funding of R&D in the private sector, e.g. grants, conditional loans. Indirect measures include tax incentives for firms to undertake R&D activities.
 - **Catalytic financial incentives for R&D in the private sector.** Includes instruments facilitating the access of R&D performers to external private-sector sources of finance. Typical measures of this type are measures encouraging the use of *risk capital* (e.g. venture capital funds) for both R&D and innovation-related activities and *loan and equity guarantee measures*.

Annex 2: Description of key indicators used in the summary graphs

Period of coverage: Two periods are used, i.e. 1995 and 2004 or the closest possible years

Index: Country=100

Source: Eurostat, 2006

Summary Graph 1: Key indicators of Andalusia's knowledge base development in comparison with Spain

1. Total intramural R&D expenditure as a percentage of GDP
 - GERD
 - BERD
 - GOVERD
 - HERD
 - PNPERD
2. R&D personnel as a percentage of total employment
 - All sectors
 - Business
 - Government
 - Higher education
 - Private non-profit
3. Human Resources in S&T as a percentage of labour force
4. Patent applications at EPO per million inhabitants
5. Students in tertiary education (ISCED 5+6) per thousand inhabitants.
6. Lifelong learning: participation of adults aged 25-64 in education and training as a percentage of population

Summary Graph 2: Key indicators of Andalusia's economic structure and development

1. GDP per capita at current market prices.
2. Long-term unemployment rate (in total unemployment).
3. Unemployment rate (%).
4. Value-added at basic prices (€ million): share (%) of sectors in total.
 - Agriculture/fisheries
 - Mining and quarrying
 - Manufacturing
 - Electricity, gas and water supply
 - Construction
 - Services (excl. extra-territorial organisations and bodies)
5. Annual data on employment in technology and knowledge-intensive sectors at regional level: percentage of total employment
 - High-technology manufacturing: NACE Rev. 1.1 codes 30, 32 and 33
 - Medium/high-technology manufacturing: NACE Rev. 1.1 codes 24, 29, 31, 34 and 35
 - Medium/low-technology: NACE Rev. 1.1 codes 23 and 25 to 28
 - Low technology: NACE Rev. 1.1 codes 15 to 22 and 36 to 37
 - Total knowledge-intensive services: NACE Rev. 1.1 codes 61, 62, 64 to 67, 70 to 74, 80, 85 and 92
 - Knowledge-intensive high-technology services: NACE Rev. 1.1 codes 64, 72, 73
 - Total less-knowledge-intensive services: NACE Rev. 1.1 codes 50, 51, 52, 55, 60, 63, 75, 90, 91, 93, 95 and 99

Annex 3: Tables and Figures

Apart from the **indicators available in the Excel file annexed to this document**, some relevant tables extracted from the bibliographic references used (see Annex 2) are reproduced below:

AÑOS	R&D Expenditure Andalusia	R&D Expenditure Spain	And / Spa (%)	Evolution on last year (%)	
				Andalusia	Spain
1993	313.981	3.350.060	9,37		
1994	270.984	3.294.472	8,23	-13,69	-1,66
1995	344.681	3.550.106	9,71	27,20	7,76
1996	379.142	3.852.632	9,84	10,00	8,52
1997	395.856	4.038.904	9,80	4,41	4,83
1998	465.402	4.715.018	9,87	17,57	16,74
1999	474.726	4.995.360	9,50	2,00	5,95
2000	542.156	5.718.988	9,48	14,20	14,49
2001	538.332	6.496.011	8,29	-0,71	13,59
2002	585.667	7.193.538	8,14	8,79	10,74
2003	903.152	8.213.036	11,00	54,21	14,17

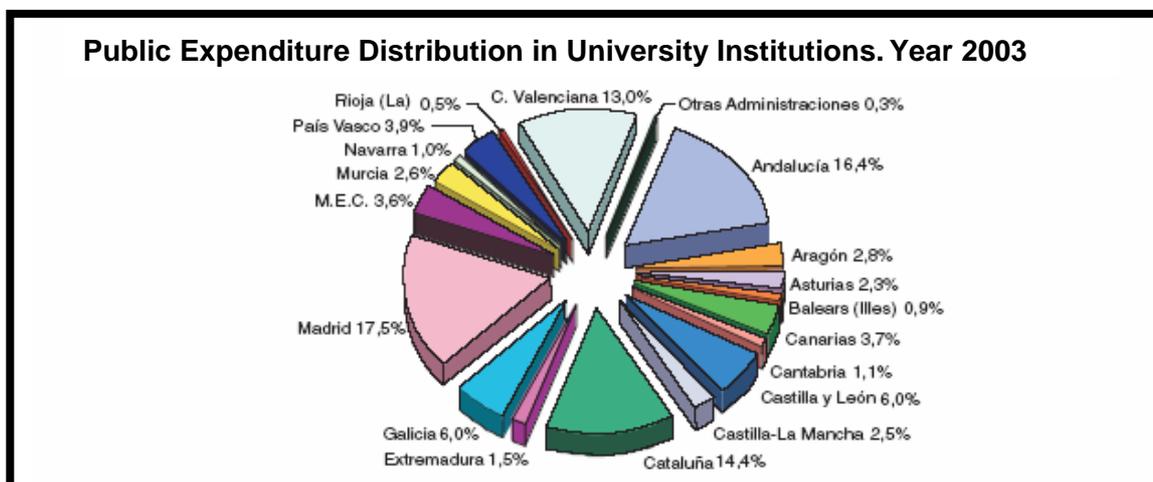
(In kEuros)

Bibliography reference [2]

AGENTS	ANDALUSIA		SPAIN		And / Spa (%)
	R&D Expense	% s/ Total	R&D Expense	% s/ Total	
Public Sector	558.228	61,81	3.753.721,60	45,70	14,87
Private Sector	344.924	38,19	4.459.314	54,30	7,73
TOTAL	903.152	100,00	8.213.036	100,00	11,00

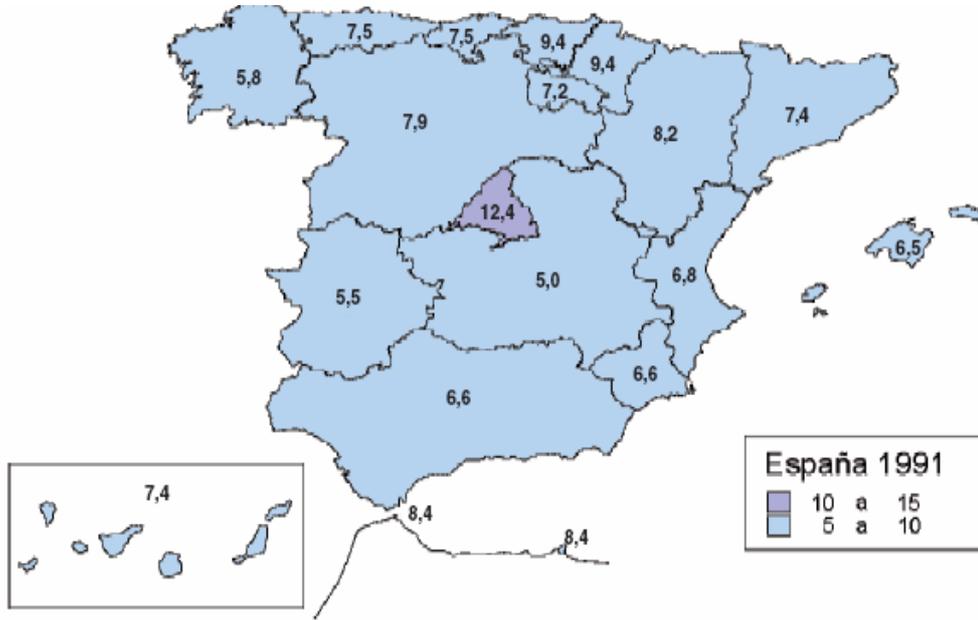
(In kEuros)

Bibliography reference [2]



Bibliography reference [4]

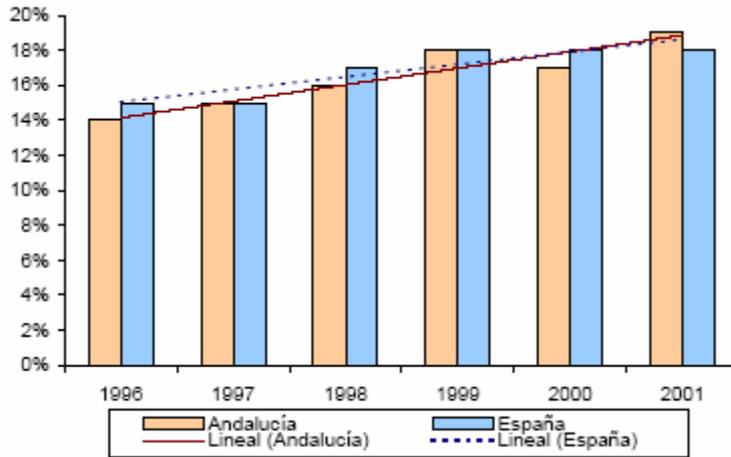
Percentage of population older than 16 years old with an university degree



Bibliography reference [4]

Figure: Temporary Evolution of Scientific documents published (Science Creation Index)

Years	1996	1997	1998	1999	2000	2001	Total
Andalusia	2296	2400	2656	2957	2835	3070	16214
Spain	17238	18210	19671	20900	20776	21462	118257



SCI)

Areas	Andalusia		Spain	
	Doc.	%	Doc.	%
Biomedicine	4398	27,1	32259	27,3
Agriculture, Biology and Environment	3851	23,8	18996	16,1
Clinic Medicine	3260	20,1	31081	26,3
Chemistry	3179	19,6	21879	18,5
Physics	2802	17,3	21999	18,6
Ingeneering, Technology	1718	10,6	14205	12,0
Maths	777	4,8	3612	3,1
Multidisciplinary	122	0,8	863	0,7

Bibliography reference [5]

**Figure: Temporary Evolution of Andalusian Production of Scientific Documents.
(Spanish Scientific and Technological Index, ICYT)**

Años	1996	1997	1998	1999	2000	2001	Total
Andalusia	687	743	707	628	784	653	4202
Spain	5511	5667	5714	5362	5228	4868	32350

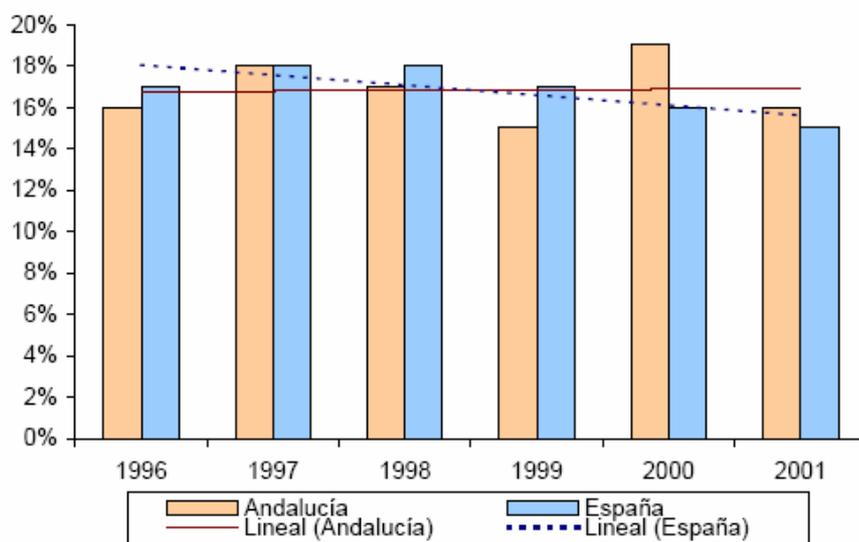


Figure: Distribution of Scientific documents published following Thematic Areas (ICYT)

Areas	Andalusia		Spain	
	Doc.	%	Doc.	%
Technologic Sciences	1183	28,2	13513	41,8
Life Sciences	1016	24,2	5647	17,5
Agricultural Sciences	855	20,3	6432	19,9
Earth and Space Sciences	797	19,0	3951	12,2
Medical Sciences	361	8,6	2385	7,4
Maths	184	4,4	1473	4,6
Chemistry	102	2,4	1041	3,2
Physics	101	2,4	937	2,9
Astronomy and Astrophysics	18	0,4	103	0,3

Bibliography reference [5]

**Figure: Production according to Institutional Sectors
(Spanish Patent & Trademarks Office, SPTO)**

Institutional Sectors	Total	%
Administration	1	0,2
Companies	136	23,5
Hospitals	1	0,2
Private	347	59,9
University	94	16,2
Total patents Andalusia	579	

Bibliography reference [5]

**Figure: Production according to Institutional Sectors
(European Patent Office, EPO)**

Institutional Sectors	Total	%
Companies	43	26,2
Private	104	63,4
University	18	11,0
Total patents Andalusia	164	

Bibliography reference [5]

**Figure: Comparison between Spanish Patents and European Patents Databases
according to Institutional Sectors**

Institutional Sector	EPO		SPTO		Total	% SPTO
	Total	%	Total	%		
Private	104	2,3	347	4,3	451	76,9
Companies	43	1,0	136	1,7	179	76,0
University	18	0,4	94	1,2	112	83,9
Administration	0	0,0	1	0,0	1	100,0
Hospitals	0	0,0	1	0,0	1	100,0
Total Patents Andalusia	164		579		743	77,9

Bibliography reference [5]

Figure: Patents according to solicitor's Autonomous Community (SPTO)

AC	Total	%
Catalonia	2256	27,9
Madrid	1847	22,9
Valencia	955	11,8
Basque Country	646	8,0
Andalusia	579	7,2
Aragon	272	3,4
Navarra	269	3,3
Galicia	216	2,7
Castilla Leon	193	2,4
Murcia	134	1,7
Castilla La Mancha	131	1,6
Asturias	115	1,4
Canary Islands	97	1,2
Balear Islands	73	0,9
La Rioja	62	0,8
Cantabria	56	0,7
Extremadura	56	0,7
Sumatory	7959	
Without Spanish solicitor's address	110	
Total	8069	

Bibliography reference [5]

Figure: Patents according to solicitor's Autonomous Community (SPTO)

AR	Total	%
Catalonia	1145	0,9
Madrid	804	0,8
Valencia	397	0,3
Basque Country	332	0,2
Andalusia	164	0,2
Navarra	141	0,4
Aragon	136	
Castilla Leon	102	
Galicia	75	
Canary Islands	43	
Castilla La mancha	42	
Asturias	41	
Murcia	40	0,9
Balear Islands	34	0,8
Extremadura	14	0,3
Cantabria	10	0,2
La Rioja	9	0,2
No information	17	0,4
Sumatory	3546	
Without Spanish solicitor's address	1039	
Total	4496	

Bibliography reference [5]

Economic Growth, 2001-2004 (% variation of GDP)

	2001	2002	2003	2004	Average 2001-2004
Euro Zone	1,6	0,9	0,5	2,0	1,3
EU-25	1,7	1,1	0,9	2,3	1,5
EU-15	1,7	1,0	0,6	2,2	1,4
Belgium	0,7	0,9	1,3	2,7	1,4
Germany	0,8	0,1	-0,1	1,6	0,6
Spain	2,8	2,2	2,5	2,7	2,6
Andalusia	3,9	3,1	2,7	3,4	3,3
France	2,1	1,2	0,5	2,5	1,6
Italy	1,8	0,4	0,3	1,1	0,8
Holand	1,4	0,6	-0,9	1,3	0,6
Finland	1,1	2,2	2,4	3,7	2,4
United Kingdom	2,3	1,8	2,2	3,0	2,3
United States	0,8	1,9	3,0	4,4	2,5
Japan	0,2	-0,3	1,4	2,6	1,0
Canada	1,7	3,2	2	2,8	2,4

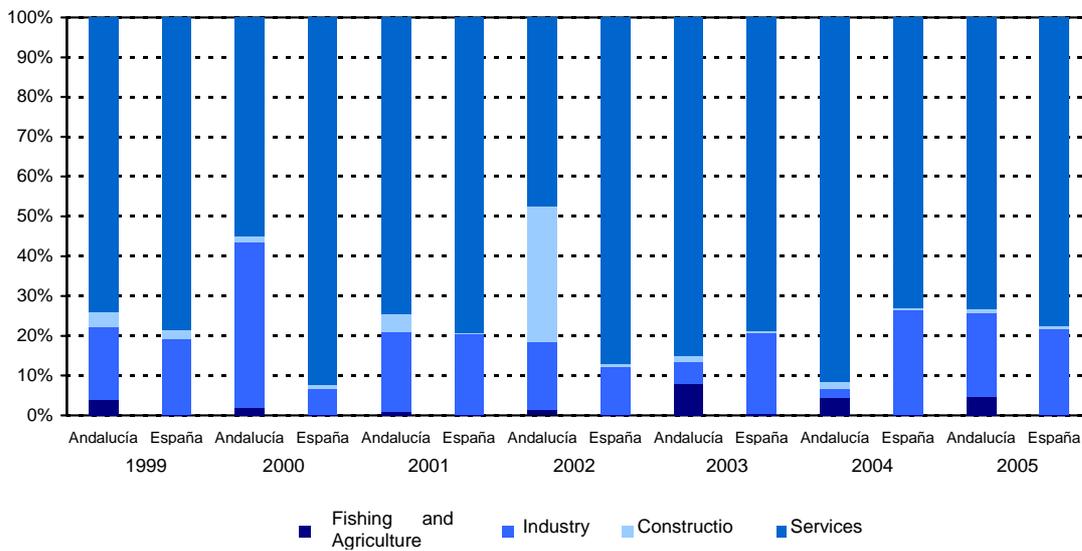
Bibliography reference [8]

Foreign Direct Investment (kEuros)

Year	1998	1999	2000	2001	2002	2003	2004	2005
Andalucía								
FDI	314.297	252.992	425.873	653.681	313.252	255.983	306.558	270.925
Spain								
FDI	9.198.520	18.434.162	38.308.939	34.786.181	32.522.813	18.178.233	18.581.136	16.617.676
Percentage Andalusia/Spain								
FDI	3,42	1,37	1,11	1,88	0,96	1,41	1,65	1,63

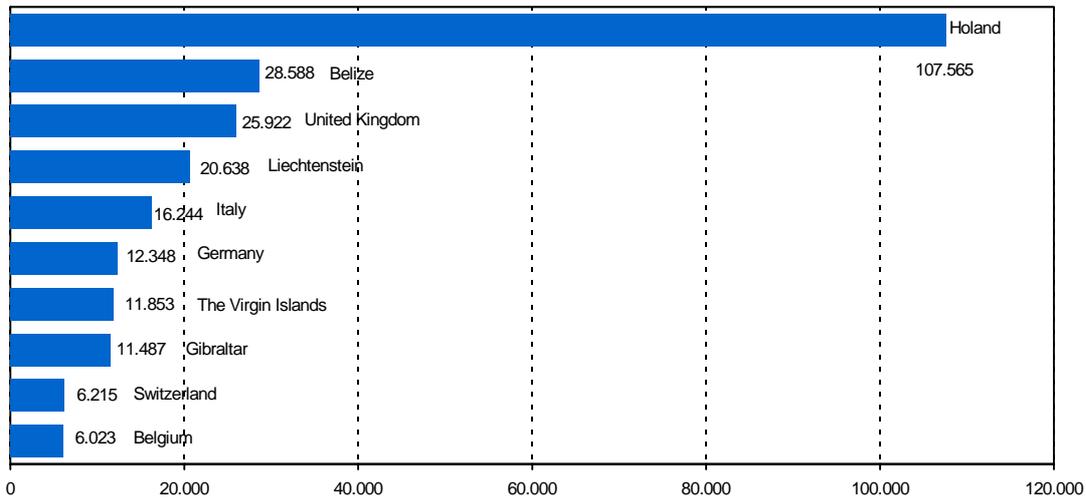
Bibliography reference [9]

FDI in Andalusia. Sectors target of FDI



Bibliography reference [9]

Main Investing Countries in Andalusia (kEuros)



Bibliography reference [9]