

## Research and innovation plan for Catalonia (2005-2008)\*

The Research and Innovation Plan 2005-2008 (PRI) is one of the main tools for realising the political commitment made by the Government of Catalonia in regard to the definitive quantitative leap that Catalonia needs to make in the area of research and innovation. The participation of Catalan society in the process of developing an advanced knowledge-based society requires clear and decided efforts to foster research and technological development and to develop the country's innovative capacities.

Catalonia, both for its history and traditions and for its current economic and social situation, should secure a leading position among the countries of Europe in terms of its research and innovation capabilities. A powerful, well-developed research system is a necessary condition for Catalonia to be able to assume its rightful role in the European construction process, bearing in mind the conclusions of the Lisbon meeting of the European Council in 2000, according to which Europe set itself the goal of becoming the most competitive and dynamic knowledge-based economy in the world. This particular aim was quantified at the Barcelona meeting of the European Council in 2002, in which it was established that by 2010, 3% of GDP would be invested in research and development, with two-thirds of this investment to come from the private sector.

The construction of a modern and competitive economy and of an advanced and culturally sophisticated society undoubtedly requires the consolidation of a highly developed and efficient science and technology infrastructure.

For this to be possible, and as established in the "*Acord per a un govern catalanista i d'esquerrers*" [Agreement for a Catalan Left-wing Government] signed in December 2003, the Government of Catalonia has drawn up this Research and Innovation Plan with the aim of drawing together, in a coherent and coordinated manner, the range of elements that go to make up the science, technology, research, innovation and corporate system in Catalonia.

The close links that exist between innovation and business competitiveness, moreover, are widely documented, and so innovative capacities have come to represent a crucial factor in guaranteeing a future for the productive fabric of a country or region. This fact underlines the need for a plan that will integrate and coordinate all actions taken in the science and technology fields and aimed at encouraging transfer to the productive sector as a way of promoting innovation.

This Research and Innovation Plan 2005-2008 has, as its twofold aim, the promotion and optimisation of research and innovation development policies as efficacious instruments for the

promotion of economic and social progress and development in Catalonia, and optimal organisation and coordination of the different elements that make up the Catalan research and innovation system. In other words, a triple helix that will generate value for the country and its society needs to be constructed on the basis of effective cooperation between the public sector, universities and research centres, and private sector enterprises.

This Plan consolidates and builds on the progress that has been made to date in research, development and innovation in Catalonia as a result of the series of measures implemented in this area by the Government of Catalonia since the restoration of the autonomous government in 1980. This commitment has, in more recent times, taken the form of four-yearly research plans introduced in 1993, and more recently in the Innovation Plan 2001-2004.

However, an analysis of the strengths and weaknesses of the Catalan research and innovation system reveals that, despite the progress of recent years, Catalonia is noticeably behind in comparison to the leading countries in the European Union. This unfavourable situation can be observed in both public and private sector research and development systems, and in the structures that mediate technology transfer to the private sector and the structures that are designed to provide support for private sector innovation.

In order to remedy this situation and attain the objectives of this first coordinated Research and Innovation Plan, a significant increase in investment will be required. For this reason, the Government of Catalonia has undertaken a firm commitment to aim for a spending level over 2% of GDP on research and development by 2008, and spending of close to 5.2% of GDP on business innovation.

Nonetheless, any initiatives undertaken in the research and innovation area should not be undertaken in isolation. It will be necessary for the different government ministries to take into account the issues affecting research and innovation in their specific fields of action. The efficacy of the Research and Innovation Plan 2005-2008 will be less than optimal, unless parallel policies essential to developing the new information society are implemented in areas such as education, culture, territorial management, industry and the labour market. The Interministerial Council for Research and Technological Innovation (CIRIT) holds the responsibility for planning, coordinating and ensuring common purpose in relation to the research, development and innovation activities of the different government ministries.

The Research and Innovation Plan 2005-2008 should be considered, therefore, as the primary instrument for meeting the challenges posed by the Lisbon and Barcelona summits, and ultimately, as the instrument that will bring about the full

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development of the knowledge society in Catalonia. Its mission is to convert Catalonia into an advanced society and to stimulate economic, social and cultural progress in the country.

The Research and Innovation Plan 2005-2008 aspires to achieving its aims by implementing a global strategy aimed at the following:

- Making possible the transition towards a knowledge-based economy and society, by developing policies in relation to both the information and communications technologies and research and development, and by encouraging structural reform processes that will create a favourable environment for innovation and competitiveness in the different productive sectors;
- Achieving full participation of Catalonia in the European Research Area, so that favourable environments can be created for high-quality research and for increasing the existing numbers of researchers, as also for the development of innovative businesses (with special attention being paid to the needs of small and medium-sized enterprises);
- Contributing to the modernisation of society and the renovation of the productive fabric as key elements in ensuring sustainable economic development and social cohesion, by means of investment in human capital, the development of an entrepreneurial spirit and the promotion of entrepreneurial initiatives;
- Promoting suitable mechanisms for coordinating and organising the different agents within the research and innovation system with a view to ensuring that cooperation is optimised, and in particular, promoting cooperation between the public and private sectors as an essential prerequisite for the attainment of the aims of the Research and Innovation Plan.

Finally, it should be mentioned that the Plan was drawn up parallel to a series of debates held between experts from different fields. Moreover, a consultation process that took place during November 2004 enabled representatives of different areas of society to participate in its development.

The Plan thus reflects the concerns that have been expressed by a broad spectrum of social agents and members of the research and innovation community in Catalonia in relation to the challenges facing the Catalan economy and Catalan society.

The Plan is perceived as a dynamic plan and so remains open to any possible modifications that future circumstances and an ongoing evaluation process may dictate.

## Mission and strategic aims of the plan

### Mission

The mission of the Research and Innovation Plan 2005-2008 is to position Catalonia among the leading research and innovation countries in Europe. It aims to do this by means of the implementation of an integrated public policy, involving public and private agents working in conjunction, which will foster the development of a society based on knowledge and entrepreneurship, and which will ultimately achieve sustainable economic development and ensure social wellbeing and cohesion.

### Objectives

The Research and Innovation Plan for Catalonia 2005-2008 establishes a set of strategic objectives which, once achieved, will facilitate the realisation of the mission defined above.

Ten specific objectives are defined. The first three focus on increasing the quantity and quality of both research and technology development activities undertaken in Catalonia. The next three are concerned with the development of an environment favourable to innovation and the fostering of links and improvement of coordination between the different public and private agents in the Catalan research and innovation system. The seventh objective refers to the much-needed increase in the innovation capabilities of private sector enterprises in general, as a fundamental element in improving business competitiveness. The eighth objective highlights the importance of defining sectoral and technological priorities, to ensure that the productive structures in the Catalan economy are transformed with a view to increasing the relative weight of knowledge-intensive activities. The last two objectives focus on defining and coordinating research and innovation policies and on fostering a scientific and technological culture in Catalonia.

These ten objectives are listed as follows:

1. To expand the research and development base by attracting new talent and facilitating the entry of young researchers into the system.
2. To build up universities, educational centres and infrastructures to the level required of advanced and high-quality research and development activities.
3. To continue fostering improvements in the quality of research conducted in Catalonia as a prerequisite for attaining full integration in the European Research Area.
4. To foster the entrepreneurial spirit and the creation of technology-based enterprises by increasing the number of joint programmes between universities, research centres and businesses and by promoting the transfer of technology and knowledge.
5. To promote the entry of researchers and qualified human capital into the private enterprise sector.
6. To consolidate and unify the research, technology transfer and innovation system in Catalonia.
7. To augment the innovation capabilities of businesses established in Catalonia and to foster internationalisation projects.
8. To draw up specific sectoral and technological strategies that will drive both the development of the economy and structural modifications in productive activities.
9. To improve coordination between Catalan research and development policies and economic, social and cultural policies, thereby making Catalonia a reference as far as coordinated research and innovation support policies are concerned.
10. To develop and promote programmes for the communication and publicising of developments in science and technology so that society as a whole becomes fully aware of the importance of research, development and innovation.

## Key indicators for the Catalan Research and Innovation System

No.	Indicator	Latest figures		Goal 2008
		Catalonia	EU15	Catalonia
<i>Research, development and innovation resources</i>				
1	Overall spending on research and development <sup>1</sup> Research and development spending as a percentage of GDP	1.38 (2003)	1.99 <sup>7</sup> (2002)	2.10
2	Overall spending on business innovation <sup>1</sup> Business innovation spending as a percentage of GDP	2.42 (2000)	3.70 <sup>6</sup> (2002)	5.20
3	Private sector spending on research and development <sup>1</sup> Research and development spending by private sector enterprises as a percentage of GDP	0.91 (2003)	1.30 <sup>7</sup> (2002)	1.26
<i>Science and technology human resources<sup>10</sup></i>				
4	Researchers <sup>1</sup> Number of fulltime-equivalent researchers	18,387 (2003)	–	24,000
5	Researchers as a proportion of total labour market participation <sup>1,2</sup> Number of researchers per 1000 labour market participants	6.42 (2003)	5.60 <sup>7</sup> (2000)	7.5
6	Researchers in private sector enterprises <sup>1</sup> Private sector researchers as a percentage of the total number of researchers in Catalonia	37.51 (2003)	50.9 <sup>7</sup> (2001)	45
7	In-company research and development employment <sup>1,2</sup> Number of in-company researchers per 1000 labour market participants	6.29 (2003)	5.83 <sup>7</sup> (2001)	8
<i>Productive structures</i>				
8	Innovative businesses <sup>2</sup> Innovative businesses (10 or more workers) as a percentage of all businesses	25.80 (1998-2000)	44 <sup>4</sup> (1998-2000)	40
9	High-technology contribution to the industrial sector <sup>1</sup> Industrial GVA for high-technology sectors as a percentage of total industrial GVA	7.50 (2002)	13.70 <sup>4</sup> (2000)	10
10	High-technology employment <sup>1</sup> Employment in high-technology industries as a percentage of labour market participation	2.68 (2002)	3.57 <sup>4</sup> (2002)	4
<i>Science and technology results</i>				
11	Production of scientific publications <sup>9</sup> Number of indexed scientific publications	10,967 (1999-2000)	622,499	12,000
12	Quality of scientific publications <sup>9</sup> Citations during the two years subsequent to publication as a percentage of the number of articles published in a specific period	5.33 (1999-2000)	6.04 (1999-2000)	6.04
13	Theses <sup>3</sup> Number of doctoral theses submitted	1,200 (2003)	–	1,500
14	Patents <sup>4</sup> Number of patents registered at the European Patent Office per million inhabitants	62 (2002)	161 <sup>4</sup> (2002)	160
15	High-tech exports <sup>2</sup> High-technology industrial exports as a percentage of total industrial exports	12.07 (2003)	–	18
<i>Science and technology policies</i>				
16	Researcher success rate in Spanish State open competitions <sup>8</sup> Catalan researcher success rate in Spanish State open competitions	27 (2002)	–	30
17	Participation in EU programmes <sup>5</sup> Value of Catalan participation (millions of euros) in EU framework and research programmes	51 (2003)	–	75

1. Source: INE (Spanish National Statistics Institute).

2. Source: IDESCAT (Catalan Statistics Institute).

3. Source: DURSI (Catalan Ministry of Universities, Research and the Information Society).

4. Source: EUROSTAT.

5. Source: CDTI (Spanish Centre for Industrial Technology Development).

6. Source: CORDIS. Different calculation procedure: innovation spending as a proportion of 'production value' (ex-factory).

7. Source: OECD.

8. Source: Spanish Ministry of Education and Science.

9. Source: DURSI. From data contained in the ISI National Citation Report.

10. Data to be classified by gender, as required by EU legislation in force.

### Key indicators

To mark progress towards the achievement of these objectives, a series of indicators have been defined for the Catalan research and innovation system. Reference figures for the European Union (2002) and current figures for Catalonia are provided, as also the figures to which Catalonia aspires once the Research and Innovation Plan has been implemented. Naturally, although other circumstances not covered by the Plan may intervene, the idea is for these indicators to act – in conjunction with incentives in the form of the resources that will be made available – as a catalyst for substantial progress to be made in developing the Catalan research and innovation system in the coming years. Among the goals defined below, of particular note are the proposals that, by the year 2008, expenditure on research and development and on business innovation will represent 2.1% and 5.2% of GDP, respectively.

### Plan structure programmes, measures and instruments

The Research and Innovation Plan 2005-2008, which is structured in terms of transverse measures and complementary measures, establishes priority lines of research and defines sectoral and technological strategies.

*Transverse measures* include all actions aimed at *reinforcing the knowledge and technology value chain in all economic sectors*, primarily by achieving critical mass and perfecting knowledge generation systems in all areas, optimising scientific and technological transfer mechanisms for business sectors, creating an exacting productive system with a capacity for absorbing new technologies, and by providing financial tools that will minimize the risks associated with technology absorption.

Transverse measures, therefore, will be implemented throughout the entire value chain, ranging from actions aimed at improving the quality of the research system and improving competitiveness, to actions designed to stimulate industrial demand (such as funding for innovation programmes).

*Complementary measures*, on the other hand, are aimed at developing a scientific, technological and innovative culture in all areas of society, and at encouraging and promoting innovative initiatives.

It is likewise necessary to promote the growth of specific areas of the economy or technologies that provide opportunities for specialisation. *Specific measures* have as their primary aim, therefore, the development of sectoral or technology areas that offer potential as engines for growth or that are of great significance to the Catalan economy. In this way their effect on the economy is multiplied and the knowledge generated is disseminated to the rest of the productive fabric.

### Transverse measures

#### *Research Support Programme*

The Research Support Programme is aimed at improving quality and competitiveness in the Catalan research and innovation system by means of the provision of support to researchers and research groups, and the creation of cooperation networks that will link up the different institutional players in the research and innovation system.

In a scientific context that is increasingly international, globalised and competitive, it is essential to develop research groups that carry out quality research capable of competing at the international level. The knowledge created by these groups should also be made available to the public at large. This Programme has as its twofold aim the provision of support to ex-

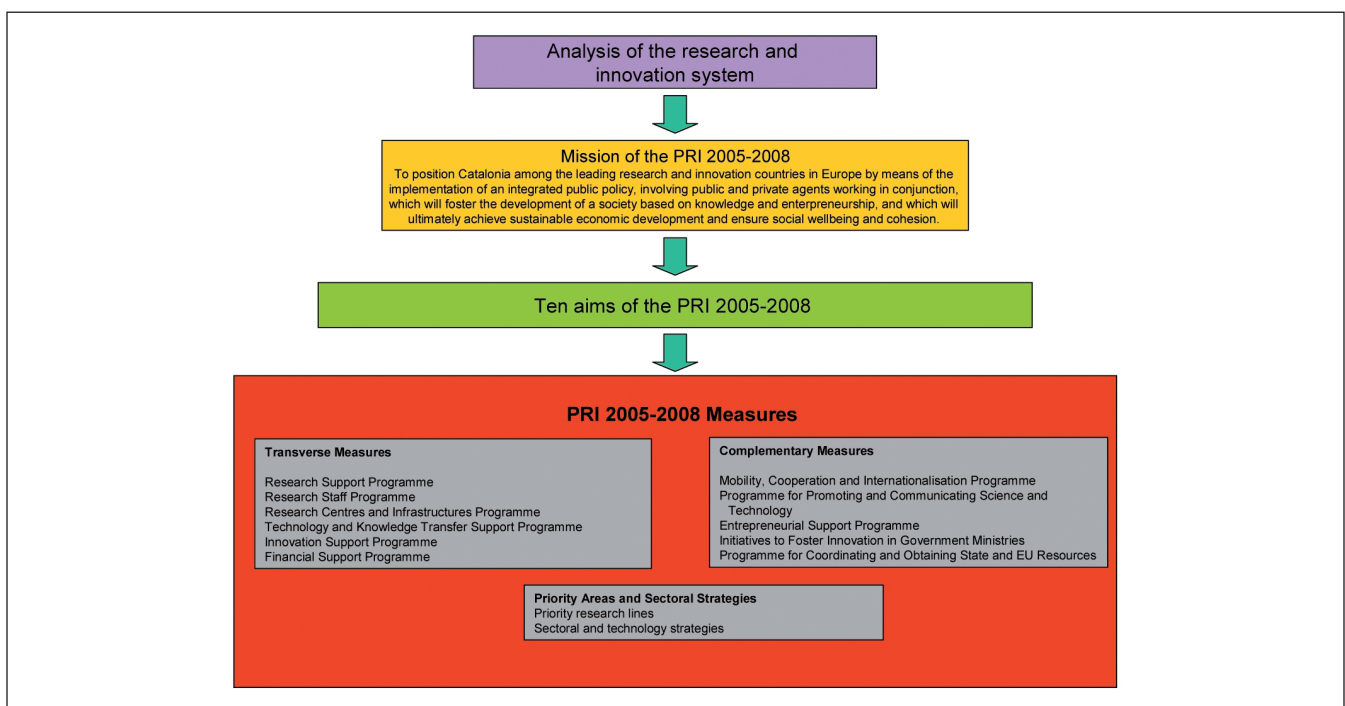


Figure 1. Structure of the Research and Innovation Plan 2005-2008.

isting research groups and the incorporation of new research groups pursuing novel lines of investigation or involved in projects in emerging fields and in multi-disciplinary areas.

#### *Priority actions*

The Research Support Programme is structured on two fundamental axes:

##### Research groups

This Programme promotes greater cohesion between groups on the basis of strict quality requirements. Its main aim is to provide complimentary funding for other calls for applications not previously included. This funding, in addition to a basic non-definitive contribution, can cover items such as the purchase of small-scale equipment and the employment of research support staff.

##### Reference networks

This programme includes a number of measures aimed both at fostering the creation of cooperation networks for research groups having common aims and at the promotion of inter-disciplinary and multi-disciplinary initiatives. The basic intention is to encourage both cooperation between groups based in different institutions and participation in these networks by private sector enterprises and research centres from outside Catalonia. In addition, it will facilitate initiatives in drawing up and proposing large-scale joint research and innovation projects.

#### *Instruments*

*Integrated support funding for research groups:* complementary funding for established research groups which have already obtained basic funding, funding for new groups working in emerging areas, and funding for groups wishing to pilot new research projects in emerging fields.

*Reference network funding:* funding for the creation of networks of research groups with common aims or themes, consisting of resources for the creation and maintenance of networks.

*Contracts for developing reference networks:* contracts to finance reference networks, which establish a framework for relations between the Government of Catalonia and these networks, and which specify the obligations and rights of each of the parties to these contracts.

*Programme contracts with the universities:* contracts to finance Catalan public universities, which establish a framework for relations between the Government and the universities, and which specify the obligations and rights of each of the parties to these contracts. By means of these contracts, the Government will be able to evaluate the research activities of universities with a view to ensuring that public policies and established aims are implemented and fulfilled.

*Funding for research projects on science and society:* funding for research projects on gender, youth, and territorial issues, among others.

#### **Research Staff Programme**

The Research Staff Programme defines the scientific education that will ensure adequate training for researchers, the consoli-

dation of their careers, and their full participation in the research and innovation system.

The European Union has proposed, as an aim for the year 2010, an increase of 700,000 in the existing number of researchers. This figure implies a substantial investment in training and career consolidation for both researchers and research support staff.

In the Catalan context, it should be remembered that a significant proportion of research is carried out in universities and largely by teaching staff. For this reason it is necessary to ensure that scientific and teaching careers are integrated.

A major problem with the research and innovation system, however, is the shortage of researchers in private sector enterprises. In Catalonia, researcher distribution between the public and private sectors – 62% in the former and 38% in the latter – deviates from the European Union average, which has approximately equal proportions of researchers in each sector. With a view to developing closer links between universities and private sector enterprises, encouraging knowledge and experience exchanges, and augmenting scientific quality in the productive sector, more researchers will need to enter the private sector. The programme provides for the inclusion, as part of the researcher training process, of new educational content in relation to developing management skills and entrepreneurial aptitudes, so as to facilitate their entry and integration in both the public and private sectors. The programme also provides for much-needed technical and management support for research and development projects.

These measures will be implemented in a context that ensures equal opportunities for men and women, in line with European policies in relation to the construction of the European Research Area. Progress towards equal opportunities for scientists of both sexes is essential in order to take full advantage of researcher potential, improve quality and encourage innovation, make society aware of research and its implications, and finally, to promote the participation of women in scientific research.

#### *Priority actions*

##### Researcher career

This programme defines a linear career path for researchers, from initial training until the consolidation of their careers within the research system, providing the instruments necessary to promote training at each stage. It also describes instruments for the provision of employment and employment consolidation opportunities to researchers in both the public and private sectors. It encourages, moreover, researcher mobility in teaching establishments and in the private sector, as also their employment in the private sector or in teaching.

The researcher training process is divided into four stages: pre-doctoral education, post-doctoral education, training consolidation, and stable employment.

##### Research support staff training

This programme is aimed at promoting research and innovation training for technical, administrative, management and other support staff, and at facilitating their incorporation in the system.

### Equal opportunities for men and women

This programme is aimed at promoting equal opportunities for men and women in science, with a view to ensuring that women have the same employment prospects and promotion opportunities as men.

### Instruments

*Grants or funding for the employment of pre-doctoral students as trainee researchers:* grants or funding for pre-doctoral training during a period of four years in the public or private sectors.

*Grants or funding for the employment of post-doctoral researchers (Beatriu de Pinós call for grant applications):* grants or funding for PhD researcher employment in research groups of acknowledged prestige and in centres other than the centre in which the candidate's doctorate was obtained. Three models of funding will be available:

- a) Grants for post-doctoral training outside Catalonia (two years) as post-doctoral or PhD researchers in a research group of acknowledged prestige in a university, research centre, private sector enterprise, public body or similar institution.
- b) Contracts for post-doctoral training stays in Catalonia (two years) as post-doctoral or PhD researchers in private sector enterprises (laboratories, research and development departments, management teams or equivalent).
- c) Contracts for post-doctoral training stays in Catalonia (two years) as postdoctoral or PhD researcher in a private or public non-profit institution (university, research centre, public body, international body or similar) other than the centre where the candidate's thesis was submitted.

*ICREA junior contracts:* five-year ICREA (Catalan Institute for Research and Advanced Studies) contracts aimed at training consolidation for post-doctoral researchers in the public or private sectors.

*ICREA senior contracts:* permanent ICREA contracts aimed at the employment in public research bodies of researchers with a solid research track record (several categories).

*Funding for the employment of technical staff:* programme aimed at incorporating technical research support staff in the Catalan research and development system. The cost will be co-financed by the universities, research centres and private sector enterprises.

*Equal opportunities committee:* a committee to ensure that women will have the same employment prospects and promotion opportunities as men, and which will also guarantee their participation in evaluation committees on equal terms.

### Related support measures

*Doctoral programmes in private sector and other organisations:* The placement of PhDs in private sector enterprises is the result of a joint initiative between universities and the business community fostered by the Government of Catalonia. These programmes allow PhD students to conduct their thesis within a private enterprise on research projects of relevance or of interest to that company. The cost of these programmes are

co-financed by the Government of Catalonia and the participating enterprise.

*Doctoral professional development courses and seminars:* immersion training for doctoral students from all disciplines aimed at reflection on their professional future, assessment of skills and abilities acquired during their doctorate, and training in how to apply these outside the academic sphere.

*Work experience contracts for research support staff:* two-year work experience contracts in public research and technology innovation organisations, aimed at higher education students.

*Gender classified data:* all public bodies involved in research and teaching in Catalonia are required to produce and make available gender-classified data for all staff levels. Non-discrimination policies will be taken into account in awarding projects.

### Research Centres and Infrastructures Programme

To complement the knowledge generation system in Catalonia, in which universities play a central role as the main instigators of research, it will be necessary to create a network of institutions and public and private research centres with specific goals and strategies for given sectors and scientific disciplines.

Given that large-scale research centres, installations, facilities and infrastructures have an important role to play in relation to this challenge, the Research and Innovation Plan considers this programme to represent one of the key targets for the implementation of policy measures.

In recent years, the Government of Catalonia has promoted the creation of legally incorporated centres with the aim of instigating and fostering research in priority areas for Catalonia. The aim now is to strengthen existing technological and research centres, continue the process of creating large-scale research centres and facilities, and organise and regulate the different structures that presently co-exist in the science, humanities and technology fields.

### Priority actions

The Catalan Science and Technology Network (XACIT)

A register will be created of the different research structures with a view to organising and regulating the Catalan science and technology system. This register will be composed of, among other bodies, research centres, universities, university research centres, university institutes, large-scale infrastructures, research facilities and installations, and science and technology parks.

The aims of the XACIT are to define, in general terms, the main categories and roles of agents in the system, and apply these categories as a basis for specific support actions for each category of agent.

### Research centres

In close cooperation with the universities, research and development centres will be promoted and created in specific scientific areas. The ultimate aim is to attain an institutional critical mass and a scientific and technological quality that will enable these centres to successfully compete in the international arena, thereby taking advantage of the possibilities opened up by the European Research Area.

The number of centres, the number of research and technical support employees, the significant level of expenditure and investment required and the probability of further growth in the coming years, means that it will be necessary to implement measures to coordinate management, optimise resource use, standardise research management criteria, promote the centres abroad, and finally, to ensure efficient knowledge and technology transfer.

**Science and technology parks**

These structures represent one of the most complex elements within a research and innovation system, given that they usually combine all the elements of the latter, namely universities, technology centres, business incubators, private enterprises, etc. For the science and technology parks, in general, initiatives will be undertaken that will meet the requirements of Catalan research and innovation policies. Moreover, the network of science and technology parks in Catalonia will be consolidated, and support will be provided for actions taken in Spain and in Europe.

**Science and Technology Infrastructures Plan**

The beginning of 2005 saw the commencement of the drawing up of the Science and Technology Infrastructures Plan for Catalonia for the period 2005-2010.

The Science and Technology Infrastructures Plan will focus, during the period 2005-2010, on promoting the creation of large-scale installations and facilities that will generally benefit economic competitiveness and scientific progress in Catalonia, by building on current potential and also taking advantage of technology areas in which this country can play an important

role within Europe in the future, both technologically and economically. The Plan is a key element in technological and industrial policy in general, and will play a particularly important role in the endeavour to prevent the relocation of national or multinational enterprises of all kinds, but particularly high value-added enterprises.

The Plan, therefore, will focus on three key areas that will enhance Catalan competitiveness at the international level in the respective fields, namely, large-scale scientific and technological facilities, biomedical and medical research facilities, and territorial-based scientific and technological infrastructures.

**Technology and Knowledge Transfer Support Programme**

The Technology and Knowledge Transfer Support Programme includes all actions and measures aimed at creating a dynamic and interdependent system that involves science, technology and private enterprise, and most particularly, at creating interfaces to facilitate technology transfer to the market and the subcontracting of technology by private sector enterprises from research centres.

This programme has as its mission the design, coordination and management of a systematic technology transfer model for Catalonia. This model will include the necessary instruments for mutually integrating scientific knowledge and business technology and for improving technology and technology management in private sector enterprises.

The diagram below illustrates the Catalan technology transfer model. The upper section of the model represents a business creation channel based on the exploitation of academic knowledge, i.e. a *technology-push* channel. The lower part of

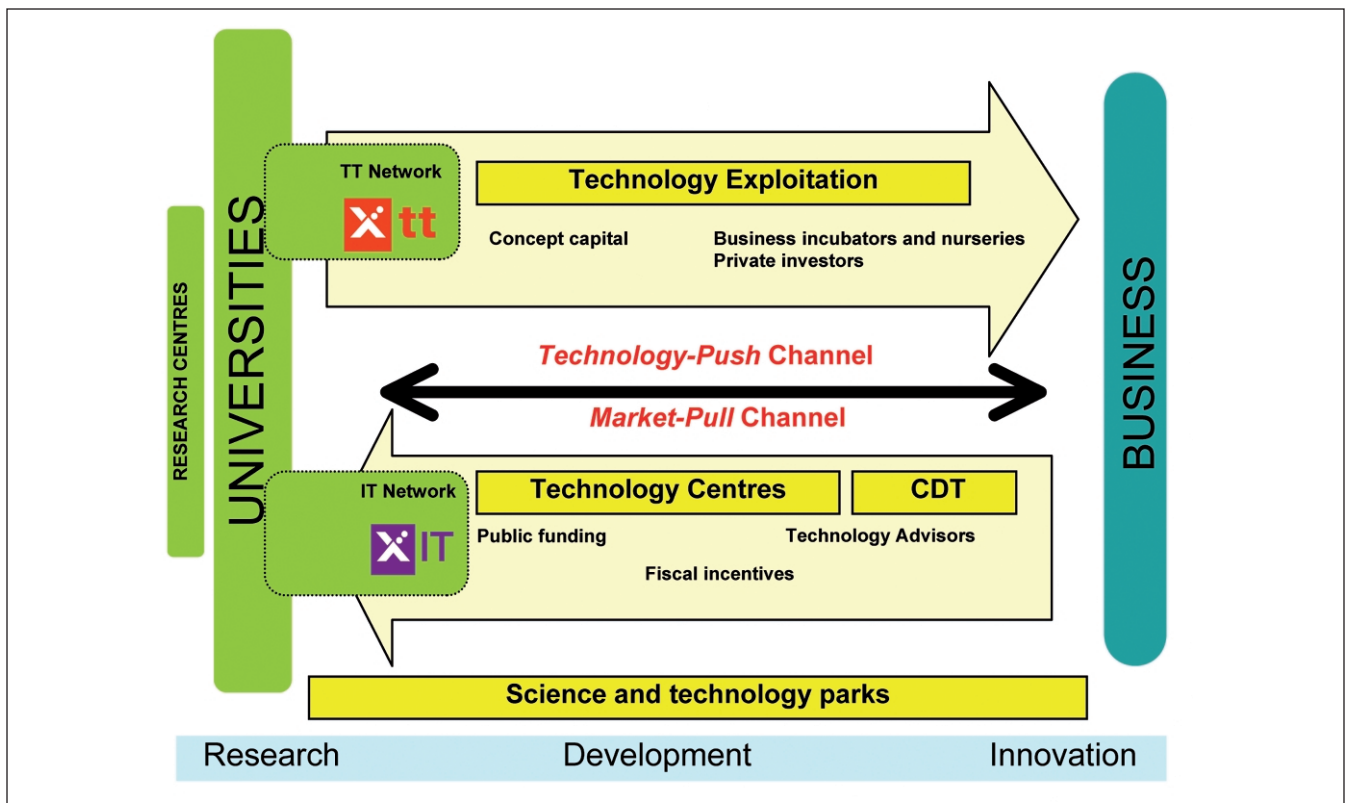


Figure 2. The Catalan Technology Transfer System

the model describes the set of agents that support businesses projects through the transmission of the technology and knowledge contained in the university and research centre system, i.e. a *market-pull* channel.

#### Priority actions

As far as the market-pull channel is concerned, existing mechanisms have been significantly enhanced as a result of the stimulus provided by the Innovation Plan 2001-2004, which has led to the creation of a first level of basic structures (via the network of technology innovation centres [XARXA IT]). This first level involves the selection and promotion of small-scale autonomous university groups that have demonstrated a clear capacity for serving the business community on the basis of knowledge generated internally.

It is necessary, however, to further develop research and innovation capabilities and to compensate for existing shortcomings in the system. This will require meeting the demand for a network of new structures to make up for the traditional deficit of large-scale technology infrastructures, such as sectoral technology centres (to undertake research and development in technology) and technology dissemination centres (to foster and promote innovation) located in various parts of the country.

As for the technology-push channel, this will also be optimised, so as to enhance measures that have already been implemented (namely, the creation of the network of intellectual property promoters [XPPI] and the technology springboard network [XTT]), and to complement these measures with other possibly more effective instruments. Financial support is also to be made available for industrial research (not intended for publication) which as yet has no market, and for maintaining the Catalan technology portfolio. Measures are also planned to encourage the description of inventions and to facilitate their exploitation by reconciling the interest in technology transfer from the universities and those of scientific excellence. In particular, the technology value chain will be complemented by a Technology Exploitation Centre which will work closely with the bodies that identify new technological opportunities (technology surveillance) and that market new technologies (competitive intelligence).

#### Horizontal actions

The Catalan technology transfer system is still fragmented, and so action is required to consolidate it and equip it with the necessary critical mass. Enhanced inter-departmental coordination, networks and mechanisms for linking agents in different areas, and simplified agreements with technology providers (in the form of programme contracts), are all measures that will enable better control over and distribution of resources that are still excessively decentralised.

#### Internationalisation of the technology market

The technology value chain is not local, and in the context of a single economy and an increasingly globalised market, technological assets are bought, sold and exploited in marketplaces all over the world. The internationalisation of the technology market requires the creation of mechanisms for purchasing and selling technology in the international market and for the inter-sectoral and international exploitation of technology.

#### Instruments

The instruments provided for by the programme are a response to the interface infrastructures that are required to complete the technology value chain that links knowledge-generation centres and the market or potential market.

With a view to fostering coordination and joining forces, a *consortium between the universities and the Government of Catalonia* will be created – called the *Knowledge Transfer Consortium (CTC)* – with the mission of identifying any transferable element in research conducted in Catalonia, evaluating its quality, and if necessary, adding to its value, protecting it and assisting in its transfer to the social and productive fabric.

The method of working through networks will be given priority at all times, so as to accelerate the learning process for the different participating agents. Moreover, the Research and Innovation Plan has established coordination systems with Catalan universities that will coordinate and provide assistance to participating agents. The agents that make up the system are listed as follows:

- Technology centres (XARXA CT): these will be widely deployed to compensate for the deficit of large-scale innovation support infrastructures in the Catalan economy;
- Technology dissemination centres (CDT): the technology dissemination centres infrastructure is smaller than the technology centres'. Distributed throughout the country, these are intended to develop economies of scales of a technological nature;
- Technology innovation support centres (XARXA IT): on the basis of experience gained, these will be consolidated and enlarged in scope to include public research centres and to lengthen the duration of support. Their actions will be coordinated with those of the technology centres network;
- Technology Exploitation Centre: this centre, common to research bodies and organisations, has as its aim the marketing of technologies by means of licences, the sale of patents, and the creation of companies. It will operate on the basis of local and international technology surveillance protocols and will collect inter-sectoral and international market intelligence in order to evaluate technology opportunities;
- Technology advisers (AT): the existing network of sectoral experts located in the country will be enlarged. The advisers' task will be to improve competitiveness by encouraging businesses to take advantage of the advisory services available to implement innovation projects
- Technology springboard network: this will be further consolidated and enlarged in scope. It will, moreover, be more focused in terms of the services it provides, through closer coordination with the Technology Exploitation Centre.

*IRC Catalonia* (Innovation Relay Centre Catalonia) has as its main aim the promotion of agreements for trans-national technology transfers (TTT) between Catalonia and Europe. This body also acts as a technology transfer medium for Spain and Catalonia, and it is anticipated that its scope will shortly be broadened to include Asia and South America. The IRC pro-



vides technology surveillance services through the European Technological Surveillance Service, as well as services and assistance in relation to the creation and promotion of the Catalan technology portfolio and technology transfer projects.

In order that IRC instruments can be applied more widely, intellectual property promoters and technology advisers will be encouraged to avail of its services. These will be responsible for identifying and drafting offers and requests for technology, as well as for control over technology transfer agreement negotiations.

Finally, special attention is drawn to the leading role to be played by the *science and technology parks* in technology transfer.

#### Related funding

*Funding for technology centres:* subsidies will be granted in accordance with the technology centre action programmes.

*Funding for technology dissemination centres (CDT):* as for the technology centres, competitive funding will be provided to implement action plans and to open technology dissemination centres throughout the country.

*Funding for research, development and innovation projects:* funding will be provided, through the intervention of the corresponding agents, to encourage the development of the innovative capabilities of businesses and to foster business links with research centres and technology centres.

*Funding for science and technology parks linked to Catalan universities:* funding will be provided for universities to create science and technology parks, bearing in mind territorial distribution issues and the priorities of the Research and Innovation Plan.

#### **Innovation Support Programme**

The Innovation Support Programme includes all actions and instruments aimed at enhancing the competitiveness of Catalan private sector enterprises through the encouragement of innovation in strategic and operational areas, at any point in the value chain, and in all business processes.

#### *Priority actions*

##### Business competitiveness

Business competitiveness measures are aimed at enhancing the competitiveness of the business sector by encouraging strategic thinking, the systemisation of innovation, and the incorporation of state-of-the-art management tools.

##### Managing innovation and strategic innovation

Actions aimed at making the Catalan productive sector more aware of the importance of innovation management as a strategic business process will continue to be implemented. Actions aimed at making the innovative process a systematic element of business management are as follows:

- Encouragement of business creativity;
- Support for strategic innovation: (the creation of methodologies for analysing innovative capabilities and for reflecting on innovation strategies; the dissemination of reference models and case studies of innovative companies);
- Creation of networks for exchanges in relation to best innovation and technology management practices among innovative companies;

- More extended use of fiscal incentives to encourage innovation, and of financial tools to stimulate innovation;
- Enhancement of the scientific-technological level of companies by encouraging doctoral studies among the business community;
- Development of business expansion programmes.

#### Design and product development policies

The Research and Innovation Plan has drawn up a specific policy programme covering all areas of design (industrial, textile, graphic, interior design, etc.), with a view, ultimately, to promoting and developing Catalonia as a 'design country'. The Plan provides for actions to draw up design and product development methodologies, as also to coordinate the agents in this field.

#### Innovation in production and logistics

The Research and Innovation Plan includes actions to promote production and process innovation in the manufacturing sector by means of the dissemination of new production technologies, new forms of organisation, and new logistics and supply chain management techniques, as well as actions for promoting synergies between this programme and the business digitisation programme.

#### Quality and productivity

A series of actions will be implemented with a view to developing and consolidating a spirit of excellence in the quality and productivity areas, improving staff motivation and training, and promoting strategic cooperation between businesses with a view to overcoming problems of size and favouring exchanges of knowledge and good research, development and innovation practices. Actions in relation to quality and productivity are grouped into three main areas: size as an issue in business management; quality, productivity and innovation systems and standards; and cooperation and exchange in regard to experiences with Government ministries and bodies, as also with other representative businesses and institutions.

#### Digitisation of private sector enterprises

Digitisation of private sector enterprises requires the systematic introduction of information and communications technologies (ICT) and the promotion of business models which, in some cases, may generate opportunities associated with the digital technologies. Digitisation will make processes more efficient, and more importantly perhaps, will facilitate real-time work via networks.

Actions to promote digitisation have two aims: to enable small and medium-sized enterprises to take advantage of the communications technologies that are essential to ensuring business competitiveness and productivity, and to foster the development of the information and communications technologies in Catalonia.

#### *Instruments*

##### ✓ Funding

- Funding for strategic innovation and for analysis and advice in regard to the introduction of the information and communications technologies;

- Funding for production, logistics and industrial design innovation projects;
- Funding for industrial research, pre-competitive development and technological innovation projects in private sector enterprises (research, development and technological innovation);
- Funding from the Small and Medium Enterprise Consolidation and Competitiveness Plan;
- Funding for PhD theses carried out in corporate environments.

Other support services for the business sector contemplated by the Research and Innovation Plan include: the publication of methodology manuals and guides; demonstration projects, sectoral pilot projects and methodology testing projects (on strategic innovation, product and process innovation, ICT tools, quality and productivity); technology awareness seminars, demonstration seminars, and training and information seminars; actions to promote an innovative spirit and entrepreneurial culture (such as the Innovation Forum); technology innovation and quality awards (aimed at bringing to the fore Catalan models of good business practices characterised by innovative capacity and operational excellence); advisory services; business growth pilot projects (aimed at creating environments and mechanisms that facilitate international projection); and, finally, equal opportunities advisory services (to develop social responsibility in the private sector and ensure equal treatment of men and women in the knowledge, research and development society).

### *Financial Support Programme*

Innovation implies risk, and those associated with the adoption of new technologies and the launch of new products are risks that the entrepreneur or businessperson cannot always assume alone. The Research and Innovation Plan provides for the development of funding instruments to assist the business sector in assuming these risks and by means of which the groundwork can be laid to enable these businesses to compete in international markets.

Having a suitable financial structure permits businesses to develop in a limited risk environment and to grow in more sustainable ways. Successful measures have already been implemented to attract capital for the early stages of business growth. Now the need is for the development of other instruments that enhance both the existing financing system and funding measures, and which will ensure growth at the national and international levels for innovative projects. For these reasons, it is essential to develop environments and instruments that ensure adequate capitalisation of innovative projects.

### *Priority actions*

In regard to capital, actions will be designed to stimulate the supply of risk capital funds and of participative and secondary market loans.

With a view to improving the existing financial and taxation framework for innovative businesses, the specific actions will be implemented with the following goals:

- To encourage pension fund investment in risk capital instruments
- To encourage the concession of participative loans by taking advantage of existing instruments (e.g. the Catalan Finance Holding Institute) and by availing of the assistance and cooperation of the relevant Catalan government bodies, as also to improve coordination with the National Innovation Authority (ENISA):
- To increase the number of reciprocal guarantee company transactions by applying new public counter-guarantee mechanisms;
- To increase capital market liquidity via disinvestment mechanisms for risk capital companies that are partners in various stages of a project;
- To bring private financing into the research and innovation system. To foster the creation of a knowledge-based business sector, in cooperation with the private banking system and with its financial support, as a means of promoting economic growth and social well-being;
- To propose a modification in taxation treatment for private investment capital gains and losses in financing corporate projects (i.e. similar treatment to institutional investors).

### *Instruments*

The Research and Innovation Plan encourages the supply of a wider range of financial products that will satisfy the financing requirements of innovation projects of whatever kind and in whatever stage of development, in particular:

- Risk capital funds aimed at covering the financial gap that generally exists in the riskier stages of a project;
- Private investor networks, that will represent a point of encounter between businesses with growth projects and private individuals with funds to invest (who will be able to avail of advisory services and experience exchanges);
- AVALIS de Catalunya, SGR, reciprocal guarantee companies, and loan guarantee funds;
- Participative loans to encourage growth in small and medium-sized enterprises (as an alternative to sourcing additional finance via a new partner).

Other services contemplated by the programme include:

- Support to businesses in requesting tax exemptions for their research and technological development activities;
- Innovation Capital: a free advisory service for those who need capital and for those who can supply capital;
- An information service concerning business size issues, specifically covering best management practices, measures for ensuring adequate working capital, advice on mergers and acquisitions, and taxation measures affecting these processes.

### **Complementary measures**

#### *Mobility, Cooperation and Internationalisation Programme*

Researcher mobility and international cooperation are basic in-

redients for human, scientific and technological progress. The aim of this programme, therefore, is to increase the number of training and research stays by Catalan researchers abroad, and to foster an international spirit in Catalan research.

In order to achieve these goals, it will be necessary for Catalan researchers to fully participate in research at the European and world level, and for Catalonia to incorporate, in its research structures, quality researchers of acknowledged prestige, so that these may stimulate the development of the Catalan research and innovation system to the point where it can take up a leading and competitive position at an international level.

Attracting outside talent to Catalonia will also bring about quality improvements in research activities implemented in Catalonia. It is therefore crucial for Catalan universities, private sector enterprises and research centres to act as poles of attraction that will bring post-doctoral and senior researchers from all over the world to Catalonia in order to conduct advanced and competitive research.

International cooperation includes exchanges of all kinds with other institutions, regions or countries with a view to attaining common goals. It is crucial that the Catalan scientific community participate fully in the major European research initiatives and infrastructures. The participation of foreign researchers in research projects being implemented in the major Catalan research infrastructures, such as the supercomputer or the Synchrotron Light Source (which is expected to be fully operational by the end of the decade) should also be taken into consideration.

#### *Priority actions*

##### *Mobility*

This series of actions will enable researchers pursuing research and innovation lines in Catalonia to make research visits or stays at research centres in other regions or countries. In order to foster excellence in research in Catalonia, programmes will also be established to arrange for researchers from other regions or countries to make research visits or stays in Catalonia. Finally, mobility between public sector bodies and private sector organisations will be encouraged among those who work in research and innovation.

##### *Internationalisation*

To ensure that Catalonia becomes a model of reference for research and innovation activity, particular efforts will need to be directed at the internationalisation of the research and development base, at publicising Catalan scientific and technological capabilities, and at promoting cooperation between Catalan institutions and bodies from other regions and countries. Efforts will also need to be directed at ensuring Catalonia's full and active participation in European and international programmes and at ensuring that Catalan researchers can successfully compete in obtaining resources at world level.

##### *International public relations campaign*

The aim is to position Catalonia in the international arena as the research and innovation reference point for the southern European area, given its creative and cultural characteristics and its entrepreneurial tradition.

#### *Instruments*

- *Grants and funding for training Catalan researchers outside Catalonia:* grants and funding to finance visits and stays at research centres outside Catalonia aimed at pre-doctoral and post-doctoral researchers and university teachers, as well as at other groups, such as specialists in research management;
- *Grants and funding for visit and stays in Catalonia:* grants and funding for further study, short research visits or longer stays, or to re-incorporate researchers in Catalan universities and research centres;
- *Funding to promote university-corporate mobility:* funding aimed at third cycle university students (post-graduates) and university teachers to encourage the implementation of research and innovation projects in business environments;
- *Funding for the organisation of international conferences:* funding to organise international conferences aimed at universities, research centres and other institutions;
- *Funding to promote cooperation between institutions:* funding to promote cooperation between institutions in different regions and countries, and particularly with those countries included in the Cooperation Development Management Guideline Plan 2003-2006;
- *Funding for Catalan participation in European research programmes and funding to obtain resources;*
- *Science and technology cooperation agreements and programmes involving Catalonia and other countries or regions in Europe or elsewhere.*

#### *Programme for Promoting and Communicating Science and Technology*

In order to develop an advanced science and technology system, society as a whole needs to be aware of the importance of science and technology for both the economic future of a country and for the daily lives of its citizens. This programme, therefore, aims to provide a range of measures and initiatives that will lead to the implementation of a series of activities to communicate the importance of science and technology for the future of advanced societies. In this context, activities that communicate and publicise science in society, and particularly among young people, are central elements of the programme.

Indeed, a knowledge-based society requires an adequate pool of suitably trained experts in the sciences to ensure further progress. For this reason, the development of an interest in science and technology among young people is crucial: in other words, scientific and technological careers need to be promoted among young people.

However, the experiences of many countries would indicate that it is necessary to foster a scientific spirit from an early age. For this reason, the actions to be carried out will include initiatives aimed at schoolchildren from primary school onwards.

#### *Priority actions*

The actions to be implemented within the framework of this programme need to take into account two target populations: on the one hand, society in general, and on the other hand, pri-

mary and secondary school pupils. It will be necessary to effectively promote greater knowledge and awareness of the importance of science and technology in the lives of ordinary people, in areas such as, for example, health, the environment, and communications of all kinds. To achieve this goal, it is intended to implement communications and publicity measures (using the press, television and the other media), open day activities in universities and research centres, informative exhibitions, and events such as Science Week. As for actions aimed specifically at primary and secondary school pupils, emphasis needs to be placed on regulated training and on active programmes that promote an interest in science and technology careers.

In this context, the School Science Day – an initiative which was implemented for the first time in 2004 – can play an important role as a catalyst in ensuring that activities to promote science and technology and communicate its importance to society will reach all areas of Catalan society.

### *Instruments*

#### *Funding*

*Funding for communication and publicity actions* will be aimed at the preparation and publication of written material, the development of programmes and exhibitions, multimedia materials, etc., the organisation of events, talks and open days by relevant organisations and associations, the general promotion of scientific knowledge and the development of an awareness of the importance of science, technology and innovation.

*CIRIT awards for young researchers* to reward research projects of secondary school students in order to foster the scientific creativity and the spirit of research of secondary school children.

#### *Other initiatives*

- The creation of a Science Communication and Publicity Plan 2005-2008 will cover all relevant communication and publicity actions and programmes;
- The Catalan Council for Scientific Communication (C4) will act as a permanent meeting point for experts and other agents from a range of fields who participate in the task of communicating and publicising science and technology;
- Plataforma Catalunya: Science and Communication (C3) will serve as a medium for exploring new tools, actions and means to publicise science, and for exploring how these can be used in society to maximum effect;
- Science Week, organised by FCRI (Catalan Foundation for Research and Innovation);
- School Science Day, organised by the Ministry of Education, the Ministry of Universities, Research and the Information Society, and FCRI.

### *Entrepreneurial Support Programme*

The entrepreneurial spirit is one of the main driving forces behind innovation, competitiveness and economic growth. To ensure the creation and growth of businesses, it is necessary, in general, to create the corresponding favourable environment. It is also necessary to stimulate an entrepreneurial culture within the education system by developing suitable instruments for

this purpose. The role of the entrepreneur in society needs to be highlighted, and an environment that favours the creation of businesses needs to be fostered. This programme, which has as its underlying mission the promotion of business creation, will take direct action in support of innovative projects and the development of a favourable innovation environment, and will also foster dynamic actions by the agents that intervene in the creation of businesses from the earliest stages.

### *Priority actions*

The Research and Innovation Plan promotes the creation of technology businesses and innovative business models by means of the technology springboard network, funding for technology-based companies during the entire financing period, and coordination with other bodies whose purpose is the creation of businesses, namely, local business promotion bodies, territorial business incubation centres, chambers of commerce, provincial delegations, etc. The actions to be implemented include:

- Promotion and development of the network of business incubators with a view to providing entrepreneurs with the necessary support to develop and implement business projects, with centralised management and network coordination to ensure optimum results. Moreover, the contracting of international business incubations services is being evaluated with a view to both promoting the growth of capitalised businesses in advanced technology areas and using this platform to attract international business models to Catalonia;
- Enlargement and professionalisation of the existing platforms (technology springboards), consolidation of the network and of the strategic partners within the network;
- Improvement in concept capital funding (so that this is converted into a simple and fast-acting catalyst for the creation of technology-based companies) and progression towards a participative loan model;
- Creation of seed funding instruments for implementation prior to concept capital i.e., the concession of initial funding for newly created companies in the early development phase, and prior to the concept capital stage, with the only requirement being that of creating the business;
- Raising awareness among universities of the value of creating businesses;
- Support for the creation of technology-based enterprises that develop within the business environment;
- Development of a community of monitors, tutors and experts with experience of the business world, to participate in the creation of a part-time business sector and to deal with consultations from and provide guidance for entrepreneurs;
- Training in entrepreneurship (development of methodologies, training of educators, creation and extension of cross-disciplinary training modules, and the creation of progressive entrepreneurial training modules to be implemented in secondary schools);
- The creation of circuits for monitoring businesses from

their inception with a view to compensating for businesses that close down, with preventive analyses on strategy and financing to be provided by intermediary organisations and economic development institutions.

#### *Instruments*

##### Funding

- *Seed (pre-concept) funding and concept capital:* aimed at providing support to entrepreneurs with a solid technological background in the early idea phase or concept phase of their business model

##### Related infrastructures and services

- *Technology springboard network:* located in the universities and business schools, the springboards are entrepreneurial advisory centres and centres where innovative business plans will be detected and selected;
- *Business incubator network:* distributed territorially, business incubators are designed to provide the entrepreneur with the shared facilities and services necessary to develop the initial phases of a business project;
- *Community of private investors:* creation of a dynamic network to be instigated by the Government of Catalonia;
- *Preventive analyses of strategies and funding models for emerging businesses;*
- *Entrepreneurial competition:* aimed at the training of social agents in the creation of businesses (active participation during one year);
- *Communication and publicity campaigns in relation to the social reference of entrepreneurship, the agents involved and the entrepreneurial services available.*

#### *Initiatives to Foster Innovation in Government Ministries*

In order to transmit, to society in general and private sector enterprises in particular, the importance of innovation and appropriate use of the new technologies, the Research and Innovation Plan contemplates initiatives to promote innovation in the ministries of the Government of Catalonia. The aim is for the government to demonstrate its commitment to the dissemination of an innovative culture and to the use of new technologies. As yet another agent in the economy and as a potential model of good practice, the government needs to demonstrate that it uses modern resources efficiently, thus generating a domino effect in the economy and society.

#### *Priority actions*

Public procurement segmentation according to specific priorities

A series of measures will be implemented, aimed at using the institutional purchasing power of the Government of Catalonia as a tool for fostering technology development and innovation in business sectors. The intention is not merely to acquire products that are already on the market (standard procurement) but rather to implement a concerted policy that favours new technologies. This approach will encourage the development of technological capabilities, especially in strategic sectors and among the more competitive technology sectors.

#### Eco-efficiency

Public procurement constitutes a significant element of the GDP of advanced economies, and decisions in relation to public procurement consequently have great repercussions in the marketplace. If this potential is directed at the acquisition of goods with reduced environmental impact, it will transmit a clear signal to the market, as well as making a significant contribution to sustainable development. Likewise, by promoting the purchase of 'green' goods, public authorities can provide a real incentive to businesses to develop new technologies and promote innovation.

#### Electronic administration

Electronic administration refers to the digital technology tools that improve and enhance interaction and communication with the public, by facilitating access to information and to the services provided by public authorities and bodies.

The aim is to advance towards digitised government ministries by introducing teleprocesses, thereby improving and making more flexible the services offered to the public, businesses and institutions. This will lead to an overall improvement in communications, encourage improved participation in the public sector, and develop opportunities for interaction between private and public sectors.

#### Human resources innovation

The Government of Catalonia should act as a model for innovation in the management of its human resources, by encouraging team work and task delegation, and by guaranteeing professional careers, workplace quality, motivation and the recruitment of talent, and finally, by facilitating the reconciliation of family and work commitments. The following measures, therefore, will be implemented:

- *Telework:* the Government of Catalonia is committed to encouraging telework wherever possible, as a way of facilitating the reconciliation of family and work commitments. This new approach to work is based on the use of the information and communications technologies to enable employees to carry out a proportion of their work away from the formal workplace;
- *Knowledge management within government ministries:* in-house training programmes will be conducted that profit from the existence of skilled personnel within the ministries;
- *Online training and teletraining:* virtual training will be encouraged.

#### *Instruments*

- Public procurement tenders and auctions (procedures to award public procurement contracts within the framework of the legislation governing public administration contracts, approved by Legislative Royal Decree 2/2000, of 16 June, which approved the consolidated act governing public administration contracts);
- Methodologies for managing innovation and public procurement;
- Workgroups for coordinating public procurement, with regular meetings and best-practice exchanges;

- Pilot public procurement projects aimed at testing the effectiveness of the actions described above. It will be necessary to select specific government ministries in which to apply the proposed public procurement methodology;
- Observation of the good innovation practices implemented in other public bodies and the development of exchange projects.

### *Programme for Coordinating and Obtaining State and EU Resources*

The development of public research and innovation policies should not take place in isolation. Rather, for Catalonia to be able to take up a leading position in Europe in terms of research and technology development, it will be necessary to complement the specific measures implemented by the Government of Catalonia with the opportunities offered by the Spanish State and the European Union, and to map out a global, coherent and complete picture of the resources available to promote research and innovation. The Research and Innovation Plan contemplates actions to employ resources obtained externally, as also to ensure optimisation of the possibilities offered by Spanish State and European Union programmes and the maximisation of returns on any funds obtained.

### *Priority actions*

#### European Union resources

The European Union develops, on an ongoing basis, research and development framework programmes as its main instrument for financing research and innovation projects in the European arena. A series of decisive actions have been defined to be implemented by public institutions in relation to the opportunities offered by the research and development framework programmes of the European Union. These include the following:

- The creation of European centres of excellence on the basis of cooperation between laboratories, universities, and private sector enterprises, and by means of integrated projects and networks promoting excellence;
- The promotion of technology platforms and large-scale strategic projects in high-potential industrial sectors and involving public and private players who will take a long-term perspective on the basis of the technology strategy described in this Plan;
- Support for individual fundamental research teams selected on the basis of excellence and competitiveness;
- The promotion of research infrastructures of European interest (laser, neutrons, genome databases, etc.);
- The involvement of small and medium-sized enterprises in large-scale projects (not exclusively EU CRAFT cooperative research programmes);
- The promotion of complementarity between research funds and structural funds;
- Systematic and regular participation by Catalan representatives in European innovation policy work groups and committees.

#### Spanish State resources

The Spanish State programme of support for research and innovation is described in the National Scientific Research, Development and Technological Innovation Plan 2004-2007. The measures associated with obtaining State resources are designed to create and consolidate the mechanisms that enable participation in State research and innovation policymaking and to obtain funds available through the State research and development plans. The following steps will be taken:

- The encouragement of active participation in Spanish National Scientific Research, Development and Technological Innovation Plan projects;
- The involvement of Catalan agents in drawing up, evaluating and reviewing the different measures provided for in the National Scientific Research, Development and Technological Innovation Plan.

### *Instruments*

#### European project support service

The support services made available by the Government of Catalonia – through CIRIT, CIDEM, DURSI, the Ministry of Health, FCRI and the public consortium Patronat Català Pro-Europa – will require coordination to ensure that synergies are detected and acted on and that the necessary joint actions are taken. This coordination will ensure adequate controls over participation in research and development framework programmes and suitable monitoring of their effect on Catalonia.

#### Priority areas and sectorial strategy

Given the importance of research and innovation for the development of a country, the enormous range of sectors and areas in which research and innovation can be applied, and the fact that resources are of necessity limited, prioritisation in terms of research areas and economic sectors is absolutely necessary. The positive aspect of prioritisation is that specific strengths and the benefits of concentration are taken full advantage of. This ensures the attainment of critical mass and effectiveness in resource deployment, among other advantages.

The measures provided for in the Research and Innovation Plan, therefore, focus on two main areas that will enable the creation and consolidation of ‘poles of excellence’ in a European and international context.

#### *a) General progress in the science and technology fields via medium- to long-term projects*

The Catalan system of science and technology needs to continue fostering – as an undoubtedly attractive asset – general knowledge acquisition based on freedom in research. The Research and Innovation Plan, therefore, aims to foster all areas of science and technology whilst awarding special priority to quality and excellence, given that knowledge should be acquired long-term without being conditioned by short-term market or productivity demands. For this reason, the Government of Catalonia will take a particular interest in fostering quality and excellence in scientific and technological research in all areas of knowledge.

*b) Determination of priority research and technological development lines in different productive sectors*

With the twofold aim of ensuring optimum interaction between all kinds of research and knowledge generation and the profitability of productive sectors considered as priorities for Government of Catalonia policies, the Research and Innovation Plan will mobilise the resources allocated to research and technological development so as to develop the innovative capabilities of the Catalan productive system. The Plan, therefore, establishes priority research lines designed to improve the connectivity between research programmes and innovation development programmes in the private sector.

### Priority research lines

The Research and Innovation Plan satisfies the demands of industry, of business in emerging fields in the knowledge-based economy, and of the government and its ministries. The ministries and bodies dependent on the Government of Catalonia develop strategies and priorities for applied research in areas that are the responsibility of the government, by means of plans such as this Research and Innovation Plan and with the support of the bodies generally responsible for science and technology, namely the Interministerial Council for Research and Technological Innovation (CIRIT) and the Ministry of Universities, Research and the Information Society (DURSI).

In relation to making general progress in the science and technology areas, the underlying goal of the Plan is *to foster all areas of science and technology, and in particular, to foster fundamental research while applying criteria of quality and excellence*. Progress in both general knowledge acquisition and in economic competitiveness requires a science and technology policy that is broad in scope, to foster the generation of knowledge in the long term without interference in the form of short-term market or productivity demands.

For this reason, DURSI and CIRIT will take a special interest in fostering quality in scientific and technological research in all areas of knowledge. This policy of promoting knowledge acquisition in a broad sense needs to be adapted, however, to initiatives and proposals for priority lines of research, in order to face the challenges posed by the need to develop a knowledge-based society.

For this reason, specific strategic lines of research for the productive sectors are identified, listed as follows:

- *Research in biomedicine and the health sciences*
- *Research in information and communications technologies engineering (ICT)*
- *Research in the agro-alimentary sciences and technology*
- *Research in social and cultural development*
- *Research in sustainable development and the environment.*

Moreover, research in cross-disciplinary areas will also be fostered, for example, in the nanoscience and nanotechnology fields.

Research and development policies in the priority areas de-

finied above will be implemented by means of the creation and consolidation of research centres, the funding of research groups and networks, and the financing of researchers and support staff. These measures will be complemented by the creation and development of large-scale (by Spanish or European Union standards) installations and facilities, scientific infrastructures and technology platforms, such as for example, science and technology parks linked to universities, the Synchrotron light source facility (Laboratori de Llum de Sincrotró) and the Supercomputation Centre (Centre de Supercomputació). To this end, the Science and Technology Infrastructures Plan for Catalonia for the period 2005-2010 will be approved and implemented.

Likewise, in order to ensure that any research carried out adds to the potential of the economic sectors prioritised by this Plan, the Government of Catalonia will specifically support cooperation between large-scale infrastructures, universities, research centres, and private sector enterprises with a view to developing local productive sectors based on emerging and inter-disciplinary fields. In this respect, the creation of a *Catalan BioCluster* will be actively promoted, to include public bodies (universities, research centres, hospitals, science and technology parks, etc.) and private enterprises (pharmaceutical companies, biotechnology companies, service providers, etc.). The purpose of the BioCluster will be to produce highly competitive products and services in the biomedicine and biotechnology fields.

### Sectorial and technology strategies

To progress towards a model of growth based on knowledge, it will be necessary, on the one hand, to improve the overall quality of research, development and innovation in the industrial sector, and on the other hand, to implement a process of structural change that promotes specialisation in Catalan industry in terms of both sectors and high value-added/high-tech products. Research and innovation policies, therefore, will need to foster innovation capabilities in the private enterprise sector in general by implementing cross-sectoral measures. Priorities should be established, however, by selecting strategic sectors and aiming specific actions at each of these sectors, so as to ensure that policies to foster innovation are genuinely effective.

Sectors with a strong growth potential and high technology content include *aerospace, biotechnology, pharmaceuticals, processed foods, and renewable energies*.

The capacity of these sectors for acting as a driving force for the economy, combined with their knock-on effects in other sectors, will be built on by identifying specific *technological competences* that generate a *competitive edge* and that can be *disseminated to the rest of the business fabric* via suitable technology transfer infrastructures.

The dissemination of differentiated technology and knowledge can only be achieved by devising the corresponding *technology strategies*; these will focus efforts in the area of achieving technological excellence and providing specific supports for business projects in the emerging knowledge fields – fundamental to the overall medium-term competitiveness of

productive sectors and the competitiveness of strategic sectors such as:

- *Production technologies*
- *New materials*
- *Nanotechnology*
- *Information and communications technologies (ICT)*
- *Energy generation technologies*
- *Biotechnology*
- *Organisational sciences.*

*The cross-disciplinary nature of these technologies and the existence of a solid support infrastructure for technological innovation guarantee a knock-on effect on all the sectors of the economy, and particularly on those sectors most vulnerable to international competition.* The fact that certain sectors are prioritised, the development of a technology strategy associated with these sectors, and the generic effects of horizontal actions will result in an integrated effect that does not exclude the promotion of scientific, technological and business quality and ex-

cellence in fields that range from the pure sciences to the social sciences.

From a systemic perspective, on the other hand, the technology absorption capability of the corporate sector needs to be enhanced by means of specific programmes and funding for business innovation. The creation of *excellent supply* infrastructures, moreover, will be complemented by the fostering of *exacting* in these areas of technology and knowledge.

In order to stimulate demand and encourage the research, development and innovation efforts of private sector enterprises, it will be necessary to implement *measures that provide direct and specific economic and financial support to business investment in research, development and innovation.*

These measures will have the following aims:

- To encourage the growth of strategic enterprises and sectors;
- To create knowledge stocks, strengthen technology development capabilities, and generate a knock-on learning

## RESEARCH AND INNOVATION PLAN 2005-2008: BUDGET

Summary Table

(Figures are given in thousands of EUROS)

<i>Priority measures</i>	<i>Responsible body</i>	<i>Managing body</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>Total</i>
<i>Transverse Measures</i>			<i>132,411</i>	<i>153,850</i>	<i>173,126</i>	<i>189,569</i>	<i>648,956</i>
Research Support Programme	DURSI/DGR	AGAUR	36,164	39,787	43,000	50,000	168,951
Research Staff Programme	DURSI/DGR	AGAUR/ICREA	27,370	31,092	36,000	44,000	138,462
Research Centres and Infrastructures Programme	DURSI/DGR	DURSI	40,174	52,102	61,000	60,000	213,276
Technology and Knowledge Transfer Support Programme	DTI/SIE	CIDEM	17,110	18,554	20,034	21,645	77,343
Innovation Support Programme	DTI/SIE	CIDEM	10,883	11,595	12,360	13,181	48,019
Financial Support Programme	DTI/DEiF	CIDEM/ICF/AVALIS	710	721	732	743	2,905
<i>Complementary Measures</i>			<i>19,663</i>	<i>21,053</i>	<i>22,598</i>	<i>24,928</i>	<i>88,242</i>
Mobility, Cooperation and Internationalisation Programme	DURSI/DGR		3,712	4,349	5,000	6,000	19,061
Programme for Promoting and Communicating Science and Technology	DURSI/DGR	ALL	896	896	1,000	1,500	4,292
Entrepreneurial Support Programme	DTI/SIE	CIDEM	5,435	5,707	5,992	6,292	23,426
Initiatives to Foster Innovation in Government Ministries	ALL	ALL	9,400	9,870	10,364	10,882	40,515
Programme for Coordinating and Obtaining State and EU Resources	ALL	ALL	220	231	243	255	948
<i>Sectoral and technology strategies</i>	<i>DTI/SIE</i>	<i>SIE/CIDEM</i>	<i>28,500</i>	<i>29,925</i>	<i>31,421</i>	<i>32,992</i>	<i>122,839</i>
<i>Research and Innovation Plan Total</i>			<i>180,574</i>	<i>204,828</i>	<i>227,145</i>	<i>247,489</i>	<i>860,036</i>

The «indirect» budget of the Ministries of the Government of Catalonia for Research and Innovation for the period 2005-2008 is:

- DURSI (Directorate General of Universities): part of the university staff salary for R&D: 800 million euros
- The rest of the Ministries (DURSI and Ministry of Employment and Industry excluded): 400 million euros (with the Ministry of Health leading the way)

PRI's budget (direct and «indirect» resources): 2000 million euros



effect among research and innovation agents working in the technologies mentioned above;

- To extend any technological competitive advantages acquired to the remaining economic sectors, particularly to those most vulnerable to international competition.

Finally, it is an undeniable fact that technological opportunities are more likely to arise when there is interaction between converging economic sectors or fields of knowledge. It is particularly important, therefore, to support cooperative multi-disciplinary, multi-business and multinational projects; in this way, synergies can be developed between technology fields, knowledge networks can be extended, interaction can be fostered, and knowledge can be transmitted – not to mention the feedback and learning cycle that is implied by the process. It will be necessary, therefore, to create research groups and joint research and development programmes between businesses and public and private research centres and technology centres.

These aims will be achieved by: providing adequate funding (for the implementation of business research and development projects in strategic sectors, joint research and development projects in strategic sectors, joint research and development projects in sectors vulnerable to international competition, and research, development and innovation projects that prioritise

the key technologies mentioned previously); through the technology centres and technology dissemination networks; through the XARXA IT (network of support centres for technological innovation); and through the creation of sectoral debating and forecasting groups ('innovation circles').

## **Butget and financing**

The Catalan Government's clear and decided commitment to the development of Catalonia as a knowledge-based society and as a socially and culturally advanced society, combined with the need to create a modern and competitive economy, are clearly shown in a substantial budgetary allocation of the resources necessary to achieve the aims of the range of programmes described above. The sum total of the resources earmarked to fulfilling the Research and Innovation Plan 2005-2008 amounts to 860 million euros, representing the budgets of the two principal executors of the Plan, the Directorate General of Research of the Ministry of Universities, Research and the Information Society (DURSI), and the Ministry of Employment and Industry through the Secretariat for Industry and Energy and the Centre for Business Innovation and Development (CIDEM).