



**STUDY ON THE STRENGTHS,
WEAKNESSES,
OPPORTUNITIES AND
THREATS FOR SPANISH REGIONS
WITHIN THE FRAMEWORK OF THE
CONCLUSIONS OF THE LISBON AND
GOTHENBURG EUROPEAN COUNCILS**

EXECUTIVE SUMMARY

SEPTEMBER 2006



1. EXECUTIVE SUMMARY

a.) Objectives

This document (prepared by Ikei Research & Consultancy under the direction of the European Commission Directorate-General for Regional Policy) presents the executive summary of the study on the Strengths, Weaknesses, Opportunities and Threats for Spanish regions within the framework of the conclusions of the Lisbon and Gothenburg European Councils. This study is designed to guide and assist the European Commission Directorate-General for Regional Policy in defining the policies, action and strategies for the period 2007-2013 with the aim of driving research, development and innovation activities in the Autonomous Communities of Spain and in the whole of the country.

The content of this executive summary is drawn from the general presentation in the abovementioned study, which provides the necessary comprehensive indepth coverage of the combination of aspects addressed in this executive summary. Beyond that, the executive summary includes the key aspects covered during preparation of the study outlined in section b.

b.) Content

The study is divided into five chapters. The first provides an introduction to the project. The second analyses in broad lines the situation of R&D and innovation (R&D+i) in the EU, with special emphasis on the new focus of European policy in this field for the period 2007-2013. The next chapter addresses the situation of R&D+i in Spain at both national and regional levels, accompanied by a review of Spanish policy on R&D+i for the next few years and the direction of Community policy vis-à-vis Spain in this area. Chapter 4 then diagnoses the R&D+i situation in each of the individual Autonomous Communities of Spain. This diagnosis includes a description of the public and private entities involved and a brief review of the main lines of regional policies being developed and/or already implemented. The same chapter also presents an individual SWOT analysis of each region's R&D+i systems, describing the principal strengths, weaknesses, opportunities and threats. Finally, the fifth and final chapter makes a series of recommendations based on the diagnosis in the previous one. These recommendations are made at national level and for each of the Autonomous Communities, with the objective of helping to define the policies, action and strategies which should be promoted by the European Commission Directorate-General for Regional Policy.

c.) Method used

This report was prepared using a combination of desk research (essentially in the form of analysis of information available from reports, studies and websites) and a process of verifying and comparing the analysis produced with various leaders of regional R&D+i policy and with a number of regional experts on the subject who made significant contributions to the material prepared by Ikei. A total of more than 85 experts and leaders covering each and every Autonomous Community in Spain were contacted.

d.) Limited R&D+i activity in Spain compared with the European Union average

As already well known, Spain is lagging far behind in R&D+i as measured in terms of investment as a percentage of GDP and private-sector's share of funding. Internal R&D spending as a percentage of GDP in Spain is 1.05%,



significantly behind the EU-25 average of 1.82% (OECD figures for 2003). In addition, average spending per researcher in Spain is well below that in other countries of similar size, like for example Germany, France or Italy.

Nevertheless, the trends in the principal indicators of R&D activity prepared by the National Statistics Institute (INE) illustrate the efforts made by Spain: R&D spending stood at only 0.72% of GDP in 1998, but had increased to 1.07% by 2004. Employment in R&D in Spain also increased by 117% over the period 1990-2003, with the number of researchers increasing by 146% over the same period.

In general it can be said that the Spanish R&D+i system (both public and private) suffers from a major lack of critical mass which, together with the abovementioned limitations on resources, results in limited progress on economic productivity and keeps real scientific output below its potential. This is clear, for example, from Spain's participation in the European Research Area (under the Framework Programme) which is below the potential of the Spanish economy as a whole.

e.) Low company participation in R&D+i activities

Spanish private-sector participation in R&D+i is the weakest point in the process that Spain has undertaken to converge with the rest of Europe. Company participation in R&D is markedly below the EU-25 average (0.57% in Spain against 1.3% in EU-25). Similarly, private-sector expenditure as a share of total R&D expenditure in Spain (54%) is below the EU-25 average (63%). The available data indicate a low number of company researchers, with only 30% of researchers in Spain performing their activity in companies versus 48% for the whole of the European Union or 82% in the United States.

This dearth of private-sector researchers results in companies failing to develop their own knowledge base and in limited progress with dissemination (in the form of technology transfer to manufacturing industry) of knowledge generated in Spain's public research centres. One indicator of the technology deficit is the limited number of patent applications made by companies located in Spain compared with the European average, the limited presence of high-tech exports from Spain or Spain's trade deficit in high-tech products. The limited presence of high-tech sectors in Spain's manufacturing industry, combined with the proportion of SMEs, are structural reasons that help to explain the limited role played by private companies in Spain's R&D+i activity.

f.) Priority for R&D+i in public planning

To address these big deficits within the Spanish economy compared with its leading European and international competitors, last year the Spanish Government presented the National Reform Programme (PNR), following the recommendations made by the spring European Council meeting in March 2005. As regards R&D+i, the PNR set specific objectives, including to increase investment in R&D as a percentage of GDP from 1.05% in 2003 to 1.6% in 2008 and 2% in 2010 and to increase private-sector participation in R&D investment. To achieve these objectives, it is estimated that during the next few years R&D+i investment will increase at an annual rate of 9.6% (11.6% in the private sector and 7.5% in the public sector), while maintaining the current increases in budgeted investment (minimum annual increase of 25%) and, above all, increasing the demand for innovation from the private sector.

To meet these objectives, Spain's PNR included the INGENIO 2010 Programme which plans to allocate more resources to R&D+i and focus them on strategic action responding to the principal challenges facing Spain's R&D+i system. The Programme proposes various regulatory reforms to encourage R&D+i activity, as well as developing a new system to monitor and evaluate R&D+i policy. All these measures are in line with the recommendations made in the Community Strategic Guidelines or the Strategic National Framework for Reforms.

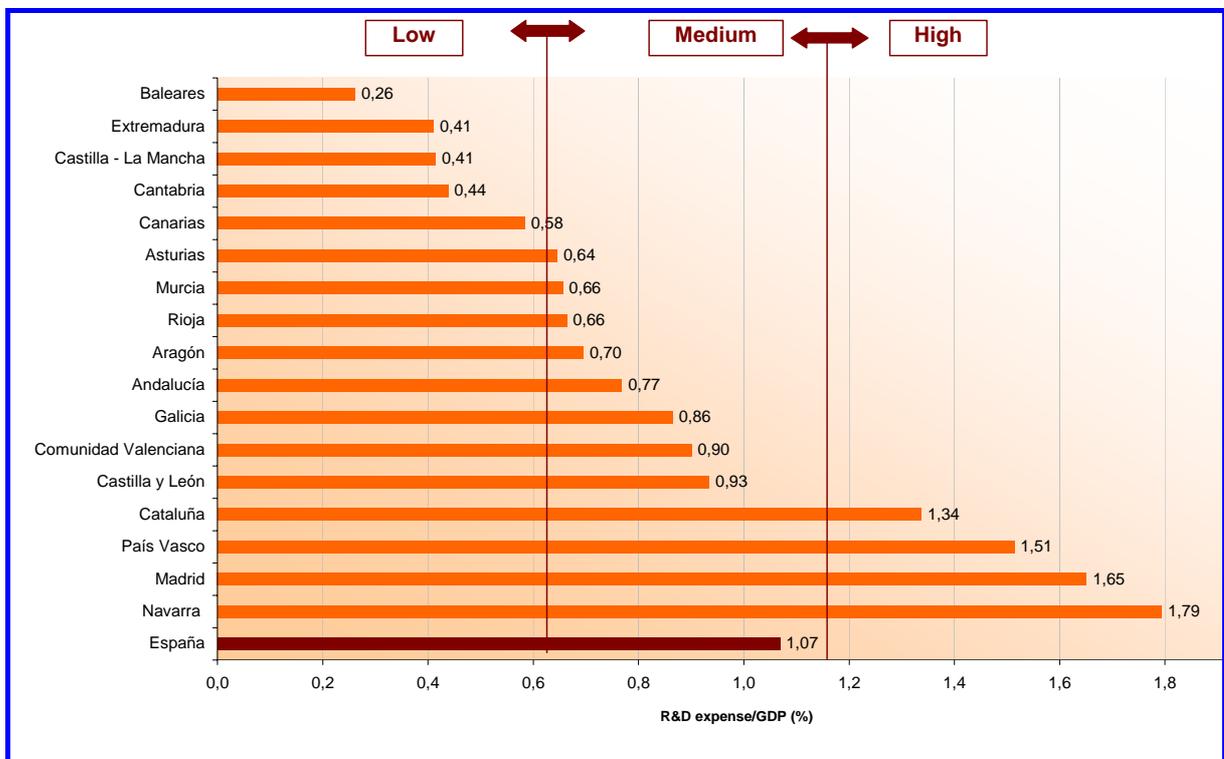


The INGENIO 2010 Programme is made up of three main components: the CENIT Programme (on National Strategic Consortia for Technological Research) which has the objective of stimulating collaboration on R&D+i between companies, universities, public bodies and research centres; the CONSOLIDER Programme which aims to increase critical mass and research excellence, increasing cooperation between researchers and forming large research groups; and, finally, the AVANZ@ Plan which promotes the convergence of Spain with the rest of Europe in terms of the principal indicators of the information society. The active collaboration of the Autonomous Communities to facilitate implementation of these programmes and to co-finance the activities on their territory will be required.

g.) Big differences in the scale of R&D+i between the regions of Spain: four Communities stand out high above the rest

From a regional perspective, first it is important to mention the significant differences between the regions of Spain in terms of their R&D+i activity. The information available for 2004 shows that research intensity varies from 1.79% in the Community of Navarre to 0.26% in the Balearic Islands, with the Spanish average at 1.07%. Graph 1.1 groups the regions of Spain into three broad bands of research intensity (measured as R&D expenditure as a percentage of GDP):

Graph 1.1. Research intensity in the regions of Spain (R&D spending as a % of GDP, 2004)



Source: INE. Statistics on Spain's R&D activities and regional accounts

- Regions with a high level of R&D intensity are Navarre (1.79%), Madrid (1.65%), the Basque Country (1.51%) and Catalonia (1.34%).



- ρ Regions with a medium level of R&D intensity (although all of them are below the overall Spanish average) are Castile-Leon (0.93%), Valencia (0.90%), Galicia (0.86%), Andalusia (0.77%), Aragon (0.70%), Murcia (0.66%), Rioja (0.66%), Asturias (0.64%) and the Canary Islands (0.58%).
- ρ Regions with a low level of R&D intensity are Cantabria (0.44%), Castile-La Mancha (0.41%), Extremadura (0.41%), the Balearic Islands (0.26%) and Ceuta and Melilla (0.1%).

Navarre is also the Autonomous Community with the highest ratio of R&D personnel and researchers per capita, with almost double the Spanish average. Behind Navarre, in descending order, come Madrid, the Basque Country, Catalonia, Castile-Leon and Aragon.

Regarding the regional distribution of R&D spending by sector, the available information shows that the four regions which display above average R&D intensity (Navarre, Madrid, the Basque Country and Catalonia) are also the Autonomous Communities with the highest private-sector share in their overall R&D expenditure.

Furthermore, the Autonomous Communities which are most advanced in R&D are those where companies demonstrate a greater propensity towards innovation (defined as innovation-related expenditure as a percentage of GDP). The leading Communities are Madrid, the Basque Country, Catalonia, Aragon and Navarre. The Communities at the other extreme are Cantabria, Extremadura, the Canary Islands and the Balearic Islands.

h.) Regional concentration of R&D activities: 63% of total expenditure concentrated in four Autonomous Communities

In absolute terms, the effort made to encourage R&D activities can be attributed to the proportionately high spending on the part of the Community of Madrid and by Catalonia and, to a lesser degree, to the Basque Country and Navarre. According to data from 2004, these four regions accounted for 63% of the total national expenditure on R&D, a percentage substantially greater than these four Communities' contribution to national GDP (44%). Meanwhile, the nine Communities designated as objective 1 regions accounted for 34% of the total national expenditure compared with a total contribution to national GDP of 48%. Among these nine regions, R&D expenditure was centred in Andalusia and Valencia.

Nearly half of the personnel employed in R&D are concentrated in Madrid (24%) and Catalonia (23%), which are followed by Andalusia, Valencia and the Basque Country (on 11%, 9% and 8% respectively).

i.) Uneven increase in regional R&D spending in recent years

Considering the past trends in R&D spending by regions, taking 1996-2004 as the reference period (see Graph 1), the increase in R&D effort has been significant in Navarre and, to a lesser extent, Castile-Leon, Catalonia, Galicia and Valencia. On the other side Madrid, Cantabria and Castile-La Mancha did not significantly increase their R&D efforts during this period (see Graph 2). Over the last few years there has been a strong technology drive in many objective 1 regions (taking their combined R&D spending as a percentage of GDP from 0.53% to 0.80% in 2004). However, there is still a wide gap between these Communities and the leading spenders on R&D.



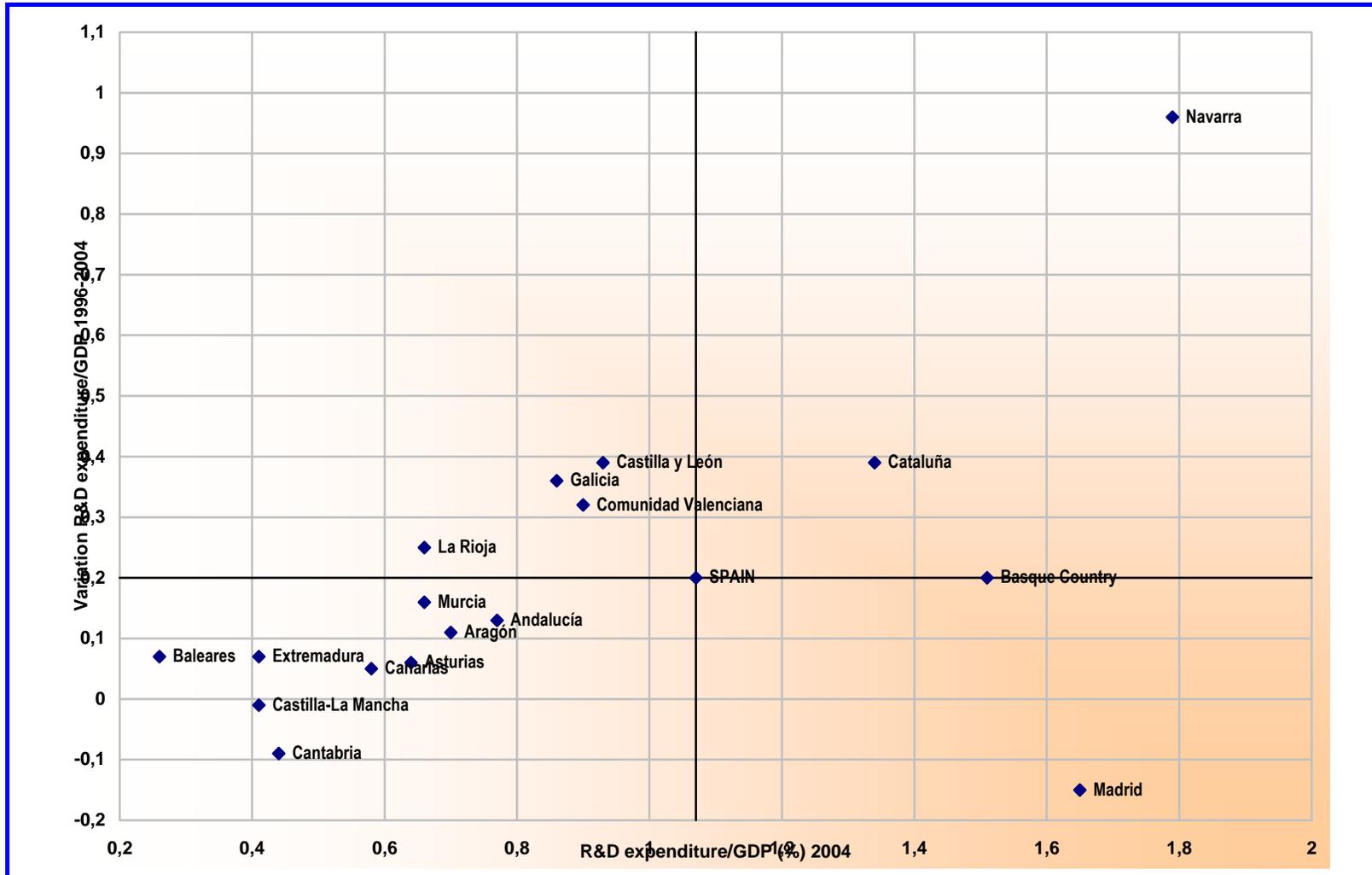
Table 1. Research intensity in Spain by region (R&D expenditure/GDP), trends 1996-2004

Region	1996	2000	2004	Variation 1996-2004 (p.p.)
Andalusia	0.64	0.66	0.77	0.13
Aragon	0.59	0.70	0.70	0.11
Asturias	0.58	0.83	0.64	0.06
Balearic Islands	0.19	0.24	0.26	0.07
Canary Islands	0.53	0.49	0.58	0.05
Cantabria	0.53	0.46	0.44	-0.09
Castile-Leon	0.54	0.64	0.93	0.39
Castile-La Mancha	0.42	0.56	0.41	-0.01
Catalonia	0.95	1.11	1.34	0.39
Valencia	0.58	0.73	0.90	0.32
Extremadura	0.34	0.54	0.41	0.07
Galicia	0.50	0.64	0.86	0.36
Madrid	1.80	1.67	1.65	-0.15
Murcia	0.50	0.73	0.66	0.16
Navarre	0.83	0.90	1.79	0.96
Basque Country	1.31	1.18	1.51	0.20
Rioja	0.41	0.61	0.66	0.25
Average for Spain	0.87	0.94	1.07	0.20

Source: INE. Statistics on Spain's R&D activities and regional accounts



Graph 2. Researcher intensity and trends in Spain by region



Source: INE. Statistics on Spain's R&D activities and regional accounts. Prepared by Ikei.



j.) Regional strategies for developing R&D+i activities in each of Spain's Autonomous Communities

All of the Autonomous Communities of Spain have their own strategies for developing R&D+i activities in their regions. This situation is new compared with ten years ago and demonstrates that each Community has taken account of the importance of R&D+i activity in the areas for which the regions are responsible. Table 2 shows the regional plans currently in effect in each region of Spain.

Table 2. Regional R&D+i plans currently in effect

Autonomous Community	Plans in effect
Andalusia	Plan for Innovation and Modernisation in Andalusia, 2005-2010 (PIMA) Plan for Research, Development and Innovation in Andalusia (PAIDI)
Aragon	IIInd Autonomous Plan for Research, Development and Knowledge Transfer (II PAID)
Asturias	IVth Plan for Science, Technology and Innovation, 2006-2009 (PCTI)
Balearic Islands	Plan for Science, Technology and Innovation in the Balearic Islands, 2005-2008
Canary Islands	Integrated Plan for R&D+i in the Canary Islands, 2003-2006 (PICIDI)
Cantabria	Ist Plan for R&D+i in Cantabria, 2006-2010
Castile-Leon	Regional Strategy on Scientific Research, Technological Development and Innovation (R&D+i), 2002-2006
Castile-La Mancha	Regional Plan on Scientific Research, Technological Development and Innovation, 2005-2010 (PRINCET)
Catalonia	Research and Innovation Plan for Catalonia, 2005-2008
Valencia	Plan for Scientific Research, Technological Development and Innovation in Valencia (PVIDI) (2001-2006)
Extremadura	IIIrd Regional Plan for R&D+i in Extremadura, 2005-2008
Galicia	Plan for Research, Development and Technological Innovation in Galicia, 2002-2005 (PGIDIT)
Madrid	IVth Regional Plan for Scientific Research and Technological Innovation (2005-2008) Plan for Technological Innovation, 2005-2007
Murcia	Plan for Science and Technology in Murcia, 2003-2006
Navarre	Technological Plan for Navarre, 2004-2007
Basque Country	Plan for Science, Technology and Innovation. White Paper on the Basque System of Innovation
La Rioja	Plan for R&D+i in Rioja, 2003-2007

Source : Prepared by Ikei

k.) European Commission priority for the development of R&D+i over the new programme period (2007-2013)

As part of the current preparations for the new programme period (2007-2013), the European Commission is setting out from the premise that Spain should make major changes to its regional development strategy, gradually abandoning financing of physical infrastructure and direct assistance to companies in favour of consolidation of the regional development factors related to the Lisbon objectives, especially R&D+i, integration of information and communication technologies and development of human capital.

To this end, the European Commission has suggested to Spain that, looking ahead to the next programme period (2007-2013), one of the priority objectives should be investment in R&D+i with the aim of achieving tangible results in terms of regional development associated with innovation processes (growth and employment) and in overcoming the difficulties which limit efficient use of the funds assigned within the framework of the Lisbon strategy. Furthermore, the European Commission suggests that R&D+i should be a priority in all the operational programmes to be implemented in future in Spain, where the measures adopted in this context should be adapted to the operations envisaged in the draft ERDF Regulation in connection with the regional objective of convergence (phasing in and phasing out) and also the overall objectives of competitiveness and employment.



From a financial perspective, the European Commission estimates that Spain should channel between 6 and 8 billion € into development of the knowledge economy during the next programme period, and the Commission is willing to contribute to this funding with the aid of a combination of Structural Funds and of the Technological Fund.

1.) Ten general recommendations

The report makes a series of detailed and specific recommendations for each of the 17 Autonomous Communities analysed, taking into account the weaknesses detected and the combination of analyses conducted as part of this study. From these analyses, it is also possible to make a set of ten more general recommendations, all from a regional perspective. These are summed up below:

1. Substantially increase investment in R&D+i

- ◆ Despite the big efforts made by Spain and its Autonomous Communities over recent years, Spain and its regions are lagging well behind the European average for research intensity and innovation activity, leaving Spain quite a long way from the 3% of GDP target set for R&D expenditure in Lisbon and Gothenburg. Furthermore, not one of the regions of Spain has yet attained the level of 2% set by the Spanish Government as the goal for 2010. Correcting this situation is without doubt one of the principal challenges facing the Spanish economy and regions if they are to be competitive in the years ahead, as recommended in the new Lisbon strategy. The implication is that in the years ahead it will be necessary to keep giving Spain's national and regional R&D+i systems more and better resources so that the whole R&D+i system increases its critical mass and research excellence.
- ◆ From a regional perspective, the starting situation is quite different between the individual regions of Spain. Despite these variations, it is possible to form three groups: regions with research and innovation intensity above the national average (Madrid, Navarre, Catalonia and the Basque Country); regions with a medium level of intensity (Aragon, Valencia, Castile-Leon, Galicia, Murcia, Andalusia, La Rioja and Asturias); and, finally, the group of regions with a low level of research and innovation intensity (the Canary Islands, Cantabria, Castile-La Mancha, Extremadura and the Balearic Islands). All action designed to increase the research and innovation efforts in the regions of Spain should therefore take into account this uneven situation. It is important to highlight the significant efforts made over the last few years in order to achieve these objectives, putting particular emphasis on certain regions, for example Navarre which, on account of the big advances over the last ten years and of its enterprising public-sector action, can be considered a model of good practice to be followed by the other regions of Spain which are currently less advanced. However, it should never be forgotten that Spain's R&D activity is concentrated in five regions: Madrid, Catalonia, Andalusia, the Basque Country and Valencia which, together, account for 78% of Spain's total R&D expenditure.

2. Foster the business sector demand for technology development and innovation

- ◆ One of the principal weaknesses of Spain's R&D system is the low level of R&D spending and personnel which the private sector contributes to the total. Because of this, one of the fundamental challenges for the forthcoming years should be to promote action to develop R&D activity within Spanish firms, and not only the existing activities in universities and technology centres. However, once again at regional level the picture is somewhat varied. The regions with the most positive R&D+i indicators (Navarre, Madrid, the Basque Country and Catalonia) are precisely the ones with the best levels of activity in the private sector (in these regions



- companies take the highest share of R&D spending as a percentage of total regional R&D spending, ranging from 78% in the Basque Country to 57% in Madrid). These percentages are roughly in line with the objective of two thirds of spending set in Lisbon and Gothenburg for 2010. At the other end are the regions which are some way behind in the case of this indicator (especially Valencia, Andalusia and Galicia, given their size). This no doubt suggests applying different policies region by region.
- ◆ With this in mind, as a possible preparatory strategy it is necessary to raise levels of awareness throughout society and manufacturing industries that innovation is a basic requirement for the future competitiveness of companies in an environment that is becoming ever more globalised and based on knowledge and creativity. To this end, some Autonomous Communities have developed different interesting initiatives in this area, particularly Aragon and Murcia. Other Autonomous Communities have developed web pages which bring together and present in orderly manner all the information related to R&D+i that could be of potential interest to the manufacturing industries in the region (topics include training, a list of regional science, technology and innovation centres, financial assistance and tax deductions available, self-diagnosis for the business community, practical information on starting a business, other documentation of interest on the subject, etc.). Relevant examples include the “*Aragón Investiga*” web page, the innovation site of the Canary Islands (*Portal de Innovación de Canarias*) and, especially, the “*Sistema madri+d*” regional information and technology promotion system developed by the Community of Madrid.
 - ◆ At the same time it is necessary to promote and stimulate use of and demand for technological services from the existing infrastructure on the part of companies and institutions. Another fundamental point is to promote demand of this kind regardless of its geographic origin in Spain in order to avoid any duplication of effort, for example in the establishment of science centres, as already seen in some regions. Lastly, it is necessary to promote active incorporation of these science centres into regional European innovation networks, particularly in those areas of research and sectors of activity defined as priorities in the regional strategies adopted.
- 3. Reinforce the R&D+i offer to the business sector, particularly SMEs**
- ◆ Effective public support for R&D+i activity should come from policies developed by differentiated but coordinated processes in each of the three areas (R = research; D = development; i = innovation). It could be argued that an effective strategy on research activities (both applied and basic) should give priority to concentration of existing resources (from various levels of the public administration and with joint and shared management and planning) in centres of reference with a minimum critical mass in terms of budget and organisational size, and that these should operate as part of the national system and with close relations with other similar centres at European and/or international level. The go-it-alone strategies applied by some Autonomous Communities directed towards developing major infrastructure for conducting leading research (at times in parallel to infrastructure projects of other Autonomous Communities) is one aspect to be improved upon in future. That said, the need for concentration of resources at selected points is compatible with the co-existence of regional points or structures to disseminate on their territory the results and activities of these united centres, especially between those regions where it is considered most necessary.
 - ◆ For their part, Spanish regions count on (to varying degrees) or are in the process of developing central technological infrastructure to serve companies and other entities involved in technological development activities (the “D” of the R&D+i equation). Obviously, this supply is highly diverse, in terms both of the size of the centres and of the services provided to companies (see Catalonia, Valencia, Madrid, Navarre and the Basque Country for examples of best practices). However, it is true to say that currently there is insufficient



- inter- and intra-regional collaboration between centres, a situation which undoubtedly limits the effectiveness and depth of the action taken. To improve this, it is necessary to form further networks and associations which make it easier to share information and experience to the benefit of greater use of existing resources, in this way avoiding duplication of effort (good examples of network structures – generally at regional level – are the *Red Andaluz de Innovación y Tecnología* (Andalusian Innovation and Technology Network), the various networks dependent on CIDEM and the *Centro Coordinador de los Centros Tecnológicos de la Región de Murcia* (Coordination Centre for Technology Centres in the Region of Murcia).
- ◆ Another strategic area for public action should be development of innovation in the broad sense (not only related to technology), which includes improvements in technological development and in other areas (management, marketing, financing, quality, design, skills development, etc.). Furthermore, the concept of innovation should not only be applied to industrial activities but also extended to the entire production base (particularly to tertiary activities with prospects for future growth such as health or leisure activities; see, for example, the INNOBAL XXI project by the Government of the Balearic Islands, designed to support innovation in the hotel and catering industry). At the same time, regional authorities should promote and support access by companies, especially SMEs, to advanced business services and intermediate innovation centres that permit such firms to upgrade their production and increase their competitive advantages by means of innovation in diverse areas, such as marketing, design, organisational improvements, etc. Competition between representatives of current business structures can help to promote these innovative activities. Certain regional business associations have already taken an active role in this regard (for example the *Asociación de la Industria Navarra* (Association of Navarre Industry) or the *Confederación Empresarial de Madrid* (Business Confederation of Madrid) which run different activities to promote innovation and technological services).

4. Reshaping and strengthen the role of the University

- ◆ With respect to the role of universities, it is necessary to encourage and extend the existing relationship between universities and other stakeholders in the regional R&D+i systems, especially technology centres and the private sector, so that a clear common thread exists between research and the world of private-sector innovation. For this, steps must be taken to encourage research oriented towards the business community. An alternative is to increase cooperation between universities along with their associated centres and the diverse technology-based centres existing within each region (for example by establishing multidisciplinary groups and structures geared to problem-solving). Finally, the OTRIs (Offices for the Transfer of Research Results) and FUEs (foundations, universities and enterprises) must be given adequate personnel and resources to work proactively towards transfer of research results and to intensify relationships with manufacturing industries so as best to detect technological needs and opportunities.
- ◆ However, attaining the aforementioned objectives will require a change in attitude within the university world so that sale of technology is considered a regular means of income for these institutions and participation in private-sector innovation is permitted and valued sufficiently within the “curriculum” of scientists and the universities themselves. To this end, setting up research institutes in universities or public research institutes based on market principles and with a high level of self-financing (for example following the existing models in Germany) could be one possible example of the types of action to be taken.



5. Match the R&D+i existing offer with the business demand, particularly SMEs

- ◆ Regional authorities should take action to strengthen collaboration and the backbone of existing R&D+i systems with the private sector. One possible strategy would be to stimulate the development of interfaces between R&D+i infrastructure and regional companies, so that existing knowledge is improved between the private-sector base and scientific and technological resources. Furthermore, this type of interface would be made available in a timeframe that favours dissemination of knowledge and of technological advances and innovations of potential interest to the business sector in the region. To achieve this, it is necessary to establish the closest possible relationship with the companies on the territory ("capillary strategy") and, where this is especially important, with SMEs (the majority in the case of Spain, as will be explained later). Examples of best practice in this area include the CIDEM Network of Technological Dissemination Centres in Catalonia or the Technological Dissemination Centres promoted by the Economic and Technological Innovation Ministry of the Community of Madrid. These activities centre on improving the competitiveness of companies by developing and disseminating innovations, technology and technological services.
- ◆ The predominant feature of the Spanish business community is the large presence of SMEs and, especially, very small companies. Therefore, all action directed towards developing R&D+i activities amongst the private sector should be based on this reality, which implies taking as the starting point a thorough understanding of SMEs' needs and of the principal challenges facing them as regards innovation (i.e. lack of financial, human and organisational resources, difficulties in collaborating with other firms, etc.) and which curb their demand in this area. Given this, one strategy could be to combine the private-sector demand for innovation into groups of companies and technological platforms (i.e. by developing business clusters, technological platforms or sectoral associations which act as facilitators on matters relating to management, technology watching and issues on which participants can reflect), so that small firms have the possibility to demand, develop and gain access to technologies and innovations (organisational, technological, etc.) that it would be more difficult for them to obtain on their own. At the same time, as mentioned earlier, regional authorities can help to develop interface exchanges between existing centres or technological infrastructure and private-sector demand which will improve communications and interrelations between these two worlds, both rooted on their territory.
- ◆ The potential role of Spain's private sector in R&D+i activities should also be based on a strategy to modernise Spain's production base, which would combine diversification of companies and traditional sectors of activity into innovative products and services which create greater value added (e.g. the textile and clothing industry, footwear industry, agro-food industry, construction, tourism, logistics and transport) with the development of new companies based on technology which, in the light of its own capabilities, each region considers to be priorities for its development strategy (aeronautics, pharmaceuticals, solar heating technology, wind generator technology, health sector, biotechnology, machinery and toolmaking, ICTs, etc.).
- ◆ An efficient strategy to strengthen R&D+i activities in "traditional" sectors could be based on specific assistance to develop companies, clusters and sectors which invest more of their resources in R&D+i activities in the region, thereby allowing results to be maximised in the relatively near term. To this end, the clusters policies implemented by the Government of the Basque Country over the last decade (and directed towards traditional sectors in the Basque Country along with emerging sectors) can be considered best practice. Other good practices worth mentioning include the experience in Valencia (with establishment of the IMPIVA network of technological institutes specialised by sector based on the production structure in Valencia) or the experience in Navarre (with establishment and coordination in recent years of various technology institutions specialising in diverse sectors or areas of regional expertise, thereby directly affecting the region's competitiveness.)



- ◆ Another possible strategy could be to assist companies and industries with a high technological content which can then pull along with them the rest of the region's private-sector base, thereby helping to encourage development of technology and innovation activities in the region's companies. Clearly, the companies and/or sectors chosen should reflect the real potential of each region that, for whatever reason, has not yet been fully developed. One relevant example of this type of strategy can be seen in Madrid, where the regional government has been working for several years on driving forward various strategic sectors, both of today and for the future, in Madrid's economy (examples include the aeronautics and space sector, pharmaceutical and biotech sectors, and information and communication technologies) via a series of activities presented in detail in its Technological Innovation Plan for 2005-2007.

6. Strongly support the technology-based enterprises

- ◆ The establishment of new technology-based enterprises (NTBEs, fundamentally spin-offs from the world of universities or technology centres) should evolve into a coherent strategy combining simplification of bureaucratic procedures involved in starting up new businesses with a legal, administrative and financial framework that facilitates innovative activity and would add no new barriers or uncertainty to those already affecting all business activity. Strengthening the forms of financing specially adapted to these types of businesses (e.g. business angels, risk capital, etc.) should be a priority for a number of Spain's regions where these types of instrument are currently underdeveloped. At the same time, it is necessary to continue to simplify as much as possible the administrative steps involved in starting up business activity in the region (for example by means of a "one-stop shop" system) in order to facilitate all the services that these newborn businesses require (location, consultants' and other advisory services, etc.). The key lies in generating an environment which favours new business initiatives which should also include support for creation of an innovative society which is open to risk and values risk-taking, entrepreneurship and innovation throughout the whole of society.
- ◆ Over the last few years various regional administrations have developed structures and initiatives designed to assist in the creation of new companies, especially in all aspects related to new business initiatives based on technology (related fundamentally to universities and existing research and technology centres). Relevant examples of public action in this area include the CIDEM *Red de Trampolines Tecnológicos* (Network of Technology Springboards) in Catalonia or the *Oficina del Emprendedor de Base Tecnológica* (Office for Technology-based Entrepreneurs) run by the Community of Madrid, where the services offered by both these institutions include assessment, advice, business training, information services, contacts, networks and studies. Furthermore, in the case of Catalonia, mention should also be made of the activities of the *Red de Inversores Privados* (Network of Private Investors, XIP), made up of twelve different informal networks of private investors who are open to finance, advice and work in newly-created companies or in the early stages of these companies' development. In addition, certain Spanish universities have launched diverse initiatives to support new companies with high technological content which were created within university departments or institutes (spin-offs). Relevant examples include the IDEAS programme of the Polytechnic University of Valencia or the University of Santiago de Compostela's risk capital fund designed to work with companies of this type.



7. Promote and strengthen the human capital

- ◆ Efforts must be stepped up to improve human capital in companies. This strategy should begin with increasing the number of training activities organised by companies and the qualifications of their personnel. To this end, the role of intermediate training centres, universities and, to a lesser extent, innovation centres in imparting this type of training should be reinforced. Also many more R&D researchers, PhDs and R&D technicians are needed to work in Spanish companies. Beyond that, these same R&D professionals need to develop closer relationships, and to generate common spaces and languages, with companies and SMEs so that many of the researchers and PhDs who actually pursue their careers in the public sector (especially in universities) can act as a bridge to transfer material to the private sector on their own initiative (i.e. potential commercial applications detected and derived from a technological solution) or via companies already formed. Established medium-sized and large companies frequently have their own R&D departments and are therefore clearly interested in activities of this nature. The presence of this type of personnel can facilitate collaboration between companies and technology centres conducting research. Certain Autonomous Communities, e.g. Madrid, are currently developing interesting initiatives along these lines.
- ◆ The efficiency with which specialised personnel are incorporated depends heavily on the type of company. In smaller firms and less technologically advanced sectors of activity, the most efficient process is to incorporate technical personnel with less academic profiles and who have received specific theoretical and practical training in technology centres which maintain a relationship with the company (for example persons with vocational training qualifications). By contrast, in relatively large companies which may have their own R&D department, the correct strategy could be to incorporate persons with a more academic profile who can drive innovation processes in companies with less research-oriented activities.
- ◆ Related to the previous point, education authorities should ensure that the entire education system, especially secondary education, vocational training and university education, provides an education that points students towards entrepreneurial, creative and cooperative attitudes, but without excluding theoretical content and training, especially in the case of vocational training. In addition, it is necessary to put into practice the idea of lifelong vocational education and learning so that individuals' education and training are continually updated and renewed to make them better able to adapt, and with a greater chance of success, to the changes required on the part of the business world and of society as a whole. On this subject, Spain has a low level of the population at large and of the active population engaged in lifelong learning.

8. Tune and adjust the existing regional strategies to the Community priorities, in order to assure the sustainability of the plans in the long term

- ◆ The information available confirms that all Spanish regions currently have their own regional plans directed towards promoting R&D+i activities in their region. This should be highlighted because it is a quite new situation compared with ten years ago. The existence of regional plans demonstrates not only that all of Spain's Autonomous Communities have (to a greater or lesser extent) digested the importance of promoting R&D+i activities, but also that these regional-level instruments have evolved from discussions between key regional public and private stakeholders which identified in detail the principal weaknesses of the regional R&D+i system, the preferred sectors for development, the priorities and objectives to attain and the instruments and action necessary to achieve them and, finally, which are evidently paying increasing attention to the subject of innovation (for example the new Innovation and Competitiveness Plan (*Plan de Innovación y Competitividad*) prepared by the Government of the Basque Country or the Innovation and Modernisation Plan



for Andalusia (*Plan de Innovación y Modernización de Andalucía*). Therefore, one key recommendation is to ensure that action targeted for European funding is integrated and coherent with existing regional plans. To this end, EU co-financing should fundamentally assist the action provided for in those plans or action consistent with the same plans and with the strategic guidelines and Community objectives, thereby ensuring the long-term sustainability of the action assisted.

- ◆ There is a certain risk that the availability of additional funds in the years ahead linked to assistance for R&D+i activities could signify additional resources that “have to be spent” in the near term, without guaranteeing their sustainability in the medium and long term. However, it must be stressed that, in general, the results of activities linked to R&D+i are not seen in a short period of time, which implies that high levels of consensus and stability are needed for some considerable time (into the medium and long term). To this end, assistance should reward the profitability and sustainability of projects in the long term, even if their short-term impact could be considered somewhat limited.

9. Improve the coordination and governance of public policies supporting R&D+i

- ◆ Measures are necessary to increase, in each of the regions, coordination of the action taken by the regional and national authorities and to develop joint action on primary-level research with the objective of capitalising on synergies and making efficient use of the limited R&D+i capacity, thus creating critical mass wherever possible. A number of Autonomous Communities have launched diverse initiatives to improve this coordination, such as ad-hoc commissions (for example the Interdepartmental Commission on Science and Technology (*Comisión Interdepartamental de Ciencia y Tecnología*) (CICYT) of the Government of Aragon, the Commission on Science, Technology and Innovation Coordination (*Comisión de Coordinación de Ciencia, Tecnología e Innovación*) of the Government of the Canary Islands, the Interdepartmental Council for Research and Technological Innovation (*Consejo Interdepartamental de Investigación e Innovación Tecnológica*) of the Government of Catalonia, the Interdepartmental Commission on Science and Technology (*Comisión Interdepartamental de Ciencia y Tecnología*) of Extremadura or the Interdepartmental Commission on Science and Technology (*Comisión Interdepartamental de Ciencia y Tecnología*) of the Government of Madrid) or in the form of integration into a single political structure of all strategic decisions where leading public stakeholders intervene in innovation and knowledge-building (e.g. the Council for Innovation, Science and Companies (*Consejería de Innovación, Ciencia y Empresa*) set up by the Government of Andalusia or the Department of Companies, Universities and Science (*Consellería de Empresa, Universidad y Ciencia*) of the Government of Valencia).
- ◆ As mentioned earlier, it is also necessary to increase coordination of the efforts made on the part of the different regional administrations in order to avoid any duplication and overlap which could undermine the efficiency of the activities. In this regard relationships between Communities are not particularly strong, even between those closest geographically or between those which have already mainstreamed the need for integrating into European regional networks for innovation. Establishment of subject-based networks and associations between Spanish regions for exchanging information, experience and best practices on matters of common interest or related work by existing technology centres can be a good strategy in that it promotes combined use of resources and research infrastructure.
- ◆ Regional authorities should make a big effort systematically to monitor and evaluate results obtained from the diverse action taken (for example progress on regional R&D+i plans currently in effect) so that efforts which are not working can be corrected in time and aspects which are working well, or show promise for the future, can



be strengthened. In this regard, the experience gained in Valencia is a good illustration. Based on activities carried out by its High Consultative Council for R&D (*Alto Consejo Consultivo en I+D*) composed of eminent personalities from the world of science and technology and who form part of the regional government, this body prepares an annual robust follow-up report on the R&D+i situation in the region. Another interesting scheme is the Office of Science, Technology and Innovation developed by the Government of the Canary Islands.

10. Direct public and private actions in R&D towards scientific excellence

- ◆ Finally, it is important to reflect on the major challenges which the majority of Spain's regional R&D+i systems must face. Regions will increasingly need access to European resources based on the scientific excellence of projects, particularly in the case of the more advanced Communities. In some regions this need to obtain competitive funding could increase the differences and distance mentioned earlier between the science and technology system and private companies. This risk should be taken into consideration when designing future lines of political action in the area of R&D+i at both European and regional levels.

As mentioned earlier, with regard to the new programme period (2007-2013), the European Commission presumes that Spain will make major changes to its regional development strategy, progressively abandoning financing of physical infrastructure and direct assistance to companies in favour of gradually centring on regional development factors related to the Lisbon objectives, especially R&D+i, integration of information and communication technologies and development of human capital. One of the primary objectives for Spain for the programme period 2007-2013 will be to invest efficiently in R&D+i and to overcome the difficulties which limit efficient use of the funds assigned within the framework of the Lisbon strategy. Spain is due to receive between €6 000 and 8 000 million to promote the knowledge economy during the 2007-2013 programme period, and the Commission is willing to contribute to this funding with the aid of a combination of Structural Funds and the Technological Fund.

The challenge is tremendously ambitious, particularly taking into account the larger risks entailed in R&D+i investment, but the opportunity for Spain is also unique, in that by increasing investment in R&D+i, increasing technological demand from the manufacturing industries, improving the existing supply of technology, reinforcing the role of universities, matching the existing supply of technology to the pattern of demand, strongly assisting new technology-based enterprises, strengthening human capital, ensuring the long-term sustainability of projects, improving governance of public policy to assist R&D+i and strongly backing excellence in the private sector, Spain can achieve the objective of competitiveness on the global market.



Table 3. Recommendations

Recommendation	Diagnosis/Weakness	Opportunity/Recommendation
1. Increase investment in R&D+i	<input type="checkbox"/> Low R&D expenditure (1.7% of GDP), although increasing in recent years	Main challenge for the economy and companies is to absorb innovation of a general nature. Need for a pattern of alternative economic growth (of higher quality in terms of innovation).
	<input type="checkbox"/> Big differences between Spanish regions (from 0.26% of GDP to 1.79% and in recent trends)	Need for specific action for each Autonomous Community (starting point, absorption capacity, size, specialisation, private-sector base, integrated strategies, etc.).
2. Increase demand for technology and innovation from Spain's manufacturing industries	<input type="checkbox"/> Low R&D activity in companies	Conduct R&D in companies. Adapt and introduce innovation in companies and SMEs (interfaces, persons, etc.).
	<input type="checkbox"/> Increase the level of information and awareness in society as a whole	Limited knowledge and valuation of technology on the part of society. Need for greater recognition by and proximity to the population.
	<input type="checkbox"/> Improve use of infrastructure by companies	Need to increase the number of companies which benefit from technological infrastructure and which use technological services, regardless of their location.
	<input type="checkbox"/> Incorporate technology centres in innovation networks	Centred on the priorities (lines of research, sectors) of innovation strategies.
3. Improve the availability of R&D+i to manufacturing industries	<input type="checkbox"/> Tackle the R of R&D+i in a differentiated manner but in a comprehensive and joined-up strategy for the long term	"R" (research) should give priority to concentration of action and attaining a certain critical mass and relationships with the national and European environments, adequately disseminating information to the economic base.
	<input type="checkbox"/> Research infrastructure centred on the "D"	Broaden the concept of innovation. Improve intra- and inter-regional coordination.
	<input type="checkbox"/> Innovation, not only technological	Broaden the concept of innovation (appropriate for SMEs) from just technology and manufacturing sectors to incorporate tertiary sectors such as leisure and health.
4. Reinforce the role of universities	<input type="checkbox"/> Limited active presence of business organisations in innovation	Real incorporation of business associations in the supply of technological services.
	<input type="checkbox"/> Greater orientation and alignment of universities on businesses	Form multidisciplinary groups and get closer to companies. Need to increase resources.
	<input type="checkbox"/> Change of mentality on the part of the university world	Technology as a regular line of income. Participation in innovation should be valued in the curriculum of university researchers.
5. Increase alignment of the existing supply with the current pattern of demand for R&D+i	<input type="checkbox"/> Collaboration and alignment of the innovation system with companies	Promote capillary interfaces within the private-sector base and SMEs and dissemination of innovation and knowledge.
	<input type="checkbox"/> Need to unify companies' demand for innovation	Build groups of companies and technology platforms as mediators and channels of innovation.
	<input type="checkbox"/> Push to modernise private-sector base	Promote high value-added sectors and activities and technology-based businesses, starting from existing potential and priorities.
	<input type="checkbox"/> Strengthen R&D+i in sectors with a high regional presence over time	Via the creation of regional clusters as innovation promoters.
6. Make a strong commitment to set up of new technology-based companies	<input type="checkbox"/> Strategic sector with high technology content	New sectors with the capacity to build relationships and take hold within the existing business base.
	<input type="checkbox"/> Facilities for creation and consolidation of new technology-based companies and spin-offs	Simplify administrative processes, types of specific and adapted financing. Accept business risk as socially valuable.
7. Reinforce Spain's human capital	<input type="checkbox"/> Improve the qualifications and training of human capital	Provide permanent facilities for continuous learning adapted to the active population and to the needs of businesses.
	<input type="checkbox"/> Incorporate researchers in companies	Search for common spaces, languages and activities via persons acting as bridges between the innovation system and companies.
	<input type="checkbox"/> Insert technical personnel in SMEs	Promote innovation processes by using personnel with relevant academic profiles, for example vocational training.
	<input type="checkbox"/> Incorporate innovative processes in the education system	Incorporate training on building attitudes of creativity and entrepreneurship within secondary education, vocational training and university education.
8. Adapt action at EU level to the current regional plans and ensure the long-term sustainability of the action supported	<input type="checkbox"/> Availability of regional R&D+i planning instruments	Integration and consistency between the set of action and innovation plans.
	<input type="checkbox"/> Need for a vision for the medium and, above all, long term in R&D+i policy	Do not specify investment spending in fixed assets and give priority to medium- and long-term action centred on persons, companies and behaviour change.
9. Improve coordination and governance of public policy for assisting R&D+i	<input type="checkbox"/> Generally insufficient institutional coordination	Create intra- and inter-regional coordination instruments (with sole responsibility for innovation) and coordination and collaboration between regions and the central administration.
	<input type="checkbox"/> Certain distance between regional authorities on innovation, including between regions geographically close or with similar subjects of interest	Create subject-based networks and associations between Autonomous Communities and common objectives and interests. Associated work by technology centres.
	<input type="checkbox"/> Evaluation, follow-up and indicators for R&D+i objectives	Specify indicators associated with the different levels of objectives and related directly to the proposed action. Participation of regional stakeholders in follow-up.
10. Direct public action to support scientific excellence	<input type="checkbox"/> New challenges to the R&D+i system: competitiveness	Create integrated instruments and structures for accessing competitive financing at European level.

Source: Ikei



EUROPEAN COMMISSION
Directorate-General for
Regional Policy

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