Entrepreneurship and Local Innovation Systems in Cantabria, Spain

A review by the Local Economic and Employment Development (LEED) Programme of the Organisation for Economic Co-operation and Development (OECD)

Edited by
Jonathan Potter and Gabriela Miranda
ORGANISATION FOR ECONOMIC CO-OPERATION
AND DEVELOPMENT

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ENTREPRENEURSHIP AND LOCAL INNOVATION SYSTEMS IN CANTABRIA, SPAIN

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Edited by
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EXECUTIVE SUMMARY

Background and contents of the report

Innovation is critical to economic growth and competitiveness in the cities and regions of advanced OECD Member countries. The key to maintaining and increasing wages and profits in these places in the face of intensified international competition on standardised goods and services is to improve firm productivity and generate differentiated products.

This innovation challenge has been recognised by the regional government of Cantabria, Spain, which in its R&D+I Plan (research, development and innovation) 2006-2010 sets the objective of increasing investments in R&D to 3% of regional GDP by 2010, of which at least one-third should be private expenditure. The Plan has put in place seven programmes to stimulate the region’s innovation system in the following areas:

P1 Human Resources.
P2 Equipment and Infrastructures.
P3 Mobilisation and Co-operation.
P4 Scientific Research.
P5 Modernisation of the Business Sector.
P6 New Technology Based Firms.
P7 Diffusion of a Scientific, Technological and Innovative Spirit.

Each programme is associated with a number of specific actions and measures. The full R&D+I Plan is supported by a regional government budget of some 92 million EUR.

In order to review the appropriateness of this innovation strategy and assess where adjustments could be made to increase its effectiveness, the regional government of Cantabria co-operated with the Local Economic and Employment Development (LEED) Programme of the Organisation for
Economic Co-operation and Development (OECD) on an OECD Review of Entrepreneurship and Local Innovation Systems in Cantabria.

This project involved an assessment by an OECD peer review panel of the challenges and opportunities for innovation activities in Cantabria, a set of OECD recommendations for the further design and implementation of the strategy, and descriptions of ‘learning model’ programmes from cities and regions from other OECD Member countries that illustrate how the recommendations could be put in place. The work, undertaken over a nine month period in 2006-7, included the preparation of a local diagnostic report on the current policy environment, a survey of companies and research organisations, a one-week review panel mission to Cantabria to meet and discuss options with local stakeholders, and a series of steering group meetings between the OECD and the Cantabrian government including its two development agencies, Sodercan and Idican.

The full OECD report sets out the findings of the review. It starts with a chapter containing the local diagnostic information on innovation policy actors and their activities and the results of the company and research organisation surveys. The following four chapters then examine challenges and opportunities, recommendations and learning models for the main components of the local innovation system, namely human capital and labour markets, the business sector, research organisations and the broader regional environment for innovation and entrepreneurship. The final chapter sets out the global messages and recommendations of the region.

**Strengths and opportunities**

The following main strengths and opportunities are identified in the report. Firstly, the regional government’s commitment to promoting innovation and the shift to the knowledge economy through its R&D+I Plan is a major advantage for stimulating the regional economy.

Secondly, there is also much to build on in this effort in terms of a strong research university, a university hospital, technology institutes and other research assets, including pockets of research excellence for example in biomedicine and life sciences, automotive components and Information and Communications Technologies. Innovation can also be promoted in the strongly developed automotive sector in Cantabria, which is the strongest industrial asset in the region.

There are many other assets that can exploited in developing the region’s innovation system further, including natural resource assets in terms of agriculture, fishing, the marine environment and landscape, which can generate certain new competitive strengths and help attract people and
investments. Similarly, there is strong development potential in the tourism sector. And the Port of Santander and related logistics activities offer a hub to further potential economic development opportunities.

Indeed, there is an opportunity in Cantabria to build a platform strategy for innovation based on related variety. Such a strategy would build up and link various activities in the region that use the same knowledge bases and benefit from mutual positive spillovers. For example, food production could be linked to biotechnology research in an upgrading process to green biotechnology.

The labour market has many strengths too, including recent net employment creation, low unit labour costs, a high share of graduates and qualified labour, and the stimulus the R&D+I Plan gives to building popular support for a learning economy. Certain attractive features of the Cantabrian regional environment, such as its natural beauty and heritage assets, also offer an attractive people climate that is helpful for attraction of talented technologists.

The science and technology park offers the potential to enhance connectivities between science and industry and is a key advantage in building the attractiveness of the region.

Weaknesses and threats

At the same time there are a number of difficulties that the regional government needs to pay attention to if the innovation strategy is to provide its full potential regional economic gains. A first issue is that the innovation system is currently driven by public sector activities, with limited private participation in R&D+I. Greater private sector contributions to achieving the objectives of the Plan are hindered by weaknesses in the innovation capabilities of a largely traditional and small enterprise dominated export base.

There are also problems of connectivity amongst the key actors of the system, namely government, industry and research. These connectivities are critical for knowledge flows, for exploitation of research assets in commercial activities, and for guiding the development of the innovation system. In particular, there is a significant disconnection between the activities of the research sector and the needs of industry. In addition, the lack of a systematic university commercialisation strategy limits the exploitation of public research. There is also a lack of critical mass in the innovation sector, in part reflecting the relatively small size of the region, which implies a need for international connectivities with customers, suppliers and collaborative partners that is currently underdeveloped.
Competition from lower cost locations on standardised products is a key threat for the future, particularly for the automotive sector. Rapid innovation is required in this sector to achieve upgrade to higher levels of the value chain. However, research and training activities for this sector are not the strongest in the region and there are also issues of external control of existing production operations. The tourism sector can also be seen as largely offering standardised products that are vulnerable to competition from other locations.

A danger that regional government should also be aware of is that its own R&D+I support measures could spread innovation effort too widely, by encouraging the university to focus on activities that support regional industry in general rather than to focus on its key research strengths that could create future economic opportunities for the university and for key sectors of the regional economy. Strong support to centres of research excellence is required, particularly in the context of increased competition for resources across the Spanish university research system.

Certain issues also need to be addressed in the labour market. The high proportion of temporary work in the region, whilst increasing firm flexibility in the short term, is likely to constrain investment in training in the longer term, in turn impeding innovation. In addition, the majority of SMEs in Cantabria undertake only limited vocational training and can largely be characterised as being in low skill equilibrium, again hindering efforts to upgrade the bulk of firms to the knowledge economy.

**Policy recommendations**

The following policy recommendations are set out and explained in detail in the full report based on the above analysis.

*Human capital*

- Broaden the innovation vision to encompass support for the development of human resources at all skill levels.
- Enhance mobility of researchers between universities and industry.
- Improve the career prospects of researchers involved in technology transfer activities within universities and research organisations.
- Develop new vocational training approaches in colleges and universities and encourage SMEs to participate in vocational training initiatives.
EXECUTIVE SUMMARY

- Link financial support to firms to training commitments.
- Attract inward direct investment on the technology and human resource best practice frontier.
- Promote a learning culture in regional SMEs.
- Build entrepreneurship skills through entrepreneurship courses in the university, linkages with regional companies and entrepreneurship awareness programmes.

Business

- Use a broad conception of innovation and support activities across all economic actors and not only in R&D and knowledge-intensive sectors.
- Introduce strategic audits and skills development initiatives to improve SME capabilities to evaluate their competitive position and innovation opportunities.
- Build the internal R&D and innovation capabilities of firms.
- Increase firm innovation connectivities with other agents within and outside the region by developing R&D consortia projects and opening up government-funded collaborative research initiatives to selected firms and organisations outside Cantabria.
- Exploit opportunities to support firm innovation through public procurement to regional government and regional public agencies.
- Set out a clear methodology for a comprehensive and integrated package of support to promote technological entrepreneurship.

Research organisations

- Agree the university’s strategic mission and main emphasis.
- Focus regional government research funding on the most promising research teams and potential centres of excellence with commercialisation potential.
- Use financial incentives, performance measures and support programmes to increase broader university engagement with business sector innovation.
- Promote entrepreneurship in the university.
• Develop training and technological services in the university to support innovation in key regional future industry sectors.
• Reinforce the university technology transfer strategy and office by involving specialists and linking with international networks.

Regional environment
• Continue to build and upgrade the region’s local innovation system.
• Build connectivities between the knowledge exploration system (university, hospital, research institutes) and the knowledge exploitation system (industry).
• Support firms in “learning to innovate”.
• Develop a platform-based innovation policy that builds “related variety” industries, i.e. those connected by complementary knowledge bases and significant spillovers.
• Produce, attract and retain talented labour through increasing regional human capital investment and improving people climate.
• Foster an entrepreneurial culture.
• Strengthen the involvement of the university and businesses in developing and managing the innovation plan.
• Promote innovation policy across the whole of regional government.
• Evaluate the R&D+I Plan and its programmes and feed back into policy learning and adaptation.

The recommendations are illustrated by 15 examples of learning model programmes from various regions in OECD member countries that demonstrate innovative and good practice approaches to addressing the issues of Cantabria.
CHAPTER 1

INTRODUCTION

This report sets out the findings of a review by the Local Economic and Employment Development (LEED) Programme of the Organisation for Economic Co-operation and Development (OECD) of the innovation strategy of the Cantabria region in Spain. The review was undertaken by the OECD in collaboration with the Cantabrian regional authorities as part of the OECD review series on Entrepreneurship and Local Innovation Systems delivered by the LEED Programme.

In the context of globalisation and the shift to the knowledge economy, growth and job creation in city and region economies depends increasingly on the success of their enterprises to innovate in their products and services and in their productive efficiency. The innovative performance of these enterprises depends in part on their own capabilities to explore and exploit knowledge and in part on the quality of the supporting innovation systems in which they operate, including their ability to provide access to necessary inputs such as labour, finance, infrastructure and knowledge. Public policies may have an important role to play in this respect by addressing the market failures that hinder enterprise capabilities to innovate and access innovation inputs.

The aim of the Entrepreneurship and Local Innovation System reviews is to examine the challenges and opportunities for innovation activity in case study cities and regions, to make recommendations on how policy can best strengthen the local innovative environment and to illustrate these observations and recommendations with descriptions of learning model programmes from other countries. The Local Economic and Employment Development (LEED) Programme of the Organisation for Economic Co-operation and Development (OECD) was responsible for the preparation of this report. The project was carried out in collaboration with the Government of Cantabria, through its Ministry of Innovation, SODERCAN.
In the case of Cantabria, the regional government has established a Research, Development and Innovation (R&D+i) Plan that sets out the priorities, actions and actors to be supported until 2010. The OECD has reviewed this Plan in the light of international best practices and the results of interviews with the key stakeholders in the region in order to provide the Government of Cantabria with a set of recommendations and examples of good international practices on how to further develop the strategy set out in the R&D+i Plan and secure its effective implementation. The central recommendations of the review are set out in Box 7.1.

In exploring the challenges and responses, this report examines four major innovation channels that have been identified in the R&D+i Plan and are critical for local innovative success, namely:

- Human capital, including skills, training, vocational education, attraction of qualified people, and labour market functioning.
- Business sector, including new start ups, large firms, business organisations, technological parks, inward investment and Small and Medium-sized Enterprises (SMEs).
- Research organisations, including the international research collaborations and the international connections of universities, technological parks, and other research organisations.
- Regional environment, including the finance markets, infrastructure and premises, place attractiveness, business facilities, and governance.

Following this introduction, the report is organised as follows. Chapter 2 sets out the local diagnostic report. This examines the current situation of Cantabria in terms of its main innovation players are briefly described, the current policy framework and some key challenges for further policy development. Chapter 3 then provides the results of surveys of companies and research organisations. The next four chapters focus in more detail on the specific issues of the review, namely human capital and labour markets, the business sector, research organisations and the broader local environment. For each of these issues, the report presents an assessment of the opportunities and challenges, policy recommendations and learning model programmes. The final chapter incorporates key overarching conclusions and recommendations.
The observations, statements and recommendations expressed in this report are based on information gathered through an OECD peer review process. The key steps of the methodology are set out below:

i. Local diagnostic report

A local diagnostic report was prepared to provide an initial analysis of innovation assets, connectivities and capabilities in Cantabria as well as to describe Cantabria’s existing innovation policies.

ii. Review panel visit

The OECD Secretariat and international review panel members undertook a one-week peer review visit to Cantabria from 2-6 October 2006 in order to interview local and regional policy makers and other relevant actors in the local innovation system and obtain their views on the issues signalled as important in the local diagnostic report as well as on other issues considered relevant by the review panel members and OECD Secretariat.

iii. Survey

An original survey and analysis was undertaken with companies and research organisations in Cantabria. The surveys include examination of the innovative activities, innovation linkages and barriers to innovation of the organisations of the respondents.

iv. Draft report

Drawing on the results of the above a draft report was prepared including an assessment of the Cantabria innovation strategy and policy recommendations.

v. Review workshop

On 15th December 2006, the OECD organised a discussion workshop in collaboration with the local stakeholders. Representatives of the Ministry of Innovation, SODERCAN and IDICAN participated in this meeting to discuss the draft report, preliminary findings and study recommendations. Further written comments were provided to the OECD Secretariat following the meeting.

vi. Final report

This final report was prepared taking into account the comments received during and subsequent to the review workshop.
CHAPTER 2

LOCAL DIAGNOSTIC REPORT

by Jaime del Castillo
Director, Información y Desarrollo, S.L. (INFYDE), Spain

Key characteristics of the Cantabria innovation system

Cantabria is located in the north of Spain bordered to the north and south by coast and mountains. It has a population of just over one-half million inhabitants and has one major town, the port of Santander. In recent years the region’s GDP has grown at a faster rate than that of the Spanish economy as a whole (in 2000-2005, 3.3% as opposed to the figure of 3.1% for Spain). However, growth rates in the region have slowed in the last two years, falling below the Spanish benchmark (3% as opposed to the Spanish average of 3.4% in 2004 and 3% as opposed to 3.1% in 2005). Table 2.1 provides key overall facts on the Cantabria regional economy.

Table 2.1. Cantabria economy: key facts

<table>
<thead>
<tr>
<th>Area</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>5 252.6 km²</td>
</tr>
<tr>
<td>% of Spain</td>
<td>1.05%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Population</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (2005)</td>
<td>562 309</td>
</tr>
<tr>
<td>% of Spain</td>
<td>1.27%</td>
</tr>
<tr>
<td>Density (people per km²)</td>
<td>107.05</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GDP Growth</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2005</td>
<td>3.3% per annum</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unemployment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment</td>
<td>9.09%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports/imports (2004)</td>
<td>87.9%</td>
</tr>
</tbody>
</table>

Source: INE, Social and Economic Report Cantabria, 2005
Cantabria’s economy has a similar structure to Spain’s, except for a few slight differences (Table 2.2):

- Although the services sector makes the largest contribution to regional GDP, its contribution is lower than the Spanish average despite employing more people.
- Industry and construction provides the next largest contribution to GDP, with an influence on the regional GDP above the Spanish average and a slightly lower percentage on employment.
- The primary sector accounts for a similar proportion of Cantabrian and Spanish GDP, although it employs a slightly larger share of workers.

So although industry in Cantabria is more productive than the Spanish average, this is not true of services, or agriculture, livestock and fishing.

**Table 2.2. Structure of GDP and employment in Cantabria and Spain 2005**

<table>
<thead>
<tr>
<th></th>
<th>CANTABRIA</th>
<th></th>
<th>SPAIN</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%GDP</td>
<td>%Employment</td>
<td>%GDP</td>
<td>%Employment</td>
</tr>
<tr>
<td>Services</td>
<td>63.4</td>
<td>67.4</td>
<td>63.8</td>
<td>65.21</td>
</tr>
<tr>
<td>Industry and construction</td>
<td>32.9</td>
<td>29.0</td>
<td>30.4</td>
<td>29.57</td>
</tr>
<tr>
<td>Agriculture, livestock and fishing</td>
<td>3.7</td>
<td>5.8</td>
<td>3.7</td>
<td>5.21</td>
</tr>
</tbody>
</table>


In 2003, the sectors were distributed as in Figure 2.1.

**Figure 2.1. Production structure of Cantabria 2003**

Source: Cantabria Regional R&D+I Plan 2006-2010.
In a report issued in May 2005, the Red transnacional atlántica de agentes económicos y sociales (Transnational Atlantic network of social and economic players) it was noted that the strategic sectors for Cantabria, in employment, production and R&D+I, were: car production, computers, information and communication technologies (ICT), the construction industry, public works and tourism. Some of them (the automotive industry and construction) are consolidated in the region, while others are sectors that have developed fast in the last few years (computers and ICT); finally, tourism represents a bid to capitalise on the region’s natural and historic heritage. In addition, the biotechnology industry has major development potential in association with biomedicine, the environmental industry and the food and agricultural industries, in line with the BioCantabria Plan.

Like other European regions, Cantabria will have to deal with a reduction in European financing over the new Structural Funds programming period. According to forecasts for 2007, it will receive 80% of the amount for 2006, with slow, but progressive reductions to 2013.

With one eye on Europe, the region now has to reach its targets in a new scenario. In R&D+I, the clearest benchmark involves the commitments in the Renewed Lisbon Strategy, which establishes a ratio of expenditure on R&D of two-thirds from the private sector and one-third from the public sector as a target for 2010, and an increase in total R&D investments to 3% of GDP. All of which is designed to meet the challenge of becoming the world’s most competitive, dynamic knowledge economy.

In Spain, INGENIO 2010 is the benchmark. Approved in 2005, this plan includes ten R&D+I commitments in a bid to converge with other European countries by 2010. It includes a commitment by the Spanish government to increase the R&D+I budget by 25% each year.

At regional level, the Governance Plan includes an undertaking to promote regional innovation through a number of strategic initiatives.

According to a diagnosis included in the Cantabria Regional R&D+I Plan 2006-2013, in the period from 1994 to 2003, R&D expenditure in Cantabria was less than 1%, a long way from the 2010 targets (Figure 2.2).

Compared with the other Spanish regions, the R&D investment situation in Cantabria is weak. The third region from bottom in terms of R&D expenditure as a percentage of GDP (The distribution of R&D expenditure did not match the target in 2003, with 38% of R&D expenditure being made by businesses and IPSFL, 25% by the public authorities and 37% by the University of Cantabria.
A substantial increase in total R&D expenditure, as well as an increase in the participation of the private sector will be required to meet the targets set by the regional authorities and to strengthen the innovative performance of Cantabria in comparison with other Spanish regions.

Figure 2.3, ahead of Castilla-La Mancha and the Balearics only, the same rate calculated per head of population brings it up just one place, leaving it with a fairly low R&D investment rate of EUR 79 per inhabitant.

The distribution of R&D expenditure did not match the target in 2003, with 38% of R&D expenditure being made by businesses and IPSFL, 25% by the public authorities and 37% by the University of Cantabria.

A substantial increase in total R&D expenditure, as well as an increase in the participation of the private sector will be required to meet the targets set by the regional authorities and to strengthen the innovative performance of Cantabria in comparison with other Spanish regions.
A glance at employment levels between 1994 and 2003 shows that the numbers of R&D staff did not increase significantly. Indeed, in terms of absolute numbers and per 1000 head of active population, the figures for research staff are a little worse (Figures 2.4 and 2.5).

Two variables measuring scientific productivity show that:

According to the CINDOC 2004 report, in that year Cantabria accounted for 1.5% of all scientific publications in Spain (compared with 1.27% of the population). Furthermore, according to the COTEC 2005 report, for the 2000/02 period, it published 6.58 articles in international journals per 10 000 inhabitants and 0.78 in national journals.

- There is no clearly observable trend in the numbers of patent applications made in recent years (Figure 2.6).
Figure 2.4. R&D staff: absolute number and per 1000 active population


Figure 2.5. Research staff: absolute number and per 1000 active population

With regard to the number of businesses taking part in national research and development programmes in Spain, the Cantabria Regional R&D+I Plan notes that:

- In the 2004 call for tenders for PROFIT, 56% of the projects presented by Cantabria were approved. Further, none of the projects presented in areas of long tradition in the region — food and agricultural industries, materials and transport — were rejected.
- The response to similar calls from the Centre for Industrial Technological Development (CDTI) has been erratic. To give businesses in Cantabria a more stable presence in such calls for tenders, in 2004, SODERCAN promoted a technology diagnosis programme with positive results.

**Innovation actors in Cantabria**

Below is a brief description of the major players in Cantabria’s regional innovation system.
University of Cantabria

Created in 1972, by the year 2005 the University of Cantabria had 2 institutes, 31 departments, 125 catalogued research groups, and 4 units associated with the Spanish higher research council CSIC, with teaching staff numbering 1 076 and 137 research workers under contract. Its budget for 2006 totalled EUR 95.5 million.

Financing for research has increased in the last five years, being distributed as follows in the 2000/05 period: 57% research under contract (via research agreements\(^3\)) and 43% regulated (i.e. financed by public bodies). For the latter type, major sources of financing are the National R&D+I Plan (75%), the European Union (17%), other calls issued by programmes for aid (5%) and the European Regional Development Fund (3%). Players commissioning contract research from the University of Cantabria in this period were, in order of importance, businesses (62%), regional and local authorities (24%), central authorities (7%), and others (7%).

The University of Cantabria has 14 research projects as part of the 6th European Framework Programme. These include seven Data Transmission Engineering – Mobile Communications & Network Design Laboratory projects, two run by the Applied Meteorology research group, one run by the Intergenomics research group, one run by the RF Microwave research group, one by the Cantabria Physics Institute, one by the Computer and Real Time (CTR) research group and one by the Oceanographic and Coastal Engineering research group. The university also took part in the INVESNOVA 2005 call for applications, to which it presented 21 projects, all of them approved. Of these, 14 were granted to businesses with which it had already cooperated, while the other 7 were granted to firms with which it was taking part for the first time. Total financing received came to EUR 504 806.

The following institutes, foundations and organisation are attached to the University of Cantabria:

- **Cantabria Physics Institute (IFCA).** Created in 1995 as a joint centre of the Spanish Higher Scientific Research Council (CSIC) and the University of Cantabria it has 50 researchers working on Spanish and European research projects. With two departments, astrophysics and the physics of matter, the institute cooperates with the regional government department of the Environment and the Cantabria Astronomy Group on the future Astronomy Observatory at Valderredible, and has its own observatory at facilities in Santander. Research projects include the XMM project, the Planck...
• **Leonardo Torres Quevedo Foundation (LTQF).** LTQF came into being in 1978 as a response to the widespread interest at the Higher Technical Engineering College for Roads, Canals and Ports in promoting research activity in general. In 1998 the foundation’s mission was extended to include promoting research at the University of Cantabria and training science and technology professionals. The Spanish Ministry of Science & Education chose the Foundation as a member of the Pymera Network, which was set up to help local SMEs access European aid for financing R&D. The foundation offers SMEs advice and assessment on creating consortia, provides information on existing ones, and acts as an intermediary between research groups and SMEs.

• **Centre for Technological Development of the University of Cantabria (CDTUC)** is managed by the Leonardo Torres Quevedo Foundation. It was created to improve the technology transfer from university to local businesses and to promote the technology-based start-ups. Its on-line services include a personalised technology alert service, a technology exchange forum, training and an on-line technology audit.

• **International Institute of Cantabria for Prehistoric Research.** An associate member of the Spanish higher research board CSIC since 2004, the institute also has strong links with the University of Cantabria. Currently working on a five-year action plan, the institute has thirteen full-time researchers, three researchers under contract, two associated researchers, eight grant holders and two members from administration and services. It began to publish a series of essays and articles in 2005 designed to publicise the results of its research and make the most important results available and understood at international level.

• **The Analytic Characterisation and Microstructure of Materials Service** aims to satisfy the demands of companies and research groups of the University of Cantabria in this field. The Education, Science and Technology Ministry has contributed to its financing.

**Marqués de Valdecilla Institute for Training & Research (IFIMAV)**

IFIMAV was set up in 2002 as part of the Marqués de Valdecilla Foundation to specialise in training and research in biomedicine. It is currently involved in 15 national cooperative research networks financed by
the Spanish Ministry of Health & Consumerism. The IFIMAV maintains close relationships and combined actions with the Marques de Valdecilla Hospital and with the University of Cantabria concerning medical research.

The institute’s 175 employees work in 35 research groups with five major research areas: cancer, neurosciences, infections-immunity, biotechnology-transplants and metabolism. In the last five years the IFIMAV has published 1 500 articles in journals with impact factor. Financing received in the same period amounted to EUR 12 million. The two sources of external funding were FIS and MEC. External financing currently stands at around EUR 3 million.

Other research players

Other research and technology development players are the environment research centre CIMA, the Inter-professional Milk Research Institute of Cantabria, the Oceanographic Centre in Santander, the Cantabria Engineering and Technology Institute ITE), the environmental hydraulics institute INHAM, the Agricultural & Rural Research Centre and the Meteorological Institute, the Environment Research Centre, the Ictiologia Centre of Arredondo, and the Expert Centre of Microsoft Integration Technology.

Cantabria regional government

The Cantabria regional government runs the initiatives of the R&D+I Plan through the Department of Education, Industry, Labour and Technological Development, and the Department of Economy and Finance. The following players are part of these two departments:

SODERCAN

The regional development agency SODERCAN is the key player in the coordination of the research and innovation system. It is directly responsible to the Department of Industry, Labour and Technological Development. SODERCAN provides a range of support for innovation projects in firms. SODERCAN innovation support programmes include:

- INVESNOVA
  This is a regional programme to support SMEs which enables small businesses to work on joint projects with the University of Cantabria and the following research centres: the component technology centre CTC, and/or the logistics technology centre CTL, by subsidising part of
such projects. The programme also facilitates the transfer of knowledge from the research centres and the academic world to the region’s businesses. The programme concentrates on the automotive industry, the agricultural industry, technology-based businesses, updating the PICTE programme and technology surveillance and network participation and membership. In the year 2005, 16 projects were presented, and all of them were approved. The subsidies were received by 15 companies and 10 research groups. INVESNOVA has induced an investment of EUR 713,267 and EUR 372,187 of approved grant, with a grant rate per project of 62%.

- **TECNOPYME**

This programme is designed to introduce innovation in the region’s businesses via the acquisition of cutting-edge technological equipment and machinery that will facilitate a major step forward in business competitiveness. The results in 2005 were: 58 projects approved of 77 presented, grants of EUR 603,486 for EUR 3,717,888 of total investment, 49 subsidised companies and 9 self-employees, and an estimated 77 work positions created and 915 maintained. The main sectors which received help were metal-mechanics (15 projects) and the automotive sector (10 projects).

- **Networking Cantabria**

SODERCAN also works on ICT. Cantabria en Red (Networking Cantabria) is a major programme launched in 2004 to help people in the region to become “digitally literate” and to run specific initiatives for the region’s self-employed, micro-SMEs and SMEs.

- **R&D+I-Business Projects**

This scheme is designed to help businesses in Cantabria to access CDTi financial aid or provide financial support to other businesses whose projects would otherwise, for whatever reason, not be eligible for CDTi aid. The results in 2005 were: 37 projects presented by 29 companies with 29 research groups inside companies. EUR 1,287,514 of subsidies of a total investment of EUR 7,445,068. The subsidy average per project was 17.3%.

- **Recruiting doctors and technology professionals in R&D projects**

The idea is to increase the production sector’s capability by encouraging R&D staff to work with industry. The previous aid scheme had the following results in 2005: 28 projects were presented by 23 companies, and 25 projects were approved, involving 20 companies. The amount of the subsidy was EUR 237,592.
• Specialised technical training

Designed to improve employee training levels in businesses in Cantabria. The results in 2005 were: 73 projects presented by 25 companies, 49 projects approved by 23 companies, and EUR 81 297 of subsidies in a total investment of EUR 153 527.

• Introducing R&D+I management systems in regional businesses and R&D+I project certification

This scheme seeks to improve the ability of companies to run R&D+I activities as a way of promoting the development of new technologies or the introduction of existing ones, thus reducing their technological dependence. Three projects were presented in 2005, and all of them were 100% financed. The total amount of subsidy was EUR 31 167 with an induced investment of EUR 4 500 000.

• Technological productivity-industrial patents

This scheme is designed to protect the rights to any new industrial applications or technologies arising from regional business R&D+I activity.

Some global information about the distribution of SODERCAN activities by business sector is given in Table 2.3. As we can note from Table 2.3, most of the actions (68.3%) were carried out in three sectors: agricultural, automotive and ICT. Actions in the automotive industry are estimated to have maintained the most jobs.

Table 2.3. Distribution of SODERCAN activities by business sector (%)

<table>
<thead>
<tr>
<th></th>
<th>Agro-Food</th>
<th>Automotive</th>
<th>Bio-technology</th>
<th>Distribution and Logistics</th>
<th>Environment</th>
<th>ICT</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of actions</td>
<td>29.1</td>
<td>14.7</td>
<td>1.8</td>
<td>5.6</td>
<td>3.0</td>
<td>24.5</td>
<td>21.3</td>
<td>100</td>
</tr>
<tr>
<td>Number of enterprises</td>
<td>33.2</td>
<td>11.3</td>
<td>2.2</td>
<td>8.2</td>
<td>3.1</td>
<td>23.8</td>
<td>18.3</td>
<td>100</td>
</tr>
<tr>
<td>Subsidy</td>
<td>17.1</td>
<td>51.8</td>
<td>0.2</td>
<td>0.6</td>
<td>5.7</td>
<td>3.2</td>
<td>21.4</td>
<td>100</td>
</tr>
<tr>
<td>Investment subsided</td>
<td>12.7</td>
<td>28.7</td>
<td>0.2</td>
<td>1.3</td>
<td>13.5</td>
<td>4.0</td>
<td>41.7</td>
<td>100</td>
</tr>
<tr>
<td>Investment induced</td>
<td>17.9</td>
<td>14.1</td>
<td>0.1</td>
<td>3.9</td>
<td>13.4</td>
<td>2.9</td>
<td>47.7</td>
<td>100</td>
</tr>
<tr>
<td>Jobs created</td>
<td>26.3</td>
<td>24.2</td>
<td>1.5</td>
<td>2.5</td>
<td>8.1</td>
<td>30.8</td>
<td>6.6</td>
<td>100</td>
</tr>
<tr>
<td>Jobs maintained</td>
<td>8.5</td>
<td>64.9</td>
<td>0.1</td>
<td>0.6</td>
<td>0.7</td>
<td>9.5</td>
<td>15.8</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: SODERCAN 2005 Report

In 2005 SODERCAN promoted nine projects subsidised by European Funds (Table 2.4).
### Table 2.4. SODERCAN projects with European funding (EUR)

<table>
<thead>
<tr>
<th>Project</th>
<th>Content</th>
<th>Investment</th>
<th>European funding</th>
<th>European Fund</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADAPT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. INALCAN Project</td>
<td>Technological audits aim for strategy and innovation and formative actions in the agricultural sector</td>
<td>909 624</td>
<td>727 699</td>
<td>European Social Fund</td>
</tr>
<tr>
<td><strong>EQUAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. EQUALCAN Project</td>
<td>To introduce lax formulas in regional SMEs</td>
<td>2 299 899</td>
<td>1 724 924</td>
<td>European Social Fund</td>
</tr>
<tr>
<td>3. EQUALCREA Project</td>
<td>To foment the creation of companies in groups with insertion difficulties</td>
<td>1 939 312</td>
<td>1 454 484</td>
<td>European Social Fund</td>
</tr>
<tr>
<td><strong>INTERREG</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. REDICAN Project</td>
<td>Virtual Network of “infovivero”</td>
<td>890 459</td>
<td>667 844</td>
<td>European Regional Development Fund</td>
</tr>
<tr>
<td>5. BRISE Project</td>
<td>Investment and creation of new technology companies, electronic trade and broad band</td>
<td>275 000</td>
<td>155 000</td>
<td>European Regional Development Fund</td>
</tr>
<tr>
<td>6. ESTIIC Project</td>
<td>Innovation Development and ICT introduction in SME.</td>
<td>1 000 000</td>
<td>700 000</td>
<td>European Regional Development Fund</td>
</tr>
<tr>
<td>7. RIS Cantabria Project</td>
<td>To define Regional Innovation Strategy</td>
<td>495 000</td>
<td>247 500</td>
<td>European Regional Development Fund</td>
</tr>
<tr>
<td><strong>Innovative actions FEDER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. IMPULSO Project</td>
<td>To promote industrial innovation. To create technological advanced services companies and new technological companies.</td>
<td>4 000 000</td>
<td>3 000 000</td>
<td>European Regional Development Fund</td>
</tr>
<tr>
<td>9. ESTER-PRAI Project</td>
<td>To develop Technological Support Structures in small regions in the Innovative actions program.</td>
<td>3 120 000</td>
<td>2 340 000</td>
<td>European Regional Development Fund</td>
</tr>
</tbody>
</table>

Source: SODERCAN 2005 Report

**Regional Agency for R&D+I (IDICAN)**

Under the Regional R&D+I Plan, an R&D+I management body, the IDICAN innovation agency, has recently been set up for Cantabria to promote and provide incentives for scientific research, technological development and innovation in society in Cantabria. It is also entrusted with promoting and executing the plan itself. Figure 2.7 shows how innovation support is delivered through this agency.
IDICAN offers services in four areas:


2. Administration of projects: Designing calls for projects, publishing them, evaluating and selecting projects for funding.

3. Technical support in R&D+I. IDICAN is entrusted with the design and co-ordination of regional of R&D+I policies.


**EMCANTA**

EMCANTA is a public company created in 2005 to modernise the regional administration and promote its technological development. Its mission includes coordinating, planning and managing the modernisation of public administration in Cantabria and acting as a network providing information about regional information society and ICT policies. Within EMCANTA, the Cantabria Information Society Observatory (OSIC) was set up in 2005 to produce regular reports on the ICT situation in Cantabria and promote the use of ICT by local people.
The Cantabria Science and Technology Park (PCTCAN)

Although still in the development phase, PCTCAN is set to become a key asset in the regional innovation system. The Park’s mission is to create a high quality science and technology environment capable of attracting and/or developing technology-based businesses and institutions that will promote R&D+I activities and projects, by facilitating relations between them and orienting the region’s business sector towards the creation of value.

PCTCAN objectives include promoting regional and local R&D+I, facilitating the transfer of knowledge and technology from the university and research centres to businesses in the region, facilitating cooperation between players, contributing to the creation of innovative, technology-based companies, providing infrastructures and technology services and training.

The six partners behind the park’s management company are SODERCAN, the University of Cantabria, Santander City Council, the Cantabria industrial land company SICAN, the directorate general for Territorial Planning & Urban Development and CEP, a general company for coordinating the regional government’s public companies.

Component Technology Centre (CTC)

Created in 2000 as a foundation, the CTC is the region’s benchmark technology centre, entrusted with the mission of reinforcing industry in general in the region. It is a non-profit private foundation, with its membership made up from firms in the automotive cluster, the University of Cantabria, the Banco Santander, and the Banco de Cantabria. The centre specialises in structural design, systems engineering, applied research in chemistry and materials and process improvements. CTC has achieved good results when cooperating with local businesses and in training graduates from the University of Cantabria.

Besides offering open and tailored courses for businesses and individuals, the CTC training area concentrates on selecting technology personnel to join companies. This guarantees the quality of the personnel selection process and prevents costs and inefficiencies that would otherwise occur if businesses took over the selection process. Other business support services include technology assessment and research applied to business, feasibility studies of industrial plans and aid and assessment on project management. The CTC is a founder member of GIRA, the regional automotive industry initiative group.
The CTC is part of the Fusion Technology Platform promoted by the Spanish Ministry of Education & Science, and was created in a bid to unite the efforts made by universities, research centres and businesses interested in the kind of large hi-tech-related installations needed to develop fusion. CTC also participates in the Spanish Technology Platform for the automotive component industry (AUTONET).

**Cantabria Integral Logistics Technology Centre (CTL)**

Set up in mid-2005 by the regional government’s Industry, Labour & Technological Development Department, the CTL is to be housed at the Science & Technology Park. Its 17 trustees include the regional government of Cantabria, the Port Authority, the Port Community of Santander, the University of Cantabria, the regional Economic & Social Council, and the leading transport companies in the region. Although specialising in port logistics, it will also launch initiatives affecting passenger transport. CTL is a response to demands from the sector for more research and technology development projects, for research results to be transferred to the business world and for the promotion of research and innovation.

**SOGARA**

The mutual guarantee company SOGARCA has been working locally for the last 25 years to support SMEs in the region, facilitating their access to a range of sources of financing and providing assessment about such sources.

**Cantabria Capital**

Founded in 2003 as a joint project between the regional government, the two major financial organisations in the region (the Santander Central Hispano bank and the Caja Cantabria savings bank) and the business association CEOE-CEPYME, Cantabria Capital is the first venture capital company created in Cantabria. With initial capital of EUR 12 million provided by the Santander Central Hispano (50%), the Caja Cantabria (25%) and the regional government (25%), the venture capital company aims to become an efficient financial tool contributing to the success of business initiatives and entrepreneurial projects.
Centre for Technological Development

The Centre for Technological Development is part of IFIMAV and the University of Cantabria. It has the following research and development groups:

- Laboratory of science and engineering of materials.
- Construction engineering.
- Laboratory of Scientific and Hydraulic Calculation Computing.
- Observatory of SMEs.
- Photonic Engineering.
- Cartographic engineering, geodesy and photogrammetry.
- Laboratory of materials characterisation.
- Engineering of systems, antennas and radio propagation.
- Group of Microwaves-DICOM.
- Impulse, development and administration of aquaculture companies.
- Telemetric engineering.
- Graphic expression in CAD engineering.

Office for the Transfer of the Results of Research

The Office for the Transfer of the Results of Research (OTRI) established at the University of Cantabria, is the key player in ensuring that the results of academic research are passed on to the regional business world. Created in 1989, it is part of the Spanish university OTRI network called Red OTRI and seeks to orient research activity at the University of Cantabria towards technology needs in the region. It is also entrusted with the task of improving relations between the University of Cantabria and local businesses.

Co-operative Centres for Oriented Research

The Co-operative Centres for Oriented Research (CICOs) are a new player in the local innovation system profiled by the Regional R&D+I Plan 2006-10. The CICOs will seek to foster the coordination and cooperation between the science and technology players and the business world, and will
act as strategic tools in the transfer and generation of knowledge in the region.

**Regional automotive industry business cluster (GIRA)**

Although the automotive component industry is of major importance in the regional economy, in recent years changes in the local environment endangered the future of the industry. To respond to this, SODERCAN lobbied for a strategic plan for the automotive industry in Cantabria for the 2005/07 period. One result of this plan is GIRA, a group for regional initiatives in the automotive industry.

GIRA was formed to be a meeting point for businesses in the industry, in a bid to increase cooperation among them, help them to adapt to technological change, increase competitive levels in the industry and defend the industry’s interests. It is a non-profit association that groups around 20 of the most important firms from the automotive cluster and, institutions like SODERCAN, University of Cantabria, and the Technological Centre for Components (CTC) and labour and entrepreneurial organisations.

GIRA objectives include defining regional strategies in the sector, identifying needs, issuing diagnoses and reports, proposing projects and lines of action, and encouraging the attraction of new investments. Within the Strategic Plan for the Automotive Industry in Cantabria 2005/07, some actions began in 2005 in areas such as R&D+I, training and profitability improvement.

**Cantabria New Information & Communication Technologies Business Association (ASCENICT)**

ASCENICT is an association of the region’s leading information and communication technology businesses. The objectives of this association include promoting the development of the ICT sector and finding common strategies designed to face the international competition, supporting initiatives to introduce ICT in the region, and differentiating the regional sector’s products and services via a brand with a fully justified quality and guarantee image.

**Cantabria Chamber of Commerce**

Cantabria has two Chambers of Commerce. The Chamber of Commerce, Industry & Navigation of Santander was created in 1886, while the Torrelavega Chamber of Commerce and industry dates from 1913. Spanish law 3/1993 defines Chambers of Commerce as Corporations in
public law with legal identity and full capacity to act and work towards the achievement of their purposes, being consultative bodies that cooperate with public administrations, without prejudice to the private interests they pursue. Besides strengthening the production system, the Chambers of Commerce have an important role to play in promoting, representing and defending the general interests of trade, industry and navigation.

The Cantabria Chamber of Commerce hosts the University-Enterprise Centre, created in 1984 by agreement between University of Cantabria and Cantabria Chamber of Commerce. This Centre has activities in different areas, like: research, training, information, employment guidance, and collaborations between companies and the University of Cantabria. It is a member of University-Enterprise Foundation Spanish Network. The Cantabria Chamber of Commerce also has a Euro Info Centre which is a service aimed to give information, advice and assistance to SMEs on European Union issues.

**Galactea Network**

The Galactea Network is a consortium that is part of the European Network of Innovation Relay Centres (IRC NETWORK) that acts in the following regions: Asturias, Cantabria, Castilla y León and Galicia. In Cantabria the organism in charge of Galactea is the Chamber of Commerce, Industry & Navigation of Santander. The general objectives of this network are:

- To improve the competitiveness of the companies through the transnational technology transfer.
- To promote the creation of European infrastructure of professional support to the innovation.

**CEOE-CEPYME Cantabria**

The Cantabrian Entrepreneurs Confederation (CEOE-CEPYME Cantabria) was constituted in 1977. It belongs to the Spanish Confederation of Entrepreneurs (CEOE) and to the Spanish Confederation of Small and Medium Enterprises (CEPYME).

**Innovation policies in Cantabria**

Two major milestones in innovation policy in Cantabria were the development of the first regional innovation strategy for the period 1999-2001 and the Innovative Action Programme 2002/04. These initiatives
helped identify the innovation barriers in the region and developed actions to respond to these needs. They have now been superseded by the following programmes.

**Governance Plan 2004/07**

The Governance Plan launched at the beginning of this legislation included 12 undertakings by the regional government. Structured in 12 strategic lines, the Plan outlines a total of 300 projects. The most relevant of the 12 lines from the point of view of R&D+I is *Industrial, Business and Technological Design* in Cantabria, which aims to introduce innovation and development programmes designed to modernise traditional industry and improve regional competitiveness. This line targets entrepreneurs, industrial companies, industrial service companies and sector clusters. Undertakings include:

- **Integral support for entrepreneurs**, with particular attention to women and young people.
- **Development of industrial land**, involving the creation of a number of business parks in different areas of Cantabria, a development area in the Buelna Valley and integral strategic production areas in several municipalities.
- **Execution of the Cantabria Energy Plan.**
- **Internationalisation of Cantabria’s economy** by attracting foreign investments and promoting business internationalisation.
- **Industrial and business promotion**, including a support service for business modernisation and competitiveness, an industrial revitalisation plan for Cantabria, an SME Plan, a regional research plan, a business aid programme for companies in the agricultural and food industry, and a programme to support firms in the fishing industry.
- **Aid for the regional innovation system**, designed to improve productivity and competitiveness by:
  - Increasing excellence-oriented business management capability.
  - Increasing the tangible and intangible capital of businesses that improve competitiveness.
  - Promoting an innovative culture in production.
- Optimising relations between business and the academic world, by consolidating interface bodies as a means of facilitating permanent contact.

- Promoting the relationship between regional players by creating a permanent commission for the promotion of R&D+I in Cantabria.

- Promoting the acquisition of new competitiveness-related capabilities and competences.

- Introducing ICT in regional businesses.

- Increasing and improving business access to financing.

To ensure that these commitments are successful, the regional government produced a regional R&D+I plan, getting the Cantabria Science and Technology Park up and running, consolidating the Component Technology Centre, creating the Cantabria Information Society Observatory (OSIC) and launching the Cantabria Network Plan and the FORINTEL 2004/06 plan.

**Innovative Action Programme 2005/07**

A project entitled *Development of Technology Support Structures in Small Regions (ESTER)* was developed in the framework of the European Commission’s Innovative Action Programme in 2005. The project involves two pilot experiences in two strategic sectors (magnesium casting technology for the automotive ancillary industry and the biotechnology industry), which will be targeted by several development and innovation policies. The aim is to study innovation support policies in these sectors and select the successful experiences. Both sectors have benchmark infrastructures in the region, the first being the Component Technology Centre and the second the Marques de Valdecilla University Hospital and the University of Cantabria.

Targets include correctly defining innovation support policies in the two sectors, creating an applied magnesium technology experimentation and development unit for the ancillary automotive industry, creating a biotechnology development unit, improving the way R&D+I initiatives are programmed in Cantabria from the experience in the two selected sectors and taking part in European networks. The programme’s budget is EUR 3 120 000.
Regional R&D+I Plan 2006/10

As a response to the undertakings of the Governance Plan 2004/07, the R&D+I Plan identifies knowledge and technology as new competitiveness factors and science and technology as factors for development. So the Plan’s mission is to act as a tool that integrates, structures and supports the regional government’s initiatives designed to give Cantabria a place in the knowledge economy on a par with Europe’s richest regions. The plan’s strategic objectives are to:

- Consolidate in Cantabria internationally recognised Science and Technology Hubs in areas with a major role to play in Cantabria’s future.
- Promote innovation by facilitating the integration and participation of all actors in the regional innovation system.
- Give the science-technology-business system in Cantabria the bodies it needs to ensure knowledge is transferred effectively.
- Develop the innovation capability of all the social, economic and institutional players in Cantabria.

The plan concentrates on nine areas: health sciences, biotechnology, the integral water cycle, physics, industrial design and materials, food technologies (food and agricultural industry), Information and Communications Technologies, logistics and the technological governance plan, all of which are set to have major applications in the future in production sectors in Cantabria.

BioCantabria

BioCantabria is a project designed to promote biotechnology as a source of regional wealth. Phase one of the project finished in 2005, after producing a diagnosis of the opportunities for the biotechnology industry in the region, which also identified strengths in biomedicine, the environment and the agriculture and food industry. The strategic lines of the BioCantabria Plan are:

- Promoting stable lines of communication and interaction between the key players in the development of the biotechnology industry in the region (university, businesses, hospital and government).
• Identifying technologies or ideas susceptible of being marketed and patented, and which might be used as grounds for the creation of technology-based businesses.

• Publicising biotechnological business applications that might be taken on board by businesses in Cantabria working in, for example, the environmental and food and agricultural industries.

Survey results

A survey was undertaken of companies and Research Centres in Cantabria in order to identify and describe innovation activities, connectivities and barriers to innovation that should be addressed by policy. This Appendix sets out the results of these two surveys.

Methodology

Company survey

A representative sample of 50 companies by size and sector was selected from a total population of 37,690 companies in Cantabria (INE, Instituto Nacional de Estadistica). Thirty responses were obtained as seen in Table 2.5.

| Table 2.5. Company survey sample details |
|-------------------------------|------------------|
| Population                    | 37,690 companies |
| Representative sample          | 50 companies     |
| Responses obtained             | 30 surveys       |

Note: This sample is representative of the population, with a 10% of error margin.

These companies were classified according to whether they have experience in carrying out R&D+I related projects in co-operation with the Cantabrian Regional Development Agency, SODERCAN or other innovation support agents in the region, or they do not. The results are distinguished between these two groups (the publicly supported and the non-publicly supported groups).

Research organisation survey

The Catalogue of R&D+I Groups of the University of Cantabria shows that there are 30 departments and 127 research groups in the university. The majority of the research groups are from engineering and technical
sciences (68 research groups), followed by life sciences with 25, social sciences with 23 and economy with 11 research groups.

A sample of 12 research groups were contacted and interviewed. This represents approximately a 10% of the total. These research groups were categorised into:

- Research groups with experience in carrying out R&D+I projects in cooperation with companies.
- Research groups representative of all the knowledge areas offered by the University of Cantabria: economy, social sciences, engineering and technical sciences and life sciences.

**Innovation activities**

**Companies**

As shown in Figure 2.8, the innovation activities of the sampled companies are oriented towards the following objectives:

- Improving products/services.
- Improving product lines.
- Diversifying production lines.
- Improving business management/organisation.

Most publicly supported companies aimed at improving their products or services or at improving their production lines. Non-publicly supported companies were more likely to undertake innovation to diversify their production lines.

In this way, these innovation processes are focused on a wide range of objectives. As shown in Figure 2.9, the main are the following:

- Improve products.
- Modernise facilities.
- Improve processes.
- Penetrate new markets.
- Diversify product/service portfolio to give customers greater options.
No company identified other innovation needs beyond those represented in Figure 2.9. Therefore these can be seen as the full set of objectives that companies are trying to achieve.
To achieve these objectives companies mostly need to develop new technologies related to their business. This implies that support may be required not only for acquiring sophisticated equipment, qualified human capital and economic resources, but also for facilitating co-operation for acquiring technological knowledge. Of course, the other main need for policy support to carry out these innovation processes is related to financial issues and helping address the high costs of innovation for SMEs.

Research organisations

The **Engineering and Technical Sciences research groups** main objective consists on searching for actual problems that exist in industry or society and that might have some innovative solution through applied technology development. The reason for this positioning is that they are conscious that the resources for R&D+I are limited, and they look to increasing the possibilities to obtain useful results from the R&D+I projects. They look to generate useful knowledge to be applied in industry and society, but also to be used in publications in scientific papers and for elaborating doctoral theses. Their objective therefore consists of carrying out R&D+I projects focused on solving actual industry and social problems and needs, by means of contracts with companies and socioeconomic bodies. However, they also seek to carry out basic research projects focused on developing state of the art knowledge by means of competitive national and European calls. This approach allows research groups to develop a basic knowledge and an adequate expertise, for being applied to the companies.

The **Social Sciences and Economy research groups** main objective consists on developing basic research, and on co-operating with Public Administration clients in designing innovative policies in social and economic fields.

The **Life Sciences research group’s** main objective consists on developing basic research. There is no pharmaceutical industry in the region, so research groups have not the possibility of co-operating with regional companies for carrying out R&D+I projects. Overall, the innovation activities are mainly oriented towards the following objectives:

- Improving products/services.
- Improving production lines.
**Innovation linkages**

**Companies**

As shown in Figure 2.10, only one-third of the sampled companies co-operate with other bodies in undertaking their innovation activities. These partners include other companies, Technology Centres, Universities, Research Centres /Institutes, technology consultancies, chambers of commerce and business associations. Two-thirds do not co-operate with partners.

**Figure 2.10. Profile of the bodies that companies collaborate with on R&D+I activities**

![Bar chart showing the number of companies collaborating with different bodies.](chart)

The main reasons for not co-operating are that the companies have these kinds of activities covered internally or because they do not undertake activities related to R&D+I.

R&D+I co-operation relationships between the university and companies are not very extensive, even though the fact that the main kind of relationship among partners is “Joint R&D+I”, a kind of relationship very adequate for universities. This reflects the problem that companies do not understand the mindset of the university and vice versa. However, some companies limit their involvement because they believe that R&D+I cooperation with other bodies is very dangerous for protecting their knowledge.
Company views on how the public sector could assist in improving innovation co-operation point to a need to reduce the gap between university and company cultures in order to establish win-win relationships.

**Research organisations**

The Engineering and Technical Sciences research groups work in developing their R&D+I projects with different economic sectors (space industry, metal mechanics, automotive, biomedicine, and others). They do not mind which is the application sector for their R&D+I projects results but are interested only in knowing what their technology can do in concrete industry applications. In general, the Engineering and Technical Sciences research groups carry out the following co-operation with companies projects:

- Integrated productive systems.
- Industrial design.
- Laboratory tests.
- Field tests.
- Hardware and software development.

The aim of these co-operation projects is to research, measure and improve the productive processes.

In this sense, traditionally the industry has developed their production knowledge via the test-mistake method. The objective of the research groups consist on establishing and getting data about measurement indicators that allow to know why things happen during a production process.

Some of the Life Sciences research groups want to co-operate with the industry for developing applied innovation projects, but they must do it with companies outside of the region.

In general, researchers are mainly focused on basic research, and they consider that to co-operate with companies for innovation applied projects implies to lower the level of their research activities. For them, the applied innovation activities in co-operation with companies have few scientific interests.

In general, there are some research groups that co-operate with other bodies, mainly with:

- Companies.
• Technology Centres.
• Public administration as client.

The main criteria of the research groups for selecting a partner is that the company has a demand of a R&D+I activity, and pays to the research group for carry it out in co-operation. The kind of relationship between research groups and companies for carrying out collaborative research projects is generally the subcontracting contract. The main reasons for the research groups in participating in co-operation projects are to have a return of the joint research investment, and to search for flexibility for carrying out the research projects. The duration of co-operation relationships is normally two years. The research partners normally are not competitors before starting the co-operation relationships. The role of the research groups within the co-operation relationship is to create the conception of a product or service.

**Barriers to innovation**

**Companies**

According to the survey, the main barriers to company innovation are related to costs factors, specifically due to the lack of finance availability, the lack of information related finance offer for R&D+I, the shortage of resources and the lack of an innovative mindset (Figure 2.11). The cost of innovation is also too high for a lot of companies, especially the smallest ones or those which have just started up. There are also companies that have just started their activities and are not still in condition to develop R&D+I activities because they do not have enough profits yet to re-invest in R&D+I projects. A common barrier is the need for advice related to technical aspects and also related to the R&D+I projects administrative management. Companies have a lack of skills and of adequate resources for carrying out innovation projects, normally in the fields of administration, planning and financial aspects, and also in technical knowledge for developing the contents of the applied research. In addition, many companies considered a further barrier to be the lack of information related to the state of the art of innovative technologies that potentially could be applied to their businesses. Finally, a key factor for facilitating access to innovation activities to the companies, it is the need of personalised advice, especially in terms of consultancy and advanced advice services.
Companies that try to relieve these barriers by means of the support offered from regional government, seek grants to acquire more sophisticated new technological machinery or equipment, aimed at modernising their production processes or products/services.

**Research organisations**

There is a lack of recognition from the academic environment to those researchers that create “spin-offs” aimed at exploiting the results of their R&D+I activities. This academic environment considers that the researcher’s career has been developed using academic resources and that it is not a merit to apply those skills and knowledge in a private research activity. Due to this situation the academic environment trends to create a culture of non fostering of the creation of new innovative high-tech “start-ups” and “spin-offs”. The university should define and develop policies aimed at changing this culture, promoting the entrepreneurship in the academic environment and providing adequate tools for the researchers to manage the creation of new innovative entrepreneurial activities.

A further important barrier for innovation is the lack of labour stability of experienced employed researchers. Researchers sign their labour contracts directly with the university and it is difficult to consolidate a professional career within the university, except by means of applying for
being functionary teacher. Therefore the research groups that want to develop co-operative research projects under contract with companies and public administration clients must operate R&D+I projects in a similar way as if they were a company but without having the same business capacity, flexibility and legal status for managing the projects. This situation is a very important restriction for the research groups to develop co-operative R&D+I projects.

This situation affects especially innovation projects (rather than research and development projects), that are:

- The major part of the projects developed under contract with the companies.
- Those that are more likely to spread the innovation culture among economic and industrial structure.
- Those that contribute more to regional economic development in the short and medium term.

Also, researchers’ labour contracts are financed by projects. The R&D+I activities do not always generate regular incomes that allow the research groups to fit staff resources to the projects’ cash flow. Frequently, the cash incomes of a R&D+I project come at the end of the project, after the work is carried out and the results of the R&D+I project have been achieved. This situation also generates labour instability for the researcher teams. Therefore, there is a need to create stable labour opportunities for regional researchers by means of providing them well financed and permanent labour contracts.

Another important barrier for the development of the regional innovation system is the lack of mobility of research personnel. The research groups are not able to offer stable and good paid labour conditions. The researchers therefore may seek to go abroad in order to obtain stability, career progress and good salaries and their potential contribution may be lost to regional economic and social development. There is therefore a need to create labour opportunities for researchers aimed at allowing them to develop their career within the region, by means of facilitating the possibility for them of moving from one research group to another. This could be a way of fostering the competitiveness between regional research groups that might contribute to the growth of more competitive research teams. If researchers move within the region, developing their professional career and improving their technical and management skills, the knowledge also grows and stays within it, creating synergies and strengthening the regional innovation system.
Another barrier to innovation is the lack of technology, well equipped laboratories and facilities for carrying out R&D+I projects. The reasons for this are that investment in sophisticated equipment is very expensive, and also that there is not a “critical mass” of regional companies and R&D+I bodies in the region, that are in situation to use the facilities on their complete capacity.

Also, there is a lack of maintenance personnel for advanced technology equipment and of laboratory technicians. It is difficult for the university to justify to contract for this kind of technical support personnel, so it is difficult for the researchers to exploit in the most efficient way the equipments and facilities available. It is therefore necessary to create new research groups and university spin-offs and also increase the number of R&D+I applied projects developed in the region in order to use the R&D+I facilities in a more intensive way. If the facilities are more efficiently used then an optimum return of the investments on R&D+I technology, equipments and facilities will be obtained by the regional innovation support bodies and the companies. And if the investments are more profitable, then the R&D+I bodies will keep on investing in more innovative technologies, equipments and other facilities. This major return will be in terms of money, new technology applications for the industry, new innovative regional products and generated knowledge that will be working for the region.

Another barrier to innovation is the lack of an evaluation system of researchers within the university, aimed at valuing both basic research and applied research in co-operation with companies. The current system values researcher’s publications on high prestige specialised scientific magazines, but does not give value for internal professional promotion to the results of the applied innovation projects carried out by the researchers in co-operation with the companies and other regional innovation support bodies. The researcher’s evaluation system should value at the same level the activities carried out by researchers on:

- Research.
- Development.
- Innovation.

The results of the applied innovation projects that nowadays do not benefit the researchers in the system are:

- New innovative products and technologies for being commercialised by companies.
- New innovative manufacturing processes.
• Patents.
• Commercial exploitation of patents.

Thus the evaluation system is mainly promoting the generation of basic knowledge. As a result, when a researcher obtains an important result of its basic research projects it is very probable that the agents that will be in position to use the new knowledge will not be agents within the region but researcher bodies from abroad since there are more possibilities that research bodies from abroad, with better financial, equipment and human resources, make good use of the knowledge obtained as result of the basic research activities carried out by regional researchers. Therefore, there is high probability that the research bodies from abroad, that have more resources for R&D+I, will have the return of the added value generated by regional basic researchers. In the end the regional society and economy that are the investors in R&D+I will not probably have the proper return on their investment. So, the system should have a logic more fitted to the society and economy demands. The need of these investors is to have a short and medium term return from their R&D+I investments, by means of:

• Co-operation with researchers for designing and developing new innovative products and processes at regional level.
• Support, advice and co-operation for commercial exploitation of patents generated by regional researchers.

The competences for designing a researchers’ evaluation system more fitted to the demands of the investors—society and economy—are the responsibility of the National Ministry of Education and Science, the Regional Ministry of Education, but also the university. It could be possible that the university reforms the system introducing indicators for evaluating research activities, allowing researchers to develop their professional research career with more stability and flexibility, and also focusing better their research approach to the needs and demands of the companies and the society. This possible reform could contribute to increase the probabilities for the R&D+I investors to return their investments in the short and medium term and also to facilitate that the added value generated by regional research activities results, is used by regional bodies, instead of by abroad ones.

As a consequence of this evaluation system appears another barrier to innovation that is the confidentiality of the R&D+I projects results. The reason is that companies prefer not to publish the results of their R&D+I activities but researchers do want to publish those results on papers and scientific magazines with the aim of having not only more prestige but also better valuation merits in the research system. This problem generates a
situation where companies are unwilling to share their knowledge with researchers and researchers are not motivated to promote research activities in co-operation with companies. This vicious circle is not good for the regional innovation system and for the development of the knowledge economy in the region. The situation could generate for companies a lack of confidence in promoting innovation projects in co-operation with researchers. Very often it is said that companies have cultural problems in sharing knowledge, innovation projects and information, but the system should provide them enough confidence that the return of their innovation investments will stay in their own company. For developing this culture of confidence an important tool could be to allow researchers to receive an added value from promoting and developing innovation applied activities with the companies by means of recognition from the evaluation system. Another tool could be to convince to the companies that it can be profitable for them to publish the results of their R&D+I activities in papers and scientific magazines. If so, companies should be advised on how they can make this publicity profitable in the market.

Another barrier for innovation is the lack of information that companies have related the R&D+I offer from the university. It seems to be the case that the university Technology Transfer Office does not have the capacity for diffusing all the information and promoting all the co-operation relationships that the technologies offer and the companies can demand. Therefore, it is necessary to strengthen the interface between technology offer and the companies in order to facilitate the communication and a better understanding between two different cultures –companies and technology offer- and also for stimulating the demand for applied innovation activities.

**Survey conclusions**

**Companies**

There are many barriers to the development of innovation activities and these vary by company. However, the following are two major global issues.

1. Lack of information

   A major barrier reported by most of the companies interviewed is the lack of information related to regional government support measures for innovation activities. Many companies have a lack of information about the existing financing schemes in the region. In many cases, the lack of possible public financial support for innovation is particularly serious because companies complain of a lack of finance availability within
their company for innovation due to the shortage of internal resources and the large costs of innovation.

2. Innovative mindset

Another major barrier to innovation for many companies in Cantabria is their mindset. This factor is more important in traditional sectors like metals and in micro-companies and small and medium enterprises (SMEs). The main reasons are:

- Lack of knowledge about innovative concepts.
- Lack of information about the advantages of innovation.
- Lack of information about innovative technologies suitable for satisfying their business needs.
- Difficulties finding collaborative partners for innovative activities.

These barriers are compounded if companies do not have information about the innovative offer.

Furthermore, there are many companies (especially in the auxiliary sector) that do not develop systematic R&D+I activities. This fact is because, due to their small size and traditional sectors of activity, they make innovations through day-to-day improvements or through improvements demanded and specified by their clients. There are also companies that prefer to cover their R&D+I activities internally rather than to co-operate with other bodies of the region, especially with universities. Many of these companies would benefit from more proactive and positive attitudes to innovation.

Research organisations

The main conclusions of the research organisations survey are that:

- The university should provide more labour stability to experienced researchers.
- Regional research agents should increase their investment in technology, well-equipped laboratories and facilities for R&D+I activities.
- Regional research agents should increase the intensity of their research activities in order to use existing equipment, laboratories and facilities to their full capacity.
A reform of the performance evaluation system for university researchers is needed with the aim of valuing at the same level the research, development and innovation activities.

A policy should be developed to increase the impact of publicly-generated R&D+I results on economic and social development in the region in the short and medium term.

A policy should be developed to foster confidence in companies in sharing their R&D+I knowledge and to motivate researchers to undertake applied innovation projects.

Companies should have detailed information on the technology offered by regional research teams.

The university should define and develop a policy aimed at promoting entrepreneurship in the academic environment.

Companies should be advised on how can they make publication of their collaborative R&D+I results profitable in the market.

The interface should be strengthened between the regional science and technology base and regional companies.

Global policy challenges

The following global challenges for Cantabria can be identified from the above assessment of the characteristics of the Cantabria innovation system and the results of company and research organisation surveys.

**Delocalisation**

There is a risk of delocalisation of companies in the region, especially in important sectors for the regional economy such as machinery and mechanical equipment, whose multinationals in the region are few in number but very important because they absorb 70% of R&D+I employees in the sector. The same risk appears in the agriculture and food industry, where multinationals account for 62% of the region’s employment in the sector. Evidence of this risk is already appearing. The “Cantabria’s Social, Economic and Labour Report for the Community of Cantabria 2005” notes that between 2002 and 2004, twenty-four medium-hi to hi-tech manufacturing companies left the market in Cantabria. The main reason is seen to be a lack of competitiveness.
The Regional Innovation System

The Regional Innovation System is a young system still in development. Some of its challenges are:

- To reinforce co-operation among agents of the system in order to obtain synergies, for example:
  - University–Company linkages. There is a need to break with the traditional disconnection between academic research and the technological needs of regional companies. The main objective of the region’s policy in this area consists of fostering cooperation among companies and university to share their R&D+I results and experiences.
  - Company–Company linkages. There is a need to create networks and connections among companies in the main sectors of the Cantabria economy to share knowledge and experiences related to R&D+I and to generate win-win relationships. For example, clusters in strategic sectors and companies participating in technological platforms and in other kinds of networks should be targets for policy. Clusters are a key factor because they contribute to improving entrepreneurial competitiveness, innovation capacities and environment, and company productivity. Some steps have been developed in this direction by GIRA (Automotive Cluster) during recent years. Moreover, companies should identify how the publications of their R&D+I project results could benefit themselves.
  - Company–Public Administration–Technological Centre linkages. The business sector lacks awareness of the different kinds of public support (financial, infrastructures) available for innovation and how to exploit them. Therefore it is essential to improve the information and advice system. Companies should also make better use of the technology centre infrastructures available in the region. Information should be disseminated on the technology offer and existing research teams among different agents of Regional Innovation System. Better take-up of existing regional, national and international programmes would also be encouraged by a greater consolidation of services such as advice, information and support systems.

- To stimulate innovation and an entrepreneurial culture in society in general and, in particular, in local companies and the University of Cantabria.
R&D+I expenditure

Although average growth in GDP was slightly superior to the Spanish average in 2000-05, Cantabria has low levels of R&D+I expenditure per capita and a low percentage of private R&D+I expenditure. In general, the level of R&D+I expenditure, and in particular the private sector participation in this expenditure, are far from Lisbon Strategy objectives. Regional agents should involve themselves in this process, for example: improving their scientific and research infrastructures and creating incentives to researchers in order to facilitate the generation of a greater intensity of research.

Entrepreneurial capacity

Entrepreneurial capacity is important in the region because it creates new business activity and increases innovation and competitiveness in the productive tissue. Entrepreneurial activity in Cantabria could increase via the promotion of suitable infrastructures, like Business Innovation Centres, and developing a favourable legal and administrative framework in the region. The university should also foster entrepreneurial activity within its own structures.

Technology-based businesses

Fostering the creation of university spin-outs is a vehicle to transfer knowledge from research centres to society. Moreover, these new companies are very competitive. Cantabria has strong research resources in some areas, such as biomedicine. Stronger efforts should be made to encourage university spin-out activity.

Focus the university on the needs of its environment

The university should focus a part of its research resources and capabilities on trying to satisfy industry needs. Traditionally there is a lack of communication and co-operation between companies and innovation support agents for designing and developing R&D+I projects. Moreover, research employees’ participation in companies is difficult due to bureaucratic obstacles and lack of complementarity between the interests of companies and scientists. There is therefore a policy challenge to foster better connections between the university and companies.
Development of the “advanced services to business” sector

The “advanced services to business” sector have highly qualified employees and offers a wide range of services that companies make use of to externalise various of their activities. Further development of the “advanced services to business” sector is a key factor in strengthening the productive tissue.

Overcoming problems of size

Cantabria is a small region. Because of this it should look into ways of overcoming problems of size by joining networks and giving some activities priority, in particular in areas where Cantabria has competitive advantages or in strategic areas for the future of the region, such as biomedicine, environmental industries, the food industry and tourism.

However it is important to extend the innovative culture in Cantabrian society, especially among companies in order to increase innovative mindsets and awareness of the necessity and benefits of innovation.

Continue on the path taken in recent years

It is important to continue on the path taken in recent years by delivering plans and strategies to structure the regional innovation system and focus players towards excellence. Moreover, the Government of Cantabria should establish suitable evaluation and monitoring systems in order to assess its performance and adapt to the new market conditions and companies needs, at different levels.

Address locally perceived strengths, weaknesses, opportunities and threats

Furthermore, policy should seek to exploit or address the following locally perceived strengths, weaknesses, opportunities and threats of the R&D+I system in Cantabria.
Table 2.6. Locally perceived strengths, weaknesses, opportunities and threats

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<tr>
<th>Strengths</th>
<th>Opportunities</th>
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<tbody>
<tr>
<td>• Public authorities’ willingness to back R&amp;D+I as the motor for change and competitiveness.</td>
<td>• Possibility to learn from best practices and experiences in European and OECD countries.</td>
</tr>
<tr>
<td>• Encouraging research experiences in several industries of the future, e.g. biomedicine.</td>
<td>• Opportunity to fund innovation projects by Cantabrian SMEs through European research and regional development programmes.</td>
</tr>
<tr>
<td>• Strong technology and research centres in components and logistics.</td>
<td>• The R&amp;D+I Plan 2006/10 provides important support for R&amp;D+I in the region.</td>
</tr>
<tr>
<td>• Major tourist potential thanks to environmental and historical attractions.</td>
<td></td>
</tr>
<tr>
<td>• GDP growth above the Spanish average in 2000/05.</td>
<td></td>
</tr>
<tr>
<td>• Strategic sectors where the technology industry could develop such as biomedicine, environment and agriculture and food.</td>
<td></td>
</tr>
<tr>
<td>• Possibility to learn from best practices and experiences in European and OECD countries.</td>
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<tr>
<td>• Opportunity to fund innovation projects by Cantabrian SMEs through European research and regional development programmes.</td>
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<td>• The R&amp;D+I Plan 2006/10 provides important support for R&amp;D+I in the region.</td>
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<tr>
<th>Weaknesses</th>
<th>Threats</th>
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<tr>
<td>• Business structure dominated by small and medium enterprise with low R&amp;D+I expenditures.</td>
<td>• New international competition from lower costs countries such as China, India, and East European countries.</td>
</tr>
<tr>
<td>• An immature innovation system.</td>
<td>• Risk of traditional Cantabrian companies relocating to lower production cost areas.</td>
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<tr>
<td>• Disconnection between academic research and the technological needs of regional companies.</td>
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<tr>
<td>• Little or no innovative culture in the business sector.</td>
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<td>• Lack of awareness in the business sector of how to exploit public aid.</td>
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<tr>
<td>• Shortcomings in science and technology networks.</td>
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<tr>
<td>• Low R&amp;D+I expenditure and low contribution of the private sector.</td>
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<tr>
<td>• Few networks for business interaction in leading industries.</td>
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Notes


3. As established in Spanish Law LOU, Art.83.
CHAPTER 3

HUMAN CAPITAL AND LABOUR MARKETS

by Tod Rutherford
Syracuse University, USA

The purpose of this chapter is to assess the assets, connectivities and capabilities of the local innovation system of Cantabria, Spain, with specific reference to the role of people and the labour market. The chapter is organized into four parts as follows i) general policy issues and good practices ii) strengths, weaknesses, opportunities and threats in Cantabria iii) recommendations for policy development in Cantabria and iv) three learning model programmes from regions in different OECD member countries which will assist to illustrate how to address the recommendations. These learning model programmes will be drawn from Italy, Denmark and Ontario, Canada

Policy issues

The case study of human capital and labour markets in Cantabria illustrates a number of policy issues which are both general and specific to Spain and Cantabria. These include the challenges of how to develop and generalize a learning culture, including the role of vocational and educational policy and the attraction and retention of talent. Important policy contexts for the findings of this report are the Spanish and Cantabrian human capital and labour market policies. Since the 1980s one aim of Spanish labour market reforms has been to enhance numerical and temporal workforce flexibility – especially for non-core employees. This has promoted the use of part time and temporary workers and indeed, Cantabria’s share of temporary employees is three times the EU average. Although this has contributed to employment growth above the EU average
it has also led to segmentation within the labour market – especially between younger workers, women and older core employees – not only in terms of wages and conditions of work but also in access to training.

Spanish policies for attracting Foreign Direct Investment (FDI) from the 1970s to the late 1990s focused on manufacturing branch plants in industries such as automobiles, facilitated in turn by the European Union Objective One Status of many Spanish regions. Spain attracted much of this investment, but it has tended to be associated with lower skilled lean and Taylorist work systems which are less linked to innovation. Thus, while what Arundel et al (2006) identify as high skill “discretionary learning” forms of work organisation represent from 47 to 60% of workplaces in Scandinavia, in Spain this is only 20%, and in Cantabria only about 25% of employees work in a “learning environment”.

Cantabria’s R&D+I programme represents an important initial policy for shifting the region’s innovation trajectory and it does involve some training initiatives, especially for higher skilled technical and professional workers. However, the training aspects of the programme should be made broader and more inclusive. Most OECD research reveals that increasing investments in formal R&D alone is insufficient to facilitate innovation, which also involves issues of vocational and education training policy (VET) and how labour is utilised in the workplace and organizational innovation. Indeed a recent study based on an extensive survey on workplace technological change in Denmark showed that firms introducing new technology without investing in training for employees and adopting practices to enhance employee involvement actually experienced declines in productivity (Lundvall, 2004). Innovation is both organizational and technological and as such it cannot rely solely on small cadres of highly trained or educated workers, but must involve those on the shop floor, R&D management and marketing (Tether et al, 2005).

Spain and Cantabria have established VET and university programmes. Cantabria has a higher share of its workforce with university education than Spain and has vocational training programmes in a range of industrial sectors such as automotive and engineering. In 2005 it was estimated that over half of the Cantabrian workforce (54%) had received some kind of employment based training. Yet VET has been relatively weak in Cantabria and Spain generally and in 2005 Spain had a VET participation rate of 41% compared to an EU average of 58%. Evidence from other advanced economies suggests that VET systems which are worst placed to cope with restructuring are those that provide specific vocational courses remote from actual enterprises and where the public education system is the main provider of vocational education (Crouch et al, 1999). This is especially true as rapid technological/occupational/skill changes have occurred and
generated a greater gap between what public systems deliver and what firms require. This could be a potential problem in Spain and Cantabria since most initial training depends on the public education system which especially at the university level is considered disconnected from industry needs, while the vocational system has a relatively low status. The Regional Government’s plan in its 2004-07 Governance document to revamp its vocational system could provide an opportunity to upgrade the VET system. Furthermore, as noted in the above comments on the R&D+I programme it was not clear that innovation and training are as “joined up” as they could be in government policy.

The University of Cantabria has the potential to play a critical role in the formation of a regional learning culture especially in engineering and biomedicine and OECD research shows universities and institutions of higher learning are playing a more significant role in regional knowledge transfer (CREST Expert Group, 2006). The case study suggests that the University of Cantabria is still in the early stages of this transition and is more linked into the national labour market than the regional one. Traditionally, in most advanced economies universities were mainly focused on delivering needed skills for a national labour market dominated by large firms and institutions. They are now increasingly seen as critical in regional economies not only in generating spin-off firms in ICT and biotech industries but also in providing a critical pool of talent and specialist skills for the regional labour market. Importantly and in a break with past higher education practice, soft skill, entrepreneurial and knowledge transfer and licensing training is becoming more significant in the human capital development of even very highly skilled technical graduates and university researchers (see CREST Expert Group, 2006). Despite the adoption of more applied MA programmes, entrepreneurial skills have been less developed at the University of Cantabria and this is a factor in the relatively low level of commercial spin-offs from the institution.

As research from across the OECD and the Governance Plan of Cantabria recognises, both university and wider vocational education and training (VET) policies are critical in the development of a regional learning culture. As the Italian, Ontario and especially the Danish learning models discussed in this report will show, support for especially continuing VET is increasingly more important in labour market policies to facilitate innovation and in particular to shift both nations and regions towards high skill and value added development. In Denmark for example, the presence of an accessible and strong continuing adult and vocational education system minimizes problems of educational exclusion (especially those without university level education) and allows workers to engage in lifelong learning. This is especially critical since on-going training and education
after initial secondary and post-secondary graduation is becoming more important and skills are often increasingly firm-specific. Moreover, as the technical level of most industries increases making higher learning more accessible is also an important policy challenge.

The study visit to Cantabria found that outside of a defined cluster of automotive components firms and emerging bio-medicine and information technology activities the economy was dominated by small and medium sized enterprises (SMEs) with relatively low levels of technological sophistication and skill requirements. As such many industries in the region are in low skill equilibrium. Thus SMEs were unlikely to hire highly technically skilled workers or those with university degrees even given incentives provided by the regional government and the European Union which meant that these firms could not move up the value chain. Moving out of a low skilled equilibrium involves a longer term multi-faceted strategy. Ashton and Green (1996) and the US National Governors Association (NGA) (2004) identify a number of general strategies which can push regions towards a high skill and value added development. These include:

1. The commitment of governments to a high level of skills and the innovative use of the production system
2. The educational system must provide high levels of basic competence in language, sciences, mathematics and information technology as core platform skills.
3. The commitment of groups of leading employers to the goal of high skill formation.
4. The need for seamless connections between the components of the system and the skill demands of the workplace –especially between secondary and postsecondary systems and education and workforce programmes and required workplace skills.
5. The existence of some form of regulation and accountability in the process of skill formation at the workplace to overcome the free market’s inherent short term bias.
6. The offer of some means by which workers and prospective workers become committed to the goal of skill formation –especially given the increasing length and complexity of the learning process.
7. A system in which work-based (on the job) learning can be complemented by off the job training in the knowledge base of the skills. This might replicate certain elements of the German dual system of vocational training in which conceptual and theoretical
off-the job training is combined with on the job experience and training.

Within Spain and Cantabria a critical policy issue is which institution(s) should take the lead in VET policy – especially regionally. Crouch et al (1999) emphasize the critical role of public agencies (including business associations) in supporting such policies. Thus stress is placed on public agencies being able (a) to relate closely to individual firms but (b) to advise firms on the basis of an authority based on constantly updated knowledge so that competences are ratcheted up and educational institutions and relevant government departments can be kept in touch with what is required (c) influence firms further VET efforts as well as their participation in initial training and (d) to link skills creation with other services (e.g. tech transfer, access to capital, assistance in work process change, export marketing etc) that can help firms make a transition to internationally competitive, high skill, high value added strategies.

The learning model of the role of Italian “real services” centres examined later in this chapter illustrates both the challenges and opportunities of agencies involved in assisting firms to upgrade skills. These centres offer a joined up strategy in that they provide training in conjunction with other services, including marketing, design and technology adoption. Funded by regional or local governments they nonetheless operate at an arm’s length. Like Crouch et al argue above they confront tensions in needing to gain the trust of SMEs, but at the same time keep a strategic perspective as they move them from addressing only short term skill needs towards a higher value added platforms. On the whole, these have been successful but the Italian government has recently indicated it is also seeking a more nationally integrated approach than that being offered by the real service centres which inevitably tend to reflect the diversity of their regional economic base.

Cantabria has many elements which contribute to what Richard Florida (2002) terms a positive “people climate” – especially its cultural-historical amenities and an attractive coastal location. Yet there is evidence that relatively few university graduates from the University of Cantabria stay in the region and some technical occupations have difficulties in attracting talent. The development of a regional learning culture in part depends on attraction and retention of talent which is turn linked to the wider people climate. Florida emphasises attraction and retention of what he terms the creative class – scientists, engineers and designers and those in creative arts – and how given locales which combine a trinity of technology, talent and tolerance, experience high levels of innovation and development.
For Florida, people climate is critical for regions to attract and retain talent as a complementary policy to firm investment. Thus regions and especially urban areas should also develop cultural amenities and stress a quality of life attractive to creative talent. Constructed Regional Advantage perspectives argue that there may be significant differences in the substantive regional knowledge base of talent—some may be employed in analytically based industries such as biotech, symbolic based sectors such as advertising or synthetic knowledge firms such as engineering. Such differences will likely influence each group’s aesthetic and life-style choices and thus need to be considered by policy makers when developing regional people climate (European Commission, 2006). Cantabria’s regional strengths tend to be in analytical and synthetic occupations, but problems of attraction and retention of talent are due more to issues of opportunity and pay than people climate per se, which as noted above, is very positive. However, as detailed in the next section, the region may want to raise the profile or augment its cultural/historic and other amenities in ways that facilitate talent attraction and retention.

Challenges and opportunities

**Strengths**

*Well-known university and research centres*

The university is one of the leading universities in Spain, not only in professions such as law, but in biomedicine, engineering and information and computer technology (ICT). Indeed, the university is in relative terms the first in R&D+i in Spain. The region is also above the Spanish average in terms of the share of the workforce which has either university or secondary education qualifications. In 2003 these figures were 21% vs. 19.6% with university education and 43.5% vs. 42.0% with secondary education.

*Performing labour market*

Since 1999 the region has had an overall positive labour market performance creating over 80,000 new jobs as activity and employment rates have risen significantly and unemployment rates have fallen from over 17 to 8.5% by the end of 2005. This growth has also been accompanied by overall income growth and by 2005 Cantabria had an income that was 94% of the EU average and no longer has Objective One assistance status. The
region has one of the lowest labour costs per effective hour in Spain at EUR 12.83 compared to the Spanish average of EUR 13.82. Cantabria also has a positive industrial relations climate – in part the result of a Social Pact signed between unions, firms and the government a decade ago and interviewed representative from the auto cluster association GIRA stated that the good industrial relations climate was attracting FDI to the region. The region has also a good people climate with attractive environmental and cultural amenities and good health care.

*Increase in overall R&D+I spending*

The government has committed to raising overall R&D+I investment and creating the basis of a learning and innovation economy. For instance, the Cantabria Regional R&D+I Plan 2006-2010 commits the regional government to spending an increasing amount on human resources each year and an overall total of EUR 40.3 million during this period. To assist in the upgrading of the technical skill level of firms, the regional development agency, SODERCAN supports the incorporation of technicians and professional into the R&D projects of Cantabrian firms co-financing up to 70% of labour costs and participates in the National Torres Quevedo Funding Scheme and the Spanish Ministry of Science and Education “Ramon y Cajal” Programme which also support the incorporating of PhD researchers and technicians into regional firms. In the private sector the region has at least one notable cluster in the automotive industry which is represented by a recently established association GIRA which has begun to take initiatives in training.

*Weaknesses*

*High levels of temporary jobs and turnover*

Although overall labour market performance has been good, there is a high level of temporary work (almost three times the EU average) and employment rates remain below that of the Spanish average – especially for women. Cantabria has a relatively well educated workforce, but one of the region’s weaknesses lies in its intermediate and vocational skill level and the overall low level of commitment by private sector firms to training and skill development at both managerial and production level. Indeed interviewed GIRA representatives estimated that overall training investment as a proportion of firm financial turnover in Cantabria was likely less than 1% annually (this compares with leading German/Scandinavian firms who allocate between 2-3% of turnover annually).
Lack of entrepreneurial education

Despite some important assets, the connectivities between these are relatively weak. Thus it was remarked upon by many respondents that the university was not well integrated into the regional economy – especially when it came to promoting entrepreneurship or providing the skills required by engineering and other firms. While the university has begun to address the latter issue in particular by developing a series of MA programmes designed, for example, to meet the needs of the region’s automotive cluster, the consensus was the university had some way to go to overcoming this legacy of skill mismatch. It was also noted that most university graduates do not stay in the region – especially in its key programmes around biomedicine, engineering and ICT, thus depriving the local economy of key talent for the development of new knowledge intensive industries.

Lack of an effective technical base and low levels of vocational training

A lack of connectivity also seems apparent in the vocational training system. In Spain generally vocational education and training (VET) has a poor image and participation rates are significantly below the EU average (Arenas, 2005). Despite the presence of vocational training institutions in industries including chemicals, health, furniture, computing, electronics and engineering it was reported that many firms, especially SMEs, lacked an effective technical base, and thus constituted a relatively weak level of demand for not only university graduates, but for intermediate vocational skills. In part this may reflect that outside of the auto parts cluster there is not a critical mass of firms in most other sectors – which may make it more difficult to deliver effective common skill based training in different industries. Some respondents also noted that many local firms were often wary of hiring university graduates (even though the Spanish national government has programmes designed to subsidize such hiring). This perpetuates a low skill equilibrium in which the low level of firm demand for highly-educated graduates is also matched by a labour supply which is not adequately prepared or with adequate skills for the workplace.

Need of more training inside and outside of the workplace

The R&D+I initiative with its emphasis on increasing investment in R&D is very welcome and it recognizes the role of training. The plan to increase the number of researchers in R&D is laudable, but needs to include developing an overall learning culture from shop-floor employees through managers. As noted in the general policy issues and good practices section a
key element in innovation and technology transfer is strongly linked with training inside and outside of the workplace especially in learning intensive economies such as Germany and the Scandinavian nations. As such, training and learning is a continuous process not an event. Also, while during the 1980s and 1990s Spain and Cantabria competed on longer working hours, numerical flexibility and relatively low labour costs, it is not clear that this remains a sustainable strategy. The success of the Scandinavian countries in developing learning based workplaces rests on different set of institutional conditions in which employment and income stability underlie a high wage but learning and skill intensive production orientation.

Opportunities

Further develop the social consensus to increase human resource investment and lifelong training

Based on its assets, Cantabria has a number of capabilities. Thus, the R&D+I initiative may provide a way of developing a strong social consensus not only to increase R&D investment, but to make a more general commitment to increasing human resource investment and training. In addition, the emerging university MA programmes in a range of industrial/economic specializations offer a way of increasing educational investment by firms but also of creating stronger links between the university and local firms. The university is also interested in developing more of a continuing education strategy to encourage a lifelong learning culture in Cantabria.

Tailored training programmes supported by the university and private institutions

The emergence of the local automotive cluster organization GIRA, in 2003 has brought with it several collaborative initiatives on training. Thus in 2005 GIRA and the university developed an MA programme in automotive components for engineers and employees without any previous university education. In 2006 they also began a system of modular courses which can allow employees to focus on specific skill sets. Other opportunities stem from policies by locally-based financial institutions such as the Banco de Santander which links some of its loans and financing to firms to commitments to improve training programmes. This policy of tying financing to developing firm training and overall human resource practices could be generalized to other lending institutions and to regional government and EU firm funding programmes.
Threats

Delocalisation of automotive firms

The principal threat lies in the potential for the increased delocalisation of automotive components firms – the region’s only true cluster, to lower wage regions in Central and Eastern Europe. Representatives of GIRA estimated that the auto components firms “had at most five years” in which to decide on whether to remain in Cantabria or move to these other regions. Indeed, one GIRA respondent stated that his firm was already actively looking at locating a new plant in Romania which joined the EU in 2007. Thus it is critical that the automotive and other industries move up the value chain quickly if they are to remain significant employers in the region.

Low levels of employment of university graduates in the private sector

There is a tendency for university graduates to leave the region upon graduation. Thus whilst the share of university graduates in the region’s employment is above the national average, most of these are likely employed within government and the university and as noted above, not in the private sector where they could provide the human resources needed to establish key new economy industries such as biomedicine and ICT.

Insufficient training programmes outside the automotive sector

Another threat is the lack of recognition or emphasis on the need for training in industry sectors outside of the automotive cluster. Interviewed tourist industry representatives noted problems of recruiting needed employees from the regional labour market. Thus the industry has developed a programme with the regional government to train immigrant workers for the industry, but at the same time admitted that despite this programme and the development of an MA in hotel and catering programme by the regional Spanish Confederation of Enterprises, many firms needed to give more training to both executive and intermediate skill employees.

Recommendations

Based on the above SWOT analysis and identification of the regional connectivities and capabilities a number of policy recommendations can be made:

The R&D+I programme should not only invest in R&D and assist the hiring of technical workers, but also find ways to assist firms adopt best
practices not only in the area of technology but also in terms of work organisation, intra-firm communication and overall human resource management. In this effort the region could link into Objective 2 Funds for Employment available to promote workforce adaptability (SODERCAN, 2006).

The region has intermediate/vocational training available in key industries, but it is apparent that only a small segment of firms in the region use them. The region could follow the Italian real services model discussed in this document for making greater links with SMEs and promoting a learning culture. If possible, this should also follow the real service model by combining technical transfer and advice, managerial skill upgrading to establish a more “joined up” strategy for firm innovation. Although the region should take the initiative in this it is vital that they do this with support from key actors/institutions in the private sector and play a key role in establishing vital skill sets.

The university should expand its applied MA programme but could also integrate entrepreneurship courses within existing undergraduate programmes and develop entrepreneurial skills programmes where possible for those with advanced technical skills and PhDs. The university could also establish a co-operative programme (subsidised if necessary by government) so that university students can spend part of their undergraduate programme working with local firms. This could complement existing programmes in Spain which subsidise the integration of MAs and PhDs in firms – especially SMEs. Interviews indicate that there is an even higher demand for technicians and co-operative programmes might augment this. Because there is a relatively low technical demand from particular sectors in the region the Cantabrian government may want to initially target specific industries which are moving up in technological and human resource sophistication and co-ordinate this with other programmes and especially with employers to encourage wider participation.

The region has an opportunity to continue the on-going upgrading of the Spanish and the Cantabrian VET system – especially as these competencies are (since 1998) the responsibility of regional governments. This should include a significant outreach to high school students (and even earlier) to offset the negative image of VET. The region should also participate with the Instituto Nacional de las Cualificaciones (INCUAL), the central Spanish administration, other regions, firms and trade unions to cover gaps in the current VET qualifications system (for example in ICT use) and to develop a lifelong training culture to ensure that qualifications obtained by different methods are recognised and transferable. Based on the Royal Decree of 2003 Lifelong Vocational Training or Formación Continua is based on three means i) lifelong vocational training developed in enterprises ii) framework
contracts with enterprises for employee training and iii) complementary actions to accompany this training. However, qualifications received by these means are not recognised by any of the others. Thus, there should also be some effort to ensure that where deemed appropriate qualifications might also be transferable between VET and universities which could supplement VET initiatives in continuing education. Finally, the region could also promote lifelong learning by developing on-line internet based programmes which could be linked to the university and other educational institutions to supplement in class education. This could build on the region’s recent and successful outreach in the use of the internet. As noted later in this document the Danish VET system may offer a learning model for Cantabria.

A key issue is which institution should be principally responsible for the governance of VET and especially continuing VET in Cantabria. As noted in the previous section there is a strong case for this to be the responsibility of a public agency, but such an agency will need to balance being close enough to firms to have their trust but also being able to maintain a strategic perspective of the region and not just meet immediate short term needs by firms. SODERCAN may be in a position to take on this role since as the regional development agency it already occupies an important position in the Cantabrian economy and has established relationships with firms and provides an important link between the region and EU. Moreover, since SODERCAN also deals with other issues such as technology transfer it may also be able to offer an integrative strategy towards overall skill and human capital development. It is vital that SODERCAN liaise closely with local firms and develop their associative capacity (it already assists firms wanting to develop networks), both to upgrade training, but also their overall technological modernisation.

As noted earlier the overall people climate in Cantabria is very positive and any talent attraction and retention problems have more to do with lower pay (perceived and real) compared to other regions and thus, a lack of critical mass of firms for skilled graduates to upgrade their technical abilities. However, there may be ways in which Cantabria can integrate people climate strategies with other initiatives such as R&D+I and upgrading overall VET. In its investment guide Cantabria: A Place to Invest the region rightly emphasizes the cultural/historical, health care and gastronomic advantages of the region. However, interviews indicated that while attractive, the region is perceived as relatively closed to those from outside the region – especially if they are non-Spanish. Attracting talent is increasingly international, if not global in scale and if the region wanted to attract non-Spanish speaking talent they might want to combine this with the Comillas Project which is designed to offer specialized training in Spanish language and culture.
Local banks and lending institutions (and government) should be encouraged to link loans to firm investment in training and adoption of overall investment in best human resource practice. The Banco de Santander already does this in some of its loans to regional firms. The adoption of this policy this would pay dividends to both firms and local lending institutions by increasing firm productivity and profitability.

The technological and human resource upgrading of SMEs in Cantabria is likely to be a medium to long term process and in the shorter term it is likely that the most important upgrading of the region will come via attracting FDI. Although the employment potential of such investment will always be a prime goal of government policy, Cantabria should also target inward investors on the basis of a commitment to technological sophistication and human resource best practice and there is some indication from interviews that the government thinking on this issue is evolving in this direction. The region will need to attract such investment as lower wage regions in Europe and elsewhere develop. Here it would be important to link to the positive people climate in Cantabria and the presence of the university as a potential source of needed skills and expertise.

Learning models

Real Service Centres and CITER in Capri, Italy

Background

The Italian national education and training system is a mixed one with public agencies providing basic training for the unemployed and private training providers developing specific skills for private sector firms. The public research system is very fragmented with limited resources and up until the late 1990s not well linked to firms or industry. As a result Italy also has a relatively poor R&D performance (Belussi, 2001). In the initial post-war period Italy had a very segregated education system with an elite classically educated stream and rudimentary mass with some vocational training (Crouch et al, 1999). Reforms first made to this system in the 1960s established a system of comprehensive schools to take children through to the first stage of secondary education without segregation and other reforms made it possible for students to transfer to university from professional and technical schools. Overall, however, the Italian training system was geared to a relatively low level of industrial skills as the north in particular went through a period of rapid growth fuelled in part by labour migration from the more agricultural south.
Until the 1980s there was no significant reform of vocational training when the Italian state committed itself to the production of a highly skilled workforce with particular emphasis on flexible general competencies and learning how to learn. This coincided with creation in 1976 of a new tier of regional government and in 1978 this new level was granted responsibilities for lower level vocational education and training (VET) in conjunction with state schools. Initially these new institutions focused on lower level manual/technical schools but in the 1990s they moved towards a continuing education focus in advanced services and ICT and began to develop apprenticeships. Despite continued overlap with vocational education at state schools regional institutions have developed closer ties to meeting industry needs – especially Italian SMEs.

Despite a relatively weak national innovation and training system, Italy has developed a strong system of network-based vocational training at the regional scale. This network-based form of training delivery emerged from the community basis of Italian industrial districts of family, friendship, church and political relations which allowed SMEs to develop based on trust. Informal systems of training also developed though such networks in part to compensate for the basic nature of formal VET institutions. As regions such as Emilia Romagna, Veneto and Capri emerged in the 1970s and 1980s as some of the most industrially advanced in Italy these often developed in connection with older agricultural industries such as food, clothing, leather goods and shoes in addition to ceramics, machine tools, and precision metal products. Unlike most SME based districts trade unions played a role in developing more collaborative industrial relations and as an overall part of a dense systems of networks. Formal and higher education systems still play a role in skill development in these regions although they typically have a higher dropout rate than in regions dominated by larger industries in the north. Research indicates that this pattern is consistent in industrial districts with the need on the one hand for some level of education, but where formal certification is deemed less necessary to the specifics skills required by SMEs.

By the 1980s Italian industrial districts were faced with growing European and global competition, and national governments, employers and unions committed themselves to creating a more advanced skilled workforce and it was here that the recently created regional governments played a significant role in addressing SME skill needs. Besides offering post-secondary intermediate and advanced level continuing education these institutions have developed close links with business providing apprenticeships and ICT training, with about 70% of training being placed via contracts to the private sector with the remaining 30% being publicly provided. In all cases training standards and certification are monitored by a
bilateral body including employer and union representatives with links to national accords on training standards and certificates.

There have also been a series of new regional agencies, created and funded by the national state and working closely with regional governments. These *agenzie regionali per l’impiego* (regional agencies for employment) have an advisory capacity on training and career advice however they also have become involved organizing training. These agencies often subsidise the training of workers they have recruited for firms and ensure that real skill based training occurs. However, they train relatively few workers and there are concerns that they not only do not provide skills that are needed in the local labour market but are contributing to fragmentation of training provision and monitoring.

Another initiative are laws passed by such regions as Emilia Romagna to develop Business Development Service Centres or “real services centres” which, as will be explored below, combine vocational training and firm guidance services (Pietrobelli & Rabelloti, 2002). These not only focus on extending and deepening technical skills but also, given the SME base of these regions, on management and entrepreneurship skills. The latter is important since few SME business owners in Italy have formal training. In the 1980s the region in conjunction with business and labour organisations also developed an overall plan to further upgrade training in part by accessing European Social Funds to subsidise skill development.

Thus government and private labour market and training networks in Italy have long had a local orientation. National government programmes are still relevant however and there are recent initiatives which link training with technology and innovation programmes. The Italian Network for Innovation and Technology transfer (RIDTT) was launched in 2003 by the Italian Ministry of Productive Activities and managed by its agency the Institute for Industrial Promotion (IPI). This programme provides innovation and technical assistance to national and regional policy makers, universities and research centres, science parks and business and entrepreneurial associations with special emphasis on network formation and assisting industrial districts. Training activities are aimed at improving the skills of innovators and research and technology transfer institutes through the use of modular programmes in terms of assistance for the marketing of innovation, technology transfer and exploitation of research results (such as via protection of intellectual property). The development of this initiative appears to reflect concerns that the principally incremental nature of Italian innovation and the regionalised and fragmented nature of Italian training noted below, are not adequate to support the new technologies and manufacturing processes needed to confront increasing
global competition and thus it emphasises better linking universities with industrial requirements.

Description of the model

Perhaps the most interesting and innovative initiative has been the creation of “real services” (servizi reali) centres. The aims of these centres are to offer a range of support programmes including training and are operated by either local or regional governments but often in co-ordination with consultancy groups. Real services centres provide five main services – design, marketing, technological, business management and training (for managers, technicians, technical engineers and trainers). According to a survey by Pietrobelli and Rabelloti, (2002) technology upgrading and training are the most common services being delivered at 90% of the centres. Technical and managerial training are the most common with 70% of centres offering such services. BDS whose main vocation is the delivery of training have the highest average financial turnover of all service centres (EUR 3.1 million/year), but their average public subsidy is also the highest – constituting 67% of revenues.

Relevance to Cantabria

Like much of northern Italy, Cantabria is dominated by a diverse SME sector which faces barriers in upgrading its technology and skill base. In both cases this challenge is part financial and part cultural/institutional in that many SMEs are often suspicious of government programmes and reluctant to change. The advantage of real service centres is that they are non-bureaucratic and attempt to be both entrepreneurial and cooperative. By the mid-1990s in Italy there were an estimated 130 real service centres covering 56 industrial districts. Their advantage is being able to be closer to local networks than most public agencies but at the same time maintaining a strategic perspective which allows them to overcome the tendencies of private networks to have narrow horizons. The real services centres cover the industrial districts of Italy in depth, but they are much less extensive in the south.

The operations of real service centres have been subject to recent studies by the United Nations Restructuring and Competitiveness Network (Pietrobelli and Rabelloti, 2002) and the United Nations Industrial Development Organization (UNIDO) (Clara, 2006). Real services are aimed at satisfying a demand which is initially only potential, often undisclosed and uncertain which depends on the willingness of SMEs to undertake radical internal restructuring, yet also depends on trust-based relationship to
be established with potential customers. Clara’s report identifies four important features of these centres:

1. A valid platform- this refers not to an overall strategic plan but an opportunity to initiate dialogue within the district and sets its tone by highlighting areas for intervention and the agenda for public-private dialogue.

2. Customisation to SME needs-ample scope must be left to local entrepreneurs to establish trust, relate their needs to the platform and develop collective consensus.

3. The achievement of embedded autonomy-public bodies need to both maintain a strategic orientation while maintaining the trust and dialogue with local entrepreneurs.

4. The ability to enhance the governance potential of the cluster and to develop capacity for local coherence when confronting challenges.

Results of the approach

Real service centres have been established in a de-centralised and un-coordinated manner and thus are subject to high variety of experiences. One example which involves training is CITER (Centro di Infomazione Tessile dell’Emilia Romagna) located in the knitwear district of Capri. CITER is a limited liability consortium whose members are part of ERVET (Emilia Romagna Regional Development Board) and is jointly owned by the regional development board, the local producers association and nearly 500 SMEs. CITER was established in 1980 and has been credited with diversifying the district towards the emergence of the highly profitable prêt à porter market in the late 1980s. CITER itself was in large part the result of a training initiative in the late 1970s based on young and motivated class tutors and the support of the local producer association which attracted over 600 people from more than 300 local firms. By the second year working groups of entrepreneurs broadened the scope of courses and focused them in accordance to their evolving needs. It became evident that a longer term training project was going to be required which led to the creation of CITER on the basis of strong local SME support.

The viability of CITER was put to the test with the collapse of the prêt à porter market in the early 1990s which led to the loss of a fourth of the firms in the region. Leading firms in the region were taken over by external producers who subsequently delocalised design-related phases of production, while remaining firms focused on subcontracting capabilities rather than fashion-related services. Also private consultancies alerted by CITER activities to a potential market also took CITER customers (Clara,
1999). This severely reduced CITER clientele and the agency re-focused their services only on SMEs with an ability to pay rather than an open to all operation. Nonetheless since the mid-1990s CITER has successfully restructured. By 2000 it employed seven professionals, four support staff and nine full time consultants and in addition to training CITER offered such services as design, marketing, technology and production to 280 firms. Client firms are mostly from the district (32%) or region (30%). Moreover while its budget was only EUR 104 000 in 1980 (only 16% from direct sales) it had risen to almost EUR 1.5 million by 1999 (61% from direct sales). As importantly, CITER has acted as a regional hub and has strong linkages with other local actors such as technical schools, universities and research centres and other institutions.

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### Reasons for success

These issues illustrate that to ensure success, the unpredictability of wider economic restructuring means that real service centres need to be continuously re-invented. Even when successful, real service centres inevitably trigger structural changes which can undermine their relevance. By revealing to local entrepreneurs that services which meet more than just immediate needs can be provided it puts pressure on these centres to keep ahead of competitive pressures. In addition by achieving leadership and autonomy, centres run the risk of alienating local producers who are threatened by this development. Thus maintaining a close yet strategic relationship with entrepreneurs requires political skill. The challenges are thus to maintain a close dialogue with local entrepreneurs.

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### Obstacles faced and response taken

Based on studies by Pietrobelli and Rabelloti and Clara a number of conclusions regarding the obstacles confronting and responses made by Italian training institutions and can be drawn:

1. Interventions by regions, provinces and real service centres can still be perceived as external to the business communities they are trying to serve. Thus they may have only institutional and not personal trust.

2. When networks directly involving SMEs develop it is difficult to keep the horizons of such beyond what entrepreneurs see as their most immediate needs, even when more developmental programmes are required.
3. This tendency to focus on immediate needs in training makes moving beyond a low skill equilibrium towards a high skill one difficult.

4. The most successful centres are ones which have a strong personal relationship with local entrepreneurs not with overall representation structures.

5. Due to trust issues some centres have tended not to collaborate and share knowledge.

6. In developing a close link with local SMEs there is a need to balance developing local trust with external monitoring of standards and to maintain a strategic perspective lacking within local networks.

7. While the plethora of training initiatives and institutions in Italy are potentially a disadvantage in creating fragmentation, overlap and redundancy, this may also, given their diverse institutional basis, be an advantage in a region characterised by an equally diverse SME structure. However, the development of the RIDTT seems to indicate that the national government wants a more “joined up” system to promote the more radical technical change and training required to meet increasing global pressures.

Considerations for adoption in Cantabria

Like many Italian industrial districts the Cantabrian economy is principally composed of SMEs who face distinct challenges with raising their overall human resource investment. In adopting the real services model in Cantabria several issues need to be addressed. A key question is the level and continuity of funding. While real service centres receive much of their funding from regional government they also depend on contracts from client firms. This may have the advantage of applying a “market test” for real services, but it can also mean that their revenue may vary considerably, hence undermining their ability to operate strategically while some of the firms in greatest need of assistance may not be able to afford to utilise their services. Evidence from other OECD nations such as the UK Training and Enterprise Councils (TECs) is that their performance suffered due to a reliance on short-term government funding and private sector contracts. Thus, any adoption of real services as public agencies would require them to be both arms’ length from government but well funded. An assessment of their performance could occur by having members of local SMEs included in their governance structures. Real service centre experience suggests that it is important to be a joint government-business response, but that it is vital
that there be strong business “buy-in”, yet one that is guided by a collective strategic vision and not simply for immediate needs.

As in Italy, evidence from Cantabria suggests that under-investment in skills is due to both a relatively low level of technological investment and a lack of strong vocational education and training institutions which require a “joined up” response similar to the real services centre model of Italy. Thus any adoption of the real services model in Cantabria should be linked to technology transfer and other assistance. Furthermore, interviews in Cantabria indicate that enhanced training is required not just for technical or production employees but for managers and entrepreneurs to upgrade their overall skills in such areas as marketing and design and business strategy.

Further information

CITER website: www.citer.it.

The Danish vocational and adult education system

Background

The Danish innovation system is embedded in a strong public education system and highly interactive institutions for training and further education involving government, firms, unions, institutions and individuals. Denmark has few large firms, relatively low R&D and labour force with higher education in science and technology, high taxation and unionisation, and a large public sector, yet it remains a competitive economy with a high income (Christensen et al., 2005). The Danish innovation system relies heavily on a high degree of social cohesion which includes continual training based on developing interactive capacity amongst both firms and employees. This supports a very competitive and export oriented SME sector based mostly (as in the Italian case) on incremental innovation in low to medium technology industries such as food, furniture and clothing (see especially: Maskell & Tornquist, 1999). Indeed in 1993 it was estimated that 90% of Danish firms provided some form of continuing vocational training compared to about 27% in Portugal, Italy, Spain and Greece. The Danish labour market is characterised by a high degree of “flexicurity” in that it combines relatively few regulations governing employer hiring and firing with a high degree of income security for employees.

One strength of the Danish innovation system is the co-operative nature of industrial relations and the role of unions (Neilsen & Lundvall, 2003). Like most Scandinavian nations Denmark is highly unionised (over 75% of
the workforce), yet industrial relations are largely non-adversarial and unions play an important role in firm innovation. In a survey of 2000 Danish firms, Neilsen and Lundvall (2003) found that unions were seen as playing a key role at the early stages of organisational change (the idea phase) of innovation – especially when they participated in management meetings and project groups, but even more importantly at the implementation stage when they participated in the firm’s board meetings. Unions also play an important role in further education and vocational education examined below through collective agreements which aim to improve vocational training at company level and by developing a pool of vocational training funds to support training activities in a specific sector.

Denmark spends a relatively high share of its GDP on education as a whole but only 20% is on higher education compared to an average 35-30% amongst most other OECD nations and over the last decade, per student, university funding has been in decline. However, since the early 1990s there has been an almost three fold increase in those graduating with arts degrees. Although as noted below the interaction between firms and universities has been increasing since the late 1990s, on the whole universities do not play a strong role in innovation. This has been a factor in the low-to medium R&D intensity of Danish firms for as Christensen et al (2005) note, until the late 1970s engineering training was focused on natural science and civil engineering rather than on working closely on technical problems with firms.

Description of the model

A key feature of the Danish labour market is the system for vocational and adult training and indeed Denmark is considered one of the leaders in terms of its commitment to lifelong learning. This is focused especially in publicly funded institutions on the upgrading of general qualifications and during the latter half of the 1990s continuing vocational training was reformed by increasing its funding while shifting towards a greater market or demand orientation (International Labour Office, 2001). In 2005 the public expenditure for adult education in Denmark was DKK 1.9b. However, when expenditures on working expenses, allowances, board, travel and lodging are included total public expenditure was DKK 4.3b. In total, there were 614 000 participants in VET programmes of which 34% were unskilled, 51% were skilled and 12% were in higher education. Technical, commercial, social health and service programmes were taken by 68% and ICT courses were taken by another 14%.

The vocational training system consists of both labour market programmes and vocational training programmes and both types of training
are offered by AMU centres (vocational training centres) and by universities and technical schools to the employed and unemployed. These programmes thus develop nationally recognised competences. Vocational training is a dual system combining periods of schooling and in-firm training. It features both initial VET (IVET), aimed principally at those between 16 and 25, and continuing VET (CVET) which focuses mostly on those 25 years and over. The VET system is divided into two parts – a basic course for general skills and a more focused and specialised main course. Thus in the technical training programme the basic course is typically 20 weeks in duration while the main course averages 3 to 3.5 years.

While administered by the Ministry of Labour the VET system is based on co-operation with labour and business that identify training needs and develop and determine the content of training in over 50 sectors/occupations which are delivered at 24 independent AMU centres. The VET system directly involves social partners in the form of an advisory council, trade committees for sector specific skill sets and local training committees who promote cooperation between colleges and the local labour market.

Relevance to Cantabria

There is a need to upgrade vocational and continuing education programmes in Cantabria and adopting some aspects of the Danish VET system would help address these needs and especially provide greater institutional support for developing a learning society. Adopting some form of dual training system like the Danish might also better prepare participants for both immediate employment and equipping them with ability to engage in lifelong learning.

An important advantage of the Danish VET system is that it allows for qualifications obtained in one part of the system to be recognized and transferred to another—something which as noted earlier the current Spanish and Cantabrian system lacks. It could draw on its existing relationship with social partners to establish skill and training standards via the establishment of advisory councils.

Results of the approach

About 80% of those completing a VET programme find employment in their field within a year of completing their programme. Yet despite the good reputation of vocational training, completion rates are a significant problem and in 2002, 79.1% finished a basic course in commercial training whilst only 56% completed a basic course in technical training. Addressing this issue is considered an important priority (The Danish Ministry of
Education, 2005). This may reflect a similar problem as prevails in Italy where younger workers tend to fulfil only a partial portion of their training programme before getting employment. The dual system may actually reduce completion rates when those in VET programmes spend part of their time with an employer. As in Italy, a new employee showing an ability to learn may in fact be more important to employer than one who has actually completed a programme – however, this may compromise the depth of training. Overall, investments by the public sector have been justified by increasing general skills and reducing free rider behaviour by firms, but there is a new emphasis on co-operative and communication skills which are viewed as more firm specific and there has been a move toward increasing the firm specificity of training (Nyholm et al, 2001).

Reasons for success

The Danish VET can be considered highly successful and has a commitment to continual training and lifelong learning. Thus training is integrated and viewed as an ongoing process not an event. It is a relatively seamless programme in that training and qualifications whether from universities and technical schools are recognized across the system. It is also a dual system of combining education with in work training and is well linked with the labour market needs through advisory councils involving government, business and labour. The public commitment to continual education and learning and training is not inexpensive and the system is mostly funded via taxes significantly higher than the OECD average.

Obstacles faced and response taken

Obstacles in the Danish VET system include less than optimal completion rates and the increasing firm specific aspects of training – especially in so called “soft skill” training such as communications which may lessen the transferability of skills outside of the firm. It was not possible to find specific details of how the Danish VET system is responding to this, but the system also relies on a highly developed not for profit technology consultancy sector (GTS institutes), who are largely financed by the sales of their services as intermediaries between research and firms and also give advice on training and human resource development. It may be that GTS institutes are in a better position to tailor training to firm specific needs. Introduced in 1995, the Danish government co-finances the Authorized Technological Services (GTS) which is an important part of the Danish innovation system, serving as a bridge between public and private actors. There are three main lines of activity at GTS-institutes: independent development of know-how, participation in joint projects together with
public research institutions and private companies, and commercial activities.

**Considerations for the adoption in Cantabria**

The central challenge for Cantabria in adopting the Danish VET model is overcoming a legacy of a low status perception of VET programmes in Spain. The current commitment of the Spanish and Cantabrian governments to upgrade VET can build on consensus of different social partners in the region. However, any reformation of the VET system will need to ensure transferability of qualifications between different elements of the system and is likely to require a commitment by government to ongoing high levels of funding. For example, the Danish VET 2005 budget was EUR 6 700 per trainee. In addition, given the shift towards greater firm specificity in training it is likely the region may need to supplement VET with GTS like institutions which could also be modelled on the Italian real services centres discussed earlier.

**Further information**


**Public research institutes and the Danish Institute of Agricultural Sciences (DIAS) in Jutland-Funen, Denmark**

**Description of the model**

Over the last decade universities and public research institutes have begun to play a more direct role in promoting training and innovation in the Danish economy. This was one goal of the LOK project (Danish acronym for Management, Organization and Competence) which was initiated by the Danish government in 1999 and ended in 2005. Designed to promote the development of flexible innovative work systems by connecting firms to wider knowledge and skills — especially promoting stronger inter-relationships with universities, LOK consisted of ten projects to promote organisational and managerial change in Denmark via increasing interchange between firms, social partners and research/academic institutes (European Commission, 1999).

Building on the LOK project there have been other initiatives especially on the regional level. This has been driven by the Act on Universities and the related Act on Public Sector Research Institutes (2003 and 2004.
respectively), which obliges universities and public research institutes to declare their objectives and make visible the social benefit – especially regionally, of those objectives, in addition to dedicating pooled grants to support these activities (Kerndup, 2006).

In the Jutland-Funen region universities and public research institutes are becoming increasingly significant actors in developing the local skills and knowledge base. For example, the Danish government has utilized the Danish Institute of Agricultural Sciences (DIAS) to promote greater links between universities, its own research centres and the prominent food and agricultural cluster in the region (Tolstrup & Længø, 2005). DIAS is part of the Danish Ministry of Food, Agriculture and Fisheries and carries out research within natural, technical, agricultural and veterinary sciences and development. In 2004 DIAS employed 356 scientists and 573 technical/administrative employees. Its total turnover is approximately DKK 562 million, of which DKK 265 million or 47% were received from the Ministry and DKK 300 million were work grants from various programmes – public and private. DIAS has five regional research centres including three of which are in the Jutland-Funen region. The research centre at Foulum focuses on genetics and biotechnology and has 552 employees – over half of DIAS total employment. The two other research centres are at Bygholm (60 employees) and Aaslev (99 employees).

Relevance to Cantabria

A significant issue which arose in interviews with respondents in Cantabria is how to augment the role of the University of Cantabria and other public research institutes, in developing the regional knowledge base and in the formation of an overall learning economy. In particular, it was suggested that the university needs to develop greater outreach and relevancy to regional firms. With some exceptions the university in particular is seen to be somewhat disconnected from the region and policies to promote such linkages in Denmark may provide insights for Cantabria.

Results of the approach

Increasing university relations with firms has had mixed results. Thus while the LOK project generated research more of academic interest it did have implications for firm training. For example, the knowledge accounting project which included 18 Danish firms did promote greater attention to the importance knowledge and human resources and investment in training (Danish Trade and Industry Development Council, 2005).
Being more applied as a public research institute, DIAS has always played an important role in co-operative and advisory services to the food and agricultural sector and more recently its role has been in both participating in and initiating joint projects and network formation between itself, universities, educational institutes, advisory services and firms. It has a significant role in technology transfer via its Science and Enterprise Network through developing and placing industrial PhDs and post-doctoral students in firms. For example, the Department of Genetics and Biotechnology has a long tradition of industrial PhDs with the cattle industry. Thus while it does not provide its own education through its links with universities, it plays a critical role not only in their education but in linking them with the needs of firms in Jutland. In 2004 it applied for more than 6000 hours in university education and it contributed to the completion of 38 PhDs and 51 Master’s theses. Furthermore, through its Jutland-Funen Business Corporation Scheme it promotes greater links between research scientists and industry. This involves some training provision and the recent Danish government’s Act on Public Sector Research places a greater emphasis on its educational role. Thus DIAS is developing initiatives in internet based education and lifelong learning to enhance the overall skill base of the food and agricultural workforce in the Jutland region. DIAS also holds a “Scientist for a Day” programme with local schools to enhance the profile of research and encourage children and young adults to consider a career in university or public research institute.

Reasons for success

In the case of LOK the more academic orientation of the project may reflect strength of a theoretical research orientation by the university programmes involved and the relatively recent emphasis on developing academic-business links. In contrast, DIAS commitment to extending training and knowledge transfer programmes to the region builds on existing links to the food and agricultural sector. However, DIAS more extensive involvement in developing training and knowledge transfer with firms and institutions is relatively recent and it is not yet possible to assess its regional impact. General awareness in the region of its expanding continuing education role is still relatively low. Finally, within DIAS there is some concern that committing more time and resources to knowledge transfer and training activities could reduce time available for basic research.

Obstacles faced and response taken

As noted above there is a cultural/institutional gap between university and even more applied public research interests and the needs of business.
In the Danish case the emphasis on these links is relatively recent and it indicates that some time and continued government and institutional support might be required before both firms and researchers can achieve a more productive relationship.

Considerations for adoption in Cantabria

Like Denmark, Spain and Cantabria have only more recently begun to stress stronger links between universities and their regional economies. The Danish example indicates that it can take some time before the legacy of a lack of an ongoing relationship can be overcome. One problem in Denmark, Cantabria and elsewhere is that the reward structure in university research departments is not as recognizing of work with private industry as it is with peer reviewed research. This plays a critical role in tenure and promotion in most universities. Cantabria may want to consider a changing reward structures in universities to give greater recognition to private industry research. At the same time one of the critical roles that universities play is basic research so governments need to be careful to preserve this while encouraging ties with industry where appropriate – especially in engineering and biomedicine.

Further information

Danish Institute of Agricultural Sciences website: www.agrsci.org.

Centres of Excellence, Ontario, Canada

Description of the model

Since the mid-1980s there have been concerted efforts by the federal and provincial governments to create a stronger link between university research and industry needs. Thus in 1989 the federal government initiated the National Centres of Excellence (NCE) programme – aimed at developing such research networks. This programme was in part modelled on the Ontario Centres of Excellence (OCE) which were founded in 1987 and consist of five centres:

- Centre for Communications and Information Technology
- Centre for Earth and Environmental Technologies
- Centre for Materials and Manufacturing
- Centre for Photonics
• Centre for Energy (established in 2005)

The goal of the OCE programme is to promote the economic development of Ontario through research, the commercialisation of technology and training for highly qualified personnel. As such the Centres are among the few publicly funded institutions in Ontario that systematically integrate and manage connections from university to marketplace to ensure the successful application of innovative science and technology to profitable new businesses.

The OCE consist of three main programmes. The first is the research programme which focuses on meeting the innovation needs of firms by linking them to the research ongoing in Ontario colleges, universities and research hospitals. The focus is on developing research collaborations that create new academic-industry relationships for example, by conducting feasibility studies and projects involving disruptive technologies that create new markets or start-up firms.

The second programme concentrates on commercialization by addressing the innovation gap between new research and the generation of marketable products through providing market analysis, business plan development pre-seed investment funds and start-up firm support.

The third programme and most relevant to this study is the Talent Programme which is designed to develop new innovators and entrepreneurs. The initiative has five components:

1. Connections - supports research collaboration between final-year undergraduate students and companies. This creates an early opportunity to conduct industry-relevant research and help young researchers develop essential skills that complement their technical expertise.

2. International Scholarships – gives student researchers opportunities to work with leading researchers outside of Canada. The initiative offers up to CAD 15,000 to support a student researcher’s related travel and stay expenses for a period of up to four months.

3. Conference Travel Awards - gives student researchers the opportunity to present their research at conferences relevant to their studies. The initiative provides up to CAD 2,000 in support of travel expenses and conference fees.

4. Value-Added Personnel (VAP) programme which assists student researchers develop key business skills which complement their technical expertise. Training includes modules on Business Development and Entrepreneurship, Strategic and Business
Planning, Management and Teamwork, and Networking and Communication. Courses are delivered in a workshop format by recognized experts from industry and Ontario universities. OCE sponsors a portion of the cost of VAP student participation and pays the participant's transportation and accommodation costs.

5. **Young researchers** with advanced degrees (MA or PhDs) are also assisted in getting their first job and firms are given a grant of 50% of the recruit’s salary of up to CAD 40 000 with start-up companies given up to CAD 50 000. Participating firms need to demonstrate that hiring the researcher will assist them in developing their innovation strategies.

**Relevance to Cantabria**

The Ontario Centres of Excellence (OCE) programme has been in operation for 20 years and thus its example can assist regions such as Cantabria which are attempting to develop stronger links between university researchers and firms. Indeed, in certain ways it resembles the National Torres Quevedo Funding Scheme which supports the incorporation of PhDs and technicians into firms, although it is a broader programme which also supports new firm start-ups by university researchers.

**Results of the approach**

In 2004-05 the OCE worked with 850 Ontario companies and 20 academic institutions and invested more than CAD 16.3 million in academic research and attracted more than an estimated CAD 43 million in private capital investment. In 2005-06 CAD 21 million in government investment drew an additional CAD 78 million from industry and other levels of government which funded over 690 commercially-oriented research projects employing over 3 000 researchers and 20 new leading edge companies.

**Obstacles faced and responses taken**

The total OCE budget is not large and mostly devoted to research commercialization and less to actual training. While the programme encourages university-firm collaboration it is less designed to promote inter-firm R&D initiatives. Although education and training of young researchers is subsidized, the programme may not be financially accessible to many SMEs or be more relevant to larger firms with greater commitments to formal R&D. It was not possible to ascertain from available documents what have been major obstacles and strategies to overcome these.
Considerations for adoption in Cantabria:

The programme reveals that with a long term financial and strategic commitment by government to developing university researcher – industry links it is possible to leverage investment from firms and develop effective avenues of knowledge transfer from universities to private firms by either supporting PhD researchers in such firms or by developing entrepreneurial start-ups by university researchers.

Further information

Ontario Centres of Excellence programme website:

The Ford Centre for Manufacturing Excellence, Windsor, Ontario, Canada

Description of the model

Since their establishment in the 1960s the CAATs or community colleges have evolved from serving principally those who had recently graduated from secondary or high school to centres of continuing or adult education and in many locations important deliverers of training to firms. This is especially true in South Western Ontario where the automotive assembly and components industries are major employers. The case of Windsor’s St Clair Community College is especially instructive. The College currently teaches 20 000 people a year in Health Sciences, Creative Arts, Engineering and Manufacturing Technology and Business. Windsor, located across the Detroit River from Detroit, Michigan, has over 500 automotive firms employing some 50 000 in the region. Faced with a declining pool of highly skilled professionals in engineering and manufacturing technology and related professions in the Windsor area, combined with increasing demand from the region’s large automotive industry, the public sector, industry and St. Clair College partnered to address this serious skills shortage (Yves Landry Foundation, 2005).

The initiative to upgrade training came from an industry task force comprised of leaders from all major manufacturing disciplines worked for two years to shape the Ford Centre for Excellence in Manufacturing (FCEM) including the design of the learning environment to the shop-floor technology. The CAD 41.6 million facility was supported by a grant from the Ontario Ministry of Training, Colleges and Universities SuperBuild Fund of CAD 12.6 million, a CAD 3 million donation from Ford of Canada
Incorporating the best practices from industry, the Centre has been designed to move the students from classroom to industrial setting seamlessly, training them in everything from automotive product design to tool and die making to robotics. Training is offered in one of thirteen disciplines which include automotive design, plastics, engineering technology, industrial automation manufacturing engineering technology and a Bachelor Degree in Industrial Management. The FCEM has also established strong links with local secondary schools where programmes such as Metalcutting Ontario Youth Apprenticeship Programme have been launched which involves high school students receiving the practical aspects of their training at the FCME. The FCME is currently being expanded including the development of a plastics lab for applied research in injection moulding, blow moulding and extrusion applications and there are also plans to develop a robotics lab facility.

Relevance to Cantabria

To improve vocational training especially in the key automotive cluster, the FCME could serve as a model of joint government, education institution and private sector partnership to upgrade technical skills –not only at production level, but in more advanced engineering and management. This especially true as there is a critical need for the Cantabrian automotive and engineering cluster move up the value chain as lower labour cost regions in Eastern Europe begin attracting most of the EU’s labour intensive automotive and engineering investment.

Reasons for success

Thus far, the FCME has been highly successful with a strong reputation for training for both SMEs and large Original Equipment Manufacturers (OEMs) in the Windsor region such as Ford and Daimler-Chrysler. It illustrates the importance of joint private sector-government collaboration to ensure a good supply of needed technical skills.
Obstacles faced and responses taken

One of the most important challenges is keeping technology updated. Despite the impressive commitment of new technology either given to the FCME by local firms or acquired through government funds, the rate of technological change in firms is faster than the programme can match.

Interviews with FCME trainers indicate there are tensions between social learning and more technically oriented skills. While there are significant challenges confronting the FCME in keeping up with technical change there are also issues of the balance between technically based education and developing social/communication skills. One way the FCME deals with this is through its advisory board which is composed of representatives from the college and local firms including SMEs in the important moulding cluster in Windsor area.

There are problems of “underground” training in that formal apprenticeships confer certified and highly transferable skills which employers fear they will lose if an apprentice leaves for another firm. Thus they have tended to develop firm specific training which does not involve the attaining of formal qualifications by the apprentice. This ultimately reduces the potential pool of trainees at the FCME. Thus at the time of the interview – admittedly only shortly after the initial opening of the FCME, there were 600 apprentices being trained – under half of the 1300 capacity.

The cyclical nature of automotive business also is strong influence on the success of the FCME. Although Ontario has made changes to apprenticeship training to better fund and underwrite the costs of training even the largest firms typically cut back on apprenticeship training during downturns thus preventing trainees from completing their programmes. For example, the College with the Federal Government’s Industry Canada and the Ontario Ministry of Skills Development developed an automotive manufacturing skills initiative which adapted some aspects of the German dual system of training. Most of the trainees (more than 30 in total) worked with Daimler-Chrysler, but due to a downturn at the manufacturer the trainees were unable complete their apprenticeship. When Daimler-Chrysler left the programme there was insufficient demand from other firms in the region to sustain the course.

Considerations for adoption in Cantabria

While increasing investment in regional VET programmes will assist upgrading skills the needs of key industries such as autos also require specific, dedicated programmes and training facilities. Thus the regional government and GIRA might want to use the FCME as a model. It is vital
that such a training and skill development initiative have a “champion” in the private sector or the least is willing to commit to work with the public sector. Thus in other regions of the EU such as South Wales, auto components firms such as Bosch (also located in Cantabria) and Nissan in North East England have taken leading roles in trying to improve the local supplier base by investing in skill development via working with local colleges of further education (approximately equivalent with Ontario CAATs) to “cascade” a stronger training culture down the supply chain (Hudson, 2002). The FCME also illustrates the need for such institutions to have constant communication with employers in both large and small firms.

Further information
Ford Centre of Manufacturing Excellence website:
www.stclaircollege.ca/fcem.

University of Waterloo Co-op Programme, Ontario, Canada

Description of the model
The University of Waterloo was founded in 1957 by local industrialists. It is known in particular, for its engineering, computer engineering and mathematics programmes. Central to the university’s development has been the co-operative education programme, which formally integrates academic studies with relevant work experience in which students spend alternate terms in academic courses and work in appropriate fields of business, industry, government, social services and other professions. The University of Waterloo operates the largest post secondary school co-op programme of its kind in the world with more than 11 000 students enrolled over three semesters. It is a model of co-operative education which has spread to more than 100 colleges and universities across Canada. Co-operative Education & Career Services (CECS) administers the co-operative education system and career-related services for the University of Waterloo. Under the co-op programme employers hire students for a term with work terms beginning in January, May or September. CECS staff functions as a liaison between students, employers, alumni, and the different faculties and departments within the University of Waterloo to help to determine and facilitate employment opportunities.

Employers are expected to pay from an administration fee and suggested salaries/wages which depend on the co-op programme in which the student is enrolled. For example, in 2005 average weekly earnings for science students ranged between CAD 485 to CAD 634 and applied health students...
weekly wages ranged between CAD 435 and CAD 635. The university can assist firms in hiring students through a system of contract hiring in which co-op students become temporary employees of the university, but work for the participating firm. The firm thus does not have to pay any social overhead such as payroll taxes and pensions. Eligible firms are also qualified to claim for tax credits from the Canadian federal government as part of the latter’s Scientific Research Education and Development (SRED) tax credit programme.

In order to graduate students must complete a certain number of successful work terms and submit work term reports which are marked by the university faculty. The evaluation and co-op system though is evolving. Thus from 2002 students who successfully a co-op work term received a 0.5 academic credit. The evaluation of the student is undertaken by the employer and students receive a credit for a performance ranked satisfactory or above. Beginning in the autumn of 2007 students enrolled in the co-op programme will be required to successfully complete professional development courses including engineers who are also required a Professional Development Programme for Engineering Students. This development has been spurred by increased concern that while the co-op programme has enhanced student technical skills soft skills are being overlooked. In total students will be required to complete three courses in professional development including critical reflection and report writing and workplace communication.

Relevance to Cantabria

The University of Waterloo Co-op programme offers a potential model for Cantabria to develop better linkages between the University of Cantabria and local firms and institutions in order for students to acquire not only further technical training but actual work experience. Current changes to programme also illustrate the increasing recognition of soft skill development such as communication ability as part of students overall training. A co-op programme would also allow regional firms and institutions to access a pool of talented university students not only for a given work term but as permanent employees after graduation. Some studies suggest that both the co-op programme and subsequent hiring of graduates amount to an effective form of technology transfer from universities to firms and institutions in the Waterloo region and Ontario (Nelles et al, 2005).
Results of the approach

Overall, the University of Waterloo programme has been highly successful. For example in 2002 the programme has been able to maintain a placement rate for co-op of around 96%, although during the severe recession in the early 1980s employment rates were as low as 82 to 83%. Annual attrition rates are estimated to be approximately 5% (600 out of a total 11,000 enrolled in Co-op). In 2004 it was estimated that 75% of co-op graduates were employed by a co-op employer; two years after graduation UW graduate salaries are higher than the Ontario average with humanities graduates earning CAD 9,000 above the average (University of Waterloo, 2004). For employers benefits are derived from accessing a pool of talent with advanced university education which as the figures above suggests leads to the permanent hiring of students after graduation. However, some employers would prefer longer work terms of approximately eight months (compared to the usual four months) in order to provide students with more meaningful projects which would be difficult for university to manage given the size and complexity of the programme.

Reasons for success

The University of Waterloo Co-op programme has been very successful because it was established over a long period and it reflected the important involvement of Waterloo region firms in the development of the university. Although successful the Waterloo programme requires considerable investment in administration (in addition to federal and provincial tax subsidies) to recruit and liaise with firms and to place students and monitor their progress. It also requires a critical mass of participating firms and institutions within the region to maintain the programme. It is also likely that SMEs may need more assistance than larger firms and institutions to effectively participate in the programme.

Obstacles faced and response taken

While a very successful programme there have been concerns over how much skills based training students are receiving. This would seem to be variable across different workplaces and as noted above some employers consider the four month work term to be too short for students to work on meaningful technical projects. There are also few systematic studies carried out about extent of student-firm knowledge transfer and learning. There are concerns over whether the University of Waterloo can maintain high placement rates. Competing institutions have also developed programmes and every term there are a certain percentage of students who are not able
gain work placements who the university effectively has to hire. In its preliminary reports the review of programme which began in 2004 has proposed that the university explore other forms of work-learning integration such as internships, exchanges and part-time employment, to complement what Waterloo already does in co-op programmes and helping graduates find permanent jobs (University of Waterloo, 2005). In addition to the issue of the extent of technical training the programme review has also highlighted the issue of a soft skill development deficit. As noted above this has lead to addition of professional development courses to augment report writing and communication skills.

Considerations for adoption in Cantabria

To some degree the success of the University of Waterloo is unique since it reflects the long term close industry-university relations which go back to the latter’s foundation. To be successful a similar programme by the University of Cantabria would likely require a long term incremental strategy given the smaller base of firms in the region and institutional and technical barriers noted earlier between firms and the university. Also, the potential for Cantabria to capture the benefits of the programme may differ from a large province such as Ontario with nearly 20 times the population. For it to be successful it would need to be part of an overall investment in Cantabria’s technical and human resource development. However, while a certain amount of “leakage” of skilled graduates is inevitable a successful co-op programme would increase the likelihood of graduates staying in the region.

Further information

University of Waterloo Co-operative Education Programme website: www.cecs.uwaterloo.ca.

Notes

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CHAPTER 4
THE BUSINESS SECTOR

by Mário Rui Silva
University of Porto, Portugal

Policy issues

From industrial history to industrial transition

Cantabria has a strong industrial tradition dating back to at least the mid 19th century. The industrial boom that began in that period has put Cantabria at the top of the list of Spanish provinces in terms of per capita income. The mining industry, based on metallic ores, and the production of intermediate goods were at the centre of the industrial growth, induced by the existence of accessible raw materials. In the early 20th century a core of heavy industries was well established in areas such as steel and metallurgy, mechanical constructions and machine production, shipyards and chemicals.

Cantabria’s industry had its greatest expansion during the 1950s and 1960s. With the Spanish domestic market closed to the exterior, the industrial sectors in place pursued their growth and new activities expanded (magnets, petrochemicals, plastics). This was also a period of concentration, leading to a firm universe dominated by a few large companies and multinationals.

The last 25 years have seen a profound change in Cantabria’s industrial sector. The openness of the Spanish economy and the new competitiveness conditions have led to a collapse of the former industrial model.

Within international tradable goods activities, the metalworking industries and chemical plants still form an important part of the industrial
activity. However, metalworking industries are evolving towards new segments and products. In particular, the automotive industries can be classified as an important cluster in the Region. The automotive cluster in Cantabria now includes approximately 130 firms, almost all being small and medium-sized firms of local origin. However, the cluster is structured around a few well known Tier 1 suppliers operating under direct contract with automotive Original Equipment Manufacturers (OEMs). Robert Bosch operates in three centres, producing manufacturing parts such as brakes, alternators and starter motors, the Daimler-Benz group runs the Evobus plant (bus chassis) and Nissan produces motor blocks. The Bravo group, a former local supplier of Robert Bosch, now runs 6 plants in Cantabria (along with one in Toledo and another one in Mexico), manufacturing mechanical components in steel and aluminium and special tools. Outside metal and mechanical products, Bridgestone – Firestone is another important company present in the automotive cluster.

Metalworking industries also have some importance outside the automotive sector. In particular, metal carpenters seem to have expanded in recent years, in association with the boom in construction.

Together with two traditional activities in the region, fishing and agriculture, the food processing industry is also important in today’s Cantabria. The dairy industry is now concentrated within a reduced number of companies, including big multinationals such as Nestlé. Other activities seem to be emerging although they are far from being consolidated (information and communications technology industries could be included in this typology) and correspond to somewhat isolated investments, even if made by foreign firms like Saint Gobain, Alcatel or Teka.

Within the non-tradable sectors, construction and public works along with tourism are important activities which have contributed to the strength of economic growth and the low rates of unemployment observed in recent years, despite the decline of mature industries. Despite its expansion in recent years, the tourism industry still has only a moderate presence in Cantabria. In 2005, Cantabria received over 1.5 million travellers; however the number of foreign travellers (260,110) and number of average nights per traveller (2.9) remain low.

Cantabria has faced the challenge of industrial transition since the beginning of the 1980s, following the decline of mature industries, centred in intermediate commodities. Growth and employment have fared well in recent years and an expansion of activities such as construction or tourism has been observed. The strong policy commitment on R&D+I, however, aims to promote or consolidate emergent activities in a competitive context.
and, in doing so, to assure the economic growth and competitiveness of Cantabria in the future.

**Policy commitments on innovation**

Considering the current trend of R&D activities, Cantabria is far from the “economic and technological frontier”. As in other “follower” European regions, the technological effort is still very low. In 2003, the expenditure on R&D in relation to GDP (GERD/GDP) was only 0.47%, far below the level which characterises the regions at the technological frontier, but also far below the average value for Spain (1.10%). In 2004, GERD/GDP represented the same value of 0.47% and BERD/GERD was around 38%, also far below the average value for Spain.

In the business sector, R&D expenditure is concentrated, as expected, on industries that have a more important weight in the regional industrial structure and, in particular, on those that correspond to more technology-intensive activities. Chemical industries, including plastics and rubber products, have their R&D expenditure concentrated within a few firms. In machinery and mechanical equipment, R&D is also concentrated in a few firms owned by multinationals. Food processing, metallurgy and metallic products, electronics, and electrical equipment are the other sectors with some emphasis on R&D expenditure and where R&D efforts are more dispersed. However, we should keep in mind the very low level of BERD in Cantabria.

In recent years, Cantabria has been developing a set of initiatives concerning the institutional network for innovation support. For example, two research institutes supported by the Government of Cantabria are IFIMAV (biomedical research) and more recently the CDTUC which carries out activities related to technology transfer and promotion of technology-based start-ups. The Component Technology Centre is a technology centre for the automotive components cluster also created through the initiative of regional authorities, which is more directly linked to the business sector. The project of the Scientific and Technological Park of Cantabria (PCTCAN) is also a very important initiative in the institutional network for R&D+I.

On the initiative of the Regional Government, SODERCAN (Sociedad para el Desarrollo Regional de Cantabria) was created in order to deliver technical and economic support to the business sector in areas such as innovation and internationalisation. SODERCAN is the main regional agency for innovation policy, and the regional government has recently created IDICAN in order to manage the R&D+I Plan.
Following the same “impetus” that was present at the Lisbon Summit, Cantabria – like many other European regions – is putting a strong focus on the increase of R&D activities. The R&D+I Plan as well as the institutional network that is being implemented illustrate this strong policy commitment to R&D and innovation.

However, the typical challenge for “follower” regions or countries is not simply to increase R&D expenditure but also, at the same time, to increase the effectiveness of their technological effort. This means that policy should look at:

- The consolidation of public and other non-profit institutions and the promotion of systematic interactions between them;
- The promotion of connections between the above mentioned institutions and the business sector;
- The stimulus towards an increase in R&D activities within firms, leading to an important increase in BERD/GERD and in patent indicators and, above all, to innovation and structural change.

The R&D+I Plan: Issues for the business sector

The R&D+I Plan (Regional Plan for Research, Development and Innovation of Cantabria 2006-2010) is directly linked to one of the 12 axes of the Cantabria Governance Plan. It also corresponds to the Spanish Plan for R&D (“Programa INGENIO 2010”) and with the European Programmes the 7th Framework Programme and the Competitiveness and Innovation Programme. In terms of global indicators concerning the technological effort, the Cantabrian R&D+I Plan presents objectives for 2010 in line with those of the Spanish Plan INGENIO 2010. The main principles include:

- Growth of GERD/GDP from 0.47% (2003) up to 2%.
- Growth of BERD/GDP from 0.18% up to 1%.
- Increase of firms with R&D activities from 100 (2003) up to 400.
- Increase of R&D jobs in firms from 0.7 per 1 000 employees (2003) up to 3.5 per 1 000.

The R&D+I Plan is divided into seven programmes, including a large scope of actions delegated to the different institutional sectors of the innovation system. Table 4.1 shows information concerning the structure of the Plan and the relative significance of the actions more directly oriented towards the business sector.
Table 4.1. The seven programmes of the R&D+I plan and actions for the business sector

<table>
<thead>
<tr>
<th>Programme</th>
<th>Budget 2006-10 (Euros)</th>
<th>Focus / measures for the business sector</th>
</tr>
</thead>
</table>
| P1 Human Resources                     | 12 750 000             | Actions are directed to all the institutional sectors. Business Sector:  
  • Formation programme on R&D+I management  
  • Placing Technology and PhD personnel in firms |
| P2 Equipment and Infrastructures       | 32 300 000 (a)         | Actions are directed to the university and to the Technological Centres |
| P3 Mobilisation and Cooperation        | 2 350 000              | Actions are directed to all the institutional sectors. Business Sector:  
  • Support to the participation in supraregional programmes, projects and networks |
| P4 Scientific Research                 | 14 000 000             | Actions are directed to the university and to the Technological Centres.                                                                                                                                                   |
| P5 Modernisation of the Business Sector| 23 150 000             | Actions are directed to the Business Sector, including:  
  • Support to the creation and to the management of R&D+I units in firms  
  • Support to technological audits and to projects of technological development  
  • Support to the development of new products and to the acquisition of technological equipment  
  • Support to collaboration between firms and the other agents of R&D+I system  
  • Support to patenting  
  • Support to the use of ICT |
| P6 New Technology Based Firms          | 6 700 000              | Actions are directed to the Business Sector, including:  
  • Creation of “platforms” or “banks” of innovative ideas, of innovative entrepreneurs and of business angels  
  • Support to institutional networks that promote programmes for technologic start ups  
  • Creation of a Fund of Seed Capital |
| P7 Diffusion of a Scientific, Technological and Innovative Spirit | 575 000                | Actions are directed to all the institutional sectors.                                                                                                                                                                       |

Note: a) The financial support to the Scientific and Technological Park is not included.

*Source:* R&D+I Plan.

In general, the R&D+I Plan seems to be well balanced, although it is to be noted that the majority of public financial support will go to the network of public or private non-profit institutions (University, Regional Agencies, Scientific and Technological Park).
Programme 5 concentrates on the actions that are more directly oriented towards the business sector (Modernisation of the Business Sector) along with Programme 6 (New Technology Based Firms). These two programmes represent approximately one third of the overall financial resources of the programme. Programme 1 (Human Resources) could also have an important impact on the business sector, through actions concerning the formation of skills in R&D and innovation management and the incentive to place R&D personnel inside firms.

Note that public subsidies to public and non-profit entities can represent a major part of the investment expenditure while subsidies to firms face more restrictions under European rules. Furthermore, instruments to support R&D and innovative actions led by firms will involve not only returnable and non-returnable subsidies but also other kinds of instruments that do not account for public budget, such as risk and seed capital and reciprocal guarantee mechanisms.

The R&D+I Plan also shows a set of priorities within the science and technology field that seems to have been defined considering existing science and technology resources and capabilities and the possible connections between these and the economic activities. The priorities are set out in Table 4.2.

**Table 4.2. Priorities for S&T and connections to economic sectors**

<table>
<thead>
<tr>
<th>Economic Sectors</th>
<th>Health activities</th>
<th>Agro industries</th>
<th>Environment activities</th>
<th>Automotive</th>
<th>ICT</th>
<th>Transport</th>
<th>Energy</th>
<th>Aerospace</th>
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<tr>
<td>Health Sciences</td>
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<td>Biotechnology</td>
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<td>Food Technology</td>
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<td>Water Cycle</td>
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<tr>
<td>Physics</td>
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<tr>
<td>Industrial Design and Materials</td>
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<tr>
<td>ICT</td>
<td>● ● ● ●</td>
<td>● ● ● ●</td>
<td>●</td>
<td>● ● ● ●</td>
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<td>Logistics</td>
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</table>

*Source: Adapted from the R&D+I Plan.*
To sum up, the R&D+I Plan reflects well the regional authorities’ strong commitment to innovation. It is an ambitious plan in terms of objectives, with a large scope of actions, but it denotes an effort to establish priorities, considering both regional capabilities in science and technology and existing or emerging economic activities.

The Plan, however, relies largely on a publicly driven strategy which could fall short in terms of results concerning economic efficiency and competitiveness. It is not clear how the objectives established for the business sector, notably the ambitious aim of increasing BERD/GDP from 0.18% to 1% in the next 5 years, will be attained. The Agro Industries, the Automotive Sector and Transport are the only economic activities that are both internationally tradable and currently relevant in Cantabria to be considered in the connections outlined in the Table 4.2, although Information and Communications Technologies and Aerospace as well as tradable activities linked to the health sector (biotechnology industry, pharmaceuticals) could be considered as emergent or potentially emergent activities.

Finally, for a small region like Cantabria, linkages between science and technology efforts and economic activities should also take into consideration national and international connectivities as key factors in order to have critical mass.

**Challenges and opportunities**

Considering both the context for innovation and the policy actions in place, we now proceed to an in-depth analysis of the strengths, weaknesses, opportunities and threats concerning the business sector in Cantabria.

**Strengths**

**A well-developed automotive cluster**

The automotive sector appears to be the main industrial strength of the region and should be considered a key asset for innovation and for innovation policy within the business sector. As mentioned before, the automotive cluster in Cantabria includes, nowadays, approximately 130 firms and 3,000 workers, accounting for 28% of the industrial gross value-added. It is structured around a few Tier 1 suppliers of foreign origin that operate under direct contract to automotive OEMs. Tier 1 suppliers represent approximately 60% of the 3,000 jobs within the cluster. Tier 2 and Tier 3 suppliers are, in general, SMEs of local origin. The cluster sells
approximately 60% of its production in Spain, mainly through the contracts between Tier 1 suppliers and OEMs with plants in Spain (Zaragoza, Vigo and Valencia). The other 40% is exported in open market conditions.

The regional automotive industry business cluster organisation (GIRA) plays an important role in strategic thinking and in the coordination of actions. As a result of GIRA activity, in 2005 and 2006 there was a clear increase of R&D projects with the participation of firms. Other than the technology field, GIRA aims to promote collective actions in the fields of professional training, quality control, the internationalisation of the industry and the infrastructures related to the automotive cluster. In 2006, on the initiative of GIRA, the University of Cantabria created a Master programme oriented towards the automotive sector.

The Component Technology Centre (CTC) represents another important asset for innovation in the automotive cluster. Its activities range across research and applied development, quality and environment, technological advice and specialised training. The CTC now has approximately 45 engineers and other technical skills and seems to have a good portfolio of projects created by firms’ demands in fields such as mechanical design, process automation, process improvements, casting, artificial vision and applied research in chemicals and materials. The CTC also carries out projects for outside companies (ESA, Mercedes, Siemens, Vodafone).

In conclusion, the automotive cluster is not only the most representative industrial activity in Cantabria but also presents, in comparison with other activities, a greater degree of collective organisation and connectivity between firms and institutions such as the university, the GIRA and the Technological Centre for Components.

Agricultural and fisheries assets

The natural environment of Cantabria is another relevant asset that has generated and can continue to generate competitive strength in some specific sectors. Agro industries (namely the dairy sector) and the fishing industry continue to be important activities in the region. The priority given to scientific areas such as biotechnology, food technology and water cycle technologies could promote an increase in innovation within the food industries and could, at the same time, increase eco-efficiency and environmental sustainability.
Port of Santander

The maritime transport tradition is another of Cantabria’s strengths. The port of Santander has good natural conditions and has always been one of the most important ports on Spain’s north coast. A key player in the port’s activities is the Technological Centre for Logistics (CTL) which works within a national network for logistics (Centro Nacional de Competencia en Logística) together with similar institutions in Zaragoza (ZLC) and Valencia (ITENE), in order to foster competitiveness of the logistics sector at public and private levels.

The Cantabria authorities and the Port of Santander intend to implement a logistics system around the bay of Santander, which will include a certain number of logistical activities and intermodal transport facilities, clustering transport and other services firms in these areas. Consequently, the CTL aims to develop technological services and advice in order to support innovation and technical improvements in the logistics cluster. Research priorities of the CTL are focused on transport systems (both for goods and people) and on multi-agent systems, namely based on software development. Firms such as Air Nostrum (Iberia), Continental, Alsa, Christian Salvasen, Bergé Maritima and Cantabriasil are participating in the on-going activities of CTL, showing a good proximity between CTL and both logistics operators and clients.

Tourism industry

Tourism is another economic activity which already has a relevant presence in Cantabria. However, as stated before, the tourism sector has yet to expand and evolve on a large scale, namely concerning the attraction of foreigners. It is clear that, in this field, the expansion should be based on the excellence of environmental resources (natural environment and physical cultural environment).

Weaknesses

Lack of local R&D in the automotive cluster

One of the weaknesses of the automotive cluster in Cantabria is the fact that it does not include Original Equipment Manufacturer (OEM) plants. Moreover, the Tier 1 suppliers are firms with decision centres outside Cantabria and, thus, conduct their R&D central activities outside Cantabria. This is a weakness because the risk of delocalisation is high and the possible connectivities between the local cluster and the regional R&D activities are
limited. Further to this, local producers are often SMEs and, as would be expected, have a strong difficulty in developing internal research and product development activities. Along with a subcontracting position, this atrophy of technological internal skills contributes to a weak position in terms of competitiveness.

Finally, the automotive cluster in Cantabria still shows some lack of coherence in terms of its supply chain. Industrialists and GIRA are, however, conscious of these limitations and risks and it is clear that action could be taken in order to improve the competitiveness position of the cluster, as will be pointed out later.

*Lack of management and qualified labour in the tourism sector*

The tourism sector presents some weak points which are restricting its evolution. Few firms have an adequate organisational level and there is a gap in management skills. Apparently, there is also a lack of collective entrepreneurship in the tourism sector and this could explain some of the difficulties in exploiting low cost airline routes into Santander for tourism promotion. The airport itself (Parayas - Santander) and the existing airline routes may represent a restriction to the expansion of tourism. Recent agreements with Air Nostrum and Ryanair affect the Cantabria tourism sector in a very positive way. Santander is now connected with several Spanish cities such as Seville, Málaga, Palma de Mallorca, Las Palmas de Gran Canaria, Valencia, and Alicante, although international connections are still limited with flights to London, Rome, Frankfurt and Liverpool.

Tourism is labour intensive and bottlenecks can therefore emerge because of labour market conditions. Due to the strong economic growth observed in recent years, unemployment seems to be low in Cantabria. Tourism expansion must be supported by actions concerning professional training and possibly by attracting outside qualified workers. Finally, tourism in Cantabria is still too strongly concentrated on the summer season, despite the natural sites of the region that could be exploited during winter time.

*Lack of entrepreneurial activity and private participation in R&D*

On a more global issue, a major weakness of the innovation dynamics and the R&D+I Plan is that it is relies on public sector driven innovation rather than on innovation driven by entrepreneurship and is based on a somewhat linear view of the innovation process. As in other “follower” regions, Cantabria’s commitment to R&D+I relies too much on public initiatives and on public institutions. Research activities lead by the
University of Cantabria still have a weak connectivity with the business sector and, in recent years, the university has faced a lack of financial resources due to a diminishing number of students and difficulties in attracting students from outside (with the exception of some Master programmes). The set of research and technological agencies that has been created in recent years as well as the Scientific and Technological Park (PCTCAN) were almost entirely put in place through public initiative.

With regards to technological start-ups and emergent or potentially emergent activities (ICT or industries based on biotechnology), the R&D+I plan appears to assume that a public-driven technology push will generate entrepreneurial activities and an increase in R&D in the business sector. However, this kind of policy can fail to be effective, namely if support to R&D is not accompanied by an adequate set of actions concerning entrepreneurship promotion.

*Weak connectivities between enterprises and research organisations*

With some exceptions (namely the Technological Centre for Components), connectivities between research and technological agencies and the business sector are still very weak. These characteristics of the regional innovation framework can put strong pressure on the R&D+I Plan, reinforcing a bias in favour of financial support to public and non-profit entities.

*Lack of critical mass and international connectivities*

Another source of weakness arises from the fact that Cantabria is a small region. In 2003 there were only 739 jobs in R&D, 35% of which were in firms and in private non-profit entities. Even with an expansion of these numbers, there will be a problem of “critical mass” in developing strong technological capabilities in all of the fields which were elected as priority. In order to overcome this kind of difficulty, connectivity with external agents should be explored. On one hand, the R&D+I Plan could be more ambitious concerning external links within R&D activities. On the other hand, close cooperation between actions within the R&D+I Plan and actions concerning the attraction of FDI should exist. In particular, a stimulus to attract foreign firms’ R&D activities to Cantabria could be a crucial issue.

*Opportunities*

In general, opportunities are well perceived by regional authorities and by the R&D+I Plan. We can characterise opportunities for the business
sector considering i) opportunities based on the up-grade of existing activities, ii) opportunities based on knowledge resources, under a technology-push logic, and iii) opportunities based on specific resources.

**Opportunities based on the up-grade of existing activities in the automotive cluster**

Concerning existing business activities, the automotive cluster presents a set of opportunities that can be concretised under close articulation between existing assets (entrepreneurial resources, GIRA, CTC) and the R&D+I Plan. There are clear opportunities to further develop technology and innovation in the business sector. The ongoing projects on the development of casting technologies for components, using magnesium as raw material, are a good example of these technological opportunities. These projects involving firms, the CTC and the university are a good example of best practices concerning connectivities among local agents. Following the opinion of CTC managers, casting activities still present great potential for new local start-ups.

In the automotive cluster, the technological improvement of local suppliers and the growing capabilities in product development can lead not only to a technological upgrade but also to more local integration capabilities. This will generate a consolidation of the regional cluster, a better organised and more regionally based supply chain and even the emergence of local Tier 1 suppliers.

**Opportunities based on knowledge assets**

Tapping into the opportunities based on knowledge assets, through a technology push, is more uncertain, but these opportunities should be considered because Cantabria needs to develop new activities within internationally tradable sectors. The assets in which these new opportunities are based consist mainly of research capabilities located within the University of Cantabria and in other institutions.

In biology and health sciences, assets rely on research teams in the University of Cantabria (Molecular and Cellular Biology) and in IFIMAV, the biomedicine institute linked to the Hospital. The Hospital itself is qualified by regional authorities as one of Spain’s highly rated hospitals. These research assets could therefore form a base for new business activities in areas such as the biotechnology industry or pharmaceuticals. The university research institute of Physics (IFCA) and of Hydraulics also show potential for new knowledge-based activities in areas such as energy, aero-
space and ICT. Note that in several of these areas the University of Cantabria also offers post-graduate and Masters programmes.

The assessment of these research facilities is detailed in the chapter related to research organisations. However, from the business sector perspective, it is important to stress that there is no evidence of recent start-ups based on the above mentioned research assets.

**Underexploited natural resources and assets**

Cantabria’s innovation strategy should strongly consider opportunities linked to specific assets in which Cantabria has a good endowment. These regional resources can generate specific innovation paths and specific sources of competitiveness. In Cantabria, assets of this kind correspond to what can be globally named as environmental assets. They include natural physical assets such as landscape, coastal and marine environment, and cultural physical assets such as pre-historical sites and good quality human built patrimony, both in rural areas and in Santander.

Other opportunities linked to environmental resources can be found in activities such as blue technologies, aquaculture and fish farming, leisure nautics, wind and marine energy and logistics services. These activities present potential connectivities with some of the main research assets existing in the University of Cantabria (physics, biology, hydraulic), and with some relevant Masters programmes (namely the Master of Science and Technology for the Management of the Coast, with Cornell University, USA, and the Master of Logistics and Transport).

**Strong development potential of the tourism sector**

Linked to these environmental assets and already an important economic activity, the tourism sector still shows great potential for development. A stronger commitment to develop tourism seems to already be in place, as in 2005 there was an increase in public action concerning external promotion. The development of the tourism sector can be accelerated both by a higher degree of coordination between tourism entrepreneurs and Government, and by a more structured set of collective actions. Following a broad concept of innovation, the R&D+I Plan should consider tourism as a recipient for innovation policy actions, namely concerning the improvement of firms’ management skills, the ICT diffusion and quality certification.

More effective collective action is also needed regarding external promotion. As stated in international reports, tourism will remain a fast growing sector. Safe destinations and high-quality environmental
destinations will reinforce their competitive advantages. Cantabria benefits from these characteristics and from the fact that Spain is one of the biggest tourist destinations.

Further development of the marine and logistics sectors

With regard to marine biology, the construction of an Oceanographic centre has been scheduled. In marine energy, an experimental project is under development. The exploitation of wind energy farms is being prepared and some counterparts benefiting local suppliers are foreseen. Logistics services are already an ongoing activity, due to the relevance of the Port, and – as previously said – the creation of the CTL and its articulation with the national network for logistics (Centro Nacional de Competencia en Logística) should help to develop the logistics private sector.

Enhancement and consolidation of the Information and Communications Technologies sector

Finally, opportunities in Information and Communications Technology (ICT) industries and services do exist and are transversal to several fields, following the linkages identified in Table 4.2. In particular, efforts conducted by public administration in logistics, healthcare and e-government should be used as an opportunity to consolidate local ICT activities. An advanced case of e-government is lead by ISIS, the Health Innovation Information Systems Bureau. ISIS is running the project “Historia Clínica Electrónica” that will allow all agents of the health care system to access the clinical information of each user. Other projects concerning telemedicine or digital image radiology are also being considered. Initiatives such as “Emcanta”, the public agency dedicated to the promotion of e-government, and “Cantabria en Red”, the public action devoted to the promotion of the public’s use of the internet, are projects that create a demand for equipment and technological services in ICT. Until now, the main suppliers of the ISIS project have been national and international firms as well as ITACA (Valencia University). However, further links with the University of Cantabria and local suppliers are foreseen.
Threats

Risk of delocalisation of enterprises

Concerning existing economic activities, the automotive sector – despite its relevance and up-grading opportunities – is one of the sectors most exposed to competitive pressures and possible delocalisation. This threat is linked to the global dynamics of the automotive industry, the fact that the cluster in Cantabria does not include OEM plants and that Tier 1 suppliers are firms with decision centres outside Cantabria. Cantabria could therefore face a risk arising from delocalisation decisions. Furthermore, strong competitive pressure with no or little innovation will reduce margins and local added value. Tier 2 and tier 3 suppliers could be already suffering from this constraint. However, GIRA and representative local firms are aware of this problem. Together with product and process innovation, and with an upgrading of integration capabilities, the active internationalisation of better prepared local firms could be a solution to this problem.

Since the 1980s, Cantabria has been experiencing great adjustment in the intermediate commodities sector through the destruction of industrial capacity and jobs. Threats of delocalisation do exist (namely due to environmental constraints) but the negative impacts of possible plant closures will now be much less important than in the past.

University’s low capacity to attract more students and create strong links with industry

Within the business sector, a possible threat could arise via the labour market, in terms of high-qualified and high-skilled technicians. Regional authorities and the university itself rate the University of Cantabria quite highly. However, in recent years the university has experienced a decrease in its number of students. Regarding 2nd and 3rd cycle programmes, the university is far from being attractive outside Cantabria, although there are some exceptions (namely civil engineering). Finally, if connectivities remain weak between research and advanced training and technology intensive activities, Cantabria could seriously risk losing qualified technicians and professionals.

Of course, this is not just a problem specific to Cantabria. Due to a more internationalised labour market for high qualified technicians and professionals, “follower” and less central regions in Europe are already experiencing this kind of threat, while central regions in Europe as well as in the USA are benefiting from their attraction capacity. Measures to embed
qualified technicians and professionals in Cantabria’s firms should therefore be considered.

**Recommendations**

Considering both the challenges for innovation in the business sector and policy actions already in place, in particular the R&D+I Plan, recommendations are presented in the following paragraphs.

*Broaden the conception of innovation policy*

The first set of recommendations has to do with the general conception of innovation policy. The nexus between technological effort and economic development in “follower” regions or countries is a complex matter. The causality between the R&D and technology effort and innovation / structural change is not linear; on the contrary, they have a circular relation. Policies based too much on a technology-push model could therefore fall short in effectiveness.

This means that innovation policy should consider several dimensions: the R&D dimension but also actions addressing internationalisation, FDI attraction, management and entrepreneurship, skills promotion and so on. This also means that innovation policy should target all priority sectors and not only those which are more knowledge based or with a higher R&D intensity.

Although the R&D+I Plan shows a clear bias towards R&D and, potentially, to knowledge based sectors, this will not be a major problem as long as policy practitioners are aware that they could articulate actions supported by the Plan with actions led under other policy instruments. SODERCAN is in fact involved in the R&D+I Plan through IDICAN, as well as being the main regional agency which manages instruments directed towards internationalisation and FDI attraction, management consulting and so on. A clear awareness of the need for articulation between these different policy instruments will be necessary in order to achieve policy effectiveness.

*Build SME perceptions of their competitive position: a pre-condition for innovation*

To seek to innovate or demand technological and other advanced services, firms must be able to perceive their competitive position. In the automotive cluster, in Cantabria, major firms including many Tier 2 local suppliers are conscious of this and GIRA plays a role in collective thinking.
However, in many other small and medium size firms there is a lack of capability to evaluate competitive position. This capability gap seems to also be present in the tourism sector: do firms perceive mountain resources or maritime resources as a source of specific innovation paths?

In general, SMEs should improve their perception of their competitive position. To do this they need to develop and use more management skills, including in international trade and international investment and not just technological skills. The GIRA model (a cluster strategic management agency) could be replicated in other sectors, e.g. tourism. Strategic audits and innovation audits, offered by agencies like SODERCAN, should continue or even be increased. Grants supporting the insertion of qualified managers and technicians in firms could be considered.

*Involve firms in the R&D+I Plan and in public procurement opportunities*

For SMEs in emerging sectors, the existence of a proximate source of demand can be the best support. Efforts being driven by public administration or publicly-owned firms in logistics, healthcare and e-government should be used as a major opportunity to consolidate local strengths in ICT.

With regard to the R&D+I Plan, firms should be seen as key stakeholders. At present, there is a sense that the Plan is strongly mobilising government departments and public agencies but that maybe there is some lack of consultation with the business sector concerning the priorities and instruments of the Plan. As a result, it appears important to involve the business sector more in further development of the strategy, in focus assessment and in future on-going monitoring and evaluation of the R&D+I Plan.

*Build the internal capabilities and external connectivities of firms in R&D and innovation*

Concerning R&D in the business sector, the objectives of the R&D+I Plan are very ambitious. As said before, passing the BERD/GDP from 0.18% up to 1% in the next 5 years seems to be an almost unattainable challenge. However, the R&D+I Plan can contribute crucially towards creating conditions for the sustainable growth of R&D activities in the business sector.

The axis P5 of the Plan, addressing the modernisation of the business sector, represents a significant part of the public financial resources devoted
to the Plan and there is large scope for actions included in this axis to be financed with public co-participation. Note that for actions like the creation and management of R&D units in firms or the collaboration between firms and other agents of the R&D system, financial instruments of risk capital or guarantee funds are not effective. So, public grants or subventions will be the major instrument.

Support for the creation and management of R&D units in firms should be seen as the central instrument in developing internal capabilities on R&D and innovation. Even the creation of small teams (2 or 3 employees) of technology experts in SMEs should be considered. Instruments such as public subsidies to wage the expenses of young researchers and technicians employed by firms have proved to be efficient in other regions. Small teams of R&D personnel would be effective in internal R&D development and would also play a crucial role in creating demand for technological services and hence in creating linkages with technological institutions.

In fact, SODERCAN is already supporting the incorporation of technicians and professionals into Cantabrian companies carrying out R&D projects. Basically, the financial support covers wage costs (up to 70% of the total amount). This instrument was in place during 2006 and should be continued under the National Torres Quevedo Funding Scheme. It also co-finances up to 75% of the wage costs of PhD students and technicians incorporated into firms to develop R&D projects, and this support could last for three years.

The execution and effectiveness of these instruments should be closely monitored by regional authorities, under the execution of the R&D+I Plan, because the reinforcement of firms’ internal R&D and technological skills can be seen as a pre-requisite for the effectiveness of innovation policy as a whole.

Concerning the stimulus to increase connectivities between firms and other institutions, the support for R&D consortia projects with mandatory participation of the business sector is of major importance. Not only this will promote R&D in firms but it will also be helpful in driving R&D activities in other institutions to be more focused on firms’ needs.

Priorities to support the creation of R&D units and teams in firms and to support R&D consortia projects should be defined in the R&D+I Plan. Accordingly, the number of R&D teams created and the number of R&D consortia projects with firms’ participation should be considered as major criteria for on-going evaluations.

Another dimension of BERD/GDP improvement and of the reinforcement of regional connectivities in the R&D system could rely on
the attraction of R&D activities linked to inward investment. Note that, for instance, Siemens has relocated a significant part of its R&D activities to Portugal in recent years. This was due to the local availability of young skilled researchers and technicians and to wage levels being inferior to those in Germany. European “follower” countries or regions could benefit from this new dynamic. This means, for the Cantabria case, that R&D policy and the support for R&D in the business sector should also be aligned with policies concerning the attraction of inward investment (Spanish or FDI).

**Develop a clear methodology for the promotion of technological entrepreneurship**

Technological start ups and university entrepreneurial spin offs should be considered crucial in order to promote new competitive clusters. The challenge of technological entrepreneurship is also crucial for the future of the university and the research system, because new successful clusters will generate a stronger regional demand for high qualified technicians and professionals and for technological services.

Although P6 of the R&D+I Plan will be devoted to the promotion of new technology-based firms, it is not clear what kind of methodology will be adopted for doing so. Successful international experiences show that the effectiveness of policy actions concerning technological entrepreneurship is augmented when several dimensions are considered in an articulated way. These dimensions include technical support, business administration facilities, entrepreneurship education and financial facilities. Under the execution of the R&D+I Plan, a clear methodology for the promotion of technological start ups should be defined, including several dimensions of support and specification of the institutional networks that will implement the actions.

Concerning financial support for start ups, it is very important to create and expand seed capital funds. Risk capital funds and mutual guarantee systems already exist, but these important instruments are more effective in supporting the development of existing firms which show good potential for growth. Seed capital funds, together with other instruments such as business angel arrangements, are specific to financial support for start ups. As pointed out by SODERCAN, projects relating to seed capital funds are under way, gathering public agencies and financial institutions. It is very important to insure that seed capital funds will be managed following a portfolio perspective and also a cluster perspective. Thus, SODERCAN or other public agencies should have a significant position in the seed funds’ management.
Stimulate entrepreneurship and creativeness

Entrepreneurship promotion actions should not be limited to technological start-up programmes. Opportunities in all activities and, in particular, in tourism and other environment based businesses can be better perceived and exploited if entrepreneurial resources are renewed and enlarged. Entrepreneurship education in schools and universities and incentives (not necessarily financial) for the creation of firms should be considered.

In general terms, it is essential to foster a more entrepreneurial culture. Government should seek to encourage cultural change by promoting human and social mobility, creativeness and entrepreneurial behaviour and by attracting entrepreneurial and talented people to the region. Of course, this involves a wide scope of policy actions which surpasses the framework of the R&D+I Plan. Cultural, educational and urban policies should integrate objectives linked to mobility, creativeness and entrepreneurship.

Under the EMPRECAN programme, managed by SODERCAN, a wide set of instruments are available in order to promote entrepreneurship. These instruments include start-up technical facilities (business plan, market studies), financial assistance (namely through instruments such as seed capital and business angels) and other technical support (training, entrepreneurial cooperation, etc.). Instruments included in the EMPRECAN programme are certainly useful (in recent years EMPRECAN has supported around 100 projects per year) but they are made for application within all sectors. Increased effectiveness could be achieved by combining these instruments and sector collective management, appealing to institutional arrangements such as the GIRA example in the automotive sector.

However, as stated in the above set of recommendations, the promotion of hi-tech start-ups needs a more focused methodology, with prior definition of a small number of targeted sectors and the integrated management of different instruments.
Learning models

**NITEC – An incentive system for creating R&D nuclei in the company sector, Portugal**

**Description of the model**

NITEC is a sub-programme of the Portuguese Operational Programme for the Economy (PRIME, 2000-2006) that was launched in 2003, partly because former incentives towards R&D in firms, based on financial support for R&D projects, were experiencing poor demand. NITEC is aimed at enhancing firms’ in-house capabilities, through the provision of financial support for the creation of internal R&D teams. Under NITEC, firms can receive support for the recruitment of a maximum of three technical staff to be fully dedicated to in-house R&D activities. The financial support is a non-refundable incentive with a base rate of 30% of the eligible expenses and the total amount of the granted incentive cannot exceed EUR 200 000. During 2003-2006, NITEC supported the creation of 141 R&D teams, mainly in small and medium sized firms, distributed across a large scope of sectors. NITEC has proved to be an appealing instrument for the business sector.

**Relevance to Cantabria**

Measures of this kind are adequate in “follower” countries or regions like Cantabria and they can be seen as a relevant part of the process to create pre-conditions for a sustainable increase of R&D activities in firms, namely in SMEs. Teams created by NITEC are not just the embryo for the development of an internal R&D department; they can also play a major role in an increasing firms’ capability to explicit a demand for technological services and to build links with the other agents of the scientific and technological system. For Cantabria, measures such as NITEC can be very effective in building firms’ internal R&D capabilities and external connectivities.

**Reasons for success**

One main reason for the success of NITEC relies on the fact that this instrument is based on the idea of supporting the “firm” and not the “project”. In fact, in follower regions, firms (particularly small and medium-sized firms) have little capability to formulate R&D projects because they lack internal resources. On the other hand, technology markets are not well
established and there is a lack of technology brokerage agents. Innovation policies often emphasise the promotion of interactions between agents within the innovation system but the results of these procedures could fall short if firms’ internal capabilities and skills are not in existence. Instruments like NITEC should therefore be seen as a priority and a pre-requisite for successful innovation policy.

Obstacles faced and response taken

There were two main difficulties in implementing NITEC projects. The first one is linked to European rules concerning public aids to R&D in the business sector. Limits to non-reimbursable funds are quite strict and this has led, in the NITEC case, to a limit of EUR 200 000 for financial support to each firm. The second main difficulty was linked to the opportunity cost that a specialised technician (e.g. a Masters or a PhD graduate in engineering) faces when going work in a firm. Because NITEC was implemented in a phase when the public science and technology system was still expanding, firms had experienced some difficulties in attracting these skills. Measures supporting the incorporation of specialised and high-qualified technicians into firms should take into account the educational system’s capacity to ensure adequate training.

Considerations for adoption in Cantabria

Instruments like NITEC are similar to the above mentioned actions lead by SODERCAN and by the National Torres Quevedo Funding Scheme. However, a strong regional focus should exist, taking the sector priorities defined in the R&D+I Plan and the development stage of Cantabria’s innovation system into account. The latter means that this kind of instrument should be managed more as public support to the firm than to a specific project. Selectivity criteria should therefore considerer aspects like the firm’s strategic commitment, the sector to which the firm belongs and clustering effects generated by the firm’s development. The contextual dimension of the selectivity criteria strongly recommends regional management of this kind of instrument. SODERCAN could form a protocol with the National Torres Quevedo Funding Scheme in order to ensure this regional management.

Further information

Information concerning NITEC can be found in governmental sites and in the European Trend Chart on Innovation, EC Enterprise & Industry Directorate General.
IDEIA – Applied Research and Development in Companies, Portugal

Description of the model

IDEIA is a Portuguese programme which was created in January 2003 to replace previous fragmented actions of promotion to R&D consortia. IDEIA is aimed at supporting cooperative R&D projects involving private firms and entities of the National System of Science and Technology. The main objectives of IDEIA are i) commercial valorisation of the results of research made by science and technology entities and the transfer of technologies to companies, ii) development and absorption of technologies and iii) support for participation of Portuguese consortia in international projects.

Under IDEIA, consortia must involve at least one company and one science and technology entity and it is mandatory that the consortium have a private partner as leader. R&D projects can include pre-competitive research, applied industrial research, development or prototype creation and commercialisation of innovation. IDEIA rules distinguish the rate of incentive by type of project. The base rate of incentive for “pre-competitive research” is only 25% but for “industrial research” is 50%, these base rates being augmented for SMEs, for firms located outside Lisbon and the Tagus Valley region and for projects developed in the context of the Community framework programme of R&D. Furthermore, the programme determines the type of incentive based on the level of total incentive. Projects with total incentives under EUR 100 000 have the right to non-repayable incentives (grants) while projects with total incentives above EUR 100 000 also have grants for some expenses (e.g. costs for human resources contracted to develop R&D or technological innovation activities, the subcontracting of NSST entities, the internationalisation of projects, or the protection of industrial and intellectual property) and subsidised loans for other eligible expenses.

Relevance to Cantabria

As previously discussed, in Cantabria there is a lack of interaction between the business sector and the public or quasi-public entities of the innovation system. Moreover, the R&D+I Plan relies largely on a public
driven strategy that could fall short in results concerning economic efficiency and competitiveness. In this context, the IDEIA approach to support R&D consortia with the mandatory participation of firms could be useful to Cantabria as it would produce positive effects over three dimensions: i) it will stimulate R&D in the business sector; ii) it will promote interactions between the business sector and the public sector; iii) it will stimulate and help entities like the university and its research centre to better focus their applied research activities.

Results of the approach

Over its four years of execution, IDEIA has presented several positive indications concerning its effectiveness. According to official data, 95 projects were financed from a total of 398 proposals. Manufacturing sectors and the R&D services sector are very well represented in IDEIA projects and within manufacturing there is a clear prevalence of technology intensive activities such as the chemical and plastic industries or machinery and equipment industries. This is the first indication that IDEIA projects are, to a large extent, targeted towards the technological development of firms in the tradable goods sector.

Another interesting feature of IDEIA projects is the relevance of recently created firms within the set of main promoters. This aspect combined with information about distribution of the projects by sector suggests that IDEIA is potentially favouring the emergence and consolidation of innovative firms in technology intensive sectors and, in doing so, is promoting structural change.

Reasons for success

This assessment of the IDEIA project allows us to consider that the benefits of tools such as public support to R&D consortia can be important in “follower” countries or regions. Firstly, in these countries or regions, R&D capabilities within firms are still weak. Therefore this kind of R&D consortia partnership will have a resource-gathering effect or even, in many cases, will stimulate the increase of internal R&D staff in the business sector. Secondly, R&D consortia will stimulate networking and interactions between different actors. This is important to firms but also to public R&D entities, because networking will help public actors to have more focused research activities. This means that R&D consortia projects will generate benefits that exceed the direct benefits for present partners, not only due to knowledge spillovers but also due to the systemic effects generated by partnerships. Another important feature of IDEIA relies on the fact that it
has been successfully co-managed by the Ministry of Science and Education and by the Ministry of Economics. IDEIA was classified as a good practice by the European Trend Chart on Innovation Report.

**Considerations for adoption in Cantabria**

As for the instruments concerning the incorporation of R&D skills in firms, we strongly recommend that the management of incentives concerning support to R&D consortia in Cantabria should be made on a regional basis and directed under the R&D+I Plan. Industrialists should have a close follow-up of the implementation of this policy instrument. From the same perspective, the regional financial support to the university and to other public R&D entities should be partially indexed with the existence of contracts with the business sector.

**Further information**

Information concerning IDEIA can be found in governmental sites and in the European Trend Chart on Innovation, EC Enterprise & Industry Directorate General:

www.prime.min-economia.pt

For the evaluation of IDEIA presented in the European Trend Chart on Innovation, Country Report 2005 for Portugal, see p. 41 in:


**The Prato industrial district, Italy**

**Description of the model**

Prato is a well known industrial district (cluster) and a good example of articulation between local embedding and external linkages. In Prato, 16kms from Florence, Tuscany, approximately 8 000 textile firms are located. This corresponds to 40 000 jobs and indicates a strong spatial concentration of very small, small and medium-sized firms. The Prato district specialises in wool textiles, including all the operations of the value added chain (spinning, weaving and finishing of tissues, and also knitwear). Prato is well known for its innovative capability which generates a high level of efficiency in production and the capability to be at the forefront of product innovation (high quality wool tissues, special yarns, technical textiles and so on).
The textile cluster in Prato includes two main kinds of firms. Firstly, the “final firms”, of a larger dimension and that constitute the core of the cluster. They organise the supply chain, directing the logistics related with the distribution of raw materials, intermediate products and finished products. These firms have more direct control over the relevant parts of productive function in terms of product innovation (e.g. finishing activities). The “final firms” also have well developed international marketing functions and strong connectivities to Italian and international stylist and fashion agents.

The second kind are the small and very small firms, the majority of which are subcontractors (“terzisti”), often specialised in one single productive operation like spinning or weaving, or even more specific operations. The “Terzisti” enterprises see themselves as the professionals who provide the productive specialised services for the “final firms”.

The Prato system also includes several private technological centres that provide laboratory analysis, tests and certification (UNI, ISO, ASTM, AATCC, JIS, etc.). As well as these technological services, the Prato cluster also incorporates suppliers of specialised services and of collective services in areas such as design, commercial promotion, economic studies and the management of the Prato image. (Union Industriale Pratese and the Pratotrade consortium are two important actors).

Prato, like other Italian industrial districts, is a good example of the collective management of a cluster that could be applied in existing and emerging sectors in Cantabria. It also illustrates how local embedding and the flexibility of SME systems can be combined with innovation and international management capabilities. The experience can therefore help in understanding and stimulating good practices within the strategic management of clusters.

Further information

Among a great number of studies, a list of texts concerning industrial districts can be found in:
www.clubdistretti.it/eng/Newsletter/Bibliography.htm

Information about Italian industrial districts, with links to studies concerning each one of these:
www.distretti.org/cgi-bin/lista-profili-distretti-eng.pl
Notes

1 The growth rate 2005/2004 was 12% for number of travellers and 15% for average number of nights.

2 GERD: Gross Domestic Expenditure on R&D and BERD: Indicates the involvement of industry in R&D.

3 Note that in 2003 there were only 739 jobs in R&D, 35% of which in firms and private non-profit entities.
CHAPTER 5

RESEARCH ORGANISATIONS

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This chapter covers the (potential) role and impact of research organisations within the socio-economic development of Cantabria. Research organisations are described in their broadest sense, and also include organisations (such as the science and technology park PCTCAN) which aim to form a bridge between public research and the private sector.

Policy issues

University of Cantabria

In Cantabria the key institution for research is the University of Cantabria, based mainly in Santander. The university has some 11,500 students and nearly 1,100 professors. Most students (85%) originate from the Cantabria region. Foreign students are mainly from other Spanish speaking countries, particularly South America. It has been reported that some of the institutes are finding it increasingly difficult to recruit students and researchers from outside the region, who tend to go to the larger universities in Madrid and Barcelona. The main Faculties, Institutes and Schools of the university are:

- The Faculty of Sciences
- Faculty of Medicine and the School of Health
- Faculty of Philosophy and Literature
- Faculty of Education
The University of Cantabria is a relatively small university, which does not feature in international university rankings such as the Shanghai University world ranking, the Times Higher Education Top 200 or the European Science and Technology indicators list of top universities. There is no official ranking of Spanish universities (reference from Erawatch) but the Spanish CINDOC, part of the Spanish Research Council, publishes rankings which illustrate the visibility of Spanish universities on the basis of their electronic publications and web presence. The University of Cantabria takes 34th place in this ranking, but this is not based on any impact analysis of the scientific output.

Nevertheless, in relation to the size of the region and its population, the university is quite large. In addition, it ranked as third best ranked university in Spain in terms of securing competitive research funding from the Spanish Scientific Council (CSIC), which selects its projects on the basis of scientific quality.

Like all Spanish universities, the University of Cantabria is now obliged to have a “contract agreement” with the Regional Government of Cantabria. In consultation with the regional government, the university’s strategic plans are developed, including goals and targets. These targets are monitored regularly, based on mutually agreed metrics. The regional government expects the university to play an active role in the region’s economic development. It has encouraged the university to increase the scope of degrees on offer to students. The outlines of this agreement are laid down in the Contrato Programa and are linked to actions in the regional R&D+I Plan and financial support from the regional government. The objectives are to:
i) create an environment and financial framework to allow the university to provide high quality education and research; ii) build excellent R&D facilities and equipment and; iii) encourage student mobility and cultural diversity. However, the performance agreement and the indicators for monitoring its progress seem to focus more on the education and research tasks and less on the “third task” related to valorisation.

Research Institutes of the University of Cantabria

In order to operate within a more flexible regulatory framework, the university has set up a number of Institutes which operate under the formal legal umbrella of the university, but have an independent position in terms of management and strategy development. The advantage of this set up is that the university can focus its attention fully on the research mission. In the peer review, we have seen three of these technology oriented Institutes operating within the university. There are a number of common issues across these institutes:

- PhD students and graduates have to be recruited mainly from outside the region and come from either the rest of Spain or South America. There is a general feeling that, across Spain, the mobility of students and young researchers is reducing and willingness to move to other regions to access the best academic conditions in certain disciplines is not common.

- It is difficult to offer good career prospects to researchers who do not have a teaching obligation in the universities. Many of the students who have completed their PhDs have left the region as there are too few job opportunities. The exception is in the medical area where the presence of the academic hospital offers job opportunities in the medical profession.

- In addition to researchers, the recruitment and hiring of good technicians is problematic.

- So far, the valorisation of research has been done through a small share of research collaborations with companies outside the region of Cantabria, as the region and even Spain as a whole has a limited number of companies with sufficient absorptive capacity in the area of the institutes’ strengths.

- Activities to form spin-offs have been limited so far, although possibilities for the future are expected. Intellectual property support from the University of Cantabria is not sufficient.
The Institute of Physics of Cantabria (IFCA)

The Institute, which has been in existence for 10 years and is partly funded by the Spanish Scientific Council (CSIC), has two departments: Astrophysics and Structure of Matter. There are approximately 50 researchers who work for IFCA. This was considered as one of the bottlenecks; the staff is very stretched as IFCA aims to participate in many projects. Recruitment of new talent in physics is a problem as there are not many students in this field.

The Institute is well connected internationally and participates in projects with the European Space Agency and in the European Framework Programmes. The Institute is the third largest Spanish centre in terms of computer resources. It operates the optical fibre link of Cantabria with Spanish, European (Géant) and international networks. This allows the University of Cantabria to connect to facilities such as CERN and to work on Grid technology and other e-science projects.

So far the Institute has produced two spin-off companies on the basis of imaging technologies (sensors and photon detection) developed in IFCA. Industrial collaborations are mainly formed within projects such as that with the European Space Agency, however in Spain there are not many companies in this business. Thus IFCA is bound to develop connections outside the region and even outside Spain.

The Institute of Hydraulics (INHAM)

The University of Cantabria’s strong tradition and original focus when it was established in 1972 was in civil engineering. It has built up a strong position in this area over the years, particularly in the water and coastal management fields. INHAM is the institute which combines these strengths and works, more specifically, in the oceanographic, coastal engineering and environmental hydraulics areas. The Institute will soon be established; however its growth possibilities are limited as it cannot offer good long term career opportunities to researchers in the given university setting. The institute does not face serious recruiting problems though as engineering is a small field and Cantabria traditionally has many students in this field.

Most of the funding resources for this institute come from the Spanish authorities responsible for water management (Ministry of Environment) and international organisations (EU, NATO). The companies they work with are mostly large engineering consultancies, which are not based in Cantabria. The research groups behind INHAM are active in disseminating their results, particularly the software developed to model coastal developments.
Potential for spin-offs are in setting up engineering consultancies and software development companies that use the expertise of modelling coastal developments.

**Institute of Biology and Cellular Research**

Also to be established soon is the Institute of Biology and Cellular Research (IBSECC), which was announced in the spring of 2006. This institute will perform basic and applied research in the areas of health, molecular biology and pharmaceutical research. It has also set itself the task of carrying out valorisation and dissemination. The research group comes mainly from the UC’s faculty of Medicine.

The recruitment of students and researchers is not a major issue, even though the university only offers medicine but not biology at Masters’ degree level. There is a national quota for the number of students in the medical area at each university. The absence of a biology faculty or research department is problematic towards further development in life sciences, as cutting edge research today is multi-disciplinary.

Collaboration with industry partners will have to be developed outside Cantabria as there are no companies in the pharmaceuticals or biotechnology fields. The aim is to approach companies throughout Spain and internationally. Another route is to support spin-offs.

The Centre does not have formal collaboration arrangements with IFIMAV (see below), who conducts clinical research, as this institute is governed by the Ministry of Health.

**The International Institute of Prehistoric Research**

With a long tradition of prehistoric research, the existence of a number of unique caves in the Cantabria region has given the region a strong international reputation and visibility in this field. The International Institute of Prehistoric Research, established in 2004, collaborates with many national and international research centres in this area. It was founded with the support of the UC, the regional government and the Bank of Santander. Its Scientific Advisory Board has an international composition, with high-level scientists from around the world.

Apart from its scientific merits, the centre and the unique strengths of Cantabria in this area could play an important role in giving the region an international profile. At the moment, the presence of unique prehistoric art in the region’s caves is already used for advertisement in tourism. It also
has an important societal role in linking the citizens of Cantabria with their ancient history.

**Medical research at the Academic Hospital**

Another key organisation relevant to research and technology is the Academic Hospital Marques de Valdecilla in Santander, which has a high reputation in the region. Its research is mainly carried out by the *Marqués de Valdecilla Institute for Training and Research, IFIMAV (Instituto de Formación e Investigación Marqués de Valdecilla).*

**IFIMAV**

IFIMAV is focused on health sciences and is one of the 15 best research hospitals in Spain. It is linked to the national R&D plan and the Royal Decree of 2004 to promote innovation. The goal of IFIMAV is integrate clinical research with basic research in the area of biomedicine.

There are currently 35 research groups and a total of 175 doctors and 65 main researchers in IFIMAV. Their total external budget is EUR 8 million a year and they have a budget of EUR 1.3 million for training and teaching activities. Most of their budget comes from public bodies, but they are receiving greater contributions towards clinical funding from pharmaceutical firms and are also seeking greater EU funding.

In the last five years the institute has produced more than 1,500 publications – most of them in highly ranked and high impact journals.

IFIMAV aims to generate more patentable research. They have an office for the transfer of research results and want to have more spin-offs and local technology transfers, especially in biotechnology and pharmaceuticals. They do try to establish the potential for spin-offs when carrying out clinical trials; however, there is only one local biomedical firm that can be considered to be a spin-off of IFIMAV.

IFIMAV use scholarships and fellowships to attract students from abroad. Like other local research institutes they have significant trouble when recruiting – especially those with a combination of managerial skills and research ability. In biomedicine mobility is high and salaries both in Spain and in the region are generally considered too low to attract and retain higher skilled talented researchers.

There is a close link between the Santander Hospital, IFIMAV and the University of Cantabria, mainly through personal linkages. The doctors at the hospital are often also professors at the Faculty of Medicine or the
School of Health. However, the Hospital is governed under the responsibility of the Ministry of Health and thus functions within different operational structures. Attempts have been made to coordinate research between the university departments and Institutes but this has not yet led to joint activities.

**Bridging organisations**

A dynamic regional innovation system should not only have high quality research performers but also adequate linkages between public research performers and the private sector who can exploit their research results and technological expertise. In addition, scientific researchers and even basic research performers need constant interaction with research taking place in the private sector to keep informed of state-of-the-art developments in (applied) sciences. In some research and technology domains the private, not the public sector, defines the trajectories for future research. For any organisation or region aiming to become a leading knowledge society, these industry-academia linkages need to be strong.

Alongside the academic research institutions there are a number of organisations in Cantabria that have a specific bridging function to bring together scientific and technological expertise in the public and private sector.

The University of Cantabria has OTRI (*Oficina de Transferencia de Resultados de Investigación*) as its main bridging organisation, responsible for technology transfer. OTRI supports its faculties and institutes with intellectual property and legal advice for external contracting. Since 2005 there has been a university wide regulation on intellectual property (30% of property goes to the researcher), however negotiations with companies are mostly done on a case by case situation. Only one person in OTRI deals with intellectual property support.

The OECD review has not been able to assess the activities of this unit and its results in great detail. The impression from the interviews was that the OTRI office mainly provides practical and legal support on contractual issues. The necessary specialised expertise to carry out pro-active business development, to scout within the university for valorisation opportunities, to develop a strategic intellectual property portfolio management and to encourage and coach potential new spin-offs would still need to be developed.

For the university management, having an OTRI type office is not sufficient to perform all valorisation activities and there is a need to develop these activities much further. So far the outputs have been modest:
The University of Cantabria now has a total of 45 patents and, at present, approximately seven per year are added. It is however acknowledged that patenting is not a goal in itself (and maintaining patents is a costly business) and the patenting policy should become more strategic. Licensing so far has been very rare.

Attracting foreign companies to do contract research with the university has proven to be very difficult, although there are a number of successes.

Attempts to organise local training sessions for regional entrepreneurs did not attract much interest.

The university is a member of the Spanish Pymera network, which aims to link SMEs to European projects. However, so far the vast majority of SME European Union contracts are not linked to universities.

The planned Technology Park in Santander (Parque Científico y Tecnológico de Cantabria), which is already partly operational, will potentially provide a place for creating stronger bridges between research organisations and the private sector. The location of a number of companies in the first phases of the park has already been ensured. To be allowed to locate within the park, companies should carry out research and development activities. The formal criteria for selection are:

- Enterprises whose bases are of a scientific and technological nature.
- A certain percentage of turnover is spent on R&D.
- A certain percentage of university graduates in relation to the rest of the staff.
- Suppliers and clients who belong to the sectors considered strategic.
- Commitment to create employment in the strategic sectors within a specific period of time.
- Minimum investment in common projects (with other institutions and enterprises already in the park).
- Non-polluting activities.

In addition, a number of the University of Cantabria Institutes (e.g. IBSECC, INHAM, IFCA) will move their activities and some of their facilities to the park. In total it is expected that 250 members of the university staff will work in the park. The co-location will thus encourage more interaction between the researchers and the business community.
university and the park management are currently analysing the possibilities of creating an incubator type of facility to nurture start-ups from the university.

Sodercan supports the incorporation of technicians and professionals into Cantabrian companies for the purpose of R&D projects, through the National Torres Quevedo Funding Scheme and according to the following rules:

- PhD students / graduates and technicians incorporated into companies between January 1st and December 31st 2006 are costs eligible to be covered. Technicians coming from overseas are accepted. Candidates must not have had previous working or social relations with the host company. Those coming from the 2005 call are accepted. Contracts must last at least one year.

- Applicants should have a minimum of one year’s experience in R&D projects.

- Industrial or service provider companies, located in Cantabria, will be eligible. The technician’s working place must also be located in Cantabria.

- Awarded companies are obliged to apply to national Torres Quevedo call for proposals for the same topic, in order to get a longer funding period (National call funds: three years).

- Co-financing could reach 70% of labour costs.

The National Torres Quevedo Funding Scheme also facilitates the incorporation of technicians and professionals into companies:

- Who - companies, technology centres, industrial associations (SMEs).

- What - incorporation of PhD students / graduates and technicians to develop industrial R&D projects.

- Timeline - three years.

- Requirements - one year of experience in R&D projects, university bachelor degree or equivalent. No previous relations with the host company.

- Supported by EU Social funds.

- Co financing could reach 75%
The R&D+1 National Plan allocates grants to employ PhD researchers and technicians through the Ramón y Cajal and the Juan de la Cierva Programmes. These programmes ensure that researchers who have been evaluated successfully can obtain permanent contracts with their research institutions. The R&D+1 National Plan (Programa I3), launched in 2005, represents an important boost to human resources policies at national level. It aims to: i) strengthen the support policies to incorporate PhD students / graduates into R&D technology parks; ii) promote the number of permanent positions in universities and other R&D centres to facilitate the integration of highly-skilled employees into the Spanish system; and iii) attract Spanish or foreign high-level professors and researchers, as well as young professionals with a strong research potential, who may want to integrate or return to the national science and technology system.

Challenges and opportunities

**Strengths**

The main strength of the research organisations in Cantabria is the expertise built up in certain research fields, in particular:

- Physics and astrophysics, including grid technology and e-science. The critical mass present in this area is however too small to be an important force for economic development or to attract foreign R&D investment.

- Electronic Engineering, Computer Sciences and Technologies, and Communication Engineering, focused on microwaves, radio communication systems, mobile communications, and signals advance treatment.

- Civil engineering, in particular coastal and environmental engineering. This is an area mainly driven by public sector assignments but with future potential for more private sector interest.

- Bio-medical research and clinical research in both the university and the academic hospital. The combination of basic, applied and clinical research and the critical mass of these areas together is a particularly strong feature for the region, in comparison with many other regions aiming to build biotechnology or life sciences “hot-spots”.
• Prehistoric Research of international reputation, with unique features that could be used to build an international profile of the region.

Each of these areas, but particularly bio-medical fields, offer the potential to develop into useful economic activities for Cantabria, provided that the right framework conditions are put in place. However these areas can only be successful if they strive for international excellence, as Cantabria offers too small a basis for expansion. Information technology, although not so prominent and visible as a standalone area of research, appears to be an important enabling technology in several other research fields and economic sectors.

The current developments and plans for the science and technology park provide good opportunities to attract companies with in house R&D activities and to build bridges between the researchers from the university, the Academic Hospital and its institutes. It will allow the region to start building a better profile and market itself using its knowledge assets. This strength will be improved if synergy is created with other regional marketing and business development activities such as the business park developments by SICAN and the overall city marketing of Santander.

The fact that the Cantabria R&D+I plan has foreseen a large role for the research organisations in its Action Plans and programmes is a positive starting point for the utilisation of this source of talent.

**Weaknesses**

The regional R&D+I Plan foresees a large role for the University of Cantabria. A significant increase in public spending on research and technology is foreseen in the coming years. The challenge for Cantabria is to use the public funding on R&D+I as leverage for increased private sector R&D+I funding and eventually economic growth. However there are a number of structural issues that hamper this leverage function:

• The enterprise sector in Cantabria is generally not R&D intensive and those sectors that are most likely to invest in R&D+I (e.g. manufacturing) are not growing. Traditional strengths are in food and agricultural products, transport (automotive components) and logistics. The growth in the economy is mostly in the construction industry.

• There is a mismatch between the specialisations of the research organisations and the regional economy, as the research
specialisations have developed independently from regional development considerations.

- Training at the university is at master’s level, while the smaller companies are more in need of more vocationally qualified staff rather than academically trained graduates.

- The university plays a very limited role in upgrading local companies through training activities or by out placing students to perform innovation tasks in companies.

- The research areas that are the most strongly developed in the university have only modest potential for creating spin-offs (e.g. prehistoric history, astrophysics). Spin-off potential is in sectors, which have high entry barriers (e.g. pharmaceuticals).

An illustration of the mismatch between the university and the regional economy is the situation in the automotive sector. In order to help the upgrading of the automotive sector, training and expertise were necessary investments. The Automotive Cluster GIRA identified this need and set up Components Technology Centre to offer the expertise. Although the University of Cantabria is historically an engineering university, it does not have strengths in mechanical engineering as its focus has been on civil engineering. The expertise for the Components Technology Centre has therefore been recruited outside the region.

Initiatives to overcome the weak linkages between the university and the regional business sector include the launch of a number of new master’s degree courses such as financial management, management in tourism and automotive engineering.

Nevertheless, Cantabria would need long term structural change to really shift the pattern of low R&D expenditures in the private sector and growth coming from industries with relatively low added value. The presence of the university could act as catalyst for new business developments. However, although the university has a technology transfer office, the university’s commercialisation strategy has not been developed systematically across the various areas of potential. This would include supporting activities on contract research for the private sector, awareness creation, scouting commercialisation opportunities, coaching new start-ups and developing a strategic intellectual property policy. Expertise and capabilities have to be built up or recruited to offer this type of support action and to create a sufficient pool of support staff for this kind of bridging activity. This not only requires financial and human resources but above all, high level support from the university management.
There are also some structural problems within the research system:

- Curricula and research activities overall are not sufficiently linked to international partners and developments and the focus is too much on the Spanish speaking community. In order to develop towards excellence and to build a stronger profile, the university should foster more diverse international collaborations and activities. A broader presentation on the Internet in English could be a starting point.

- Career opportunities for research staff are considered to be sub-optimal. In order to reverse the brain drain from Cantabria, better overall labour conditions need to be developed for dedicated research staff.

- Only a few departments participate in European Framework programme projects. Interviews suggest that with the introduction of the new instruments of FP6, entering into consortia with multiple partners has become more difficult and therefore participation dropped in the last few years. The university should explore what can be done to support the departments and institute in their applications for EU projects, for instance by supporting the administrative procedures necessary for application or by providing detailed information.

**Opportunities**

As mentioned above, the combined research activities of the Academic Hospital and the university provide Cantabria with a considerable critical mass in biomedicine and life sciences that not many regions in Europe possess. This potential strength could be better exploited in the future. In order to do so however some actions have to be undertaken:

- Closer collaboration and coordination between biomedical research in the university (particularly IBSECC) and the hospital presents the opportunity to link basic and applied research, with the possibility to do clinical research in the academic hospital. Currently the research and technology transfer activities are formally taking place separately.

- In addition, it was suggested that Cantabria’s research and education presence in biology was not strong enough to develop a multidisciplinary approach to the life sciences – including agro-food applications. Strategic partnerships in this area should be taken under consideration.
• There are currently too few research links with industry, because Cantabria does not have strong pharmaceutical or medical sectors. The possibility to provide the whole knowledge chain, from basic to clinical research, could be attractive to firms from outside the region. This means that active business development activities would have to take place outside Cantabria and even outside Spain. There is no apparent organisation to perform this task at the moment. The organisations responsible for marketing Cantabria do this mainly using very general information on the region and its human potential. It would require specialised knowledge of the sectors and science involved to be able to market this actively abroad.

• The encouragement of potential spin-offs from these research areas has to be tackled in a much more systematic manner and requires specialised expertise and resources. This is a general issue for all research activities in Cantabria, which have been described in the previous section. In addition, in the area of bio-medicine this is even more complicated as spin-offs have to deal with strict regulations surrounding clinical trials, often require a long period of seed and venture capital and rely on good intellectual property portfolio management. Thus, it is important to build good expertise in technology transfer and connect this with international specialist networks.

Overall, the Cantabria research system has some pockets of strength, which could be supported to become more internationally linked and to expand towards a position of international excellence. The Cantabria research system has to identify specific niches in which it can excel and valorise research results. This would require the university and government to be selective and prioritise one or two areas that have the best potential.

**Threats**

The increased role of R&D in Cantabria’s development plans and financial resources is, overall, a positive achievement, putting development towards the knowledge economy more central on the political agenda. Possible threats, stemming from the closer involvement of the regional government in the research strategy of the University of Cantabria, relate to finding the right balance of direction:

• A policy strategy that encourages the university to widen its scope towards more faculties, more masters degrees and more regional students, could mean that current strongholds are neglected or at
best not reinforced. This would dissipate the possibilities to create long-term economic growth on the basis of excellence.

- A policy strategy that is mainly focused on encouraging the university to create links with the local economy would have a similar effect, as the mismatch between research strengths and economic activities has strong structural routes. This does not mean that the university is exempt from working with local industry, but the regional government and politicians should be realistic in examining how this linkage creates added value for both the university and the business community.

- Thirdly, a policy strategy that aims only at providing funding for more and better research will not necessarily lead to automatic commercialisation once a larger pool of research excellence has been built up. These are activities that need to be fostered simultaneously and need financial and human resources as well as high level political support.

Recommendations

The main recommendations to the Cantabria government and particularly for the implementation of the regional R&D+I plan follow logically from the previous sections:

In relation to the research organisations the government should develop a dual track strategy, with each strategy needing separate actions and policies. On the one hand this would include supporting some pockets of scientific strength (potential centres of excellence) already in the university, with opportunities for spin-off development in the longer term. On the other hand it should stimulate a number of interfaces between the university and a limited set of sectors, e.g. automotive, logistics, food, that could benefit from upgrading through training, technological services, development and possibly research activities. However due to the lack of absorptive capacity in a majority of the sectors this should not become the dominant focus of the university’s role in the R&D+I Plan.

The university should engage in a strategic exercise to decide whether the main emphasis lies on its education mission, its technology transfer mission or on its research mission; whether it aims at a regional role or an internationally recognised position. The choice for each of these roles has consequences for the governance model of the university and how priorities are set. Several European universities have undergone similar strategic processes and could be interesting as examples such as the University
Twente, which has similar problems of brain drain but has managed to develop regional networks with local companies, through years of encouragement, for the expansion of its regional technology transfer role.

Co-ordination of the university with regional technology centres and vocational training centres would be necessary to make the overall technology transfer more effective. Vocational training now has a poor reputation in Cantabria, but additional investments in staff and competences could help overcome this. Examples can be found in the German system of vocational training where pupils work within a dual system (partly work in a company, partly go to school). Cantabria has already set up some dedicated technology centres for specific sectors (e.g. automotive). Their mission should not be confused with that of the universities and access should have low entry barriers. Nevertheless, these technology centres should build interfaces with university departments and individual people who could provide expertise for the technology centres. The technology centres could start to map the available competences of those members of staff who have an interest in working with the local private sector. The university could encourage this in their staff performance assessments (not only include academic achievements but also award innovation achievements).

The region should aim to achieve excellence in a few research areas (1-3) where Cantabria already has strengths and where potential for new business development in the long term could have a wider impact. The choice could be made on the basis of well developed research and commercialisation plans produced by the research centres and groups. This choice should be sustained over a long period and not change every 3-5 years. There are different models for making these choices. One model is a top down model where the management of the university makes a choice on the basis of today’s parameters on scientific excellence (e.g. scientific outputs, ability to attract researchers from outside the region, participation in international research networks, attraction of national and international competitive science funding) and possibly potential for creating high technology spin-offs. Given the size of the university and its research centres, this choice could probably be made with a relative consensus. A more elaborate model would be to do this in a more bottom-up manner and invite the stakeholders to justify their position of research excellence though an open bidding procedure. In a bottom-up approach the Cantabria Government, in close collaboration with the university, could invite consortia of researchers representing a specific scientific domain, to write a proposal for their research plans – not for a single project but for the launch of a dedicated “excellence centre” or research group. These plans should subsequently be peer reviewed by external parties. An example of a similar
approach is the Special Research Fund run by the Flemish government. Each university in the region receives a considerable fund for excellent research. Universities such as the KU Leuven decide to allocate these funds to a number of excellent research domains based on peer review assessment and the universities’ own strategic priorities. Other approaches that could be an inspiration for Cantabria are the Competence Centre programmes that several EU countries have adopted (see learning models below). If the university opts for an excellence route, the attraction of professors from outside the region and preferably from outside Spain is a prerequisite. The learning model of visiting professors in Finland (see learning models below) could be used as an example. As a result, some of the graduate programmes would be offered in English instead of Spanish.

As sketched above, a university wide technology transfer strategy and unit should be reinforced. To start it should involve professional technology transfer specialists with experience in both the business and research aspects of valorisation. Experience shows that good commercialisation officers know how to speak the language of both the research and the business community. These people are however difficult to recruit and would need a substantial investment from the university. The Cantabria government could support this investment, making clear agreements on goals and targets. However, experience in other countries shows that this needs to be tackled professionally and if so it would take quite some time to see a return on investment.

In order to learn from existing experiences the university should link its technology transfer organisation with other technology transfer offices or international networks that exchange best-practice (such as www.astp.com). A stronger collaboration with the Cantabria science and technology park would be important, particularly for creating an incubator facility where young researchers or researchers with an ambition to commercialise research results could be located in their initial stage. The technology transfer office will not, however, be accepted within the academic community if it is set up as a separate entity with mainly “outsiders”. Experience also shows that these types of activity need strong support from the highest level in the university to succeed. Some examples of universities that have set up extensive technology transfer offices with proven success in the exploitation of research are the KU Leuven (www.kuleuven.be/lrd/about/mission.html); Isis Innovation (www.isis-innovation.com) at Oxford University; and Chalmers University (www.chalmers.se/en/sections/collaboration). The life sciences and medical technology areas require specific skills, as commercialisation has to deal with additional procedures such as “proof of principle” and applying to international medical authorisation processes. Here, examples could be the
commercialisation activities of the Flanders Interuniversity Institute for Biotechnology (www.vib.de) or the European Molecular Biology Laboratory (EMBL) www.db.embl.de/jss/EmblGroupsHD/g_163.html).

Learning models

**Kplus competence centres programme, Austria**

*Description of the model*

“Competence centres” or “centres of excellence” are a comparatively new form of university-industry research alliance for both fairly fundamental but also more applied, problem-oriented research. Their aim is to foster more long term public-private linkages in research. Their long-term nature and the comparatively high rates of subsidy involved allow them to have a structuring effect on i) sub-systems of innovation; ii) educating and generating communities of research practice between research-performing institutions and industry and; iii) generating common, use-oriented research agendas with the potential to have significant, positive socio-economic effects.

Around the world there are quite a number of these programmes in operation as shown in Table 5.1.

<table>
<thead>
<tr>
<th>Country</th>
<th>Start Date</th>
<th>Agency</th>
<th>Competence Centre Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>1985</td>
<td>National Science Foundation</td>
<td>Engineering Research Centres</td>
</tr>
<tr>
<td>Ireland</td>
<td>1988</td>
<td>EOLAS/Forfás</td>
<td>Programmes in Advanced Technology</td>
</tr>
<tr>
<td>Canada</td>
<td>1989</td>
<td>NSERC, CHIR, SSHRC</td>
<td>Networks of Centres of Excellence</td>
</tr>
<tr>
<td>Australia</td>
<td>1990</td>
<td>Ministry of Industry</td>
<td>Co-operative Research Centres</td>
</tr>
<tr>
<td>Sweden</td>
<td>1994</td>
<td>NUTEK/STEM/VINNOVA</td>
<td>Competence Centres</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1997</td>
<td>Ministries OCW and EZ</td>
<td>Top Technological Institutes</td>
</tr>
<tr>
<td>Austria</td>
<td>1999</td>
<td>BMVT/TIG</td>
<td>Kplus</td>
</tr>
<tr>
<td>Austria</td>
<td>1999</td>
<td>BMW/FFF</td>
<td>Knet, Knet</td>
</tr>
<tr>
<td>Hungary</td>
<td>2000</td>
<td>Ministry of Education</td>
<td>KKK Co-operative Research Centres</td>
</tr>
<tr>
<td>Estonia</td>
<td>2004</td>
<td>Ministry of Industry</td>
<td>Competence Centres</td>
</tr>
</tbody>
</table>

*Source:* Erik Arnold et al, An international review of competence Centres, Technopolis, 2004

Competence centres have some recognisably special features relating to their role, especially:
They are normally funded by three partners: industry, university and a state agency. They are intended to have an effect on university resource allocation and strategy, in addition to reinforcing university-industry links.

They involve long term contractual arrangements, requiring a much bigger commitment than traditional project by project funding of collaborative R&D.

They create new on-campus structures, and therefore make new organisational and structural demands on the universities.

They are interdisciplinary and generally problem-focused in the research they do, demanding “horizontal” networking across traditional university structures.

Their long-term presence on campus and their engagement with postgraduate education draws them into closer contact and co-operation with the universities’ “core business” of education and research than is often the case with linkage actions, which tend to focus more purely on research.

By drawing industry personnel onto campus to join in research, they also extend academics’ networks into the industrial research community.

The practical example that will be elaborated in this chapter is the example of the Austrian Kplus programme.

The Kplus programme was created in reaction to a gap in the Austrian National Innovation System, namely bridging the gap between science and industry. The centres perform long-term pre-competitive research. The projects are defined jointly with industry. The aim of Kplus is to bring together excellent researchers and companies who are active in the specific research field. The programme is regarded as one of the key measures of the Austrian innovation and technology policy.

The Kplus programme has established 18 joint-research centres ("centres of competence") which consist of university institutes, non-university research organisations and enterprises in Austria. The centres are expected to exist for at least seven years. The financial contribution of the public sector will account for up to 60% of the budget. One important feature of the programme is the multi-enterprise approach; a second feature of Kplus is its orientation towards science-industry co-operation. Co-operation/networking is mandatory (e.g. through cluster programmes) to receive funding.
Relevance to Cantabria

This approach is particularly relevant for those parts of the University of Cantabria that are already relatively strong and have started building an international reputation. It would help them to:

- Actively identify and engage with industrial partners outside the region.
- Allow the research organisations to formulate medium to long term research plans.
- Give research staff a longer term career perspective.
- Enter into European research projects for which they are now considered too small or for which the administrative burden to enter is too high.
- In the longer term it could encourage more R&D investments in Cantabria from medium to large sized companies outside the region.

Results of the approach

Several of these European programmes have been evaluated, but the Austrian Kplus programme only mid-term. Although results are only to be expected in the medium term, results of these types of programmes elsewhere have been:

- Academia and industry gaining a better understanding of each other’s cultures, expertise and demands.
- The improvement of the critical mass and industrial relevance of the research performed at universities.
- A longer term approach to academia-industry collaboration.
- Industry gaining a better understanding of longer term technological developments and adapting business strategies accordingly.
- Better mobility of the researchers involved.

Reasons for success

Reasons for the success of the approach are:
• Long term commitment from all three parties: research, industry and government.

• A good programming process and procedure that generates research which is strategic enough to maintain the interest of scientists and not too long term and “blue sky” to frustrate the business partners.

• Willingness to cooperate and share research agendas between the collaborating companies.

• Sufficient absorptive capacity, on the part of business partners, to formulate challenging research needs.

The obstacles faced and response taken

There are potential obstacles to this approach:

• Finding and committing interested industrial partners to support collaborative research projects. In the case of the Dutch TTI programme, for example, the response taken for some of these centres was to attract foreign companies into the consortia. At the same time this could lead to objections from existing (local) partners who do not wish to collaborate with their competitors. Another response could be to find partners from different positions in the value chain who do not directly compete.

• University researchers not interested, committed or geared to work on more industry oriented research. A response could be to build in additional incentives for research work done under the umbrella of the competence centre. These could be financial incentives or opportunities to perform research in the research premises of the partner companies.

• The expertise needed for a specific thematic area is not present in one university department. Many of the competence centre programmes are set up as virtual institutes, combining the expertise of a multiple of disciplines and research groups. As an example, the Dutch centre of excellence for food research combines research groups, from different universities, on food technology, agriculture and medicine to develop programmes on functional foods.

Considerations for adoption of this model in Cantabria

If this model were to be adopted in Cantabria it should:

• Limit itself to 1 or 2 of these centres.
• Allow plenty of time and effort to develop a business plan and involve industrial partners as these have to be identified from outside Cantabria.

• Ask the university as well as the industrial partners to co-fund a certain percentage of the initiative (e.g. 25% each).

• Operate on a more thoroughly developed intellectual property regime within the University of Cantabria.

• Have a high level panel of scientific and industrial experts to assess the quality of the business plan before it is awarded.

In Cantabria it would be necessary to create partnerships with companies outside the region since regional private sector research is not yet developed enough to find sufficient partners who can articulate medium to long term R&D needs to the university.

Further information.

The programme is managed by the Österreichische Forschungsförderungsgesellschaft mbH (FFG):

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T +43 (0)5 7755 – 2101
otto.starzer@ffg.at
www.ffg.at/content.php?cid=62

Innovation Vouchers, Netherlands

Description of the model

To tackle the reluctance of SMEs to get into contact with research centres and other “knowledge providers” the Netherlands has introduced a scheme called Innovation Vouchers.

The main objective of the (Pilot) Innovation Vouchers scheme is to enable small and medium-sized companies (SMEs) to buy knowledge from knowledge institutes (e.g. universities, technology centres) with innovation vouchers and thus, to stimulate interaction and exchange between the knowledge suppliers and SMEs. With an innovation voucher, SMEs can buy knowledge from (semi-) public knowledge institutes, from large companies with R&D expenditure that exceeds EUR 60 million per annum, and from foreign public knowledge institutes. The knowledge supplier can hand in the voucher to the innovation agency SenterNovem and receive payment. In 2006, 6 000 vouchers will be available for SMEs. For the first time since the
initial pilot in 2004, two types of vouchers will be available: small vouchers of EUR 2 500 to stimulate SMEs to make a first step towards knowledge institutes; and larger vouchers of EUR 7 500 to enable SMEs to go to knowledge suppliers with a more substantial request. For the latter, one-third (i.e. EUR 2 500) has to be contributed by the applicant himself. The vouchers will be made available at the same time. The budget for the innovation vouchers scheme (EUR 22.5 million for 2006) comes from the Dutch Economic Structure Enhancing Fund (FES).

Firms are eligible if:

- The SME is based in the Netherlands and is not under suspension of payment.
- The firm is an SME as defined by the EU.
- The firm is not active in the agriculture, fishery or aquaculture products sectors.
- The firm is not active in the transportation sector.
- The firm has not received earlier subsidies (EUR 92 500 or more) without approval of the EC in the three years preceding the application.
- The firm did not receive an innovation voucher in the earlier rounds of the scheme.

Relevance to Cantabria

Cantabria has a double sided problem. On the one hand, regional companies do not make the step towards approaching research organisations or technology centres for support on technical or technological matters. On the other hand the research organisations find it difficult to develop services for these companies as they have little experience in mapping the demand. In a number of countries, schemes have been set up to provide companies with vouchers of a certain value, which can be used to buy R&D or technological services from universities. This could be extended to specific training services. It gives firms an incentive to inform themselves about the potential suppliers and what they could offer.

Results of the approach

The scheme is a pilot. The first round in 2004 proved to be a success as all available innovation vouchers were sold out within a few days. In 2005, the second round of the pilot scheme was, like the first round, sold out
within a few days, which shows the popularity of the innovation vouchers. From the first round, 92% of the vouchers were used. 83% had not used a specific innovation scheme before. 40% of the applicants were new to SenterNovem, the innovation agency. In other words, the Innovation vouchers appear to have reached a new target group. The value added was estimated to be 80%, which means that 8 out of 10 R&D jobs would not have been carried out without a voucher. Longer-term effects cannot be measured yet. From interviews with applicants it appeared that the administrative burden was perceived as low.

**Reasons for success**

The principle reason is that the scheme has a very low threshold for firms, with hardly any administrative burden. The use of the voucher was very flexible and it was the firm’s choice where and when to use the voucher. It helped address the cultural gap between SME managers and researchers and engineers in public organisations. Once this first step was taken, it proved easier for firms to set the next steps and approach the person/organisation again.

**Obstacles faced and response taken**

There were not many large obstacles with the launch of the scheme apart from the fact that there was much more interest from companies than available vouchers when the scheme was launched. The government solved this by making the programme permanent and raising the annual budget for the scheme.

**Considerations for adoption of this model in Cantabria**

If such a scheme were to be applied in Cantabria, it would most likely need some adaptations:

- An intermediary such as SODERCAN might be necessary to promote and diffuse these vouchers.

- The type of technology supplier might need to be expanded to sector technology centres such as CTC and CTL or vocational training centres.

- It would need good promotion, to inform companies of the action and to give them the initial leads on where they could go for support.
• An extra bonus, for the knowledge suppliers who manage to attract a high number of requests from companies, could be awarded to give the research and technology centres incentives to invest more in this type of service provision.

• A decision should be made beforehand as to whether it would be possible for firms to use these vouchers for research and technology centres outside Cantabria.

Further information

Contact details on this scheme can be found at:

www.senternovem.nl/innovatievouchers

The Distinguished Professors Programme, Finland

Description of the model

The learning model is a Finnish scheme, which provides incentives for foreign professors to work in Finnish universities. Despite being at the forefront of R&D in Europe, Finland has a similar problem to Cantabria. Due to its geographical location and the language barrier, few foreign researchers go to work in this country. The scheme, adapted to the situation and possibilities of Cantabria, could be a trigger to invite guest professors or researchers to take up a position at the University of Cantabria.

The Finland Distinguished Professor Programme (FiDiPro) is a funding programme which was jointly launched by the Academy of Finland and Tekes, the National Technology Agency of Finland, to recruit foreign professor-level researchers to Finland for a fixed period of time. Finnish top researchers who permanently work abroad are also eligible.

The goal of the funding programme is to raise the level of scientific and technological knowledge in Finland, add a more international element to the Finnish research system, generate added value in the national innovation system and support research-driven profiling of universities and research institutes. The programme is also aimed at creating a new kind of international cooperation between basic and applied research and the R&D efforts of business companies.

Within the framework of the funding programme, Finnish universities and research institutes can hire foreign researchers, or professor-level Finnish researchers who permanently work abroad, to conduct research together with Finnish researchers and research groups for 2 to 5 years. The
Researchers should be internationally highly merited and have strong experience of researcher training.

Applications for funding from the Academy of Finland and Tekes may be made by Finnish universities and research institutes who submit proposals on researchers to be selected.

The programme aims to establish long-term international research cooperation. Funding is especially targeted towards researchers in the key disciplines that universities and research institutes find strategically important. These disciplines strengthen internationally competitive research and innovation activities. Funding may be applied for either from the Academy of Finland and/or Tekes. The application process is a two-phase procedure. In the first phase, the application is based on the applying university’s or research institute’s strategies and key areas of competence. This short proposal may already include the name of a foreign or foreign-based Finnish researcher, who is expected to strengthen the research environment in this field. The applicants selected for the second phase are asked to submit a full application and the level of expertise and competence of the proposed candidate is evaluated.

The recipient of funding (university or research institute) is responsible for recruitment, appointment and the terms of employment. The selected researcher will actively take part in the work of the research group or groups to which he/she has been appointed. The selected researcher may give a limited amount of scientific instruction, but should, above all, transfer special knowledge into Finnish research environments. The grants cover labour costs and also the cost of settling the family in Finland.

Relevance to Cantabria

One of Cantabria’s problems is that it has become more and more difficult to attract talent from outside the region and particularly from abroad. Even though national programmes exist for visiting professors, this is not specifically used in Cantabria. In addition, the University of Cantabria needs more incentives to work on an international level and provide more courses in English to attract non-Spanish speaking foreign students and PhDs. Through the networks of the foreign visiting professors, stronger networks with other universities can be created enabling the university to enter into cross-border EU collaborations more easily.
Results of the approach

The FiDiPro Programme has only recently been launched. The first call for proposals closed at the end of January 2006 and therefore evidence considering the success of the programme is scant at the moment. Finnish universities and research institutes named, within the first call, close to a hundred foreign or expatriate Finnish researchers whose visit to Finland they propose to Tekes and the Academy of Finland to be funded within the programme. In the first call for proposals, universities and research institutes defined their strength areas and proposed a foreign researcher or a foreign-based Finnish researcher, who is expected to strengthen and advance the research environment in the field in question. Tekes received applications from ten universities or research institutes, including 27 proposals on a total of 29 researchers to be invited to Finland. The Academy received applications from 20 universities or research institutes, including 69 proposals on funding for 65 researchers. Tekes decided to select ten project proposals comprising twelve researchers for the second stage. The Academy selected 23 proposals comprising 23 researchers.

Considerations for the adoption of this model in Cantabria

If adapted to the situation in Cantabria, the choice of scientific areas in which these professors can be recruited could be aligned with the strategic priorities for creating “centres of excellence” and improving the critical mass and international reputation of that research area. The programme should be well promoted in relevant European research networks and journals.

Further information

www.fidipro.fi
Notes

1 The European S&T Indicators Report lists the top 19 Spanish universities and the CSIC in terms of scientific output but the University of Cantabria does not feature on this list. The Institute of Physics of Cantabria is however part of it.


CHAPTER 6

REGIONAL ENVIRONMENT FOR INNOVATION AND ENTREPRENEURSHIP

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Policy issues

Problems and challenges in making Cantabria a knowledge economy

Cantabria is one of Spain’s smallest regions with less than 600,000 inhabitants. The main city is Santander with around 200,000 inhabitants. Until the 1970s Cantabria was – together with the neighbouring Basque Country – one of the leading industrial regions in Spain with an industrial structure dominated by heavy industries (chemicals) and primary sector activities in livestock and cattle breeding dominated by family run small farms, which were very unproductive before Spain entered the European Union (EU). During the 1970s these sectors stagnated and were exposed to increased international competition, which led to a slow down of economic growth and growing unemployment. As a consequence Cantabria received the status of an Objective One region in the EU between 1986 and 1994.

Twenty years membership in the EU has brought economic growth, employment growth and the beginnings of change in the industrial structure for the Cantabrian economy as for Spain in general. However, most of these positive developments were due to economic support from the Structural Funds particularly for infrastructure investments and the general modernisation of the Spanish economy as a consequence of EU
membership. Closer economic integration with Europe resulted in increased export opportunities and a large expansion of Spain as a tourist location. These general changes have also had an impact on the structural composition of the Cantabrian economy and the with the service sector as the dominating sector with 67% of gross value added in 2003, while industry accounted for 19%, agriculture 3.3%, and building and construction 10.5%.

However, these sectoral and structural changes have not been associated with any fundamental restructuring of the economy in the direction of becoming a knowledge economy. Cantabria has one of the lowest levels of R&D expenditures among Spanish regions with less than 0.5% in 2003, compared to a Spanish average of 1.1% and Madrid with the highest of 1.8%. Both the Basque Country and Catalonia had in comparison around 1.4%. The EU average is 2%. Looking specifically at the presence of knowledge intensive activities, only 8% of employment and output is found in high-tech manufacturing and there are no Knowledge Intensive Business Services. This also reflects the size structure of the Cantabrian industry which is heavily dominated by (very) small firms with 98% of the workforce employed in SMEs. According to the Chambers of Commerce of Cantabria only 20-25 firms could be said to belong to technology-based sectors compared to a total membership of the Chambers of Commerce of around 30 000 firms. Thus, the economy of Cantabria is very distant from being a knowledge economy, and its economic and industrial structure, dominated by low-tech SMEs in industry and services is not the best point of departure for an upgrading process. The private share of the regional expenditure in R&D was less than 0.2% in 2003, which demonstrates that there is little culture of innovation among firms in the region. Adding to this is a lack of entrepreneurial culture in the region with only 140 new start ups in the period 2000-2004 creating 350 jobs. Finally, Cantabria cannot yet be said to have a regional innovation system, as there is a disconnection between the strong regional university in Cantabria and the industry in the region.

The new and very ambitious regional R&D+I Plan must be seen against this background. It is today widely recognised among researchers as well as politicians and practitioners that competitiveness in the global economy must be built on constantly innovating firms. Michael Porter as one example strongly emphasised in his 1990 book “The Competitive Advantage of Nations” (Porter, 1990) that the only sustainable strategy for (especially) high cost countries and regions was what UNIDO calls the “high road strategy”, i.e. competing on the basis of continuous innovation, and not the “low road strategy” based on a cost (i.e. most often wage) squeeze strategy. As the global economy is becoming increasingly knowledge intensive, both
knowledge generation and knowledge exploitation become pivotal in order to create an innovative and competitive knowledge economy.

Even if it is important to recognise that knowledge intensity is far more than research and development, R&D is still an important part and indicator of the knowledge intensity of an economy. The increasing knowledge intensity in the economy also implies that the relative importance of codified vs. tacit knowledge is changing in the direction of explicit knowledge, and that this moreover leads to an increased importance of formal education as well as to more areas of studies being upgraded to be part of the portfolio of higher educational institutions (e.g. universities and technical schools). In recognition of this, the European Union in its Barcelona declaration of 2003 announced a goal for its member states to strive to achieve a 3% allocation of GNP to R&D in 2010. The EU has also started to adapt this goal to the regional level, and DG Research published a study on how to achieve this on the regional level by “Constructing Regional Advantage” (CRA) in May 2006 (Asheim et al., 2006). The theory of constructed advantage allows for more attention to the role and impact of the public sector and policy support, preferably in public-private partnerships, by acknowledging to a greater extent the importance of institutional and economic complementarities in knowledge economies than theories of comparative and competitive advantage do. Institutional specificities constitute the context within which different organisational forms with different mechanisms for learning, knowledge accumulation and knowledge appropriation evolve. Instead of market failure, the rationale for policy intervention is the reduction of interaction or connectivity deficits which lies at the core of a networked regional innovation systems approach.

**Strategies for creating regional knowledge economies – “carriers” of innovation policies**

In August 2006 the State Science and Technology Institute (SSTI) prepared a report called “A Resource Guide for Technology-based Economic Development” for the Economic Development Administration, US Department of Commerce. In the report elements generally acknowledged to be required for a knowledge economy are listed:

- A knowledge infrastructure, i.e. universities and public or private research institutes that generates new knowledge and discoveries
- Technology transfer agencies and mechanism.
- Physical infrastructure that includes high quality Information and Communications Technology systems and affordable high speed internet connections.
• A highly skilled workforce in both technical and commercial occupations.

• Sources of risk capital.

• An entrepreneurial culture.

• Quality of life.

These elements are more or less the same as those the aforementioned DG Research report on CRA lists as “carriers” of policies for CRA promoting regional knowledge economies:

• Regional innovation systems understood as creative knowledge environments.

• Territorial competence bases underpinned by:
  – Regional knowledge infrastructure, i.e. regional universities as drivers of the regional knowledge economy.
  – Soft knowledge infrastructure, where the provision of innovation supportive social capital creates synergy interacting with upgraded human capital.
  – Attractive people climate as well as business climate.

• SME and entrepreneurship policies, where:
  – Promoting people climate can be part of fostering entrepreneurial climate in the region.
  – Investing in physical infrastructure (e.g. technological parks).
  – Programmes supporting the formation of local seed and venture capital resource.

This way of thinking is very much in line with the ideas behind the Cantabrian R&D+I Plan. In the presentation of the plan, called “Cantabria’s challenge for the future”, it is stated that “times are driving us into a Globalised Era where Education, Research, Development and Innovation are the roots of the new society: The Knowledge Society. Therefore there is only one path to be a competitive region: To put research and innovation at the heart of regional policies”. In the plan the university, the university hospital as well as the research institutes network and the technology centres are referred to as strong bases to develop the R&D+I Plan, which indeed is very ambitious as the main objective of the region is to reach the overall Spanish objective for 2010 of using 2% of GDP for R&D investment, growing from less than 0.5% invested in 2004 within Cantabria.
To achieve this aim, the regional government has “strongly decided to position regional R&D policies as a main priority”, which is manifested in budgetary effort for R&D+I for 2006, with an increase of 500%, and, moreover, promoting an annual growth of 30% for the following years. In total the plan’s budget will be more than EUR 300 million. The plan contains all government initiatives aiming at upgrading Cantabria to become a knowledge economy “in order to reach the most advanced regions within Europe”. This plan represents an excellent illustration of the understanding of the need for competitive advantage to be consciously and pro-actively constructed for European regions to be able to cope with the challenges they are facing in the globalising economy. It points to a new and more dynamic role for the public sector (including universities) generally and government and governance specifically in interaction with the private sector. It is precisely this that is outlined in the plan, which, thus, is in correspondence with the new approach to regional innovation policy presented in the DG Research report on CRA.

In addition to focusing on education, research and innovation, and on knowledge and technology as the new bases of competitiveness and the driving force for the development of regional knowledge economies, the plan also emphasises that “innovation, new ideas and development come from people”, and, thus, “the region must become a magnet for young talent which contribute to forming a creative society”. Therefore, the plan underlines the Floridian relationships between “Technology, Talent and Tolerance” (Florida, 2002). Finally, motivating and training entrepreneurs to foster an entrepreneurial culture is also among the many elements that are outlined in the plan.

**Strategies for creating regional knowledge economies – content of innovation policies**

In the report on Constructing Regional Advantage for DG Research a distinction was made between the “carriers” of policies for constructing regional advantage, i.e. the actors, agencies, organisations and institutions that are required to implement and realise the policy, and the content of such policies, focusing on substantial elements of a knowledge economy. The overall argument was to promote a proactive and platform oriented policy transcending traditional sector policies (see Box 6.1 for an example of a platform policy).

The new perspectives of such a platform oriented policy were:

- Related variety creating knowledge spillovers combining the strengths of the specialisation of localisation economies (spillovers
within industries) and the diversity of urbanisation economies (spillovers among industries).

- **Differentiated knowledge bases** (analytical, synthetic and symbolic) instead of a simplistic high-tech vs. low-tech perspective.

- **Distributed knowledge networks** in contrast to the traditional perspective of knowledge internal to the company.

First, the traditional dichotomy between specialised localisation economies and diversified urbanisation economies ought to be further developed by introducing a distinction between related variety (accounting for spillover effects) and unrelated variety (covering the portfolio effect). Related variety in many ways combines the strength of the specialisation of localisation economies and the diversity of urbanisation economies. Since Jane Jacobs (1969) diversity in urban or regional economies is regarded as one of the driving forces of economic growth. It stimulates new ideas and creativity, it gives access to complementary resources that might be essential for innovation processes, and it reduces the risk for a sector specific shock harming the whole of local economies.

Related variety is defined as sectors that are related in terms of shared or complementary knowledge bases and competences. Unrelated variety is defined as a diversity of sectors in a region that do not complement each other. As such, it is expected to protect a region from an external shock (e.g. fall in demand in one particular sector). This risk-spreading effect (or portfolio effect) of regional diversity dampens regional unemployment. Furthermore, related variety is expected to have a positive effect on regional development, because knowledge is likely to spill over between complementary sectors. That is, their co-location may provide an extra source of knowledge spillovers and innovation, and thus, cause additional economic growth.

When constructing regional advantage a policy framework that is based on a related variety approach may be highly relevant. Firstly, studies have demonstrated that it is actually one of the driving forces behind urban and regional growth. Secondly, the risk of selecting wrong activities is reduced when the region-specific context is taken as a point of departure. This would mean that regional competences are used as building blocks for the purpose of broadening the economic base of a region. Thirdly, such policies acknowledge the fact that generic technologies (like Information and Communications Technologies and biotech) may have a huge and pervasive impact on economic development, due to the many potential fields of application, giving birth to many new sectors and creating new related variety also among the carrier industries (Asheim et al., 2006).
Box 6.1. A platform strategy

An example of platforms strategies being implemented can be found in Japan’s “New industry promotion strategy” which is part of the national basic plan for Science and Technology. The strategy is part of Japan’s attempts to correct the flaws in its industrial model in terms of a strong focus on perfection, on refining and mass-producing other people’s inventions, and on a teamwork approach to steady incremental innovations in manufacturing processes, leading to a neglect of product breakthroughs. It was just these qualities that powered the industry’s ascent, but also led to its decline. The new strategy aims to realise a competitive and sustainable industrial structure for the next 20-30 years by:

- Revitalising strong manufacturing industries.
- Developing the service industries that meet the emerging needs of society.
- Forming industrial clusters to end regional economic stagnation.

In the evolution of cross-sectional priority policies (or a platform based policy) the focus has been on innovative science and technology (Life science, Information Technology, environmental science, nanotech/materials) as well as on human resources, intellectual property management etc.

In the updated version of the new industry promotion strategy from June 2005, specific attention is paid to policies for advanced components/materials industries. The figure below describes the content of this policy, and also provides an excellent illustration of what could be understood with platform policies:

**Strengthening policies for advanced component/materials industries**

- Extensive accumulation of advanced components/materials industries is the origin of strength of new cutting-edge industries.
- In FY2005, METI is preparing a new programme “Support Programme for Advanced Components/Materials Industry and Small and Medium-Sized Manufacturing Enterprises”.
Secondly, differentiating between industrial knowledge bases represents another dimension of constructing regional advantage (Asheim and Gertler, 2005; Asheim and Coenen, 2005). The argument behind this is that the innovation process of firms and industries is strongly shaped by their specific knowledge base. Here a distinction is made between three types of knowledge base: “analytical”, “synthetic” and “symbolic”. These types indicate different mixes of tacit and codified knowledge, codification possibilities and limits, qualifications and skills required by organisations and institutions involved, as well as specific innovation challenges and pressures.

Regions display a large diversity when it comes to industrial structure, innovative capacity, competitiveness and economic growth. One way of analysing regional diversity with regard to its implication for regional economic development is to apply a differentiated knowledge base approach. This typology encompasses and acknowledges the diversity of professional and occupational groups and competences involved in the production of various types of knowledge.

As an ideal type, a synthetic knowledge base is critical for activities where innovation takes place through the novel combination of existing knowledge. Therefore a common social and institutional context is considered as a prerequisite for interactive learning processes. The main rationale for knowledge creation is the construction and improvement of a functional system that works as a solution to a practical problem. An analytical knowledge base is critical for activities where knowledge creation is based on formal and codified scientific models. The main rationale for knowledge creation is to understand and explain features of the universe. Activities that draw on a symbolic knowledge base are more directly dependent on informal interpersonal interaction in the professional community. The main rationale of these activities is creation of alternative realities and expression of cultural meaning by provoking reactions in the minds of consumers through transmission in an affecting sensuous medium. Policies must therefore be adapted to the different innovation processes involved in particular industries and particular regions. It is therefore important for the regional agency to understand where industries in their region are situated in terms of these knowledge bases and to adapt policy accordingly.

Table 6.1 in the following page provides a summary of the main differences between the knowledge bases and the implied policy intervention. But as this threefold distinction refers to ideal-types, most industries are in practice comprised of all three types of knowledge creating activities. The degree to which certain activities dominate, is however different and contingent on the characteristics of the industry. As an
example, Figure 6.1 illustrates this situation for three industries that are important in Cantabria (biotech, food and automotive) and selected other industries. It implies a differentiated focus on science-industry collaboration for biotech and client-supplier networks for food and automotive industries.

**Table 6.1. The differentiated knowledge bases**

<table>
<thead>
<tr>
<th>Analytical</th>
<th>Synthetic</th>
<th>Symbolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation by creation of new knowledge</td>
<td>Innovation by application or novel combination of existing knowledge</td>
<td>Innovation by recombination of existing knowledge in new ways.</td>
</tr>
<tr>
<td>Importance of scientific knowledge often based on deductive processes and formal models</td>
<td>Importance of applied, problem related knowledge (engineering) often through inductive processes</td>
<td>Importance of reusing or challenging existing conventions</td>
</tr>
<tr>
<td>Dominance of codified knowledge due to documentation in patents and publications</td>
<td>Dominance of tacit knowledge due to more concrete know-how, craft and practical skill</td>
<td>Reliance on tacit knowledge, craft and practical skills and search skills</td>
</tr>
</tbody>
</table>

**Process that policy seeks to support:**

- Research collaboration between firms (R&D department) and research organisations
- Interactive learning with clients and suppliers
- Learning through interaction in the professional community, learning from youth/street culture or “fine” culture and interaction with “border” professional communities.

**Figure 6.1. Knowledge bases and industries: an illustration for Cantabria**
Thirdly, another policy challenge is represented by the transition from an internal knowledge base of firms to (more and more) open and globally “distributed knowledge networks” (e.g. as part of global value chains organised by Transnational Companies (TNCs) or globally dispersed epistemic communities of scientists). This accompanies the characteristic feature of the globalising, post-Fordist economy, which outsources and offshores the production of goods and services to subcontractors and suppliers as a result of the shift from vertical integration to vertical disintegration in the organisation of production. Thus, the knowledge creation and innovation processes have become increasingly complex in recent years. There is a larger variety of knowledge sources and inputs to be used by organisations and firms and there is more interdependence and division of labour among actors (individuals, companies, and other organisations). As a result, the knowledge creation process becomes increasingly inserted into various forms of networks (at regional, national and international levels).

Much of the knowledge intensity enters as embodied knowledge incorporated into machinery and equipment, or as intermediate inputs (components and materials) into production processes. More importantly, knowledge flows can take place between industries with very different degrees of R&D-intensity and different knowledge base characteristics, e.g. when food and beverages firms (predominantly drawing on a synthetic knowledge base) produce functional food based on inputs from biotech firms (predominantly drawing on an analytical knowledge base). This also weakens the importance of the distinction between high-tech and low-tech industries, which may have strong implications for constructing regional advantage and, thus, for regional innovation policies, and demonstrates that “the relevant knowledge base for many industries is not internal to the industry, but is distributed across a range of technologies, actors and industries” (Smith, 2000, p.19). It is therefore important for policy to promote knowledge connections between industries.

**Challenges and opportunities**

Based on the discussion in the introductory section the following SWOT analysis concerning the regional environment for innovation and entrepreneurship can now be carried out. The analysis will focus on problems and challenges in making Cantabria a knowledge economy in accordance with the ambitions of the regional R&D+I plan.
Strengths

The strengths of the regional environment in Cantabria can be identified following a triple-helix model. This means that Cantabria has strength in the regional government, the university as well as in industry.

The R&D+I plan is as already said very ambitious and impressive, showing a high degree of competence, initiative and vision in the regional government and its various agencies of which Sodercan and IDICAN in this context is the most important for implementing the plan.

Another important asset is the University of Cantabria, which ranks among the best research universities in Spain in a number of areas, of which especially engineering, physics, Information and Communications Technologies and medicine could be mentioned. Contributing to the strengths of medicine is also the university hospital, which has a high reputation in Spain. Adding to the strength of the knowledge exploration system of Cantabria is the establishment of new research institutes in biology, environmental hydrology (engineering) and physics, which have the potential to increase the amount of research carried out compared to normal university departments as well as to facilitate engagement in research cooperation with industry. An important part of the university as a strong asset is its capacity to produce highly skilled graduates in various professions of importance for promoting economic growth and competitiveness in the region. A high class university is also attractive to teachers, students and capital from outside the region.

Concerning the last “agency” of the triple-helix model, industry, it cannot be said to be as strong as is the case with the university and the government. However, the automotive cluster has so far demonstrated its competitiveness and is the largest industrial sector in the region. Of specific importance are the organisations established to support the continued competitiveness and innovativeness of the industry such as the GIRA cluster organisation and the technological centre for the automotive component sector. A similar technology centre in support of the Information and Communications Technologies sector is also established.

Finally, two additional assets must be mentioned as examples of strengths of the regional environment of Cantabria. First, having the strong presence (even if the head quarter has moved to Madrid) of one of the ten largest financial institutions in the world, the Banco Santander, must clearly be referred to as an asset contributing to the strengths of the region. Likewise, the quality of place attractiveness of Santander and the region should also be mentioned as a strength by referring to Florida’s theories of its importance for attracting and retaining talents.
Weaknesses

Most of the weaknesses that characterise the regional environment of Cantabria can also be associated with the triple-helix model, partly with respect to industry, and partly concerning the lack of connectivity between the actors of the triple-helix constellation. First of all the size of the enterprises (i.e. the dominance of SMEs) is a weakness when aiming at building an innovative, knowledge economy. The SME sector is very far from being a technology based sector. There is a lack of private business sector involvement in innovation and R&D, and very few links between research and industry, which reflects the lack of interaction and collaboration in general between university and industry (lack of connectivity). Where Cantabria has a reasonable strong industrial sector, i.e. the automotive sector, the actual research milieu is rather weak at the regional university. Adding to this is the nearly total lack of entrepreneurial culture in the region. Taken together this demonstrates severe weaknesses with regard to the knowledge exploitation capacity of the Cantabrian industry.

This has in part to do with weaknesses of the stock of human capital in the region. There is a mismatch between job opportunities in the region and the demand of the local firms on the one hand, and the graduates trained at the regional university on the other hand. This creates problems for the local firms in finding workers with relevant qualifications. Furthermore, Cantabria has a low labour productivity, which is even worsened due to increasing use of low skilled immigrant workers in sectors such as construction and tourism.

Opportunities

Opportunities in the regional environment are related to exploiting and realising the potentials of the strength in new areas compared to what has been done so far. Thus, the strength of the knowledge exploration system represented by the university and hospital has to be applied to new or other (mature) sectors, and the willingness to support R&D and innovation by the regional government should also be better made use of by new or other (mature) industries in e.g. establishing intermediate organisations and agencies such as cluster organisations and technology centres.

In realising these opportunities a platform strategy building on related variety and a differentiated knowledge base perspective is likely to be very beneficial. This could take the form of linking various food sectors such as dairy and fishing to knowledge exploration subsystems to make them more knowledge intensive and moving them up the value-added ladder. For
example, there are promising attempts in fish farming of cultivating new types of fish and shellfish such as sole, bass, and oysters. Norway could serve as a good example of the potentials in this sector. Moreover, food and gastronomy could be linked together with more traditional tourism products in a platform strategy for targeting more up-market tourism. In such a strategy the internationalisation process of the Santander airport represents a great opportunity. Likewise, food production could be linked to biotechnology research in an upgrading process to green biotechnology.

Finally, there is an opportunity to build and promote people climate in recruiting international talented labour, firms and capital which could be more heavily exploited as a strategy of promoting regional economic growth.

**Threats**

The automotive sector, which was considered a strength of the Cantabrian economy, is also under threat. There is no Original Equipment Manufacturer company in the region and neither a Tier 1 firm. Of the 60 firms in the sector, 20 are tier two firms and 40 tier three firms. These firms are exposed to very strong price competition from firms in Eastern Europe and Asia, especially China. One of the tier 2 firm said that the price competition was very hard to face as around 60% of the production cost was represented by the raw material input. As this sector represents around 25% of the regional manufacturing sector, this threat is a serious one for the regional economy. The sector, thus, has to upgrade focusing on product innovations with higher value added to become tier 1 firms. Examples of such efforts already undertaken are the development of new car injection systems, new engines, and substituting magnesium with aluminium. The weak mechanical engineering department of the regional university is a key problem for succeeding with this upgrading process.

Another type of threat is represented by the weak absorptive capacity of local firms due to lack of human capital. The solution to this problem is not easy partly due to the small size and low knowledge intensity of most Cantabrian firms and partly due to the fact that the majority of graduates from the University of Cantabria leave when graduated as they cannot find relevant employment in the region. There is also a lack of trust between industry and university, which hampers the formation of well-working technology transfer and regional innovation systems.

Finally, the tourism sector is very traditional and under threat from alternative locations, e.g. Bilbao with the Guggenheim museum. Very characteristically while the opening of international low fare routes by Ryanair has resulted in a high increase of people flying to/from Santander
airport, the actual number of tourists staying in Cantabria has been reduced. This is a telling story of a traditional sector not being able to adapt to new forms of tourism which requires a more complex and sophisticated product than just a beach and a hotel. Adding to the difficulties of solving the problem is the lack of entrepreneurial culture in the region. To turn tourism into an asset a platform strategy combining natural scenery (sea and mountains) with gastronomy, cultural events and historical heritage must be developed. The regional government ought to establish an agency specially dedicated to this task or allocate such a task to an already existing organisation.

Recommendations

In the Cantabrian R&D+I Plan the following strategic sectors for the development of the region are mentioned: Life sciences, biotechnology, sustainable water use, physics, industrial design, materials, agro food technologies, Information and Communication Technologies (ICT) and logistics. These are sectors with differentiated knowledge bases, creating knowledge and innovation in different ways, and, thus, needing different forms of innovation support and partners to cooperate with regionally, nationally and internationally. The sectors are also more and more exposed to globally distributed knowledge networks, and they all contain potentials of related variety either as platform technologies (ICT and biotechnology) or as carrier industries (life sciences, materials and agro food technologies). In this part on policy recommendations these potentials will be further specified. Most of these recommendations for implementing the necessary policy initiatives to strengthen the “carriers” of the R&D+I Plan are of a rather general character, as more specific recommendations are presented in the previous chapters of this report. Here the focus will be on the need to continue building a regional innovation system, and in particular to establish centres of expertise in order to connect knowledge exploration and knowledge exploitation and to improve the knowledge exploitation capacity of local firms (learning models 1 and 3), to produce, attract and retain talents, and to foster an entrepreneurial culture in the region (learning model 2). All such policy measures will be the responsibility of the regional government, either formulated and carried out by their various ministries or implemented through public agencies such as Sodercan and IDICAN and public-private partnerships or associations such as the cluster organisation GIRA. In the following the rationale for and content of such policy initiatives are further elaborated.
Continue building the regional innovation system

The region of Cantabria provides a very interesting case for implementing an innovation-based regional policy. In many ways the region could be looked upon as a unique testing ground for new approaches based on constructing regional advantage. Cantabria is today a relatively well-off region in the Spanish as well as in the European context. However, it has an industrial structure that is characterised by a heavy dominance of SMEs in less knowledge-intensive sectors, reflected in the region’s investment in R&D of less than 0.5% of regional GDP. On the other hand, Cantabria has one of the leading technological universities in Spain in spite of the small size of the region with several strongholds in engineering and physics as well as a high-quality university hospital and four research institutes in physics, environmental engineering, health, and history (the latter based on the impressive pre-historical caves in the region). In this perspective it seems quite correct to do what the proactive regional government has decided to do, namely to pursue a science and technology-based strategy in order to promote regional economic development, as the knowledge generating network of university, hospital and research institutes probably are the only real innovation assets of the region. This is also in line with Gibbons et al. (1994) argument that the process of knowledge production is moving from the traditional disciplinary and Newtonian model (Mode 1) towards a new mode (Mode 2) which is described as knowledge production in the context of application, marked by transdisciplinarity and heterogeneity. Thus, the most important policy recommendation to Cantabria is to continue building the regional innovation system.

There is hardly any other example of a region pursuing so strongly such a strategy and Cantabria could be therefore be described as a testing ground for trying to implement this approach, which is also very much in accordance with the recommendations from the DG Research Constructing Regional Advantage report. On the national level, however, Finland represents one paradigmatic case of a successful implementation of a science-based approach. Finland’s innovation policy is to a large extent rooted in the economic crisis at the beginning of the 1990s, when the government started to invest heavily in science-based R&D and education in order to promote a restructuring of the economy away from heavy dependence on natural resources towards R&D as the basis for future economic growth. Innovation policy in Finland has primarily been a national policy with a very strong science and technology orientation. Typically, the Finnish innovation policy is strongly embedded at the highest governmental level through the Science and Technology Policy Council, where also top managers from private business (e.g., Nokia) take part, and with TEKES (Finnish Funding Agency for Technology and Innovation) as the main
operating agency. This guarantees the legitimacy of the policy as well as underlines how important it is considered to be, and also ensures that the innovation policy initiatives are well coordinated and orchestrated between the various ministries within the government. Finnish policy makers see industry-university relations as a crucial edge in global competition, and more innovative firms in Finland than in other European countries cooperate with universities.\(^1\)\(^2\)

**Build a better connected and better functioning Triple Helix**

Compared to the situation of Cantabria we find the following similarities and differences. As in the case of Finland the government plays a key role in promoting the innovation system. In the case of Cantabria this is originated and promoted by the relatively autonomous regional government of Cantabria rather than the national government. Cantabria has a strong knowledge exploration system (university, hospital), too. One of the main differences is a relatively weak knowledge exploitation system, as the region neither has an entrepreneurial culture in the business world nor any large company that can take on the role that Nokia had in the Finnish case. Another difference is that Cantabria is characterised by a lack of connectivity between the three dominating actors of the Triple Helix system (research-industry-government). This is especially the case between industry and university, which in Cantabria is particularly problematic as it is caused by a lack of absorptive capacity of industry because of the dominance of SMEs in less knowledge intensive sectors, by a suboptimal level of technology transfer from university to industry, and by a mismatch between research carried out at the university and the needs of local industry.

This implies a strong emphasis is needed on building a better connected and better functioning Triple Helix. The initiative by the regional government in collaboration with the most advanced parts of local industry and the university to establish four research institutes or *Technology Centres* is a promising start in improving connectivity. The centres cover the automotive industry, which is the largest and most important existing industry with 23% of the industrial gross value-added as well as logistics and ICT which represent two of the most promising emerging industries in the region. The region of Cantabria may wish to take more direct initiatives to improve the link between these research institutes and industry to strengthen relations between the knowledge exploration and diffusion and the knowledge exploitation subsystems of the regional innovation system. If strong links were established between the research institutes and industry, this could constitute “Centres of Expertise” (see learning model 3).
It is also important to support the transformation of the university to a more entrepreneurial model. The “Triple Helix” approach maintains that in a swiftly emerging knowledge economy those places with entrepreneurial universities would increasingly see growing demand for knowledge transfer to industry and, through government, to society. In this context policies have been formulated and implemented in other regions promoting SMEs contacts with R&D institutes and more frequent use of R&D, while universities at least in Finland and Sweden for some years have been given a so called “third mission”, i.e. to cooperate externally with the surrounding society in addition to doing research and teaching. The new funding of the University of Cantabria through the contract programme is a promising strategy of strengthening the third mission of the university by creating a basis for regular contacts with the regional government and incentives for increased external co-operation.

Support firms in “learning to innovate”

A further key factor in building knowledge connections is strengthening of firms’ knowledge bases, and hence their capacities to access and exploit innovation from other actors, by supporting firms in “learning to innovate” (Asheim et al., 2003). Sodercan can play a very important role in this respect by supporting for example skills development for managers, placement of graduates in enterprises, by providing financial support for innovation activities and by supporting inter-firm and science-industry linkages. It needs to be recognised that non-local as well as local connections need to be promoted, but both will be promoted by polices that increase the capacity of firms to “learn to innovate”. This requires a change of focus of support from allocation of resources for direct innovation projects in firms to focusing on learning aiming for behavioural value-added, i.e. changing firm behaviours towards continual efforts to innovate.

Develop a platform-based innovation policy

In order to maximise positive spillovers in the innovation system it is recommended to develop a platform-based innovation policy transcending traditional sector policies. This implies supporting the development of related variety supporting spillovers both within industries and among industries, i.e. developing in parallel sets of sectors that are related in their use of knowledge and other resources.

Platform oriented policies build on promoting related variety in order to secure maximal spillover effects by combining industries with complementary and differentiated knowledge bases in a distributed
knowledge network perspective, and, thus, transcending the traditional sector policies as well as the high-tech/low-tech dichotomy. Among the strategic areas mentioned in the R&D+I Plan several sectors can satisfy these criteria. Just to give some examples, the following could be mentioned as illustrative cases:

- A **red** biotechnology (pharmaceutical) strategy focusing on life sciences and health care based on developing and exploiting the knowledge base of the university hospital in cooperation with the newly established health research institute.

- A **green** biotechnology (agricultural) strategy focusing on agro food technologies and sustainable water use.

- A **white** biotechnology (industrial) strategy focusing on physics, materials and industrial design.

- An **Information and Communications Technology (ICT)** based strategy focusing on logistics, information systems and e-governance.

- A **tourist** industry strategy focusing on offering an upmarket product combining natural scenery (sea and mountain), cultural and historical settings (the pre-historical caves), a rich urban life as well as high quality food (gastronomy). Parts of the Comillas project focusing on teaching Spanish culture could be integrated into this platform.

What is common with many of these sectors is that the public sector and the regional government and administration is a critical and potentially major buyer, and could, thus, use a public procurement policy as one element in supporting the growth of these sectors. This is the case with health care, information systems, e-governance and logistics. They would in part promote emerging and potentially important new industrial sectors such as ICT and biotechnology at the same time as they would satisfy public demand for public services and, thus, fulfil social needs. Furthermore, they build on the endogenous knowledge exploration capacity of the university, hospital and research institutes, and, thus, would be of strategic importance in realising the ambitions of the R&D+I Plan of the Cantabria region.

Building a platform-based innovation policy also implies differentiating the policy approach to take account of differences in the knowledge bases of the various strategic sectors in the Cantabrian R&D+I Plan since there are differences in the way that each creates knowledge and innovation, and, thus, differences in the forms of innovation support required and the partners with whom to cooperate with regionally, nationally and internationally.
Produce, attract and retain talent

It has been shown that the absorptive capacity with respect to the acquisition of exogenous or extra-cluster knowledge as well as the diffusion of this knowledge within a cluster is dependent on the level of knowledge of the firms (Asheim et al., 2006). Thus, the knowledge and competence bases of firms and regions are important determining factors for the distribution of knowledge as well as for inter-firm learning in the region. A region’s level of absorptive capacity is of strategic importance for creating and sustaining a knowledge economy, especially with respect to appropriation of non-local knowledge. The building-up of absorptive capacity is highly dependent on the stock of human capital in the region, thus, underlining the role of local universities of producing human capital. The University of Cantabria is clearly a strong asset when it comes to the production of human capital. However, the limiting factor is the employment opportunities in local industry, which due to its small scale and low knowledge intensity does not provide affluent job opportunities for well-educated candidates from the university.

In a knowledge-based economy, the ability to produce, attract and retain highly skilled labour is crucial to the current and future prosperity of city-regions as well as entire nations. Thus, the people who play the lead role in knowledge-intensive production and innovation – who provide the ideas, know-how, creativity and imagination, are becoming a distinct advantage for economic success. Because value creation in many sectors of the economy rests increasingly on non-tangible assets, the locational constraints of earlier eras – for example, the access to good natural harbours or proximity to raw materials and cheap energy sources – no longer exert the same pull they once did. Instead, what matters most now are those attributes and characteristics of particular places that make them attractive to potentially mobile, much sought-after talent. Consequently, the distribution of talent, or human capital, is an important factor in economic geography, as talent is a key intermediate variable in attracting high-technology industries and generating higher regional incomes. This makes it an important research task to explore factors that attract talent and its effects on high-technology industry and regional incomes (Florida, 2002).

The replacement of raw materials or natural harbours with human capital and creativity as the crucial wellspring of economic growth means that in order to be successful in the emerging creative age of the knowledge economy, regions must develop, attract and retain talented and creative people who generate innovations, develop technology intensive industries and power economic growth. Such talented people are not spread equally across nations or places, but tend to concentrate within particular city-regions. The most successful city-regions are the ones that have a social
environment that is open to creativity of all sorts. This, together with other factors such as labour markets characterized by high demand for qualified personnel, cultural diversity and tolerance, low entry barriers and high levels of urban service, largely determine the economic geography of talent and of creativity. The ability to attract creative people in arts and culture fields and to be open to diverse groups of people of different ethnicity, race and lifestyles provides distinct advantages to regions in generating innovations, growing and attracting high-technology industries, and spurring economic growth.

Thus, it is not enough to attract firms: the “right” people also need to be attracted. Richard Florida calls for complementing policies for attracting firms with policies for attracting people, which means addressing issues of “people’s climate” as well as of “business climate” (Florida 2002). Indeed, the former is seen as basic to the latter, in that the presence of human capital and talent is essential for attracting and developing high-tech industries and consequently for the economic growth of cities, a diversification relationship, exploiting urbanisation economies, pointed out by Jacobs (1969) decades ago. This suggests that the attention of politicians and planners should be directed towards people, not companies, i.e. away from business attraction to talent attraction and quality of place (Florida, 2002).

A critical factor in following a policy of improving people climate is to open up and internationalise the somewhat closed and inward looking Cantabrian environment through establishing international school teaching in English, substantially improving English teaching and knowledge in the society, and promoting cultural events that demonstrate a willingness to support openness, diversity and tolerance.

However, whilst the creative class, as defined by Florida, in most developed OECD countries contains between 30-40% of employment, these talents are employed in industries drawing on all the three knowledge bases presented earlier. These various groups of talents will clearly have different preferences and trade-offs between firms, occupations, life-styles and place. An engineer working in an industry making packaging machines or automotives based on a synthetic knowledge base will normally have different preferences than an art director in an advertisement agency (based on a symbolic knowledge base) or a researcher in a biotech firm (based on an analytical knowledge base). Innovation policies for constructing regional advantage must, thus, reflect the particularities of requirements of industries based on different knowledge bases for talents, institutional support, and so forth when promoting the business climate of regions, as well as recognising the varying preferences of the creative class or talents depending on the knowledge bases of the industries they are employed in when improving the people climate.
In addition to the presence of human capital in a region, highly affected by the people climate and the quality of place, the territorial competence base is also constituted by the region’s knowledge infrastructure. As the learning economy becomes increasingly prevalent, tertiary education becomes essential as it gives access to codified knowledge that is needed to obtain various skills to be competitive on labour markets and in work life. However, the role of human capital as a contribution of universities to regional development appears to be understudied. Nonetheless, providing for local highly-skilled labour markets and keeping the skills of the local workforce of firms up-to-date through education and training programmes can be considered as a critical contribution in enhancing the regional innovative capacity. Concrete examples of human capital inputs are placing and connecting students within local companies and programmes of continuative professional development to enhance the skills of local managers. Traditionally, universities have been mainly concerned with delivering graduates for a national labour market dominated by large employers. Little attention was paid to graduate retention in local labour markets but this situation seems to be changing not the least through a strong regional policy push. Nowadays various universities have responded increasingly to signals within the regional economy and are working with industry to establish degree courses dedicated to providing specialist training.

**Foster an entrepreneurial culture**

The distinction between business and people climate could also be used to highlight the difference between policy in support of SMEs and entrepreneurship policy. While SME innovation policy is a question of improving the business climate through financial support, use of brokers, mobility schemes, establishment of technology centres and building clusters and innovation systems, entrepreneurship policy – especially directed towards technology-based entrepreneurship – must in addition contain strategies to improve the people climate, as this indirectly will create an environment conducive to creativity and risk taking by increasing the level of tolerance and reducing threshold levels for taking various initiatives as well as lowering entry barriers facing newcomers, which imply that people from different backgrounds can easily fit in.

Technology-based entrepreneurship is a phenomenon that has become increasingly important during the last decades. One of the most important reasons for this is the role it plays in industrial renewal and economic growth. While many traditional, heavy industrial sectors have witnessed a declining importance, new emerging creative and knowledge-based technological sectors have instead been expanding rapidly. This type of
entrepreneurship is also one of the keys to a success of Cantabria’s R&D+I plan. This issue points to an urgent need of fostering an entrepreneurial culture in the region. One way to do this is to establish a master programme at the university on “Entrepreneurship and Innovation Management”. This has been tried in several places with success, in particular when customised to science graduates, which is one of the strongholds of the University of Cantabria. Furthermore, various programmes to support entrepreneurial activity in the business community could be implemented. One example of such initiatives is presented as learning model 2 in the next section.

An important aspect of fostering an entrepreneurial culture as well as supporting the formation of starts-ups in general is policies in support of providing risk capital. In the aforementioned report from the State Science and Technology Institute it is argued that the lack of risk capital indicates that the market operates in a sub-optimal way, e.g. because banks traditionally require tangibles as security for loans, and, thus, represents an argument for public intervention either by indirectly providing incentives to the market for an increased supply of risk capital or by directly in one way or another offering risk capitals to companies through a public venture capital agency. In addition, the report argues that government may play a role in identifying starts-ups with high economic growth potential that have not been able to obtain capital through the normal market mechanisms. Thus, today it is fair to say that most governments at national and regional levels have adopted programmes to deliver, encourage, or facilitate the formation of local seed and venture capital resources.

Another strategy to compensate for the lack of endogenous entrepreneurial culture is to attract knowledge-intensive direct investments from other parts of Spain and abroad in specialisms that match with the region’s sectoral and knowledge exploration and training strengths. Such investments could complement the formation of a regional innovation system by providing external capital, transnational knowledge sources, skilled employees and links to knowledge markets outside the region. The latter could be of strategic importance in exploiting new knowledge generated by the regional knowledge exploration system that is not being exploited by local firms and capital. When seeking FDI it is important both to attract the knowledge intensive parts of the business (e.g. their R&D divisions) and to be able to embed such operations locally by linking them to the knowledge provided in the university and other research organisations and firms.

Finally, an important part of policy to foster an entrepreneurial culture is to produce, attract and retain human capital and talents (i.e. the creative class), as discussed above.
Learning models

The policy learning models presented in this part of the chapter will argue in favour of taking policy initiatives within at least three different areas:

- To continue building a regional innovation system or Triple Helix.
- To use research institutes or Centres of Expertise to promote knowledge transfers.
- To foster an entrepreneurial culture.
- To promote the use of R&D in the small firm sector.

The examples are all taken from the programme portfolio of VINNOVA – The Swedish Agency for Innovation Systems, and further information can be obtained from their home page: www.vinnova.se. Even if these programmes are operated by a national agency, they all have an explicit regional focus, and can, thus, be useful and of inspiration also to the regional government of Cantabria.

**The VINNVÄXT Programme, Sweden**

*Description of the model*

VINNVÄXT (wingrowth) resides under the Swedish Agency for Innovation Systems, VINNOVA. The purpose of VINNVÄXT is to promote sustainable growth in the regions based on international competitive ability, by developing the functioning, dynamics and effectiveness of innovation systems in functional regions at an international level. By “functional regions” the programme defines the geographical boundaries of its projects based on the location of those groups/coalitions/partnerships that apply to the programme and their core activities instead of defining them on the basis of given administrative regions.

The programme requires explicitly that such a functional region has to be constructed around a triple helix involving active participation from the i) business community, ii) research organisations, and iii) politics and public administration. This specific focus on triple helix collaboration originates in the programme’s central problem identification vis-à-vis Swedish regional economic development: the asserted lack of a system-based approach to innovation among politics and public administration, the business community and research organisations. The main “accusations” are that: regional politicians and public administrators are insufficiently engaged in
harnessing active economic growth and development, relying too much on redistributive regional policy; colleges and universities have been aligning their research and education programmes insufficiently to the needs of their region; and companies have been paying insufficient attention to the assets available in their regional environment. VINNVÄXT seeks to overcome these perceived barriers to constructing regional innovation systems.

The general characteristics of the programme are:

- Competition-based selection procedure.
- On-going process support, education, monitoring and evaluation.
- Long-term perspective (the programme runs for 10 years).

VINNVÄXT total budget comprises Swedish crowns (SEK) 600 million (approx. EUR 70 million) built on the principle of co-financing (the applicants stand for 50% of the budget). VINNOVA provides each selected regional programme SEK 10 million per year (total budget SEK 20 million) over a period of maximum 10 years. It has identified a set of critical factors and attributes as guiding principles for its regional programmes. These overlap significantly with the guiding principles of regional experimentalism. A concrete illustration of this initiative is given in Box 6.2 presenting the VINNVÄXT project “Food Innovation at Interfaces”.

Why this approach is relevant to Cantabria

The aim of this approach is to build regional innovation systems (or Triple Helix) by promoting a systemic and long-term cooperation between regional universities, industries and public administration. As emphasized in the SWOT analysis, the major strengths of Cantabria was the knowledge explorative capacity of the university as well as the pro-active R&D+I policies of the regional government, while the weaknesses were identified as a limited degree of absorptive capacity of the majority of SMEs and the lack of connectivity between the actors of a Triple Helix system. As a result there are very weak relations between university-industry, which leads to a suboptimal level of technology transfer from the research milieus at the university to industry as a strategy of restructuring the economy into a knowledge economy. Thus, a policy aiming at solving these problems seems to be highly relevant for Cantabria. As a strategy to achieve this there is much to learn from the VINNVÄXT initiative of VINNOVA, which is considered one of the most innovative regional innovation policy initiatives in Europe.
Box 6.2. Building regional innovation systems: The VINNVÄXT project “Food innovation at interfaces”

“Innovation i Gränsland” (Food Innovation at Interfaces) has been granted funding as a VINNVÄXT programme in 2003. The application was written by the network organisation “Skånes Livsmedelsakademi” (Scania’s food and beverages academy) whose members are from the triple helix of business, research organizations and regional public administration. The application builds on the shared strategic vision to increase the added value of the region’s food industry’s products and services. It intends to do so through a focus on multi-disciplinary innovation projects in the borderland between different knowledge bases. The project builds on the recognition that the Swedish food industry as well as important related areas such as logistics and machinery is heavily concentrated in the country’s most southern region Scania. The total growth of the cluster is however low as parts of the sector are dominated by typically Fordist bulk production aimed at price competition and economies of scale.

Acknowledging that this approach is not economically sustainable, the programme aims to access new, more specialised and knowledge-intensive segments of the market such as high-quality niche products, convenience foods, ecological foods and functional foods (defined as artificially developed food with added ingredients that demonstrate scientific evidence of positive health-related effects). To make this shift, companies need to collaborate more actively with the existing knowledge infrastructure found in Scania. Both Lund University and the Swedish Agricultural University in Alnarp (located between Lund and Malmö) have indeed aligned parts of their education and research activities to the historical presence of the food industry in Scania. For example, already early in the 20th century, firms and organisations in the regional farming community as well as the Swedish state supported and collaborated with scientists in plant breeding through the Svalöf Institute (which was part of Lund University) to develop better seeds for the agricultural conditions prevalent in Sweden.

Within “Food Innovation at Interfaces” triple helix collaboration is organised both on a strategic and operational level. The board of the programme consists of representatives from the regional food industry, universities as well as regional government and serves as a reference group for the programme as a whole. On an operational level, the programme is divided in four main project areas: Food and Health - Functional Foods, International Consumer Marketing, Good and Convenient Food on a Large Scale, Innovations in Theory and Practice. These project areas reflect the broad scope of activities that the programme aims to cover, targeting analytic knowledge-based innovation (e.g. in Food and Health - Functional Foods) as well as synthetic knowledge-based innovation (e.g. in Good and Convenient Food on a Large Scale). Within these project areas, various projects are carried out drawing on collaboration in a public-private or triple helix context coordinated by project managers which often are affiliated with organisations that have substantial previous experience with such collaboration.
Results of the approach

As the programme has only been running since 2003, and each project has a ten years period of funding, it is too soon to evaluate its success. The first evaluation on the three first projects (among them Food Innovation at Interfaces) has just been undertaken but the results are not yet published. However, the evaluation report should be accessible by approaching VINNOVA directly.

Reasons for success or failure of the approach

Two main problems can be identified. The first is related to governance problem, i.e. how to get a triple-helix constellation to work together in an efficient way. The various actors (e.g. university vs. industry) have different rationalities, motivations, time perspectives etc. for engaging in such collaborations. Secondly, lack of realism with respect to the areas in which a region possesses sufficient research and industrial capacity to build international competitiveness can also undermine the effectiveness of such initiatives. There are some examples of VINNVÄXT projects that will not be able to support international competitive firms due to a too weak knowledge exploration subsystem in the regional innovation system and/or too large and globalised firms in the region to be supported basically by the regional university.

Obstacles faced and response taken

In the cases where the outcome so far has not been up to expectations it has partly to do with the governance problematic, and partly with lack of willingness or interests for cooperation among actors of the Triple Helix constellation (especially industry, but also regional governance due to lack of relevant competence). Response to such problems may be finalising funding from VINNOVA before the 10 years period has passed.

Considerations for adoption of this model in Cantabria

Such an initiative should be easy to integrate in the R&D+I Plan, and could almost be looked upon as a necessity in order to realize this ambitious plan and to engage in formulating a platform oriented, regional innovation policy. It could directly build on the established Technology Centres.

Contact details and website for further information

www.vinnova.se
VINN NU (Win now), Sweden

Description of the approach

Small and medium-sized companies (SMEs) play a decisive role in promoting national and regional competitiveness and employment. Not only do they represent the overwhelming majority of companies (as is the case in Cantabria, too), they also act as a source of renewal and a driving force for the development of new business areas. Moreover, a large number of SMEs want and need to become international in order to reach new markets and exploit new business opportunities.

R&D operations have become more complex and are also associated with major costs and risks. This means that it is more difficult for SMEs to conduct their own R&D operations than for large companies. By investing in R&D programmes that focus on SMEs, VINNOVA aims to help these companies increase the knowledge content of their products and processes and thus increase their competitiveness. Below is described an initiative from the programme portfolio of VINNOVA directed towards SMEs and technology-based entrepreneurship, which has shown to be a very popular initiatives among entrepreneurs and SMEs. However, the programme has only been running for a short period of years and thus has not been subject to any evaluations so far.

VINN NU is a competition for new companies that base their operations on R&D results. The aim is to make it easier for new R&D-based companies to prepare and clarify commercially-interesting development projects at an early stage so that they can progress, find subsequent funding and, in the long term, become successful Swedish companies. The fields covered are the development of working life, biotechnology including biomedical engineering and foods, energy technology, information and communications technology, materials, product realisation, process engineering, services and IT utilisation and transport. VINN NU was started in 2002 together with NUTEK and the competition has been held every year since then. In 2005, VINNOVA was the sole founder of the competition, while from and including 2006 the programme will be run together with the Swedish Energy Agency. Every year, 20 winners are announced and each of these receives SEK 300 000.

Relevance to Cantabria

Cantabria has a double weakness in connection with its population of SMEs. Partly, they are characterised by a low level of knowledge-intensive activities, low levels of internal R&D, few connections with the university,
and little innovative activity, and partly their owners demonstrate a lack of entrepreneurial culture as well as an insufficient absorptive capacity. This is seen in traditional manufacturing, the service sector and the tourist sector, and has been pointed at as a major weakness in the SWOT analysis. Such a programme is one way to try to promote a higher knowledge intensity and entrepreneurship in the small firm sector.

Results of the approach

This is a new initiative, thus, it is much too early to have any concrete ideas of the results. However, there was an overwhelmingly interest in applying for funding from SMEs.

Reasons for success or failure of the approach

See above. It is too premature to anticipate reasons for either success or failure of the approach.

The obstacles faced and responses taken

The main obstacles threatening such schemes are lack of venture capital and competence, especially on market opportunities for the new products. Thus, the provision of either private or public-private risk willing and competent venture capital or business angels is normally of key importance for the success of such initiatives.

Considerations for adoption of this model in Cantabria

As fostering an entrepreneurial culture in Cantabria as well as promoting the use of R&D in the small firm sector must be seen as a key requisite for realizing the ambitious R&D+I plan, this and similar initiatives have to be part of the region’s strategy. This specific initiative could be carried out as the responsibility of SODERCAN and IDICAN and public-private partnerships (especially with respect to the provision of competent, venture capital), or associations such as the cluster organisation GIRA.

Contact details and website for further information

www.vinnova.se
**VINN Excellence Centres, Sweden**

**Description of the approach**

For small and internationally interdependent countries with an open economy such as Sweden (which is the case also for many European regions), the need to focus its efforts on a number of strong, internationally distinguished research and innovation environments is a critical factor in the effort to promote competitiveness and growth. It is a question of creating a number of globally-recognised spearheads so that Sweden can become an attractive partner for both companies and R&D investments. In strong research and innovation environments, cutting-edge research, development and innovation operations are conducted and there is an effective interplay between these operations.

The VINN Excellence Centres provide a forum for collaboration between the private and public sectors, universities and colleges, research institutes and other organisations that conduct research in a Triple Helix constellation. These Centres of Expertise deal with both basic and applied research and they work to ensure that new knowledge and new technological developments lead to new products, processes and services and are funded for a period of 10 years. According to VINNOVA internationally strong research and innovation environments are one of the most important competitive factors in the face of global competition. This is why all of VINNOVA activities are guided by the ambition to promote and further develop strong research and innovation environments.

**Relevance to Cantabria**

The region of Cantabria has already established their centres of excellence in the form of the four research institutes mentioned earlier. However, this Swedish example may be of interest in the further development of these and new centres, especially if the government decides to take more direct initiatives to improve the link between these research institutes and industry to strengthen relations between the knowledge exploration and diffusion and the knowledge exploitation subsystems of the regional innovation system to promote knowledge and technology transfer to industry. If strong links were established between the research institutes and industry, this could constitute “Centres of Expertise”, which this VINNOVA initiative is an example of. Such “centres of expertise” would represent a strong support for the successful implementation of the R&D+I Plan of the regional government of Cantabria.
Results of the approach

The VINNOVA Excellence Centres programme has been operating for a period of two years and, consequently, it is much too early to evaluate the results or talk about obstacles faced. Thus, this is also a brand new initiative and in fact the first of these Excellence Centres only become operative last summer (June 2006). The interest for becoming such a centre has – as with the other of the above mentioned VINNOVA initiatives - been big.

Reasons for success or failure of the approach

As it is too early to give such a report from the Swedish initiative, one could refer to Finland, which established similar Centres of Expertise earlier. This first round of such centres, which also had a clear regional dimension, was very successful. However, when the program was extended from the original five centres to more than 20, the result was that many of the lastly established centres turned out to be not as successful as the first ones. The reason for this is that the industrial as well as the research competence were “overstretched”, so that the centres were not able to produce the world class knowledge and innovation which was the ambition. One example of this is the attempt to build up a biotech industry in the same way as the successful ICT industry.

The obstacles faced and response taken

Based on similar international initiatives the main obstacles for success is governance problems and lack of sufficient capital and competence.

Considerations for adoption of this model in Cantabria

The existence of the research institutes as well as the technology centres should represent a very relevant basis for the establishment of such centres of expertise. In realizing such a strategy the regional government of Cantabria must of take a leading role in cooperation with the regional university and local and non-local industry.

Contact details and website for further information

www.vinnova.se
Notes

1 The information on Finland is taken from Science and Technology Policy Council of Finland (2003), “Knowledge, innovation and internationalisation”, Helsinki.

2 An interesting aspect concerning the role of universities in Finnish innovation policy is the fact that they have taken up the role of knowledge transfer organisations.
References


CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

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The innovation challenge

The importance of innovation to regional economic growth is now well recognised, particularly for the cities and regions of advanced OECD Member countries. Global competition is placing downward pressure on wages and profits on standardised products and services. Higher value added on the other hand can be achieved through innovative activities that increase productivity or product differentiation. Competing on innovation, rather than cost, is therefore critical to securing regional economic prosperity in Cantabria, as in other OECD regions, in the context of a secular shift to an increasingly knowledge-intensive global economy. The Cantabria R&D+I Plan represents an appropriate response to this innovation challenge. It is impressive in its scale and content and appropriate in its overall conception. The principal conclusion of this review is therefore that the regional government’s efforts on research and innovation, through its R&D+I Plan should be maintained. However, several adjustments and additions may be made to the strategy and its implementation in order to remedy certain weaknesses in Cantabria’s current innovation system and to exploit new opportunities.

The recommended adjustments and additions will be discussed shortly. However, it is first worthwhile to underline the importance of the innovation strategy that the Cantabria government has decided to adopt. Cantabria’s challenge is more difficult than that of the most advanced OECD regions
because of the strong recent industrial restructuring Cantabria has faced and because of a relatively weak starting position on innovation activity.

Cantabria has significantly restructured its industry in recent years and successfully moved from a European Union (EU) Objective 1 region, meriting the highest level of EU Structural Funds support, to a region that is relatively prosperous in EU and Spanish terms. However, Cantabria still faces the prospect of further restructuring away from high dependence on traditional manufacturing industries supplying Spanish domestic markets to new internationally competitive sectors. Economic integration in the European Union and in the global economy has led to new competition in Cantabria’s traditional sectors and a period of strong rationalisation and structural change in the late 1980s and early 1990s appears still not to have entirely worked through. Thus sectors such as metalworking, chemicals and food, as well as tourism, need to evolve towards new more specialised products and markets. The automotive sector is one of the largest economic base industries in Cantabria, but is made up of subcontractors to Original Equipment Manufacturers and needs to develop differentiated products in higher value added niches and move up the value chain in order to meet low cost competition in lower tiers of the value chain. Thus Cantabria’s traditional industries need to innovate in order to find new products and services in which higher value added can be secured. At the same time, to compensate for contraction in certain traditional sectors in the past, there is a need to develop new potential growth industries in knowledge-intensive sectors that can contribute new dynamism to regional economic growth and competitiveness. The strategy underpinning the R&D+I Plan needs to be seen against this objective.

It must also be recognised that Cantabria starts from a relatively weak position because of its currently low level of innovation activity as a proportion of GDP compared with Spanish and European Union averages and a relatively low critical mass of knowledge-intensive activities reflecting the small size of the region and its university and the nature of the sectoral and size structure of its industry. The most advanced asset for local exploitation of research is its high technology manufacturing sector, but this is relatively small in size and there is a large bed of traditional SMEs in low technology manufacturing and services that currently undertakes little innovation. This implies a need for Cantabria to develop in certain specialised niches and to collaborate with actors in other regions in order to access and exploit knowledge. The relatively underdeveloped knowledge exploitation capability in the business sector is the most important weakness in the region’s innovation system. Thus whilst Cantabria, has important public research strengths and strong government funding and guidance for the development of the innovation system, its weak knowledge exploitation
sector makes it difficult to build a strongly connected system across the three components of industry, government and research. Overall, this review highlights the strong effort that is required to strengthen research, development and innovation activities across the region’s innovation system and particularly to develop the knowledge exploitation capacities of the business sector and its connectivities with research organisations.

The conceptual framework behind the review stresses how successful local innovation systems rely on strong knowledge generation assets (e.g. public research organisations, research departments of enterprises), knowledge transfer connectivities (e.g. R&D collaborations, labour mobility among firms, technology bridging institutions) and capabilities for knowledge generation, transfer and exploitation (e.g. skills for innovation absorption, motivations and incentives for knowledge transfer). These assets, connectivities and capabilities can be examined across the sectors of human capital, firms, research organisations and in the broader regional environment. Some key building blocks then for the development of regional knowledge economies are knowledge generation assets in the public research sector and private research departments, technology bridging institutions, knowledge transfer channels and incentives for science-industry linkages, human capital in the business and research sectors and more broadly an entrepreneurial culture and attractive people climate.

The Cantabria R&D+I Plan has a critical role to play in developing these necessary characteristics of a successful innovation system in the region. The regional government budget allocated to strengthening regional innovation is considerable for the period 2006/10. In total the budget is planned to exceed EUR 300 million during the period, representing an impressive growth of some 500% compared with the previous period and an annual growth planned of around 30% per annum. Furthermore, the regional government’s contribution, and that of the SODERCAN and IDICAN development agency arms of regional government, extends beyond this funding role to encompass guidance and steering of the innovation system’s development through its funding and incentives to research and industry players and the creator of appropriate framework conditions for innovation in the region. This effort is needed to meet the objectives of growing public and private sector R&D activity, increasing the number of firms involved in innovation and research and increasing qualified human capital in science, technology and innovation and ultimately supporting the innovation, growth and job creation sought by the regional government.
Assessment of challenges and opportunities

This section provides an overview of the main challenges and opportunities for Cantabria in meeting its objectives as identified by the OECD review panel. First the strengths and opportunities are set out and then the weaknesses and challenges. This sets up the discussion of the consequent OECD LEED recommendations that follow in the next section.

Strengths and opportunities

Regional government involvement in promoting the knowledge economy

The regional government has made a very appropriate and impressive commitment to raising R&D+I investment and creating the basis of a learning and innovation economy in Cantabria. This includes substantial funding for research activities in firms and research organisations as well as significant spending on human resource development. The Plan is made up of a number of very good practice programmes and projects. The commitment and vision of the Cantabrian government and its SODERCAN and IDICAN development agencies will be very important for driving forward the region’s shift to the knowledge economy. The development of innovation activities by firms and research organisations in the region can also benefit from the funding and connections offered by European Union research and regional development programmes.

Knowledge exploration assets

Cantabria has some strong assets in its knowledge exploration system. The university of Cantabria ranks among the best research universities in Spain in a number of areas including engineering, physics, information and communications technologies (ICT), and medicine. The university hospital contributes to the region’s research strengths in medicine. Furthermore, new research institutes in biology, environmental hydrology (engineering) and physics have the potential to increase the amount of research carried out as well as facilitating research co-operation with industry. These research assets may be applied in support of both new and mature sectors.

Pockets of research excellence

The Cantabria knowledge exploration system also has some important centres of research strength that are capable of achieving international
excellence and supporting potential future growth sectors in the region, including in the areas of biomedicine and life sciences, automotive components and ICT. The regional government, university and industry can further promote development of such niches.

A well-developed automotive cluster

There is strong business cluster in the automotive industry containing approximately 130 firms and 3,000 workers, representing some 28% of manufacturing value added. The cluster has strong potential inter-firm linkages and linkages to the research sector that can help drive regional innovation. There is a formal business cluster organisation, GIRA, that supports the development of strategies and co-operative research and innovation, training, internationalisation and sector infrastructure projects. The University of Cantabria also operates a Master programme for automotive industry studies. The Component Technology Centre (CTC) is another important automotive cluster asset that supports applied research and development, technological advice and specialised training. There are clear opportunities to further develop innovation in this sector.

Sectors related to natural resources assets

Cantabria has some very strong natural resource assets in agriculture, fishing, the marine environment, and landscape. These assets can generate competitive strength in certain sectors, including biotechnology, food technology, aquaculture, water cycle technologies, tourism, wind and marine energy and logistics services. In some of these areas there are complementary assets in the research and training sector, including University of Cantabria research and teaching activities in physics, biology and hydraulics and the planned establishment of an Oceanographic centre.

Strong development potential in the tourism sector

Related to the above, tourism is an important sector in Cantabria based on the natural assets of sea and mountain environment as well as cultural and heritage assets. Its development could further be stimulated by encouragement of innovation associated with a shift to higher added products, the offer of new services and creating connections among businesses involved in different activities in the tourism value chain. The tourism sector should be supported by the activities of the R&D+I Plan in addition to the high technology manufacturing and knowledge intensive services more traditionally associated with innovation strategies.
Port of Santander and logistics activities

Santander is an important freight port supporting a certain number of logistics services. There is potential to further develop related freight activities, inter-modal transport connections and the region’s logistics cluster with the support of the Technological Centre for Logistics.

Science-industry bridging activities by the science and technology park

The science and technology park provides a basis to attract and host innovating companies and to bridge the gap between directly hosted and non-hosted companies and researchers in the university and the other public research institutions. It is also an important asset in building the image of Cantabria as an innovative place.

Opportunity to build a platform strategy based on related variety

There is an opportunity in Cantabria to develop a pioneering approach to cluster building based on related variety that is more appropriate to the economic base of the region than single sector based policies as well as being in line with the latest academic thinking on regional innovation systems. Such a related variety platform strategy could build up and link activities already present in the region that use the same knowledge bases and benefit from mutual positive spillovers. For example, food production could be linked to biotechnology research in an upgrading process to green biotechnology.

Well performing labour market

Since 1999 Cantabria has had a very positive labour market performance, creating over 80 000 new jobs as activity and employment rates have risen significantly and unemployment rates have fallen by half. The region also has one of the lowest labour costs per effective hour in Spain and a positive industrial relations climate. This is very positive for a development strategy based on innovation.

Availability of university graduates

The university is a strong human resources as well as research asset in terms of its capacity to produce graduates in various skills and occupations relevant to the development of the region’s knowledge economy. The university has some of the leading teaching departments in Spain, not only
in professions such as law, but in biomedicine, engineering and ICT. Cantabria is also above the Spanish average in the share of the workforce with either university or secondary education qualifications.

Opportunity to build popular support for a learning economy

The visibility of the R&D+I Plan offers the potential not only to increase R&D investment in the private sector, but also to give a boost to the motivations of the general public to investing in their own training and to firm internal training efforts. At the same time support can be provided to the university and vocational training colleges to match supply to demand.

People climate

There are many features of Cantabria that contribute to an attractive people climate, including its natural beauty. These features should be protected and other aspects of the region’s people climate developed. Regional people climate assets should also be promoted more strongly in recruiting international talented labour and knowledge-intensive firms and in attracting tourists to the region.

Weaknesses and threats

Limited private participation in R&D+I

Aside from a few technology-based innovative businesses, the Cantabria economy is dominated by SMEs with relatively low levels of technological sophistication, low innovation skills and capabilities and a weak entrepreneurial and innovative culture. Whilst those manufacturing sectors that appear most likely to increase innovation are threatened with decline, businesses in other sectors tend to be very small and have low knowledge intensity. Current R&D+I activity is therefore being driven by knowledge exploration in the public sector without adequate knowledge exploitation by the business sector. Although the regional government is seeking to address this problem with a range of innovation support to traditional SMEs, these firms lack information on the support measures available and how to access them. Furthermore, the research and technological institutions and the science and technology park, although important measures, were almost entirely put in place through public initiative, therefore putting strong demands on public funding and potentially depriving the park and research institutions of information on regional industry needs and connections to regional industrial projects. In this context, a danger is that such a publicly-
driven technology push strategy will not generate the anticipated business innovation required for regional growth and competitiveness, unless actions can be taken that will address the current lack of innovation activities in the private sector.

**Weak connectivities between research and industry**

There is a significant disconnection between the activities of the research sector and the needs of industry. This hinders the functioning of the local innovation system and makes it difficult for the regional government to meet its objectives for driving economic development through the R&D+I Plan. Part of the problem is a disconnection between the nature of academic research being undertaken and its specialisations and the specialisations and technological needs of regional companies. Thus some of the research areas that are the most strongly developed in the university, such as astrophysics and pre-history studies, have only modest potential for local commercialisation exploitation because of high entry barriers and lack of domestic industry in these sectors. In addition, where local industry is strong, for example in the case of the automotive sector, the research and training activities of the university are relatively weak. On the specific issue of training, there is also a mismatch in terms of the level of training, since the university mainly focuses on Master level qualifications whilst SMEs also require vocationally qualified technical staff, which are not sufficiently generated in the region. There also appears to be some lack of trust between industry and university and differences in cultures of operation that hinder connectivity. Unless public research, commercialisation activities, innovation support and human capital investment can be developed together and in parallel the R&D+I Plan will not be able to meet its full potential in stimulating economic development in the region.

**Lack of critical mass and international connectivities**

Another weakness arises from the fact that Cantabria is a small region, which in 2003 had only approximately 700 R&D jobs outside of the public sector. In this context it is not practical either to expect to develop strong innovation activities in all sectors targeted by the R&D+I Plan or to achieve all the knowledge generation and exploitation required from entirely local sources. Moreover, although there are many good examples, the international research partnerships of the various public and private sector actors are not as strong as they should be.
Competition from lower cost locations on standardised products

With economic globalisation, Cantabrian companies operating in standardised product markets are increasingly facing competition from lower cost locations such as China, India, and East European countries. There is therefore a risk both of in-situ decline and of relocations of domestic firms to lower production cost areas. This is a particular threat for the Cantabrian automotive sector that is made up of subcontractors, which are one or more steps removed from Original Equipment Manufacturers, largely supply standardised components, are largely externally-controlled and lack R&D units. If firms in automotive and other standardised components do not move up the value chain quickly, using adapted R&D and innovation activities, they are likely to lose out in price competition with firms in lower cost locations. The research and training capacities of the mechanical engineering department of the university are not the strongest in the university and this may be a barrier to supporting the upgrading of the automotive sector from entirely local sources, suggesting a need for some external linkages.

Threats to the tourism sector

The tourism sector is still quite traditional and under threat from alternative locations that have developed key attractions, stronger customer service, better visibility and better links across the value chain, including links to travel agents, airlines and so on. It is important that this sector adapts away from traditional beach-based tourism towards more sophisticated products. However, this adaptation is hindered by weaknesses in management skills and qualified labour and in collective entrepreneurship in the sector.

Lack of a systematic university commercialisation strategy

More could be done to encourage commercialisation of the university’s research. Further activities could be encouraged to promote improved working conditions and promotion prospects for applied research staff, increased contract research for the private sector, increased awareness of commercialisation potential, auditing of commercialisation opportunities, the creation of facilities and mentoring and financial support for university spin-outs and the development of a strategic intellectual property policy across the university. This is likely to require a strengthened university technology transfer office accompanied by a high level commitment to commercialisation from university management and incentives more
adapted to encouraging commercialisation. Overall there is a need for a more systematic commercialisation strategy across the university.

*Risk that regional government programmes could reduce the university’s focus on its centres of excellence*

There is a danger that, if spread too widely and too strongly focused on linkages within the region, the increased R&D+I investment planned by the regional government could go mainly to widening the university’s training and research at the expense of strengthening the position of its main centres of excellence. The existing centres of excellence provide strong revenues for the university, reinforce its reputation and capacity to attract very highly qualified staff and develop activities with real international competitive advantage. Any reduction in the emphasis on these centres of excellence would reduce their capacities to drive long term economic growth, particularly in the context of anticipated increases in competition for national funds amongst centres of excellence across the Spanish university system.

*High levels of temporary jobs and turnover*

Although overall labour market performance has been good, the level of temporary work in Cantabria is almost three times the European Union average, whilst labour turnover also appears to be high. Whilst this may increase labour market flexibility, it is also likely to reduce investment in training and hence constrain innovation activity. This is connected with a general weakness in the intermediate and vocational skills of the region’s workforce and a low level of commitment by private sector firms to technical training and skills development.

*Lack of technical skills and low levels of vocational training*

The majority of SMEs in Cantabria have only weak innovation activities and undertake relatively little training. Because of this there is a relatively weak level of demand for graduates from the university and vocational colleges. Indeed there is a tendency of university graduates to leave the region upon graduation or join the public sector rather than take up posts in the private sector. The region’s SME sector can therefore be characterised as being in low skill equilibrium with relatively low supply and demand of trained labour. This lack of skills in the wider workforce is a threat to the capacity of firms to upgrade their products and services and increase their efficiency and hence also to the future competitiveness of the large part of the region’s business sector.
Summary of recommendations

Following from this assessment, this section sets out the main recommendations of the review by the four themes of the report, namely human capital, businesses, research organisations and regional environment. They represent a set of activities that the regional government may pursue over the duration of the R&D+I Plan, some being feasible in the short term and some representing longer term objectives. Box 7.1 sets out the recommendations in summary form. They are expanded on the text below. The full details are available in the chapters in the body of the report.

Box 7.1. Summary of recommendations for Cantabria's innovation strategy

**Human capital**

- Broaden the innovation vision to encompass support for the development of human resources at all skill levels.
- Enhance mobility of researchers between universities and industry.
- Improve the career prospects of researchers involved in technology transfer activities within universities and research organisations.
- Develop new vocational training approaches in colleges and universities and encourage SMEs to participate in vocational training initiatives.
- Link financial support to firms to training commitments.
- Attract inward direct investment on the technology and human resource best practice frontier.
- Promote a learning culture in regional SMEs.
- Build entrepreneurship skills through entrepreneurship courses in the university, linkages with regional companies and entrepreneurship awareness programmes.

**Business**

- Use a broad conception of innovation and support activities across all economic actors and not only in R&D and knowledge-intensive sectors.
- Introduce strategic audits and skills development initiatives to improve SME capabilities to evaluate their competitive position and innovation opportunities.
- Build the internal R&D and innovation capabilities of firms.
- Increase firm innovation connectivities with other agents within and outside the region by developing R&D consortia projects and opening up government-funded collaborative research initiatives to selected firms and organisations outside Cantabria.
Box 7.1 Summary of recommendations for Cantabria's innovation strategy (cont.)

- Exploit opportunities to support firm innovation through public procurement to regional government and regional public agencies.
- Set out a clear methodology for a comprehensive and integrated package of support to promote technological entrepreneurship.

Research organisations

- Agree the university’s strategic mission and main emphasis.
- Focus regional government research funding on the most promising research teams and potential centres of excellence with commercialisation potential.
- Use financial incentives, performance measures and support programmes to increase broader university engagement with business sector innovation.
- Promote entrepreneurship in the university.
- Develop training and technological services in the university to support innovation in key regional future industry sectors.
- Reinforce the university technology transfer strategy and office by involving specialists and linking with international networks.

Regional environment

- Continue to build and upgrade the region’s local innovation system.
- Build connectivities between the knowledge exploration system (university, hospital, research institutes) and the knowledge exploitation system (industry).
- Support firms in “learning to innovate”.
- Develop a platform-based innovation policy that builds “related variety” industries, i.e. those connected by complementary knowledge bases and significant spillovers.
- Produce, attract and retain talented labour through increasing regional human capital investment and improving people climate.
- Foster an entrepreneurial culture.
- Strengthen the involvement of the university and businesses in developing and managing the innovation plan.
- Promote innovation policy across the whole of regional government.
- Evaluate the R&D+I Plan and its programmes and feed back into policy learning and adaptation.
Human capital

Broaden the innovation vision to encompass support for the development of human resources at all skill levels. Use the R&D+I Plan to support not only R&D and innovation projects but also human resources development. This should include support to firms for recruiting and training science, technology, professional and technical workers and adopting best practice forms of work organisation and intra-firm communication.

Enhance mobility of researchers between universities and industry. Create programmes and incentives to promote the placement of university staff and graduate students in industry in order to develop innovation projects. Increase the exposure of university departments to industry thinking by increasing the involvement of industry representatives in university research projects.

Improve the career prospects of researchers involved in technology transfer activities within universities and research organisations. Motivate a number of university and other public researchers to undertake applied innovation projects. Reform the performance evaluation system for university researchers to increase the valuation of applied research and technology transfer activities in the public research system. The university should also provide more job stability to experienced researchers in these fields.

Develop new vocational training approaches in colleges and the university and encourage SMEs to participate in vocational training initiatives. Continue the upgrading of the Cantabrian vocational training system. This should include significant outreach to school students to improve the image of vocational training. The region should participate with the Instituto Nacional de las Cualificaciones (INCUAL), central government departments, other regions, firms and trade unions to cover gaps in the current vocational training system (for example in use of information and communications technologies) and to ensure that qualifications obtained by different methods are recognised and transferable. There should also be effort to promote lifelong learning by developing on-line internet based programmes. These could be linked to the university and other educational institutions for additional classroom education. Regional companies should also be encouraged to co-operate on joint initiatives to upgrade training. Finally, the regional government should consider allocating primary responsibility for governance of Cantabrian vocational training initiatives to SODERCAN, as a public agency able to have the support of firms to have their trust but also to maintain a strategic perspective for publicly-supported training provision. Given its responsibility for other economic development
issues, SODERCAN can also offer the advantage of offering an integrative strategy towards overall skill and human capital development.

*Link financial support to firms to training commitments.* Attach certain public financial support for innovation to agreements by firms to undertake training and adopt good practice human resources practices.

*Attract inward direct investment on the technology and human resource best practice frontier.* Cantabria should target inward direct investment in knowledge-intensive activities from the rest of Spain and overseas. In contrast to the standard projects targeted in the past for their contribution to direct employment creation, projects should be targeted for their potential contribution to regional innovation. They should therefore involve innovation activities and high level human resources practices and help build critical mass in the regional innovation system in terms of innovation activities and knowledge connectivities. This will also increase the supply of managers, technologists, professionals and technicians, and a number of these people are likely to be associated in the longer term with company spin-outs or mobility to other companies in the region. Efforts should be made to embed inward investors in the local economy through collaborations with local suppliers, customers, research organisations and other enterprises in local clusters. The link should also be recognised between attracting inward investment and developing a positive people climate in Cantabria.

*Package human resources development and business development support in a combined service.* Include support for managerial skills upgrading and skills development across the broader workforces of regional companies in a joined-up package with business development advice and support for innovation and internationalisation.

*Build entrepreneurship skills through entrepreneurship courses in the university, linkages with regional companies and entrepreneurship awareness programmes.* The university should integrate entrepreneurship modules within undergraduate programmes and develop short entrepreneurial skills programmes for researchers. Such courses might be complemented with placements in small firms or mentoring by existing company managers. This should be complemented with broader entrepreneurship awareness programmes for the general population.

**Business**

*Use a broad conception of innovation and support activities across all economic actors and not only in R&D and knowledge-intensive sectors.* Combine financial support for business investment in R&D with actions
addressing other aspects of innovation, including internationalisation, inward investment attraction, business management, entrepreneurship promotion, skills upgrading and so on. Support all priority sectors in the Cantabrian economy and not just the most knowledge-intensive sectors.

\textbf{Introduce strategic audits and skills development initiatives to improve SME capabilities to evaluate their competitive position and innovation opportunities.} Support SMEs to improve their perception of their competitive position by promoting investment in management skills, for example in international marketing. The GIRA model (a cluster strategic management agency) could be replicated in other sectors, e.g. tourism, to strengthen collective strategic thinking. Strategic audits and innovation audits, offered by agencies like SODERCAN, should continue or even be increased. Grants supporting the insertion of qualified managers and technicians in firms should be considered.

\textbf{Build the internal R&D and innovation capabilities of firms.} Support for the creation and management of R&D units in firms or small teams of researchers in SMEs should be seen as the central instrument in developing internal capabilities on R&D and innovation. Instruments such as public subsidies to the labour costs of young researchers and technicians employed by firms should be considered.

\textbf{Increase firm innovation connectivities with other agents within and outside the region by developing R&D consortia projects and opening up government-funded collaborative research initiatives to selected firms and organisations outside Cantabria.} Companies should have detailed information on the technology offered by regional research teams in order to encourage research and innovation collaborations. Regional government projects supporting R&D consortia should normally also involve the participation of the business sector. These regional government supported projects should be opened up to firms and research organisations from outside the region when this would assist the sourcing, development or exploitation of knowledge. To encourage business participation in collaborative projects a policy should be developed to foster company confidence in sharing their research and development and innovation knowledge. This is likely to imply appropriate intellectual property protection policies in the research collaborations. Companies should also be advised on how they can make publication of the results of their collaborative research, development and innovation projects beneficial, for example by accessing market opportunities and technology partners.

\textbf{Exploit opportunities to support firm innovation through public procurement to regional government and regional public agencies.} The initiatives of the regional government and publicly-owned firms to build
logistics, healthcare and e-government should favour local procurement where this can support innovation at the same time as providing good value, particularly with regard to consolidating local strengths in ICT, where the public procurement opportunities are particularly strong. Firms should be encouraged to identify opportunities for their technological development in the broader implementation of the R&D+I Plan and communicate them to regional government.

Set out a clear methodology for a comprehensive and integrated package of support to promote technological entrepreneurship. For the implementation of the R&D+I Plan a clear methodology for the promotion of technological entrepreneurship, such as university and corporate spin-offs and knowledge-intensive new firm start ups, should be defined, including the support measures to be used and the institutional networks that will implement the measures. A comprehensive package of support measures should be developed across several integrated dimensions of firm needs, including premises, mentoring, technology services, business administration facilities, entrepreneurship education and financial facilities, including new expanded seed capital funds. The package of measures should be joined-up and easy for firms and entrepreneurs to access.

Research organisations

Agree the university’s strategic mission and main emphasis. The university should engage in a strategic exercise to decide whether its main emphasis will lie on its education mission, its technology transfer mission or on its research mission and whether it aims at a regional role or an internationally recognised position. This decision may of course vary according to the department or research activity concerned. The choice for each of these roles has consequences for the governance model of the university and how priorities are set. The regional government should be involved in these strategic discussions since it has important decisions to make on how it will support and use the university.

Focus regional government research funding on the most promising research teams and potential centres of excellence with commercialisation potential. Support a limited number of potential centres of excellence already in the university with opportunities for spin-off development in the longer term. The region should aim to achieve excellence in a very limited number of research areas that are selected because of existing university and industry strengths and their potential for stimulating regional business development in the long term. The choice could be made on the basis of well developed research and commercialisation plans produced by research centres and groups and the final selection made by university management.
or by a joint procedure with the regional government. The choice should be sustained over a relatively long period, perhaps even going beyond the current time horizon for the R&D+I Plan (2006/10). The centres of excellence should be supported by increased investment in technology, well-equipped laboratories and facilities and efforts to attract professors and researchers from outside the region and outside Spain.

*Use financial incentives, performance measures and support programmes to increase broader university engagement with business sector innovation.* Stimulate a number of interfaces between the university and a limited set of potentially future competitive sectors, e.g. automotive, logistics and food processing, that could benefit from upgrading through training, technological services, development and possibly research activities. This can be achieved by adapting regional government financial incentives and performance measures to university departments and through contributions to support programmes for specific sectors. Nonetheless, because of the lack of absorptive capacity in many sectors this regional business support activity should not become the dominant focus of the university’s role in the R&D+I Plan. It is important not to focus on local linkages at the expense of strengthening the university itself.

*Promote entrepreneurship in the university.* The university should define and develop a policy aimed at promoting entrepreneurship in the academic environment. This should support those academics who wish to, in both technology and other subject areas, to create spin-off companies or to undertake consulting advice and other services to the business sector. The policy should help to retain and motivate these staff and add value to the university in terms of income from its intellectual property as well as bring in information for research and teaching on company needs and industry issues.

*Develop training and technological services in the university to support innovation in key regional future industry sectors.* Invest in staff and competences in training and technology support activities within the university in parallel to mainstream Masters level education and research courses. These enhanced activities should aim to support regional enterprises in key future competitive sectors to improve the innovation absorption capacity of firms in these strategic sectors. Dedicated technology centres should be provided for these strategic sectors. Selected university staff should also be encouraged to work with the private sector through links with the technology institutions. Finally, simpler and more visible interfaces should be provided to public research institutions for easy access of firms to individual researchers and teachers in other university departments.
Reinforce the university technology transfer strategy and office by involving specialists and linking with international networks. The university’s existing technology transfer office should be enhanced to make a greater contribution to Cantabria’s innovation strategy. The capabilities of its staff are critical. The office should therefore focus on staffing by professional technology transfer specialists with experience in both the business and research aspects of commercialisation. These people are difficult to recruit in significant numbers and a substantial investment will need to be made by the university. Financial returns to the university can be expected from their activities. The regional government could support the university’s investment in these staff, making clear agreements on goals and targets in terms of the anticipated activities and regional development benefits. The university should also link its technology transfer office with others in Spain and overseas and join international networks that exchange best practice. A stronger collaboration with the Cantabria science and technology park should be developed. This should include an incubator facility for researchers attached to the university.

Regional environment

Continue to build and upgrade the region’s local innovation system. The vision that the Cantabria government has developed to base its future economic development on innovation and a shift to the knowledge economy is a sound one. The recognition that innovation success will depend on promoting collective learning and co-operation between research, industry and government is also sound. Currently the two key pillars of the regional innovation system are the university and related research facilities and the regional government’s financial and strategic guidance commitment. These need to be maintained. The principal weakness in the innovation system is to be found in the business sector. In this context it is right to continue what the regional government has launched, namely a science and technology based strategy that builds on the knowledge generation assets of the university, hospital and research institutes. These need to be protected and maintained whilst at the same time the knowledge exploitation capacity of the business sector is developed, including its linkages with other regional actors and actors outside the region. The R&D+I Plan is critical in this effort.

Build connectivities between the knowledge exploration system (university, hospital, research institutes) and the knowledge exploitation system (industry). Connectivities between the knowledge exploration and exploitation systems of the regional innovation system should be strengthened through continued support to the existing Technology Centres and efforts to increase the involvement of business in their strategy and
operations. It is also important to support the transformation of the university to a more entrepreneurial model emphasising a “third mission”, i.e. to interact with its surrounding regional economy in addition to research and teaching. The new regional government funding arrangements for the University of Cantabria through the contract programme presents an opportunity to strengthening this third mission of the university by creating a basis for regular contacts with the regional government and incentives for increased external co-operation. It is also important to use inward direct investment, university-industry research collaborations and human capital attraction to compensate lack of critical mass in the innovation capacities of the region’s business sector.

Support firms in “learning to innovate”. Increasing the innovation absorption capacity of actors in the local innovation system is critical to obtaining regional economic development benefits from the Cantabrian research and innovation strategy. This requires a shift of support from direct subsidy of specific and precisely delineated innovation projects in firms to activities that change firm behaviour in a range of areas that support innovation, i.e. changing firm behaviour from seeing innovation as a precisely delineated activity in terms of a research project towards a process of continuous efforts to innovate in all areas of firm activities. Efforts are required to strengthen firm’s research units and human capital and hence their capacities to access and exploit innovation from other actors. This corresponds to a strategy of supporting firms in “learning to innovate”. SODERCAN can play a very important role in this respect by supporting for example skills development for managers, placement of graduates in enterprises, financial support for innovation activities and inter-firm and science-industry linkages. Non-local as well as local knowledge transfer connections are required for the innovation inputs required by Cantabrian firms. Both will be promoted by polices that increase innovation absorption capacity.

Develop a platform-based innovation policy that builds “related variety” industries, i.e. those connected by complementary knowledge bases and significant spillovers. In order to maximise positive spillovers in the regional innovation system it is recommended to develop a platform-based innovation policy transcending traditional sector policies. This implies supporting the development of groups of related industries amongst which there is the potential for significant spillovers, in particular knowledge transfers (because of their use of similar knowledge, labour, networks and other resources). Among the strategic areas identified in the R&D+I Plan several sectors can satisfy these criteria, including: a red biotechnology strategy (pharmaceutical), a green biotechnology strategy (agricultural), a white biotechnology strategy (industrial), an Information and
Communications Technology strategy, and a tourist industry strategy. For example, in the case of tourism the strategy could seek to combine natural scenery (sea and mountains) with gastronomy, cultural events and historical heritage. It is important to differentiate the policy approach to take account of differences in the knowledge bases of the various strategic sectors since there are differences in the way that each creates knowledge and innovation, and, thus, differences in the forms of innovation support required and the necessary collaborative partners regionally, nationally and internationally.

Produce, attract and retain talented labour through increasing regional human capital investment and improving people climate. Highly-skilled human capital, or talented labour, is increasingly considered to be important to regional growth because of its role in supporting knowledge creation, transfer and exploitation. Cantabria should therefore develop actions to increase the production of locally-trained highly-skilled labour. Investments should be made in producing graduates in strategic industry sectors for Cantabria through the university and in providing continuing education and training programmes for managers, professionals and technologists in colleges and firms. However, talented labour is potentially highly mobile geographically. Therefore, in addition to local production of highly-skilled labour, an attractive “people climate” should be fostered. This will involve encouraging a social environment that is open to creativity, labour markets characterised by high demand for qualified personnel, cultural diversity and tolerance and high levels of urban service. A further critical factor in improving people climate is to open up and internationalise the somewhat closed and inward looking Cantabrian environment through establishing international school teaching in English, substantially improving English teaching and knowledge in the society, and promoting cultural events that demonstrate a willingness to support openness, diversity and tolerance. It is also recommended to promote and build the natural and cultural assets of the region for the attraction of talented labour as well as for tourism. It may also be possible to combine attraction of talent with the Comillas Project which is designed to offer specialised training in Spanish language and culture. In developing people climate initiatives it is important to recognise that the location preferences of talented labour are likely to vary by industry (or more precisely by the type of knowledge base underlying the industry). Because of the nature of its economic base the people climate that Cantabria should develop should be consistent with the preferences of technologists rather than other categories of creative worker.

Foster an entrepreneurial culture. A broad culture of entrepreneurship in knowledge-based sectors is one of the keys to the success of Cantabria’s R&D+I plan. Initiatives should therefore be promoted to foster a stronger entrepreneurial culture in the region and integrated within the R&D+I
strategy. A Masters level programme should be established at the university on Entrepreneurship and Innovation Management, targeted in particular on science graduates who will be at the heart of innovation in many of the sectors in which Cantabria is likely to hold future competitive advantage. Other potential initiatives to foster an entrepreneurial culture include communicating information on entrepreneurial success stories to the press and other media and creating entrepreneur prizes and awards. It is important that conditions are also in place to facilitate start-up and business growth by those motivated by and capable of entrepreneurship, particularly in innovative businesses. To support start up businesses the regional government should consider adopting a programme to deliver, encourage, or facilitate the formation of local seed and venture capital resources. In addition the region may play a role in identifying starts-ups with high economic growth potential that have not been able to obtain capital through the normal market mechanisms and to support them in accessing potential investors. It is also relevant to link the strategy of fostering an entrepreneurial culture with efforts to produce, attract and retain talented labour.

Involve the university and businesses throughout the process of development and management of the R&D+I Plan. In the spirit of the Triple Helix approach (connecting research, industry and government) to innovation strategies, the university, other research organisations and businesses should continue to be closely involved with regional government in the further design and implementation of the R&D+I Plan. The university and businesses have critical knowledge of the technological opportunities that may be exploited in the region, of what will be necessary to promote the exploitation of these opportunities and of how research and industry are likely to respond to different incentives and programmes. This information has been taken into account in the initial design of the R&D+I Plan but should continue to be drawn on throughout the Plan’s evolution in order to respond flexibly to new developments in technologies, markets and competition and to help define responses to any unforeseen problems or opportunities in the implementation of the Plan.

Promote innovation policy across the whole of regional government. It is important to promote the goal of innovation and a shift to a regional knowledge based economy across all the regional government activities that can be brought to bear on these objectives. Fragmentation and disconnection of innovation policy related initiatives should be avoided. The R&D+I Plan should therefore be understood, accepted and promoted across the whole of regional government and not only the industry ministry. This requires co-ordination and championing of the Plan from the top level of the regional government with all regional government ministries. The
regional government should also promote and communicate the R&D+I Plan to the general public to secure an understanding of and support for the objectives and to take the opportunity of its potentially high visibility of the Plan for promoting a stronger learning, entrepreneurial and innovative culture in the region.

_Evaluate the R&D+I Plan and its programmes and feed back into policy learning and adaptation._ The impact of the innovation strategy and its individual programmes should be evaluated periodically and its activities and outputs continuously monitored. The evidence from this monitoring and evaluation should be used to assess the Plan and its components against key criteria including appropriateness to needs, superiority over alternatives, efficiency and effectiveness. The results should be fed back into policy learning and in particular into decisions about potential adjustments to the design or delivery of the Plan that increase its benefits for the people of the region.

**Summary of learning model approaches**

This review provides several examples of learning model initiatives in other OECD regions that help illustrate how the above recommendations can effectively be put into place and therefore offer potential inspiration to policy makers and their partners in Cantabria involved in the further development of the R&D+I Plan. Table 7.1 summarises the aims, approach and relevance to Cantabria of the main international learning model programmes included in this review.

Further information on these learning models is provided in the body of the review report and from the contact points provided there. Additional models and analysis will be provided in other case studies to be taken in due course within the OECD LEED Programme review series on Entrepreneurship and Local Innovation Systems.
Table 7.1. Summary of messages from international learning model programmes

<table>
<thead>
<tr>
<th>Programme</th>
<th>Approach</th>
<th>Relevance to Cantabria</th>
</tr>
</thead>
<tbody>
<tr>
<td>NITEC, Portugal</td>
<td>Financial incentives to firms to recruit technical staff to create R&amp;D teams.</td>
<td>To build firm innovation absorption capacities, connectivities and demand for technological services and skills.</td>
</tr>
<tr>
<td>IDEIA, Portugal</td>
<td>Consortiums led by private companies for applied research and commercialisation.</td>
<td>To stimulate business R&amp;D, promote science-industry links and define applied research demands to research organisations.</td>
</tr>
<tr>
<td>Technology centres and collective services, Prato, Italy</td>
<td>Technology centres providing laboratory facilities and collectively managed specialised services for cluster firms, e.g. design, marketing.</td>
<td>To support the technology upgrading of the automotive cluster.</td>
</tr>
<tr>
<td>Kplus competence centres, Austria</td>
<td>University-industry research alliances involving long term contracts, on-campus structures for university and industry staff and interdisciplinary co-operation.</td>
<td>To support medium-term university engagement with industry partners outside the region, reinforce centres of research excellence and attract inward investment.</td>
</tr>
<tr>
<td>Innovation vouchers, Netherlands</td>
<td>Vouchers to SMEs to buy knowledge services from universities and technology centres.</td>
<td>To stimulate interaction between knowledge suppliers and SMEs, build a market for research services and build a market for training services.</td>
</tr>
<tr>
<td>Distinguished Professors Programme, Finland</td>
<td>Support for hiring of research professors in strategic areas from overseas for 2-5 years.</td>
<td>To strengthen research and training in university centres of excellence, increase international knowledge connections and attract talented labour.</td>
</tr>
<tr>
<td>CITER, Capri, Italy</td>
<td>Business Development Service Centres combining training services to SMEs with design, marketing, technology and management services.</td>
<td>To upgrade the SME sectors technology and skills base, move SMEs up the value chain, increase demand for training services and ensure a strategic perspective on training supply.</td>
</tr>
<tr>
<td>Vocational and adult education system, Denmark</td>
<td>Vocational training courses that combine generic training, specialist training and firm placements; recognition and transferability of qualifications obtained.</td>
<td>To build technical skills in firms and create a lifelong learning culture.</td>
</tr>
<tr>
<td>Danish Institute of Agricultural Sciences, Jutland-Funen, Denmark</td>
<td>Grants to a public research organisation tied to achievement of stated regional development objectives; focused on promoting innovation in the region’s food processing cluster including contract research, advice services and training programmes.</td>
<td>To better exploit public research for achievement of regional innovation strategy objectives and provide outreach support to strategic industry sectors.</td>
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### Table 7.1. Summary of messages from international learning model programmes (cont.)

<table>
<thead>
<tr>
<th>Programme</th>
<th>Approach</th>
<th>Relevance to Cantabria</th>
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<tbody>
<tr>
<td>Centres of Excellence, Ontario, Canada</td>
<td>Five Centres of Excellence promoting research, technology commercialisation and training of highly qualified personnel in their technological specialism.</td>
<td>To increase access of firms in strategic industry sectors to university technology services, demonstrate industry needs to public research, support technology start ups and strategically manage and direct services provided.</td>
</tr>
<tr>
<td>Ford Centre for Manufacturing Excellence, Ontario, Canada</td>
<td>Automotive training centre financed and managed in partnership between government, industry and Windsor College.</td>
<td>To upgrade skills in the automotive sector and move up the value chain with strong industry participation in the design and funding of training programmes.</td>
</tr>
<tr>
<td>University of Waterloo Co-op Programme, Ontario, Canada</td>
<td>Formal integration of university studies with in-business training; liaison between university staff and firms to help facilitate employment opportunities.</td>
<td>To improve linkages between the university and firms on technical training and access to graduate labour.</td>
</tr>
<tr>
<td>VINNVÄXT Programme, Sweden</td>
<td>Development of triple helix interactions in functional region defined innovation systems through competition for funding of long term innovation projects.</td>
<td>To increase university-industry relationships and technology transfer and introduce a more strategic regional development vision to publicly funded research projects.</td>
</tr>
<tr>
<td>VINN NU, Sweden</td>
<td>Annual competition to fund selected start-up companies based on research results.</td>
<td>To stimulate technology spin-outs from the university and other public research institutions.</td>
</tr>
<tr>
<td>VINN Excellence Centres, Sweden</td>
<td>Centres funded in partnership by government, universities and industry for 10 years to undertake basic and applied research and commercialise new products and services.</td>
<td>To develop existing and potential new research institutes and strengthen connections between knowledge exploration and exploitation in the local innovation system.</td>
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