Open Method of Co-ordination (OMC)
3% Action Plan
Second Cycle

# Report of the CREST Expert Group on:

## Encourage the reform of public research centres and universities, in particular to promote transfer of knowledge to society and industry

FINAL REPORT

March, 2006

Final Report submitted to CREST

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# Executive Summary

This is the Final report of the OMC 3% CREST Expert Group on the priority topic *"Encourage the reform of public research centres and universities, in particular to promote transfer of knowledge to society and industry"*. Between March 2005 and February 2006, four Country Peer Reviews and twelve Country Reports were produced. On the basis of this material, widely discussed in 11 plenary group meetings, with additional presentations by invited experts, the Group is proposing 20 recommendations for policy action.

The recommendations aim at contributing to the development of successful reform of public research centres and universities to promote knowledge transfer, focusing on four specific areas, which are listed below. These recommendations are addressed to national and regional governments, the EU and the PROs themselves, since they involve organisational aspects as well as support and funding issues. Depending on the policy area the EG has proposed detailed recommendations and general principles for action.

## The changing role of public research centres in knowledge transfer

In this first policy area the Expert Group concentrated on the overall restructuring of public research centres as it considers that public research centres should the knowledge transfer as their main mission intertwined with research. The research organisations should undergo a process of reform. This EG has proposed a set of key principles on which the reform process should be based.

The core message is that: ***To integrate demand driven approaches into the planning of research activities as well as into the redefinition of the operational management of the organisation.***

## Support and development of university knowledge transfer activities

To enable more efficient contribution to the innovation process, universities should see knowledge transfer as an important mission. However, while fostering this "third mission" the crucial role of universities in education and fundamental research must be preserved. Therefore, undertaking a reform of the whole organisation to promote knowledge transfer may be too difficult a task if not a wrong strategy. Entrusting the management of third stream activities to a professional, well organised and well supported, knowledge transfer unit would seem to be the solution. If this unit is effective in promoting cooperation with industry this should overcome cultural resistance within universities and make the university more aware of benefits of knowledge transfer.

Our core message in this area is: ***To achieve a successful knowledge transfer a change in the organisation cultural attitude and awareness, professional management of knowledge transfer activities, a proper knowledge transfer infrastructure and a system of performance assessment will be necessary.***

## Design of funding schemes to support knowledge transfer

Knowledge transfer is not a very self-sustaining activity, especially in the early stages. PROs cannot be asked to develop an additional activity while preserving their performance in previous ones if their funding is not increased accordingly.

The core message is: ***The additional burden and non self-sustaining character of knowledge transfer activities requires dedicated public funding.***

## Creation of incentive schemes for researchers to conduct knowledge transfer activities

Policy actions related to career rewards and mobility are being addressed by a dedicated steering committee. Thus, our contribution in this area is simply to highlight that successful knowledge transfer cannot be achieved without the cooperation of individual researchers. In most countries, career promotion mechanisms and salary regulations provide no incentives and actually discourage collaborative research with industry.

Therefore, our core message in this area is: ***There should be career and financial rewards for researchers linked to knowledge transfer activities.***

This Expert Group strongly supports Country Peer Review as an effective tool that directly responds to the needs of OMC. We recommend its systematic use in future cycles, with some methodological improvements to allow more critical reflection and produce more constructive feedback to reviewed countries.

The peer review experience, together with the mapping exercise in other countries and the input of invited experts has shown that there are a variety of PRO systems across countries, and has identified a number of examples of very high performance in knowledge transfer. The variety should be seen as a strength, since it can be used to inform policy action at EU and country level. This is especially important for new member and candidate countries whose PRO systems need major restructuring.

This Expert Group also recommends an evolution of OMC towards coordinated implementation, monitoring and evaluation of concrete policy actions.

# 1. Introduction

## 1.1 Background

In the context of the European Commission's (EC) Action Plan[1] for achieving the Barcelona objective to increase investment in R&D to 3% of GDP by 2010, and recognising that the primary competence for policy in this area lies with Member States (MS), the Spring European Council of 2003 called for the Open Method of Coordination (OMC) to be applied to research policy. OMC is a soft governance tool, agreed between MS at the Lisbon European Council in March 2000 as an instrument for coordinating national policies by collectively defining objectives and indicators in specific areas. The OMC aims at ensuring satisfactory progress in policy areas that are primarily within MS competence, involving an exchange of information and best practice, fixing European guidelines and translating them into national and regional policies, establishing indicators and benchmarks, periodic monitoring, evaluation and peer review organised as mutual learning processes. The Council also decided that the Committee for Scientific and Technical Research (CREST) should be the interface used to put into practice and oversee the application of OMC to reach the 3% objective.

The first cycle of 3% OMC took place between November 2003 and October 2004. CREST regrouped into different themes 25 recommendations of the Action Plan where OMC could be applied, and created 5 Expert Groups (EG) to deal with them. Each EG submitted a report to CREST in June 2004 outlining the main trends, key issues and suggestions for action. Building on these recommendations, on 1 October 2004 CREST adopted and submitted to the Council a report[2] of the main recommendations from the first cycle of 3% OMC. The report included 30 recommendations across 20 different action areas, as well as future orientations.

In December 2004, CREST adopted a "Modus Operandi for the application of OMC to Research Policy"[3] as an overarching framework for the second cycle of 3% OMC, which stresses the relevance of monitoring the implementation of the action plan and developing actions for specific priority topics. Work in the second cycle builds on voluntary reporting, a rolling work-programme with a continuous selection of priority topics, leadership by certain countries in relation to chosen topics, peer review, and the development of guidelines. A first list of priority topics and leading countries was agreed at the CREST meeting held on 20 January 2005, on the basis of suggestions from Directors General (DG) for Research, Innovation and Enterprise and CREST delegates.

## 1.2 The Priority Topic

The mandate of this Expert Group has its origin in the following action proposed in the Commission's 3% Action Plan: *"Pursue or initiate necessary regulatory and administrative reforms, and support measures, to enable public research institutions to develop more effective links with industry, in particular SMEs, while safeguarding their public mission in education and fundamental research. Issues to address include notably the establishment of incubators, science parks, seed funds and new type of public-private partnerships and the performance appraisal of researchers".*

During the first cycle of 3% OMC, this action was addressed by the EG on "The Public Research Base and its links with Industry". Building on the final report of this EG, CREST proposed to focus on further developing the recommendation *"Encourage the reform of*

[1] Investing in Research: An action plan for Europe, COM(2003) 226 final.
[2] CREST Report 1.10.2004: On the application of the open method of coordination in favour of the Barcelona research investment objective.
[3] Report of the CREST Advisory Subgroup on the Modus Operandi for the second and future cycles of OMC.

*public research centres and universities, in particular to promote transfer of knowledge to society and industry*" in its final report of the first cycle. This gave rise to the present priority topic. Together with a rationale for their recommendation, the CREST report includes seven additional suggestions or comments, and some examples of good practice.

The aim of this EG was to develop a common understanding of policy developments and challenges in the member countries in the area of knowledge transfer between Public Research Organisations (PROs includes all types of public research centres and universities), society and industry, to develop specific recommendations and proposals for more effective national policies, joint actions and mutually reinforcing actions at the EU and national levels.

## 1.3 Scope and Focus

The remit of the EG outlined by CREST is to "Encourage the reform of public research centres and universities, in particular to promote the transfer of knowledge to society and industry." To clarify this mandate the EG agreed the following interpretations:

- "*Encourage the reform*" refers to regulatory and administrative reforms and support measures, including programmes for financing public-private collaboration in research and supporting public-private partnerships.
- The topic covers both *Public Research Centres (PRCs) and universities*, as in some countries, research centres are mixed with university departments (see the CNRS "mixed units" in France) and also universities could benefit from good practice schemes initially designed for PRCs, and vice versa.
- *Transfer of Knowledge* has a much wider scope than just Technology Transfer (TT). Inserting doctoral graduates into firms (transfer of human resources) is a very efficient form of knowledge transfer and clearly encourages private investment in research and innovation. It is also crucial to keep in mind the relevance of non-technological innovation (such as the transfer of new organisational best practice).
- *Society and industry*. It is convenient to focus mainly on industry links, provided that "industry" is interpreted flexibly, to also include services.
- *Boundaries of the Group.* Pertinent areas were clearly defined in relation to the work of other CREST EGs on issues of relevance to knowledge transfer.

As the timeframe for delivery of results was short, the group focused on a subset of areas, avoiding overlap with work on other priority topics (e.g. the ownership of Intellectual Property Rights (IPR) or support for development of small and medium sized enterprises (SMEs), and exploiting the synergies with ongoing parallel initiatives.

In the first few months of the EG's work the priority topic was analysed focusing on: K*nowledge Exchange* (the role, activities and performance of knowledge transfer units, training and networking programmes); *Organisation* (adapting disciplinary-based structures for network-based innovation, new forms of public-private partnerships); *Venture* (generation of private research-based firms from the public sector, incubators and seed funds); *Researchers* (obstacles and incentives to engaging in collaborative research with industry, career rewards and mobility).

## 1.4 Work Programme and Structure of this Report

The work of the EG was organised along three axes: Country Peer Review, Country Reports and Policy Actions.

The EG conducted peer reviews in Sweden, Italy, Spain and Lithuania. A "light" approach was adopted. The peer review aimed to identify and establish a thorough understanding of interesting policy initiatives in the area of knowledge exchange in these countries, and to identify evidence of the success of schemes and conditions of transferability to inform policy

decision making. It was also decided that feedback from the Peer Review team to the country in question should aim at positive recommendations as the short duration of visits made it difficult for a meaningful critical analysis to be carried out.

A template for the Country Reports was developed to ensure a focus on information useful for the analysis of the policy areas identified by the EG as being of primary importance. The country reports were useful to map knowledge transfer policies and mechanisms existing in the different countries and were used to select practices analysed further in the development the policy recommendations.

Finally, based on lessons learnt during the Country Peer Reviews, information collected in the Country Reports and presentations by invited experts, the EG put forward a set of recommendations for policy action in the following areas:

1. The changing role of Public Research Centres in knowledge transfer;
2. Support and development of university knowledge transfer activities;
3. Design of funding schemes to support knowledge transfer;
4. Creation of incentive schemes for researchers to conduct knowledge transfer activities.

This report is organised in two main parts. Chapter 2 presents the summary of the peer review process (more detailed information on the countries reviewed can be found in Annex 1). Chapter 3 presents the policy actions needed to support the reform of PROs, proposing a set of policy recommendations relevant for national governments, the EC and the PROs themselves.

# 2. Country Peer Review

## 2.1 Peer Review in the Context of this EG

In line with the goal of this EG, the Peer Review teams aimed to identify and establish an understanding of interesting policy initiatives in knowledge transfer in a selection of MS.

The EG chose to use a "light" peer review approach, as agreed by CREST in 2004,[4] which made use of reviews by peers, rather than external experts *per se*, thereby making a positive impact on *participation and networking*, while at the same time gathering information. Although noting some of the challenges faced by particular countries, it was **not** within the scope of this EG's mission to provide an in-depth critique of their particular research and innovation systems.

It was agreed that a Peer Review team, consisting of up to four MS representatives from the EG, a representative of the Commission and an Expert Consultant, would visit four MS over a period of eight weeks. The four countries visited were Sweden (17-19th May), Italy (8-9th June), Spain (28-29th June) and Lithuania (4-5th July). These countries had volunteered to participate and were selected because, between them, a wide spectrum of innovation environments and initiatives was represented (see Peer Review reports of the four countries for comparative data). The Peer Review team members for each visit varied, with no MS representative being involved in more than two reviews. MS representatives involved in this process were from: Sweden, Italy, Israel,[5] Denmark, Germany, France, Greece and Spain.

ANNEX I provides detailed summaries of the Peer Reviews. Full copies of the Reports are available from the Chair of this EG. The following sections provide a brief summary of the key characteristics of the countries visited and the initiatives within their innovation systems considered by the EG to be of particular interest and potential, in terms of possible applicability to other MS or applicability at the European level.

### 2.2.1 The Swedish Innovation System: Notable Initiatives

Whilst rightly proud of their successful knowledge-based firms and strong history of R&D investment – Sweden has invested about 4% of its GDP in R&D since the 1990s – Swedish participants in the Peer Review pointed to some key challenges faced by the country. First, whilst industry R&D accounts for 74% of R&D spend in Sweden, 20 large companies account over half of this. In today's global R&D environment large companies seek to work with the best research partners, often regardless of location; thus, the Sweden government must continue to demonstrate a deep commitment to maintaining its knowledge base in order to retain these companies. Second, like other MS, Sweden is working to stimulate R&D demand in other companies, in particular in the SME sector, so the economy continues to diversify. Third, and again like other MS, Sweden wants to encourage the formation of more high technology SMEs to promote economic growth in the long term.

Sweden's experience suggests there will always be a pivotal role for substantial public funds in research and innovation; indeed, as company expenditure on R&D increases, government expenditure must also grow to maintain these "knowledge hungry" companies.

*Approaches to promoting the transfer of knowledge to Society and Industry*

Sweden is notable for its **people based** approach to transferring knowledge and the emphasis it puts on **networking**. The country has some dedicated technology Transfer offices (TTOs) at

[4] Meeting, 10th December 2004.

[5] Not an EU MS, but a member of the European Research Area (ERA). The OMC is open to ERA members.

universities or Public research centres but no specific funding for "third mission" activities or as defined in Sweden; - cooperation with surrounding society.

Three activities were identified as being of particular interest by the Peer Review Team:

- **The Swedish Competence Centre Programme**
- **The "Nordic" Public Research Centre Model**
- **The KTH Entrepreneurial Faculty Project**

The Competence Centre Programme brings university researchers and companies together around a 10-year strategic research theme. Centres are co-financed by the companies, the participating universities and the government. They have a responsibility to train industry-aware PhD students and are seen as pivotal in knowledge exchange. Funding and legal status reforms at a selection of PRCs in Sweden have supported them in becoming externally focused and better able to work with industry partners. The centres, managed under IRECO Holding AB, receive less than 10% of their income directly from government, with the majority of funding coming from industry for sponsored projects. Through the Entrepreneurial Faculty Project, Sweden's largest technical university, KTH, has begun a programme of culture and managerial change to support increased industry interaction and spin-off activities.

### 2.2.2 The Italian Innovation System: Notable Initiatives

With over 4 million SMEs, many of whom operate in lower technology sectors, Italy has found it challenging to encourage higher levels of industry engagement in R&D; just 0.46% of GDP R&D spending is from private sources, compared with the EU average of 1.27%. Whilst wanting to support SMEs in innovation activities, Italy's innovation policy must also support its remaining large industry, e.g. Fiat, Finmeccanica, ST Microelectronics, *and* promote both the growth and establishment of high tech SMEs. The multiple challenges are further accentuated by declining researcher numbers.

*Approaches to promoting the transfer of knowledge to Society and Industry*

Particularly striking in the Italian approach to its innovation system is the balance that has been struck between national initiatives such as FAR, the Fund for Advanced Research,[6] and local initiatives, such as Technology Districts. This model no doubt reflects Italy's strong regional structure and is another example of the **importance of networks**. As in Spain, strong localised nodes have been developed to deliver broader national needs.

It should also be noted that Italy has established **clear financial incentives** for promoting knowledge exchange. FAR, for example, has changed the way funding is directed to Italian universities meaning that they must seek external opportunities if they wish to increase current funding levels. **Greater competition** in general has been introduced into research funding to support researchers in taking a more external perspective.

Activities identified as being of interest by the Peer Review Team include:

- **FAR, the Fund for Applied Research**
- **Technology Districts**
- **Funding reforms at Consiglio Nazionale delle Ricerche (CNR)**

FAR provides a framework within which several types of industry-focused R&D activities can be stimulated and managed. SME (and other industry) R&D projects can be supported by

[6] FAR, "Fondo per le Agevolazioni alla Ricerca" literally "Funds for incentives to research"

public funds for up to 75% of their costs and there are strong financial incentives for enterprises to engage universities or PRCs in their research activities. Regional Technology Districts engage local government, universities or PRCs, and companies in a shared vision for the future development of the region based on synergies between its intellectual and industrial capital. In some cases, the Districts also support spin-offs from high technology firms. Italy has undertaken substantial funding reform at its major PRCs, CNR, making a large proportion of research awards dependent on competition rather than allocations, thereby promoting a culture based on solution provision rather than hierarchy.

### 2.2.3 The Spanish Innovation System: Notable Initiatives

As in Italy, the Spanish economy is dominated by SMEs with just under 3 million SMEs registered.[7] These SMEs are in sectors associated with lower levels of technology such as tourism and personal services. With regard to larger companies, just four of the world's 700 highest R&D spending companies are Spanish. Amadeus Global Travel, a provider of IT solutions to the Travel and Tourism industries, leads with an R&D expenditure of €151M.[8]

In spite of the absence of large R&D intensive companies and high levels of low tech SMEs in Spain, there are signs of a strong potential in innovation. In particular levels of R&D expenditure and personnel have increased. To maintain higher levels of employment, productivity and economic growth in the long-term, however, the Spanish government recognises that it must support further investments in research and innovation. Total expenditure on R&D in 2003 was just 1.10% of the Spanish GDP. Privately financed R&D accounts for 48.4% of this total, well below the Lisbon target of two thirds.

*Approaches to promoting the transfer of knowledge to society and Industry*

Spain, on both a national and regional level, has **invested in dedicated third mission offices and projects**, in particular in a network of TTOs known as OTRI offices. Programmes that provide incentives for universities to play an active role in the exploitation of their research base have also been promoted. Both these activities reflect the fact that Spanish universities and PRCs, in most cases, own the IP that their researchers produce, and alsothat Spain would like to increase its number of high tech spin-offs. As in Sweden there has been a focus on **people**, though in this case greater emphasis has been placed on engaging young researchers in industry R&D environments rather than creating "mixed" centres.

Initiatives identified as being of particular interest by the Peer Review team include:

- **OTRI and the RedOTRI Network**
- **Torres Quevedo Programme**
- **Andalusia Regional Development Agency Campus Project**

Funding from the OTRI scheme provides basic funding for TTOs at universities and PRCs; it supports TTOs at 90% of Spain's universities. The RedOTRI network was established to facilitate knowledge exchange and networking between OTRI offices. To promote the creation of research capabilities in companies, the Spanish government initiated the Torres Quevedo Programme which enables mobility of young researchers from academia to industry. Companies are subsidised for up to 75% of the costs of employing a researcher for up to three years - though it should be noted that the proportion of support declines over the three years and that in the third year the support is in the form of a grant. A fulltime job position is guaranteed after the third year of employment. The Andalusia Regional Development Agency's Campus project aims to directly stimulate spin-off creation from regional

[7] Spanish Census, January 2004
[8] Figures from the UK Department of Trade and Industry R&D Scoreboard for 2004

universities by providing loans to the university to invest in the establishment of companies based on their research. If the company succeeds, the capital gains from selling any equity acquired are split 80:20 between the university and Development Agency. If the company fails, the Development Agency assumes the final risk, and the university incurs no debt.

### 2.2.4 The Lithuanian Innovation System: Challenges and Responses

The fourth Peer Review visit was made to Lithuania. Reflecting the distinct needs of Lithuania's research and innovation system, this summary is structured differently from the previous three, making recommendations for supporting actions from the EU and other MS.

Since 2001, the Lithuania economy has shown a healthy growth rate, with annual GDP growth in the range of seven to ten percent. However, due to a decline in GDP of more than 40% during the early years of independence, Lithuania's GDP in 2005 will be only the same as in 1989-90. No figures are available for R&D expenditure as a percentage of GDP; however, it is estimated to be below 1%, with private sources contributing less than a third.

Lithuania has many of the important elements of an innovation system, including universities, PRCs, a business community, and a set of institutions aiming to support technology applications. It has not, however, managed to bring these elements together in a coherent and co-ordinated framework, and in a manner that links the public research and the enterprise communities. Many organisational structures reinforce the old practice of separating, rather than unifying the partners of innovation. An increased role for business in the governance of universities and PRCs, including serving on their boards of governors, can be viewed as a first step in closing this gap.

It was apparent to the Peer Review team during its visit to that Lithuania's universities, PRCs and businesses need more and *different* support to ensure that they become the core of sustainable growth. One idea put forward by the Peer Group was a "franchising" mechanism between, for instance, the German Fraunhofer system or the Swedish Competence Centre Programme, and Lithuania, which would help Lithuania leap-frog development of knowledge exchange. The main conclusion reached by the Peer Review team was that, by using EU funds for targeted investments in knowledge creation and exchange, the Commission has an opportunity to become a proactive force in the growth of Lithuania's knowledge economy. Ideas developed in the Lithuania context could be applicable to other new Member States.

# 3. Policy Recommendations to Promote the Transfer of Knowledge from PROs to Society and Industry

The mission of the group *overall* is to address the transfer of knowledge to society, and within society many different types of stakeholder can be identified. This EG argues it is important to note the differences between PRCs (PRCs includes public and some cases also private research institutes, large public research centre and academies of science)[9] and universities in order to promote knowledge transfer successfully. Although each member state has its own legal frameworks and traditions for knowledge production, universities are traditionally associated with tertiary education and basic research, while PRCs can be associated with mission-orientated R&D and, sometimes, specialist educational programmes. This EG is of the opinion that PRCs should consider knowledge transfer as a very important part of their mission, while for universities, knowledge transfer will become a third mission.

On the basis of the Country Peer Reviews, Country Reports and the work in the four Policy Areas, the EG developed the following recommendations organised in four main sections. The first deals specifically with the changes in the role of PRCs. The second focuses on the role of universities in knowledge transfer and presents recommendations for the development of the knowledge transfer infrastructure to support the creation of spin-offs and to develop a method for the assessment of the performance of knowledge transfer units. The third proposes a set of general recommendations for the development of programmes in support of knowledge transfer. Finally, the last section focuses on the researcher level. As this area is the primary focus of the Steering Group on Human Resources and Mobility (SGHRM), the EG comments only briefly on actions that could be taken to promote knowledge transfer at the researcher level.

## 3.1 The Changing Role of Public Research Centre in Knowledge Transfer

This section focuses on PRCs and knowledge transfer to industry and in particular SMEs, as these latter play a vital role in Europe's economy and appear to be an audience that PRCs can address with some success. Some of the recommendations presented below are also relevant in the context of the changes taking place in universities.[10]

In the 1980s and 1990s differentiation within the PRC sector emerged. Some PRCs have maintained their traditional role, mainly public sponsored *research* institutes, while others became much more market oriented with a decreasing level of public funding, but an increasing number of private clients, both from the group of SMEs and from large enterprises. This tendency towards a market orientation apparent within some PRCs has been most obvious in the Nordic Countries; hence we term it the "Nordic PRC Model".

It is recommended that the more market oriented Nordic Model of PRCs, with their longstanding external orientation, is better suited to promoting knowledge transfer with

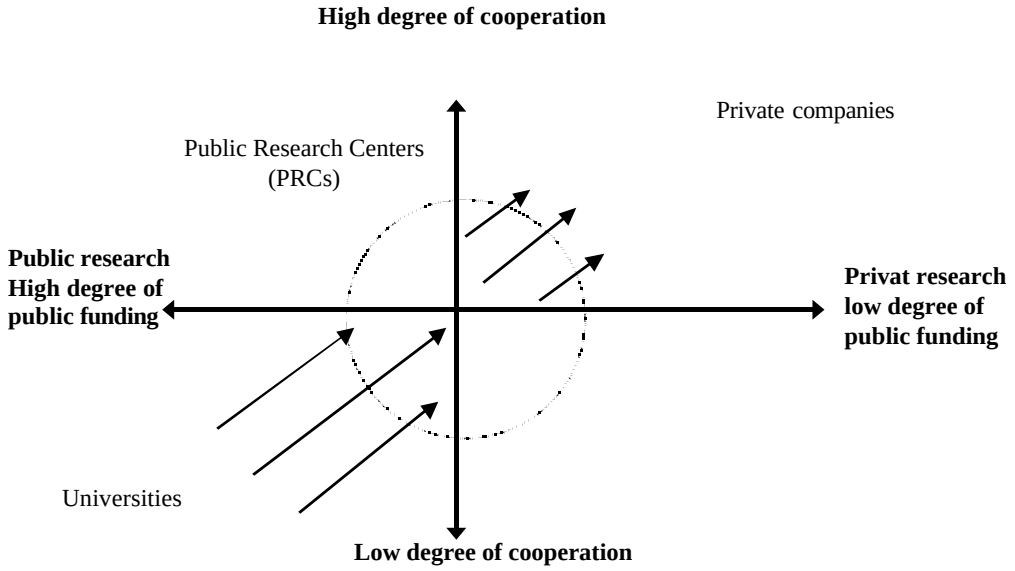
[9] In some MS PRCs are organised as private non profit holding companies with mandatory obligations to serve public goals such as developing and dessiminating knowledge to private enterprises especially SMEs; some of the clauses in their contracts are linked to the fulfilment of this goal. Since they serve public demands they are included in the PRC group although they are not public in a legal sense.

[10] In a few European countries the PRC function in society has been merged with that of universities. In this case the recommendations below will apply to the knowledge transfer centres within universities, and in cases of a weak or non-existent PRC structure or function, a strengthening or establishment of PRCs should be considered.

industry and with SMEs, rather than universities. Following from this it is recommended that PRCs in general (including academies of science) should be given a clear, market orientation and legal framework, enabling them to undertake knowledge transfer activities with SMEs and other enterprises. It is suggested that changing PRC funding structures towards decreasing dependency on government funding and the development of a "business management" culture could strengthen the ability of PRCs to interact with private enterprises. PRCs have substantial potential to strengthen their role in Europe's innovation system, acting as a targeted "link in the chain" to connect the "knowledge base" with the "enterprise base".

The dynamics of society within all EU countries are moving us towards a much higher degree of integration between public and private research than we have experienced before; these dynamics are occurring regardless of political actions, but can be promoted or postponed by political intervention. EU-countries that have promoted a higher degree of integration have, generally speaking, experienced a much higher degree of knowledge transfer from universities to SMEs and other enterprises. Graph 3.1 depicts the dynamics of society.

**Graph 3.1 The dynamics of society: bringing public and private research closer**




It should be noted that this dynamic development is more powerful in some countries than in others. In Israel, and to a great extent also in the UK, the role of PRCs has decreased and universities or sections of universities have specialised in addressing the needs of companies. In all countries, however, the limited co-operation between today's research base and private companies of yesterday, is changing at a different pace.

In line with these social dynamics, over the past 20 years PRCs have been subject to considerable reform and consequent change leading to a highly diverse sector. It remains a

large sector accounting for 13.5% of Europe's gross expenditure on R&D[11] and employing over 293,000 scientists.

The vast majority – 80% to 90% – of SMEs have no or very limited contact with PRCs or universities. Studies indicate that many SMEs do innovate,[12] despite having no contact with universities and little with other research institutions. Often very small improvements in production can mean the difference between success and failure for a SME. However, achieving these incremental improvements is not necessarily a basis for a co-operative project with a basic-science research orientated university, but will likely be tackled through collaboration with a market oriented PRC.

A 2002 study of the functions of European PRCs reported that a clear majority, some 80%, considered their primary mission was applied research with just half engaging in basic research. The application of capabilities, both development and diffusion/extension, accounted for some 70% of recorded activities. A variety of mechanisms were reported to be used for diffusion of knowledge, the most common being the provision of training and education, information services, publications, reports, seminars and conferences. These are activities with which SMEs can, and do, engage in productively. As noted above, two broad types of PRCs can be identified; those that receive the majority of their funding from public sources and those that receive the majority from external, competitive sources.

- Those PRCs that are clearly market oriented and have a high degree of funding from external partners have become expert in knowledge transfer, indeed, this could be argued to be their *primary* mission as their survival is dependent on their success in transferring knowledge. These organisations excel at knowledge transfer to industry and in particular to SMEs.
- Those PRCs that have more core public financing, whilst performing externally orientated R&D, generally position knowledge transfer *second* after applied research. Though clearly positive about the importance of knowledge transfer, these PRCs do not depend on it to flourish.

It is possible to use the matrix in graph 3.1 as a tool to place the two types of PRCs within their national science, technology and innovation (STI) system. It should be noted that the underlying dynamics in the EU are that most universities and PRCs are moving from the bottom left towards a higher degree of external cooperation, and, at the same time industry, SMEs as well as large enterprises, are becoming more and more knowledge based enabling them to contact universities directly. In some countries this has meant that PRCs have been merged with universities or been forced to close. This has forced the surviving PRCs to become even more marked oriented moving from the centre left to the top right. This movement is most apparent among PRCs in the Nordic countries, hence the term "The Nordic PRC Model" (typical examples of Nordic PRCs are the GTS network of Denmark, SINTEF of Norway and VTT in Finland) as opposed to the more common Central and South European "large scale PRCs and academies of science".

[11] Within the EU-15, PRCs in 2003 accounted for 12.8% of R&D expenditure, down from 16.4% in 1990 (EUROSTAT data); n MS have stronger PRC traditions, which raises the average.
[12] Disko analyses 1 to 8, conducted by Aalborg University in Denmark for the Ministry of Business and Industry from 1996-2001.

**Example 1: The Nordic Model**
**GTS – The Advanced Technology Group of Denmark**

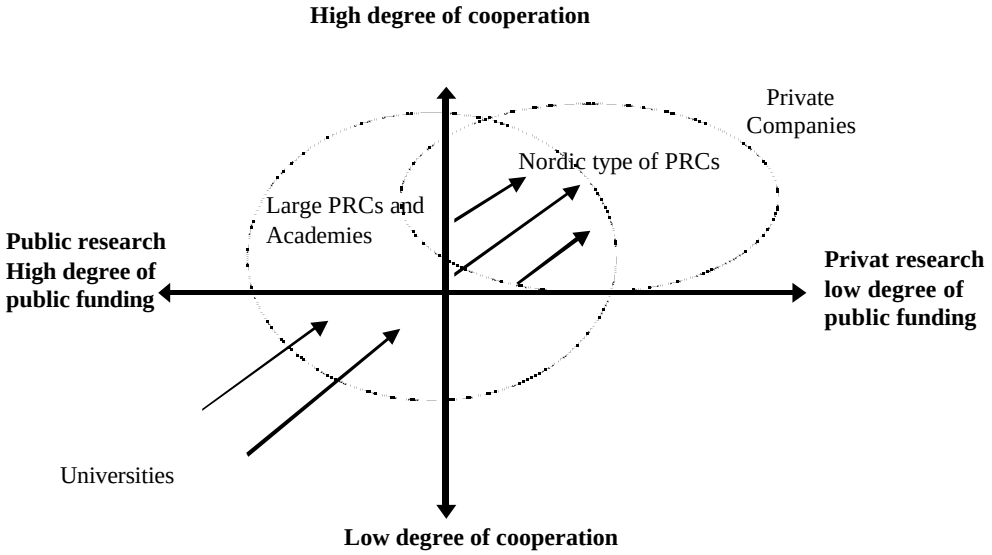
The seven partners of the GTS – Approved Technological Service - network had a customer portfolio of 47,500 in 2004, 31,000 of which were private Danish enterprises (2,500 were large enterprises and 28,500 SMEs). 15% of all Danish SMEs had contact with the GTS network in 2004. This is considered exceptionally strong performance in the European context.

Total number of employees is 3,000, half of which hold a masters degree or higher. Total commercial activities constitutes 81% of total turnover. Of this, commercial contracts with SME constitute 25% and international contracts 42%. Government grants 10% of the GTS networks turnover in performance contracts to particular R&D projects. These projects are bid for a competitive basis among the GTS partners.

An important element of the GTS system is, that they have an obligation to serve the Danish society with knowledge dissemination in particular SMEs. All services are sold on commercial terms and there are no special incentives for using the services of the GTS network. GTS operates independently of government in legal terms and is subject to commercial law. The GTS partners operate as a mot for profit foundation with the "right" to go bankrupt or to plough back excess turnover into research in the institute. The culture and management style of the organisation has been developed to become externally focused with staff being rewarded for successful industry engagements as well as publication.

Cooperation with universities is secured by a special Innovation Consortia Scheme including universities, a GTS partner and a group of private enterprises. The enterprises have to match the university and GTS partner costs, and obtain no govemmental subsidy for their participation. The oldest GTS partners have a 100 year history. *For more information see www.teknologiportalen.dk*

**Graph 3.2 The changing role of Universities and Public Research Centres**



**Example 2: Large Size Public Research Centres**
**CNR (National Research Council), Italy**

The National Research Council (CNR) is the most important Italian PRC and its reorganisation represented one of the noteworthy significant tasks within the framework of the reorganisation of the entire Italian research system. In the terms of this recent reorganisation the CNR has to promote and manage research and innovation networks involving universities and enterprises in order to support national competitiveness and European integration.

The permanent CNR staff comprises 8,185 people, of which 6,340 are researchers or engineers. Annual turnover is 805 M€. 66% comes as a government grant, 7% from industrial contracts and 25% is awarded on a competitive basis from national funds for joint research projects with industrial enterprises.

The operational structure –with the scientific departments as the most recent new pillars - has been completely re-defined in order to better match the needs of industry.

Activities other than routine research, are subject to internal contracts (currently 650 internal contracts are operating) and Centre's budgetary rules which include:

- full cost representation;
- money allocation by departmental projects;
- multi-partnership projects, preferably with external partners.

The operational model is designed to take advantage of experience gained through cooperative research in the EU Framework Programmes. On-going activities in re-defining operational models with reference to P2T2 take into account the needs of large countries characterised by many SMEs rather than large industry. Particularly, definition of priority areas for channelling P2T2 in favour of SMEs and creation of "ad-hoc" CNR participated enterprises, together with targeting selected research sectors in such areas, are considered to be a sound option to integrate SMEs in the process of P2T2 and, substantially, the resulting model appears to be in line with the approach adopted in the "Nordic Model".

**Example 3:Public Research Centres in New Member States**
**Lithuania's Public Research Centres**

Currently in Lithuania there are 35 PRCs, all of which seem to exist under very different conditions. Some institutions are clearly favoured by the formula based state allocation. This group receives about 60-80% of their budget from the government. This situation means that PRC managers spend considerable time lobbying for government support.

There are other research institutes that receive little government support but have become much more effective at working with industry. The Textile Institute, for example, now receives 100% of its income from industry. This, though, impacts on its ability to conduct basic research.

Many PRCs appear isolated from the market. While several PRCs are focusing on generating more funds from EU sources; it is not apparent that similar levels of activity are being expended on industry interactions. When governments are the main source of funding, they become the main focus of activities.

## ***Recommendations***

With their mission-orientated approach to applied R&D, the Nordic PRCs have shown themselves to be a strong partner for industry, and especially SMEs. It seems that generally

PRCs with less core public funding have a stronger engagement with private enterprises and SMEs. Different types of PRCs require different budgetary regimes e.g. several PRCs are engaged in nuclear research.

PRC funding structures should be carefully reviewed; PRCs should be seen as facilitating certain types of activity. Performance contracts linked to basic funding as a small proportion of total turnover, other competitive public funding and a strong orientation towards contracts with private enterprises seems to work in well developed market economies. In other economies, with different structures a higher degree of public funding than that provided under the Nordic PRC model will be necessary if the PRCs in these countries are to play a role in the knowledge transfer system. But a strong market orientation, the ability to earn money from commercial activities, and a high degree of independence from government interference seem to be necessary for PRCs to be successful in disseminating knowledge to industry.

### 1. Integrate demand driven approaches into larger Public Research Centres

PRCs can be a critical "link in the chain" between knowledge and society, but the nature of this linkage needs to be established so that both internal and external parties understand the contribution of PRCs. As noted above, it may not be appropriate for all PRCs in a national system to work with industry in general and SMEs in particular.

The Nordic experience points toward a completely new approach to the needs of SMEs, whilst the more traditional model of the large sized PRC needs to evolve dynamically in order to match the needs of the modern society. The two approaches are not contradictory.

As far as larger PRCs are concerned, there is the need to re-define the operational model, and to integrate demand driven approaches in planning research activities. This can be done by taking account of the industrial structure, the ratio of SMEs to large enterprises and the dimensions and peculiarities of individual countries. At the same time, re-shaping of large PRCs should include the possibility of creating "ad hoc" participated enterprises with the mission of selecting and transferring appropriated technologies to industrial bodies (especially SMEs) or of allowing internal research laboratories to fulfil this function. Such an approach would integrate the Nordic model and the large PRC model, resolving any seeming contradiction between the two models.

### 2. A market orientation should be integrated within existing and new support schemes and legal frameworks

Whilst some countries may opt to increase core public funding to encourage SME interaction, this may not have the desired effect. There is considerable potential for the current conditions of core public funding, and legal frameworks, to be modified to promote interaction with SMEs, or large industry partners.

To reward and encourage success, any income from patents, IPR or spin off activities of PRCs should be ploughed back into the PRCs' R&D activities.

The legal framework of the PRC organisation should favour a market orientation, to include their being forced to close down or, as is the case in the UK, Denmark and Sweden, having the right to declare themselves bankrupt if they are not able to generate sufficient income.

### 3. Set clear, long term goals for knowledge transfer activities at Public Research Centres and link funding to compliance

The government should set clear, long-term goals specifically related to PRCs knowledge transfer activities. These goals should include the number and type of enterprises engaged in

this activity, targets for SME turnover and other knowledge transfer activities. Achievements should be measured and improvements rewarded. If a PRC does not achieve its goals, its current working practices should be reviewed and changes implemented. Funding could be reduced or discontinued depending on the strategy adopted and the market demand for the services of the PRC. Consideration might be given to providing part of the budget based on a performance contract, and part in open competition involving other PRCs and universities, with awards being made based on the most deserving projects.

4. **Public funding should allow Public Research Centres to maintain and renew their knowledge base**

Success can only be reached through long term strategies and long term funding. The funding can be from public sources, cooperation projects or PRCs' own income.

If a PRC's activities are focused on limited opportunities e.g. space research or nuclear power, thus limiting the scope for generating income, public sources must make up the deficit. PRCs with a clear defined orientation towards dissemination of knowledge to enterprises, could be provided with less public funding, but greater freedom to conduct commercial activities, including engagement in international contracts.

Contacts, and competition with the best players in the world in particular scientific fields will yield cutting edge knowledge, which can be utilised when PRCs engage in research projects with domestic large enterprises and SMEs.

5. **Encourage management structures and cultures to be more outward looking by developing reward systems that value knowledge transfer activities**

The PRCs should have in place systems for rewarding activities in relation to knowledge transfer contracts and spin offs. The award of this internal funding should be based on qualitative and quantitative success. The PRCs should have sufficient administrative flexibility to operate in a business environment

Funding programmes supporting knowledge transfer should ideally be operated by dedicated foundations, awarding finance directly to the unit involved in the knowledge transfer and sometimes to the recipients of that knowledge. Close links between such foundation and the PRCs should increase the chances of successful investments.

The promotion and reward of PRC staff should be reviewed. If they are being asked to undertake additional duties to what might be expected from their university researcher counterparts i.e. more knowledge transfer, less basic research, then these staff should be reviewed not based on academic criteria, but in criteria that take account of their interaction skills, as well as their research skills.

## 3.2 Support and Development of University Knowledge Transfer Activities.

Knowledge transfer and its assessment have recently become important issues for policy action in most EU countries. A few countries such as the UK and Germany have been active in this area for some time, whereas others such as Greece, which has established knowledge transfer units only in the last two years, or the Czech Republic, which has no policy in place, are lagging in this respect. Knowledge transfer refers to contract research, consulting, spin-offs and licensing. Some of these activities referred to separately in the text below.

A wide variety of institutions is subsumed under the broad heading of Knowledge Transfer Units (KTUs). These include: the traditional university or PRC TTOs (e.g. Spain and the UK); holding companies (e.g. Sweden); and Technology Transfer Companies (TTCs) (e.g.

Israel). In some countries various types of KTUs coexist. In general, TTOs are created within universities or PRCs as adjuncts to existing KTUs, such as the holding companies in Sweden.

The diversity in the institutional organisation of public research in the EU countries has generated this variety in KTUs. To focus the analysis here, we consider only those KTUs owned, associated or affiliated to a university. Some of the recommendations presented below apply more generally to PROs.

It is important to understand how the aims and objectives of KTUs have evolved. Currently TTOs tend to be focused mainly on the exploitation of IPRs via licensing or the creation of spin-offs. In a number of EU countries Technology Liaison Offices or Industry Liaison Offices have been active in the support of university-industry interactions via contract research or consultancy. While some of these organisations evolved into TTOs, others continued in their original role. Although much current policy attention is devoted to IPR related issues it is important to acknowledge that contract research and consultancy still make a dominant contribution to knowledge transfer. Finally, although there is some indication of convergence across countries towards a KTU model that is based within the university and is focused on IPRs, i.e. the TTO, there continues to be wide variety in the organisation, aims and work of KTUs.

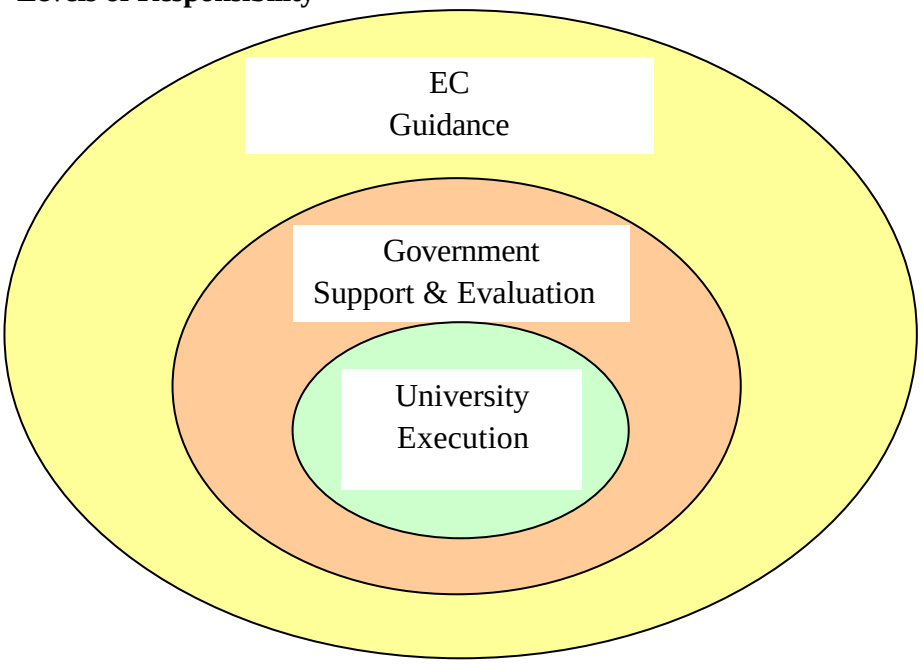
In some countries KTUs in universities were established in the 1960s and 1970s, e.g. Belgium and Israel. But it was not until the late 1980s and early 1990s that KTUs became widespread in European universities generally. In most countries with active KTUs there is an association or network of KTUs that aims to support the transfer of best practice across members, to develop training support and international connections, to influence national and European policy and to collect data on the performance of its members. Some of these associations such as the AURIL (UK), CURIE (France), NetVal (Italy), RedOtri (Spain) are also part of the ProTon network, which links the various national associations at European level. Similarly some of the national associations more oriented to IPR management, such as UNICO, are member of the ASTTP (Association of European Science and Technology Transfer Professionals).

The recommendations set out in the three sections below focus on the development of policies to support the development of knowledge transfer activities in university KTUs. Firstly, we look at the creation of a knowledge transfer infrastructure. Secondly, we examine how the creation of spin-offs can be supported; in recognition of its importance some of the recommendations apply to licensing too. Thirdly, a method for the assessment of the performance of KTUs is proposed.

### 3.2.1 Creation of a Knowledge Transfer Infrastructure

A major key to effective collaboration with the industry is to establish a body closely related to both the universities, and industry organisation. The recommendations below deal with the organisational aspects of the KTU, and provide the basis for the specific actions and support required for each purpose. The recommendations below are aimed at the three levels of involvement illustrated in Figure 1.

**Figure 1 - Levels of Responsibility**




***Recommendations***

**6. Establish a programme for the encouragement of the creation of KTUs and their support**

KTUs are important for effective cooperation between universities and industry, for the transfer of knowledge generally, and particularly for spin-off activities. It must be understood that effective knowledge transfer activities require the involvement of professionals, combining expertise and experience. Regional or national government must be responsible for supporting KTUs while their establishment must be in line with the fit of the university with the demands of the industrial environment. The size of the KTU should be determined based on the scope and size of activities envisaged (for example, one KTU might serve several universities).

**Example 4: The UK HEIF**
The UK example of the Higher Education Innovation Fund (HEIF) instituting a competition between the universities for the allocation of national funding from government is interesting. The universities had to prepare an implementation and budget plan for the activities of their proposed KTUs. The 2003 competition enabled the award winners to establish the KTUs and to begin knowledge transfer activities. Cooperation for the development of specific knowledge transfer activities carried out at the regional level was supported through this fund.

Occasional spin-offs can occur in the absence of a KTU, but the existence of a professional, well connected and networked unit is necessary to support large scale spin-off activity. Success and experience promote increased activity, leading to greater experience and improved efficiency, which should characterise effective KTUs. However, the commercial concepts of knowledge transfer and spin off are as yet not very familiar within the academic organisational culture; therefore the establishment of KTUs will require support, and guidance will be needed in the initial phases of their operation. As the UK example (4) shows, some countries have these systems in place and results are encouraging.

### 7. Establish a KTU network

KTUs are centres of specialisation. The commercial effects of collaboration with the industry are limited compared to those of a network of KTUs. The expertise and experience stemming from a KTU active in knowledge transfer can be augmented by the network. There are established networks that collect and disseminate the joint experience of several KTUs, allowing each to benefit from a wide base of experience, and speeding up the learning process. Networks enable the creation of specialized centres for specific activities (see example below), and referrals among KTUs, thereby reducing costs and inefficiencies (a KTU specialised in spin-off could assist another specialised in knowledge transfer - see Example 8: Torino Wireless).

This joint experience could result in reduced training or other fixed expenses (joint spin-off website, collaboration in technology fairs and workshops, shared platforms and personnel, etc.) and would exploit size advantages. Individual KTUs could thus be of small size, and need not have the capabilities to cover the full range of expertise of knowledge transfer activities, including spin-offs and licensing. The network should be nationally supported with this support decreasing over time counterbalanced by the increased support of the KTUs within it.

It is recommended that national/regional networks relate to other networks within the ERA, to maximise learning effects, and work towards a unified work methodology.

**Examples 5: Red OTRI**
Red OTRI allows the Spanish TTOs to use joint experience and expertise and thus increases their learning.

### 8. Establish external support organisations

When a technology sector critical mass exists in a specific region, and if the economic activity in the area and the supporting knowledge transfer infrastructure are considered underdeveloped, it is beneficial to form regional organisations, external to the universities (the universities could and should of course be partners) to deal with spin-offs and licensing in the region,. Such organisations, with partners such as stakeholders banks, local authorities, NGOs and others, can assist not only in the creation and organisation of spin-offs, but in the processes and support required for knowledge transfer. When spin-offs require the formation of a local venture capital company (VCC), or the assistance from local banks for special debt programmes, this is better managed on a regional basis; it is very difficult for a university on its own to achieve such a shift. This can also be applied to licensing which is such a complex area that mediating entities to provide links with industry and increase the legitimacy of the relations with the industry should be encouraged.

**Examples 6: Technological Districts**
The Italian Technological Districts, and more specifically IMAST and Torino Wireless (TW), are interesting. IMAST, situated in the heart of Campania Material district, specialises in licensing and has created links with the big firms providing support for further research and standards applications.
TW has created a spin-off infra-structure and established two VCs; it encourages strong links between the local technology incubator and large firms. TW has become so expert that it becomes involved in spin-offs from areas other than communications, based on its experience and past successes.

When the KTU requires an efficient and active presence in the industry to find the best licensee it helps if there is a body already involved in the industry on a regular basis. Thus the regional critical mass can be the motivation for the creation of a supporting environment for

spin-offs. A regional organisation also has more influence when legislative changes or regional support from central government are being sought. Such regional organisations might be part owned by and could support KTUs, but would also act for the general public, and support non-university originated economic development.

### 3.2.2 Support the Creation of Spin-offs from Universities

This section outlines the recommendations in relation to spin-offs. It is assumed that the environmental infrastructure at local or national level is supportive, and that it remains for universities to improve their spin-off creation rates. A model that could be applied to the EU region is proposed in Annex III. The recommendations below in relation to government support for actions taken by the universities; without this support (local/regional government) universities will not accomplish the necessary changes, and the rate of take up will be very slow.

***Recommendations***

#### 9. Create a specialisation within the KTU for spin-offs

While KTUs have the capabilities and tools necessary for many of their activities (e.g. licensing, contract research), in order to encourage and support spin-off activity they must specialise. This includes hiring a spin-off expert, setting up a database linking technologies and potential investors, and creating the necessary network for investment funding (VCs, local institutes and private investors, investors clubs, etc.).

**Rationale**

To support spin-off activity the KTU needs a specialist infrastructure, including expert personnel, an evaluation system, supporting network. Since the KTU generally will opt for the most efficient way of transferring knowledge, it may favour licensing over spin-off activity. However, the authorities (government, local or regional) should encourage KTUs to develop spin off expertise. Support in the form of both funding and training should be provided. Spin-off activities are complex and intensive. For example, an entrepreneur (and sometimes a whole team) is needed to lead the project, something that is not required for licensing. It requires contacts in the VC and financing community, the building of a reputation and good screening and business planning capabilities. Such a major investment necessarily requires long term commitment to spin off activity.

**Process**

Government support should be given to enable the KTU to hire a professional with a strong technology background, experience in industry, and experience of forming at least one start-up company. To be effective the person holding this position must quickly familiarise him/herself with the regional/national facilities and establish a nucleus forspin-off activities within the KTU. The KTU should be encouraged (by the supporting authority) to modify its evaluation process to identify spin-off candidates among the technologies reported for commercialisation.

The networking aspect is a continuous effort that requires support, as do the potential investment sources. Here government support is required not onlyto encourage the KTU to promote and support the networking activity by creating sympathetic regional / national conditions, but also to enableaccess to potential partners (venture capitalists, large industries, foreign investors, etc.).

All these activities and their support and monitoring could improve the economic development of the region.

**Examples 7: KU Leuven RTD**
The KU Leuven RTD model shows how the spin-off companies created by KU Leuven RTD helped to attract multi-nationals, increase licensing activity and cooperation with industry, and promote the creation of a leading knowledge based technological district in the area. The model incorporates a screening mechanism, establishment of an internal VC fund, and cooperation with external venture funding sources and leading financing organisations, providing them with a reputation that attracts high quality personnel and finance.

**Examples 8: Torino Wireless**
Torino Wireless is a very good example of the creation within a KTU of a specialist centre for spin-offs, employing expert personnel, with an appropriate evaluation process, network and tools for investment (including two VCCs, and links with a technology incubator for hosting new firms). Government support, both national and regional in this case, was critical to the development of the spin-off centre and the networking with industrial partners and investors.

### 10. Allow and encourage the formulation of the KTU spin-off and licensing activity as companies (legal profit oriented entities)

KTUs can exist in different organisational forms. The above examples show that it is beneficial for KTUs to be companies, or profit oriented organisations. However, another organisational form is for the KTU to be a unit within the university structure, for example a TTO. Each of these organisations has advantages which are discussed below. However, it would seem from the examples of good practice identified above, that the profit oriented organisation, institutionally separated from the university, produces the best results in terms of spin-off and licensing activities. The university must decide whether the entire KTU should be a separate company, or just the part managing its spin-off and licensing activities. This separate unit would still be owned by the university.

**Rationale**
The qualifications, values and methods of operation, and the skills and routines required for a successful spin-off creating, and licensing organisation, often differ from those normally found within universities. Universities tend to be conservative in terms of their management, and to focus on process rather than ends, to focus more on inputs and less on final results. Moreover, there are cultural differences between universities and for-profit organizations that must be resolved. A unit or an office internal to the university can be handicapped by these aspects and as a result would likely function less efficiently than an organisation that is both separate from the university, and is profit oriented. The cultural problems are summarised below:

| University | Corporate |
|---|---|
| Social responsibilities | Organisation responsibilities |
| Basic research | Applied research |
| Create new knowledge | Develop new products |
| Pure scientific driven research | Specific objectives: products |
| Publications and collaborations | Ownership and secrecy |
| Sharing of information | Control of information |

However, a profit oriented organisation, owned and controlled by the university, when operating vis-à-vis industry or financial institutions has the advantages that:

- It can enjoy its similarity to industry and financial institutions while maintaining total access to and cooperation with the university. It will become a bridge between the university and the economic world.
- It can hire people from industry on industry terms and conditions which will help them in their day to day negotiations.
- It can enter into fund raising activities and build up experience in financial and economic venture management.
- It can operate on an economic basis and legally own property such as firm shares, or other financial assets.

This type of organisation is likely to be efficient when dealing with the economic world on behalf of the university. The top university management must be involved (Deputy Director, Rector for instance, chairing its board) to ensure that the university retains the control over its operations, and adheres to academic principles

**Process**

The establishment of a unit / office within a university to serve as a KTU, is allowed in all European countries. However, in several countries the ownership by universities of profit oriented organisations is prohibited by law. Therefore, the first step is for the governments to pass legislation allowing the universities to own and operate these types of organisations. The second step is to obtain financial support, and make a training and marketing effort – information days, workshops demonstrating the advantages and operation methods for such organizations to persuade the high levels of university management. This would also involve the publication of the best practices and success stories of similar organisations in order to encourage all universities to adopt the pattern It should be pointed out that in assessing the performance of a university for the purpose, say, of national funding, the performance of an outside unit would be taken into account.

**Examples 9: Israeli TTC**

Israeli universities have been operating TTCs since the 1950s with great success (two of the eight Israeli universities are ranked among the world's 10 leading universities in terms of royalties earned from commercialising their knowledge). The structure of the TTC combines the benefits of a profit oriented company, limited by shares, employing people from industry, often with personal experience of establishing start-ups, and with good relations and contacts in the VC industry, to manage the university / TTC spin-off activity.

See also Example 7: KU Leuven RTD and Example 8 : Torino Wireless

### 11. Supply basic spin-off training for researchers

While the recommendation above referred to the ability of the KTUs to create spin-offs, it is important to remember that the most important factor in knowledge creation, and therefore its transfer, is the researchers. In addition to having academic freedom and ability publish, the creators of the knowledge, who have a decisive role also in its protection and transfer, should have a basic understanding of spin-off and licensing activities. It is not suggested that they must become expert in these activities, but they should be familiar with the terms and processes, and understand the stages involved in protecting their IP and making its spin-off or licensing more worthwhile.

**Rationale**

In most cases the researchers form the "front line" in identifying the commercialisation potential of their work. It may be necessary for them to provide technological support for any spin-off and they should be made aware of what might be involved. Generally, universities have not seen these types of capabilities as needing to be included in a researcher's repertoire. If spin-off activity is to really accelerate this will require the re-training of the research

community and their adaptation to new demands on their time. This retraining and informing effort should be encouraged and coordinated centrally; each university should adapt this training to its particular system and circumstances.

**Process**
The researchers should be encouraged, as part of their on-going training and promotion cycle, to participate in basic training in spin-off and licensing activity. This training should be supported by government, and regulated as part of the national requirements for the academic training and capabilities of a university researcher. All universities should be encouraged to develop a training programme designed for all researchers, both existing staff and new members.

The training could be nationally coordinated and financially supported to ensure conformity and relevance across all universities, and augmented by tailored sections to suit the requirements of individual institutes and universities, to be delivered by the university KTU.. The KTUs would be able to design specific training to build on the basics; this might include details of specific by-laws and methodologies in a particular university. The KTU should provide advice about marketing giving examples, of success stories and presentations from invited entrepreneurs. This training is not to turn the researchers into KTU staff, but to furnish them with some know how about spin-offs including basic legal knowledge about establishing and operating a firm (legal function, authorities etc.), business financing models (angels, seed funds, first round, IPO, etc.) and basic training in patenting (submission, approval, PCT, EU patents, etc.), and similar information about licensing. Researchers should be familiar with what is involved and the terminology, but not the fine detail, which should be the responsibility of the KTU personnel.

**Example 10: Industrial PhD Programme**
In Denmark under the industrial PhD programme, trainees are given a thorough basic training in Entrepreneurship, which includes TT aspects. The national authority responsible for the programme provides the training.

### 3.2.3 Assessment of KTU Performance
Current practice in performance assessment of KTUs can be categorised as association lead and ministry lead. The former aims to: (1) gather information to identify best practice and promote it among its members, (2) publish the results of its activity, (3) lobby government, and (4) provide benchmarking tools. The latter aims to: (1) gather information to improve knowledge transfer activities via the diffusion of best practice among KTUs, and (2) collect indicators that could be used in formula funding for programmes supporting the development of knowledge transfer.

In some countries associations have surveyed the performance of KTUs in recent years . For example the UNICO association in UK is completing the 4$^{h}$ survey of the activities of its members. In Spain the Red-OTRI association has conducted an annual survey of the effectiveness of OTRI offices since 2000 (from 1990 the Spanish Ministry of Science surveyed OTRIs); they collect information on: new patents applied for, PCT applications, patents licensed, spin-offs and contracts with companies and other private or public entities. In Italy surveys were completed in 2003 and 2004. ProTon has just completed the second European survey of KTUs obtaining about 160 institutional responses from KTUs located mainly in Spain and Italy, but also in Germany, UK, The Netherlands and other countries. This survey was based on a common core agreed with the partner national associations.

Spain, France and the UK are the only countries that have developed a formal assessment of KTU performance at ministerial level. In France, A prototype survey was carried out in 2003;

and another survey was conducted in 2005. The main lesson from the French experience is that "ownership" of the survey should be clear. The fact that the 2005 French survey was supported by both the ministry and the CURIE association of KTUs, rather than maximising the response rate, resulted in unclear and difficult to compare responses because respondents were not sure how the survey would be used. The UK has been carrying out a formal evaluation of broadly defined knowledge transfer activities at ministerial level since 2000. There have been four Higher Education-Business and Community Interaction (HE-BCI) surveys of higher education institutions. The survey aims to capture a broad range of the interactions that occur between universities and industry and society at large. Up to now funding has been allocated on a competitive basis, but from 2006 the allocation in the UK of the £238 million to HEIs from the HEIF will be made partly on the basis of competitive contracts and partly on the basis of a formula built with indicators generated by the HE-BCI survey and others. This means that 75% of 3rd stream funding will be allocated on a formula basis to all universities that replied to the questionnaire in the previous year. Less than 50% of the formula allocation will be based on the number of academic (teaching and research) staff.

On the basis of current practice and experience in the EU countries examined, the following recommendations are made for the development of an assessment method that will help to improve knowledge transfer practices, support the development of knowledge transfer professionals and support government in the development of policies. Below we outline the rationale for the assessment method chosen, and then highlight the basic characteristics of the methodology selected and make some recommendations.

**Rationale**

Although knowledge transfer to companies and society has always been one of the activities of universities, it is only recently that this activity has been formalised within KTUs. These organisation need to develop competences and skills to carry out their tasks in an effective and efficient way. This necessarily involves a process of learning by doing, as there are very few experts in knowledge transfer management, especially in PROs. Any assessment of KTUs needs to take into account that the performance of these organisations is strongly affected by their history and financial resources (existence of explicit policies related to knowledge transfer, experience, competences, network connections, and funds).

Depending on the existence or not of a dynamic industrial presence (accompanied by financial intermediaries) near the university, the activities and aims of a KTU will differ significantly. There is increasing evidence that a simplistic supply side model of regional development based on the idea that the university on its own can become the source of industrial development does not work. The university must work and interact with the local environment requiring different knowledge transfer activities depending on the characteristics of the local environment.

Knowledge transfer from the university to industry, and society at large, can occur through several channels. It is important to recognise that KTUs differ in terms of what they have been set up to achieve. The weight given to different exploitation mechanisms, such as consultancy, contract research, spin-offs, and licensing, is different across organisations. It should also be taken into account that over time the aims of KTUs may diverge from those of the universities.

Some knowledge transfer activities occur outside the university system through personal contacts, and are not necessarily reported to, or recorded by, KTUs. Such informal and invisible activities (for instance much consultancy work) are therefore hard to track and difficult to coordinate. However they play an important role in the diffusion of new knowledge. The successful interaction between companies and KTUs is affected by, and

affects (in case of centralised over formalised management of the these interactions), in positive or negative terms, these activities. Small, informal consultancy and contractual relationships are the basis of the trust that is needed for more important activities to develop. One example of where a determined attempt to extract economic returns from university inventions via formal IPR resulted in weakening the informal knowledge diffusion process can be seen in the decrease in Danish academic participation in patents after the 2000 Law on University Patents was introduced.

Any assessment of KTUs should take into account the broader knowledge transfer activity of the university and try to evaluate the performance in relation to the overall knowledge transfer of the institution so that the various channels and activities of knowledge transfer are mutually reinforcing. Given the problems inherent in measuring knowledge flow and especially third stream activities, we think that a performance assessment based solely on simple quantitative indicators of activities or outcomes/impact will only capture a fraction of the broad set of the knowledge transfer activities taking place.

**Example 11: HE-BCI Survey**
An interesting example is the HE-BCI survey in the UK which aims to capture a broad range of interactions, not only commercialisation of research. Acknowledging the difficulty in collecting indicators of broadly defined knowledge transfer, the results of the survey were not immediately used as a basis to allocate funds. Three preliminary rounds were used to: (1) improve question design, (2) create incentives for universities to develop a measurement system of their knowledge transfer activities and (3) give universities time to organise and monitor their knowledge transfer activities. One member of the university is responsible for collecting the data needed to reply to the questionnaire. To achieve high quality data, responses are validated with direct communication with the respondents where analysis suggests dubious figures (approximately one-third of HEIs were contacted following the most recent survey). To obtain a high response rate it was made clear that eventually the indicators from the survey would be used as the basis for funding allocations, and thus universities that did not respond would be disadvantaged in 3rd stream funding.

## ***Recommendations***

### 12. Performance assessment of university KTUs should be based on a modular approach (questionnaire, self-assessment, peer-review)

The UK approach described above can be defined as "carrot and stick". Another approach to achieving broad measurement of knowledge transfer, commitment of the universities involved in a way to creating incentives for the organisation and development of knowledge transfer and commercialisation activities, is based on: a questionnaire based collection of a minimum set of mainly quantitative information (Block I), a qualitative self-assessment process (Block II) and a light or fully-fledged peer review (Block III). Each of the modules is independent; can be carried out independently or not, depending on the type of information needed and the willingness of individual universities (and the government) to commit to the higher costs associated with the more informative Blocks II and III.

The three modules could be structured as follows (see Figure 1). First, Block I would consist of a short facts and figures module similar to the association surveys. This information could be complemented by information gleaned in Block II, a self-assessment template that aims to extract qualitative information on the university's future strategy for knowledge transfer. These two modules would be the basis for the final peer-review assessment in Block III.

Members of the peer-review panel should be scholars, industrialists, practitioners, and policy makers with international reputations. Universities being assessed would be visited by national and international peers, allowing issues that the university, and the peers, judge to be most important for knowledge transfer and commercialisation activities to be more deeply probed. Meetings should be held with the university staff responsible for knowledge transfer and commercialisation and with other academic and support staff. A prototype of such an assessment is currently being conducted in a few Swedish universities with the support of VINNOVA.

**Figure 2: Structure of the Modules**


### 13. A minimum set of comparable data should be collected at EU level

As demonstrated by the problems encountered with the ministry-led surveys in France and the UK, and also with some of the association-led surveys, much of the data are not available in a structured way across EU universities. It will be necessary for universities to put in place monitoring systems to allow them to collect structured information. For Block I (questionnaire), existing experiences at the national and EU level need to be further developed and standardised across countries; in terms of Block II (self assessment) and Block III (peer-review) very little has been attempted. These activities must be specifically supported at the EU level for Block I and mainly at the national level for the other two blocks. Blocks II and III will require considerable investment from universities.

It is important to recognise that international as well as national comparability is difficult due to the specificities of knowledge transfer that have been highlighted and the systemic differences among countries.

### 14. The implementation of the methodology should be carried out by member states on the basis of a common EU approach

MS should adopt an approach common at EU level, to diffuse best practice in relation to the peer reviews and perhaps facilitate international ranking of performance. Developing rankings

based on knowledge transfer and commercialisation indicators would be very difficult, due to problems of comparability (e.g. how would you weight consultancy compared to patenting activity). However, it is possible to envisage identification of high and low performers both nationally and internationally, thus creating reputation-based competition among top performers at EU level.

The minimum set of EU level common indicators for the quantitative questionnaire should be sufficiently large that input and output indicators would avoid over emphasis of a single approach to knowledge transfer. An example of the dangers of a standardised approach is the case of IPR based indicators that can create the wrong set of incentives. Universities could applying for lots of patents, none of which could result in an important innovation diverting attention from other knowledge transfer activities that are more difficult to quantify.

Repositories should be established that store the results of the assessment (based on a minimum set of guidelines common across EU countries) at EU level, to facilitate diffusion and continuous learning to improve systems across countries.

**15. The proposed methodology should be used by university leaders to improve knowledge transfer practices and by governments agencies or other relevant organisations to support policy measures**

The three blocks would differ in their degree of ownership and openness. Block I (questionnaire) is open and internationally comparable, it can be carried out annually. Block II (self assessment), depending on the country, can be owned by the university and used internally in a formative way, or owned by the ministry and used for summative evaluation aiming at ranking. However, there should be a set of qualitative questions that is common across countries the results of which should be internationally available. Given higher costs involved this Block could be administered every two years. Finally, Block III (peer review) is country specific and would be owned by the university, but a summary should be made publicly available; it could occur 5 yearly.

**Figure 3: Summary characteristics of the proposed methodology**

| | Ownership | Implementation | Suggested Period |
|---|---|---|---|
| Block I | Open | EU/MS | Yearly |
| Block II | University/Ministry | University/MS | Every 2 years |
| Block III | University | MS | Every 5 years |

**16. CREST is invited to endorse the proposed assessment methodology and to promote its implementation in member states**

If a successful international methodology that supports best practice in knowledge transfer is to be achieved, there must be strong support from CREST to create a common approach that it is not perceived as strictly connected to the national allocation of funds.

## 3.3 The Design of Funding Schemes to Support Knowledge Transfer

This section makes recommendations for the support of knowledge transfer in both PRCs and universities. Public funding might be needed when there is a market failure in the supply of new knowledge from risky R&D projects adapted to business needs. There is a gap between curiosity driven public research (public good freely available in scientific publications) and innovation as a business process. The knowledge transfer programmes must concentrate on these needs and should support knowledge transfer channels.

Funding influences the dynamics of science processes. This occurs independently from the willingness to steer the processes. The creation of new research results originates from several, mostly individual and cumulative steps, though breakthroughs may also occur. The composition of funding schemes and instruments must therefore be based on a sensitive system of institutions, programmes and special funding measures.

Some of the following recommendations concerning the support of the knowledge transfer process apply generally while others will only become effective in a specific environment.

***Recommendations***

**17. Funding systems must stimulate universities to transfer knowledge to society and industry**

If the transfer function of universities is to work efficiently, support for IP and patent services must be available for scientists on a reliable and efficient basis. Funding authorities should provide long term basic funding for KTUs

The KTUs should be supported because they provide an important service for scientists in terms of patenting and transfer agreements for IP. The services they provide are not self sustaining and certainly in the early years they will need continuous financial support. KTUs should be specialised in particular research areas or functions and some division of labour in cooperation with units at other universities is recommended. In economic terms KTUs will need to specialise and cooperate to be successful.

**18. National funding schemes for PROs should enable public and private research to build strategic alliances at the national and international levels**

Funding should encourage cross sector and cross border cooperation (e.g. public, private and international). National funding should encourage PROs to operate joint international laboratories or projects. The European Commission supports such alliances through EUREKA and the Networks of Excellence within the 6th Framework Programme, and will continue to do so in the planned 7th Framework Programme.

Public and private cooperation research efforts often come up against legal and other barriers. If MS rules do not allow cross-border projects, special project funding or some other financing scheme could become a bridging element. Models such as the mutual use of research facilities and exchange of staff do exist, but only in small numbers; these activities should be encouraged through financial incentives.

**Examples 12: The Chalmers Research Centre in Göteborg**

The Chalmers Research Centre in Göteborg, a cooperative venture between Fraunhofer and the Chalmers University, is an example of an efficient alliance in the field of applied mathematics. It allows the partners to have access to each other's markets and their complementary expertise results in a very efficient collaboration. This venture has been working successfully for 5 years and is an excellent example of a long-term European Joint Institute.

**19. Develop funding schemes to assist spin-offs from PROs**

The support of programmes promoting spin-offs from PROs should include support for cooperation, specialised funding, and business support at an early stage. Efficient mechanisms providing financial stability for entrepreneurs and early stage companies are required.

Funding schemes should follow the rationale described below. The preferred strategy would be for spin-offs to enable PROs to extend their range of activity to the economic area. The spin-offs would exploit the state of the art in PROs to develop their products and enable cooperation and contract research. Before the stage or production is reached it is often necessary to undertake long series of experiments. Spin-offs are ideally placed to conduct this work and the institutes have the chance to gather experience in applied research close to the market.] Where appropriate, PROs could contribute know-how in return for participation in and a share of the risk of the spin-off. Once the development phase has been completed, the PRO should sell its shares in the spin-off and reinvest the profit realised in new projects.

Often, available funding for spin-off and venture funding, is awarded on a case by case basis, which are not suited to the early stage of spin-off development. The often long duration of the start-up phase of technology spin-offs must be taken into account in the development of funding schemes.

## 3.4 Creation of Incentive Schemes for Researchers to Carry out Knowledge Transfer Activities: Reward, not Discourage Them

This EG is very aware of the importance of incentives for researchers to improve the transfer of knowledge. In this report though, the institutional rather than the individual aspects have been the focus. The subject of individual researchers is dealt with in depths by four working groups, established by the Steering Group on Human Resources and Mobility, which have developed recommendations on knowledge and skills development, career appraisal, and the legal and administrative obstacles to mobility and structuring initiatives.[13]

**Rationale**

The country reports and data collection show that in most countries, one of the major bottleneck in the transfer of knowledge to society and industry is the attitude within some research environments that pure fundamental research is "better" research than research done in cooperation with industry.

This attitude, which has historical and cultural roots, promotes a negative view about the commercialisation of research. Moreover, as joint research in certain fields does not result in publications, many scientists do not see the advantages of cooperating with industry. This in many cases blocks knowledge transfer. To change this situation and improve the transfer of knowledge to society and industry, it is necessary to develop and apply efficient policies, designed to change researchers' attitudes to knowledge transfer and cooperation with industry and society.

***Recommendation***

**20. Develop and apply across the PRO sector evaluation tools resulting in career and financial rewards linked to knowledge transfer**

Assessment criteria have traditionally been based on indicators such as publications. It is recommended that quantifiable indicators related to knowledge transfer, including patents, should be included in national (university and PRC) evaluation systems of R&D efficiency.

[13] See the report "Recommendations by the Expert Working Group on Intersectoral Mobility", December 2005.

How these evaluation tools should be developed will depend on the characteristics of individual countries. It is therefore difficult to make general recommendations. However, the EG was in agreement that depending on the research activity being evaluated, some "new" indicators of knowledge transfer were needed. It is important to remember that the aim of these measures is to improve knowledge transfer, not to create incentives for knowledge production activities to be substituted with knowledge transfer.

**Example 14: The Czech Republic uses a new evaluation system**

From 2005, the Czech Republic is applying a new system of evaluation for PROs, which includes not only the "usual" R&D indicators but also "new" ones covering knowledge transfer.

A proposed version of this system would include the following indicators:

| | | |
|---|---|---|
| 1. New products, prototypes | value | 25 |
| 2. New technology developed | value | 25 |
| 3. Patents, know-how | value | 20 |
| 4. Ph.D supported from project | value | 15 |
| 5. Papers | | |
| a. impact journal | value 10 x (IF/median. IF category ISI) | |
| b. non-impact, refereed | value | 5 |
| c. non-impact | value | 2 |
| d. book | value | 15 |
| e. book chapter | value | 5 |
| f. proceedings | value | 5 |
| 6. Cooperation with company | value | 10 |

# 4. Conclusions and final remarks

## 4.1 Peer Review as a tool

This Expert Group found that Peer Review is a particularly effective tool as it can be used to facilitate the collection and exchange of information on national policies, to identify good practice in MS and to establish networks of national policy-makers able to work together on a multilateral basis through OMC or other forms. It directly responds to the needs of OMC, providing evidence that can be used to inform the process of making recommendations *and* establishing close relationships between policy-makers in MS.

The objective of the Peer Review Exercises in our case was to gather evidence on the research and innovation systems of the countries involved and to identify good practice in relation to our goals. Examples of successful schemes identified by this Expert Group are:

- The ***Competence Centre*** model in Sweden, a good example of a long-term public-private partnership with three sources of support (national government through VINNOVA, business companies and in-kind contributions from universities).
- The ***Fund for Applied Research (FAR)*** in Italy, an instrument mainly aimed at promoting industrial research, but also encouraging public-private collaboration and supporting third stream activities. FAR funding is also used to support the ***Technological Districts*** scheme, a good example of collaboration between national and regional governments.
- The ***OTRI, PETRI and Torres-Quevedo*** programmes in Spain, examples of national programmes supporting concrete third stream actions. Support from these programmes is a key contribution to the training and networking activities of ***Red-OTRI***, a national network of university TTOs. ***NEOTEC*** (at national level) and ***CAMPUS*** (at regional level in Andalusia) are examples of good practice in supporting and encouraging spin-off activity.

In Lithuania, rather than focusing on the identification of successful schemes, the Peer Review identified a set of challenges To some extent, these challenges are also common to other new MS and Candidate countries.

## 4.2 List of recommendations

On the basis of our work, this EG considers the following list of policy actions of particular importance for the development of more effective transfer of knowledge from PROs to society and industry:

***The changing role of Public Research Centres in the knowledge transfer***

1. Integrate demand driven approaches into larger Public Research Centres
2. A market orientation should be integrated within existing and new support schemes and the legal frameworks
3. Set clear, long term goals for knowledge transfer activities at Public Research Centres and link funding to compliance
4. Public funding should allow Public Research Centres to maintain and renew their knowledge base
5. Encourage management structures and cultures to be more outward looking by developing reward systems that value knowledge transfer activities.

***Support and development of university knowledge transfer activities***

*Creation of the Knowledge Transfer Infrastructure*

6. Establish a plan for the encouragement of the creation of KTUs and their support

7. Establish a KTU network
8. Establish external support mechanisms.

*Support the Creation of Spin-offs from Universities*

9. Create a specialisation within the KTU for spin-offs
10. Allow and encourage the formulation of the KTU spin-off and licensing activity as companies (profit oriented legal entities)
11. Supply basic spin-off training for researchers.

*Assessment of KTU Performance*

12. Performance assessment of university KTUs should be based on a modular approach (questionnaire, self-assessment and peer-review)
13. A minimum set of comparable data should be collected at EU level
14. The implementation of the methodology should be carried out by member states on the basis of a common EU approach
15. The proposed methodology should be used by university leaders to improve knowledge transfer practices and by governments, agencies or other relevant organisations to support policy measures
16. CREST is invited to endorse the proposed assessment methodology and promote its implementation in member states.

***Design of funding schemes to support knowledge transfer***

17. Funding systems must stimulate universities to transfer knowledge to society and industry
18. National funding schemes for PROs should enable public and private research to build strategic alliances at the national and international levels
19. Develop funding schemes to assist spin-offs from PROs.

***Creation of incentive schemes for researchers to carry out knowledge transfer activities***

20. Develop and apply across the PRO sector evaluation tools resulting in career and financial rewards linked to knowledge transfer.

## 4.3 Some additional observations

Although much needs to be done in the process of reforming PROs to promote knowledge transfer, this expert group has identified a large number of examples of very high performance. For all forms of knowledge exchange (contract research and consultancy, long term public-private partnerships, IP management, licensing and spin-off creation) there are in Europe pockets of excellent practice. Therefore, it is worth emphasising the importance of mutual learning and that further attention should be paid to the transferability of successful schemes and initiatives.

It is important to recognise that PRO systems differ greatly across MS. Far from representing a difficulty for policy design and coordination, this should be considered a strength, if only because it enables a vast source of information to be tapped. European countries should take advantage of this variety by enhancing mutual learning and using it to inform policy action at the EU and country level. This is especially important in the case of new member and candidate countries where a critical assessment can be made of which organisational configuration would be more effective.

The new member and candidate countries have PRO systems that will require major restructuring. This reform process will affect universities, mainly by the emphasis on accountability, but is even more significant for PRCs. Outside universities, the Academies of

Science are the public research base in these countries, most of which follow a traditional model based on curiosity driven research, with high levels of individual autonomy for researchers and little compliance with business innovation objectives. Evolving towards a fully fledged public research sector which is mission oriented, more responsive to society's needs and more open to collaboration with industry are the challenges that face these systems. To promote this evolution, an approach that focuses specifically on avoiding cultural resistance and creating new organisational models will be required. Learning from countries with longer experience in reform and modernisation of traditional structures will surely contribute to the success of these reforms. Thus, OMC seems to be an especially useful governance tool for these countries. Moreover, the role of structural funds mainly in providing the infrastructure needed to support this process, should not be underestimated.

We feel that there is still little reliable knowledge (and especially little comparable data) in the area of knowledge transfer from PROs, which underlines the need for further analysis and data collection to inform policy decisions. This was the main reason why the group decided to focus on assessment and evaluation issues. Implementation of the recommendations made on these issues should make a positive contribution to the improvement of information in this area, at least at the national and institutional levels. Evaluation and performance appraisal of third stream activities at the individual level is also a pending problem in most countries.

## 4.4 The way forward

Finally we offer some suggestions that might be useful for the third and subsequent cycles of OMC. As explained above, we found Peer Review to be a fruitful and effective practice within the OMC and should continue to be one of its main tools. However, we think that it should be more detailed in order to yield deeper insights into the countries and policies reviewed. There are some methodological changes needed; for instance, our study suffered from a very short timeframe which did not allow for serious critical examination and thus the feedback on the reviewed countries is limited.

The ongoing reform process in the PRC sector of several countries is a major topic which deserves further analysis, assessment and benchmarking. It should remain a priority topic on its own in addition to its particular reference to new member and candidate countries.

At the same time, there is need for more analysis focusing specifically on the development of strategic alliances and mergers and acquisitions (M&A) (mergers and attempted acquisitions have started to happen in the UK and France) between universities at the national and EU levels. This analysis is motivated by the globalisation of the HE market, but the performance of all universities in terms of knowledge transfer will surely benefit from these alliances, and universities in new members or candidate countries will find the development helpful.

We should underline that although in this report we have focused upon the economic impact it is important to recognise the relevance of knowledge transfer for societal needs, i.e. for quality of life improvements. Thus there is a need for future action in this area.

Apart from suggesting new priority topics or finer analysis of those under discussion, we would stress that in future cycles OMC should evolves towards coordinated implementation of concrete policy actions, effective monitoring of this implementation and outcome evaluation through reliable and comparable indicators. The OMC-NET initiative seems to be the right tool to support and encourage this evolution, provided that actions funded through this scheme are in tune with OMC objectives and produce adequate feedback for CREST.

Finally, a general comment on the functioning of this group which might be useful when launching similar expert groups on related topics. The non-linear group dynamic required

repeated interaction to arrive at a group identity, to agree on the work procedure and to find common language, especially difficult since group members are from countries with very different higher education and innovation systems. It took time for the group to work together effectively to produce the desired output. A longer timeframe or the use of an established expert group(s) might be worth considering.

Open Method of Co-ordination (OMC)
3% Action Plan

**Report to the CREST Expert Group on**

Encouraging the reform of public research centres and universities in particular to promote the transfer of knowledge to society and industry

# Annexes

Final Report
March 2006

Annexes to Interim Report submitted to CREST

CREST Expert Group

# Encouraging the reform of public research centres and universities in particular to promote the transfer of knowledge to society and industry

## ANNEX1: Peer Review Reports: Summary

The objective of the Peer Review team was to gather evidence on the research and innovation system of the country, relevant to the goal of the EG, with the objective of identifying and establishing a thorough understanding of interesting policy initiatives in the area of knowledge transfer in the country visited. Whilst noting some of the challenges faced by particular countries, it was **not** the objective to provide an in-depth critique of their particular research and innovation systems.

Alongside descriptions of schemes, the Peer Review team was asked to identify **evidence** of the success of schemes to aid in policy decision making, and conditions for transferability. It was also decided that feedback from the Peer Review team to the country visited should aim at positive comments on developments as the short duration of visits made critical analysis infeasible.[14] The EG focused on four areas of activity; Knowledge Exchange, Organisation, Venture Creation, Researchers, and the findings of the review are organised around these same areas.

Prior to the visit of the Peer Review team, each of the four countries submitted a Country Report outlining its research and innovation system and relevant initiatives. Generally two days of meetings were scheduled, and a pattern emerged that visits started with an overview of national research and innovation policies, followed by a more detailed examination of specific initiatives. The countries involved selected the initiatives they wanted to highlight in more detail. The actors affected by these initiatives e.g. SMEs, large companies, universities, were also interviewed so that the "everyday" impact of these initiatives could be assessed. Senior people were available in all the countries visited which increased the value of the discussions for the Peer Review team. The Peer Review team was fortunate to meet senior people responsible for the different initiatives; all parties were involved in in-depth discussion of initiatives and experiences.

After each visit, the Expert Consultant drafted a Peer Review Team Report which described particular practices identified, and their applicability to other MS. In some cases these reports described a single example of good practice in great detail e.g. Competence Centres in Sweden, covering other initiatives more briefly. Where appropriate, opportunities for engagement/cooperation on a European level were identified. The reports were circulated to the relevant country and the members of the Peer Review team for comment before revision and submission to the EG.

Subsequently the Peer Review Reports were presented at meetings of the EG in Brussels. Some of the countries visited chose to send representatives to the meeting to give further details of some of the key initiatives. Each presentation took around two hours and the process enabled extremely useful knowledge exchange among the **whole** group.

The Peer Review process was evaluated after the Swedish meeting to assess its impact. The assessment was positive; this approach to peer reviewing was found to be useful, flexible and effective overall.

[14] It should be noted that the representatives of the four countries visited thought a more in-depth review would be useful in the future to help them to develop their innovation systems.

# The Swedish Innovation System: Notable Initiatives

## The Innovation System: Successes and Challenges

Whilst rightly proud of their successful knowledge-based firms and strong history of R&D investment – Sweden has invested about 4% of its GDP in R&D since the 1990s, has the highest levels of business investment in R&D in the world and the second highest number of researchers per 1000 population in the world – Swedish participants in the Peer Review pointed out some key challenges faced by the country.

These include:

- Industry R&D accounts for 74% of R&D spend in Sweden. Of this, over half is accounted for by 20 large companies (Ericsson, Volvo, Scania, AstraZeneca, etc.). In today's global R&D environment these companies seek to work with the best research partners meaning that Sweden must continue to illustrate a deep and active commitment to its knowledge base in order to retain these significant actors. Stable and, indeed, higher levels of public R&D funding were argued for as being vital in ensuring that Sweden's science and skill base remains of sufficient quality to retain key industry R&D investors.
- Sweden is also working to stimulate R&D demand in other companies, in particular in the Swedish SME sector, so that these companies are supported in their growth plans and Swedish universities and research institutes can relate to a broader range of companies.
- To support established R&D intensive companies and promote economic growth in the long term, Sweden needs to work harder to encourage the formation of new high technology SMEs.

Sweden's experience suggests there will always be a pivotal role for substantial public funds in research and innovation, indeed, as company expenditure on R&D increases, government expenditure must also grow to maintain these "knowledge hungry" companies. As Sweden's high levels of GDP per capita and productivity illustrate, investments in research and innovation can bring considerable benefits to a country.

## Approaches to promoting the transfer of knowledge to society and industry

Sweden is noted for its **people based** approach to transferring knowledge and the emphasis it puts on **networking**. The country has few dedicated TTOs at Universities and surprisingly limited funding for specific "third mission" initiatives. Considerable resources have instead been ploughed into developing the role of researchers and establishment of Technology Transfer Institutes (TTIs) such as spin-off incubators and University Holding Companies which enable universities to undertake commercial activities such as executive education. No doubt influencing this situation is the fact that in most cases researchers in Sweden own their own IP; this is being reviewed.

A key player in research and innovation activities in Sweden is VINNOVA, the Swedish Agency for Innovation Systems. Through three projects in particular; Competence Centres, VINNVÄXT and the Entrepreneurial Faculty Project, VINNOVA has worked to adapt the manner in which (some) research is conducted in Sweden, with the hope of establishing a **culture** within universities that is positive towards engagement with society and industry, rather than a set of offices to facilitate interaction.

VINNOVA, together with TTI partners such as the Innovation Bridge and ALMI, also works to build strong networks within Sweden, for example, promoting collaborations between

universities, businesses in their region and local politicians through the VINNVÄXT scheme. Clear examples of network promotion were also found in Italy (e.g. Technology Districts) and Spain (e.g. RedOTRI), illustrating the significance of this approach.

### The Swedish Competence Centre Programme

The Competence Centre programme, first launched in 1993, has as its objectives to:

- Create multi-disciplinary Centres of Excellence by involving a number of companies actively in joint, university-based research
- Promote the introduction and implementation of new technologies mainly through the Centre's industrial partners
- Improve the research and innovation capabilities of Swedish industry.

Currently, 28 centres have been established at 8 of Sweden's universities. Each centre receives annual funding of 2.5 million Euro, with a third being provided by the industrial partners, a third by the university and a third by the government (through VINNOVA). The centres are funded for 10 years and centre status was awarded as a result of a nation wide competition. 220 companies are engaged in the research programmes of these centres; one third of these companies are (high tech) SMEs. A centre typically engages a network of 40-100 people from 6-20 companies and 3-6 research groups. PhD students are educated through the centres, and senior research staff are employed in them. Each centre's functioning and research production has been reviewed on three occasions by an international expert team.

The Peer Review Team selected the Competence Centre model as being of interest as the schemes has been shown to be productive.[15]

**Key Principles**:

- The competitive element of awarding centre status stimulates bottom-up planning for knowledge exchange activities between universities, researchers and industry embedding a cooperative culture
- The ten-year, i.e. long-term **but not permanent**, duration of funding has allowed both research and knowledge exchange practices to develop fully whilst ensuring that heavy overheads are not incurred
- Frequent, **early** and international evaluation of the centres' operations has provided the feedback necessary to enable the centres to keep evolving during this duration – they are also able to accept further industry partners
- Ensuring that the centres educate PhD students has meant that a generation of knowledge exchange agents with highly advanced skills has been created
- The single university base for the centres has given them cohesion and plugged them in to a stimulating campus environment
- High levels of public subsidy are necessary to conduct "use-inspired basic research" of interest to both academics and industry.

The Competence Centre model is seen elsewhere in Europe (e.g Austria and Hungary) and cooperative activities are already pursued through the ERA-watch network. The Peer Review team suggested that researcher mobility between different European Centres could be promoted and that this model could be transferred, indeed "franchised" to other countries. The second phase of this expert group will examine the feasibility of the transfer of an "expanded" Competence Centre model to other EU countries.

[15] Reviews of Sweden's competence centres are undertaken by international experts regularly. VINNOVA publishes these reviews.

## Key Area Findings from Sweden

| | Knowledge Exchange | Organisation | Venture | Researchers |
|---|---|---|---|---|
| Learning from the Competence Centre Model | Centres are seen as positive arenas for *informal* knowledge exchange as they bring researchers from many different backgrounds together on an almost daily basis. Sweden argues strongly that this is the most significant type of KE activity.<br><br>With regard to formal knowledge exchange in the form of IP, each Centre negotiates its own agreement with participating companies. In most cases this results in IP being transferred to the companies on a royalty basis. These agreements are usually open for re-negotiation every three years, allowing terms to develop as appropriate. 19 centres have applied for or filed, 160 patents over the past 10 years. | Competence Centres are geographically concentrated, i.e. based at one university and contribute to the organisational development of the host university. In most cases the activities of a Centre imply multidisciplinary collaboration and as a rule 3-4 departments are involved. In order to have a clear position in the university, Centres are organised either as a separate body or as a special unit in a host department. A Competence Centre Agreement states that a centre should have its own accounting and be governed by a board. In accordance with VINNOVA´s recommendation, the chairman and in most centres, a majority of the board members come from industry. A director appointed by the university manages the centre.<br><br>Centres are established and funded for 10 years giving the continuity necessary to both university and industry to explore "use-inspired basic research". | The core business of Competence Centres is academy-industry research **collaboration**, which means that creation of innovations and commercialisation based on ideas and knowledge from the research is mainly pursued through the industrial partners of the centre. Nevertheless, 15 centres have contributed to the start of 35 new companies.<br><br>In the new generation of Competence Centres– VINN Excellence Centres – recently launched by VINNOVA increased emphasis will be put on the creation of innovation environments so that ideas outside the core interests of participating actors can be utilised e.g. through spin-off activity | Centres act as arenas for promotin g collaborative activity. University researchers at all career levels are engaged in Centres and actively work with counterparts from industry. 950 industry researchers have so far been engaged in Centre activities. The centres have produced 550 graduate students (100 of whom are industry PhDs) whose experience in this mixed environment makes them uniquely attractive to both industry and academia. Heading or working in a Centre is seen as a positive career development for a researcher – who remains an employee of the university and is able to return to his or her position. |

# The Italian Innovation System: Notable Initiatives

## The Innovation System: Successes and Challenges

The Italian government has developed considerably its approach to and management of innovation over the past 5-7 years, to bring about a new structure for research and innovation funding under a National Research Programme.

Italy's new research and innovation structure has been developed to reflect the economic and geographical opportunities/challenges the country faces. Italy has over 4 million SMEs, many of whom operate in lower technology sectors. This ensures the country has a flexible and diverse production base, however, as many other MS appreciate, SMEs do not readily engage in R&D activities. Indeed the large number of SMEs in Italy is seen as being responsible for the low levels of private investment in R&D made in the country (0.46% of GDP R&D spending is from private sources, compared with the EU average of 1.27%). Italy is also clear that its innovation policy must support its remaining large industry e.g. Fiat, Finmeccanica, Pirelli, ST Microelectronics, and promote both the growth and establishment of high tech SMEs.
Italy has the highest average age for university researchers in Europe and a very low index of researchers/support staff compared to other systems. Recruiting and developing researchers for academia and industry is a key area of concern that the National Research Programme also aims to tackle.

## Approaches to promoting the transfer of knowledge to society and industry

Of particular note in the Italian approach to innovation management is the balance that has been struck between national initiatives such as FAR, the Fund for Advanced Research,[16] and local initiatives, such as Technology Districts. This model no doubt reflects Italy's growing strong regional structure, but is also another example of the **importance of networks**. As in Sweden and Spain, strong localised nodes have been created; funding has been directed to ensure that these nodes are able to cooperate and respond to broader national needs. The government and other national actors consider their role as that of the tailor, sewing together the different actors in a complex system through the scope of research projects and funding incentives. Within this framework, the strong changes in PRC policy should be noted, especially the National Research Council (CNR), the most important Italian PRC.

**Key Principles**:

- In a non-linear model of knowledge generation and transfer, high quality cooperation and coordination between multiple public and private bodies in identifying goals and executing strategies is necessary. Policies and incentives should be developed that support networking.
- Actors should be coordinated and able to act autonomously to be sensitive to different aspects of the knowledge exchange environment and enable the system as a whole to cope with uncertainties in innovation patterns.

It should also be noted that Italy has developed **clear financial incentives** for promoting knowledge exchange. FAR (see below), although providing an integrated set of tools primarily targeted to industrial research and pre-competitive development, has changed the way funding is directed to Italian universities, resulting in their needing to seek external engagements if they wish to increase or even maintain current funding levels, based upon institutional transfer from MIUR. It should be noted that in recent years academic research funding has also increasingly being subject to competition for grants either reserved to universities (PRIN), or opened to other PRCs (FIRB, FISR). Under the two latter schemes

[16] FAR, Fondo per le Agevolazioni alla Ricerca" literally "Funds for incentives to research"

universities or PRCs can ask for the involvement of enterprises. Researchers have been assigned their own IP rights giving them and incentive to commercialise research, and company grants for R&D projects are boosted if they cooperate with universities or research institutes. The President of Italy's National Research Council (CNR, which governs most research institutes in Italy) has changed the funding rules from block grants to a project based system, this change being seen as critical in bringing about organisational and cultural progress.

## A national and regional example to promote research and innovation

**National: FAR, Fund for Applied Research**

Law n.297/99 represented an important step in the reform of Italy's innovation system "*Reorganisation of measures and simplification of procedures in support of scientific and technological research, technology dissemination and mobility of researchers*".

The law aims to create a favourable context for industrial investments in research, seeking in particular to engage SMEs. It provides for the establishment and running of FAR, Italy's Fund for Applied Research. The main types of activities funded under FAR include:

- Industry stimulated, "bottom-up", R&D Projects not exceeding 7.5M€. These are primarily targeted at SMEs
- Industry stimulated, "bottom-up", R&D Projects over 7.5M€. These are primarily targeted at larger companies and must be accompanied by triennial R&D planning (Article 6)
- Spin-off projects from university professors, researchers, PhD students, post-doctoral fellows; PRC researchers (Article 11)
- Calls for Proposals in response to MIUR strategic targets in both particular industrial sectors and/or defined regions
- Temporary (4+4) mobility of public researchers to industry; the researcher continues to be paid from public funds
- Other projects deriving from national political commitment and/or agreements with regional governments (e.g. technological districts).

FAR can be considered a framework within which several types of industry-focused R&D activities can be stimulated and managed. The new support measures have both bottom-up and a top-down aspects providing respectively for proposals to be submitted freely in any field and on a continuous submission basis, or under specific calls for proposals in predetermined priority areas. They are also scaled to suit the needs of different industries i.e. SMEs or larger companies.

Actors allowed to submit proposals to FAR include enterprises, private research centres, consortia of public-private institutions and science parks. Industry R&D projects can be supported by public funds at up to 75% of their costs, either as equivalent gross incentives, that is as the sum of actualised value of discounted interest rate loan and/or non-repayable grants. There are strong financial incentives for enterprises to engage universities or PRCs in their research activities; if a company engages a university or PRC in its R&D activities for over 10% of the value of the project, the project as a whole is eligible for further government contributions, a clear financial incentive to companies to collaborate with universities and research institutes. Costs of research carried out abroad, within the EU, are also eligible, and if the R&D is carried out by foreign EU enterprises, which do not have Italian firm participation of more than 10% of the value of the project, the whole project is eligible for further contributions.

Since its start of operations in 2001, FAR has received 2,118 proposals, requesting over 7.2B€ of support. To date, 529 proposals have been approved and 1.45B€ [17] have been allocated. By far the largest number of applications (1,435) has been received from SMEs applying for funding for projects below the 7.5M€ level, illustrating the positive effect this policy has had. 50 spin-offs have been created through FAR from university research over the past three years.

**Key Principles**:

- Financial incentives in the form of grants and subsidised loans encourage SMEs to undertake R&D
- Systems should be free to respond to bottom-up SME requests as well as top down strategic priorities
- "Bonuses" for working together with universities or other PRCs can be built into schemes and actively reward networking.

**Regional: Technology Districts**

The mission of Italy's Technology District initiatives is threefold:

- To improve collaboration between national and regional governments to develop research activities aimed at increasing the social and economic growth of the region
- To realise and support research and innovation networks in the **whole** national territory
- To increase results valorisation targeted at social and economic development.

A Technology District should engage all actors in the "Triple Helix" of government, universities and PRCs, and companies, in a shared vision for the future development of the region based on synergies between its intellectual and industrial capital. Lombardia, for example, operates a Biotechnology Technology District that draws on the strengths of its universities and an emerging biotechnology sector.

Any region can apply to MIUR for the formalisation of a Technology District, to be co-financed by FAR. A successful application releases central funding, which must be matched by local government and industry funding. A. application requires a structured plan that analyses the region's assets and the proposed Technology District's mission. This plan should adhere to the government's guidelines for research and strategic areas. It should also illustrate solid governance structures for the district and define a legal body, usually a foundation or consortium, to be co-owned by all the actors, which will be responsible for the running of the distict. What is particularly noticeable about the networks engaged in these Districts in Italy is the engagement of private banks and the role of the district in raising VC.

Under FAR, 11 Technology Districts, covering most areas of Italy, have been established.

**Key Principles:**

- Regions and local governments are critical in making innovation initiatives function (this applies also to Spain)
- Strong links to national programmes help to ensure that networks function on a national level too, avoiding duplication and creating synergies
- Banks, as well as local companies are critical private partners in consortia.

[17] It should be noted that this sum is made up both of direct grants and subsidised bank loans (which the enterprise has to repay).

## Key Area Findings from Italy

| | Knowledge Exchange | Organisation | Venture | Researchers |
|---|---|---|---|---|
| Learning from FAR | Professor Privilege i.e. ownership of IP, has just been introduce in Italy possibly to incentivise researchers to become agents of knowledge exchange as they now have a financial interest in its results.<br><br>Additional 10% of incentive allowed if universities or PRCs are involved in carrying out at least 10% of overall admitted costs of industrial research project | FAR has had considerable influence on iniversity activities because it redistributes their funding. Financial support to universities is now defined not only by the number of students, as in the past, but 1/3 is related to the results of research, 1/3 to the university's **external relations**, and 1/3 to number of students. This has increased considerably incentives for universities to contact industry. | FAR has facilities for stimulating spin-offs. Researchers are also permitted up to 4 years leave from the university to establish a company. This option is seldom taken and many professors wish to keep developing their research profile alongside their business interests. | Whilst FAR promotes mobility schemes for researchers, senior academics rarely take up industry positions as this is considered detrimental to their careers. |
| Learning from Technology Districts | In the first phase of their evolution many Technology District chose to specialise TT activities to reflect the needs and potential of their specific activities. This focusing was seen as vital for ensuring that they developed powerful links with appropriate industry partners and developed deep skills. It should be noted that the key skills specialised TTOs developed are now being expanded into other sectors e.g. Torino Wireless is now assisting with TT in the Biotechnology sector | Technology Districts have in some cases established institutes which act as industry-project orientated actors for sourcing and combining research excellence with universities or PRCs. | Technology Districts provide coaching, usually on a selective basis, for spin-offs from research in both universities and companies. They work with local banks to secure early stage finance and also market their spin-offs internationally to encourage other risk capital investments.<br><br>Some Technology Districts have gone on to start VC funds. These primarily private funds have played an important role in securing early stage investments.<br><br>This proactive model has produced strong results, for example, Torino Wireless has spun off 30 companies in less than 2 years. | |

# The Spanish Innovation System: Notable Initiatives

## The Innovation System: Successes and Challenges

Since the 1980s Spain has benefited from healthy economic growth, driven bytourism, construction, automotive manufacturing and EU supported infrastructure projects.With a population of slightly over 40 million, Spain has a GDP of $955.1BN (GDP per capita of $22 406), just slightly below the EU average.

Like several other EU countries, the Spanish economy is dominated by SMEs with just under 3 million registered.[18] These enterprises are found mostly in sectors traditionally associated with lower levels of technology such as tourism and personal services, though there presence in the manufacturing and design sectors is increasing. With regard to larger companies, just four of the world's 700 highest R&D spending companies are Spanish. Amadeus Global Travel, a provider of IT solutions to the Travel and Tourism industries, leads with an R&D expenditure of £102M (€151M).[19]

In spite of the small presence of big companies and the high numbers of low tech SMEs, there are signs of Spain's having a strong potential in innovation. In particular levels of R&D expenditure and personnel are increasing.

To maintain higher levels of employment, productivity and economic growth over the long-term, the Spanish government recognises that it must support investment in research and innovation. Overall R&D expenditure in 2003 was 1.10% of Spanish GDP. Company financed R&D accounts for just 48.4% of this total, well below the Lisbon target of two thirds. In order to address this situation, the Spanish government has committed to increasing R&D expenditure by 25% a year over the course of this legislature.

## Approaches to promoting the transfer of knowledge to society and industry

In an R&D and Innovation Strategy entitled *More and Better* presented by the Spanish government in May 2005 four specific areas for action were identified:

- Creation of new technology-based firms
- Promotion of public/private collaboration in R&D
- Support of critical mass and research excellence in R&D
- Support of Information Society Convergence Plan

In complement to these actions the Government aims to focus more on what it calls **strategic actions**. These actions aim to be both **substantial and targeted**, addressing, for example, thematic areas such as Biotechnology. This response aims to tackle the risk of fragmentation in what is both a large and a regional country. Greater competition for funding will be introduced, affecting both basic research funding and the funding of knowledge transfer initiatives. All areas of research and innovation are to be open to greater scrutiny through international assessment and unnecessary bureaucracy is to be dispensed with to improve the efficiency of the management of research and innovation.

At a national and regional levels Spain has **invested in specific third mission offices and projects**, in particular in a network of TTOs known as ORTI. Programmes that provide incentives for universities to play an active role in the exploitation of their research base have also been promoted. Both these activities reflect the fact that in most cases Spanish universities and PRCs own the IP of their researchers. As in Sweden there is a a focus on

[18] Spanish Census, January 2004.
[19] Figures from the UK Department of Trade and Industry R&D Scoreboard for 2004.

**people**, but with greater emphasis on engaging young researchers in industry R&D environments than creating "mixed" centres.

**OTRI and the RedOTRI Network**

TT from the public to the private sector is promoted within Spain's National Plan through two schemes: OTRI and PETRI. Funding via the OTRI scheme provides basic support for TTOs at 90 % of Spain's universities and at research institutes. PETRI provides project funding for these offices and other knowledge "nodes" such as Technology Centres, focusing on such early stage initiatives as verification of the commercial potential of research. Most PETRI projects have a commercial partner who provides matching funds. In the future, more funding will be provided via PETRI i.e. Spain's TTO offices will become project focused and externally orientated. It is possible that basic funding to these offices through OTRI may be discontinued, making them reliant on project funding, commercial contracts and direct support from universities. It is hoped that this will make these offices more pro-active and strategic in their activities, and choose to specialise say in Biotechnology, or spin-offs.

Whilst the OTRI TTOs established in Spain reflect the needs and potential of the universities they are associated to, the Spanish government has made funds available to ensure that these offices become active members of a national network and work cooperatively, for example, sharing best practice, skills development courses, etc. The Spanish Conference of Rectors (CRUE) established the RedOTRI network to facilitate such cooperative working.

RedOTRI funding is used to support several areas of activity. These include a web based communication platform and various working groups e.g. on knowledge transfer indicators, policy issues, training and learning activities (the "OTRI School"), annual surveys of key knowledge exchange indicators at member offices, networking events and international relations. The positive trends evident in most knowledge exchange indicators in Spain suggest that the OTRI and Red OTRI programmes have had a positive influence.

**CAMPUS: Engaging universities in the spin-off process in Andalusia**

CAMPUS is an initiative of the Andalusia Regional Development Agency (RDA), which reports to the Regional Government, and the Andalusian Universities, and aims to directly stimulate spin-off creation from regional universities by providing loans to the university to fund the establishment of companies based on their research.

The programme was launched in early 2004 and provides loans of up to €100 000 **to the university** for investment in early stage companies. The university contracts with the company and can invest in returns for equity. If the company succeeds, capital gains from selling any equity acquired are split between the university and the RDA on an 80:20 ratio. If the company fails, the RDA assumes the final risk, and the university incurs no debt.

Companies funded in this manner should be based on research or knowledge produced by the university receiving the loan, but need not be started up by its researchers. The university is responsible for ensuring that the spin-off receives high quality business coaching. As many universities currently lack resources for assessing the market potential of their research, the selection procedure for companies is managed by CAMPUS. It is the company promoters who apply for the loan, with support from their university.

To date, the CAMPUS project has funded 11 projects and awarded €968,966. The companies funded so far have created 31 permanent and 7 temporary jobs. Funded companies, based on initial CAMPUS investments, account for a total €2,524,710 profit.

**Making universities partners in the spin-off process**

The Andalusian RDA considered it critical to get the support and input of the universities in the spin-off process and hence has made the universities its key agent; the university invests in the company and stands to profit from its success. By giving the universities this responsibility the RDA hope to encourage a culture in which universities will begin to actively seek opportunities to apply their research.

#### Key Principles

- Government supported loans help address the very early stage risk capital "gap" that many university actors in EU countries face, scrutinising and packaging the idea
- These loans should support both the incubation and financing of the spin-off ; universities are a key agent for delivering support.

**Enabling researcher mobility: the Torres Quevedo Programme**

This programme was initiated in the late 1990s to encourage the establishment of research capabilities in companies by promoting mobility of young researchers from academia to industry. Companies are subsidised for up to 75% of the costs of employing a researcher to execute an R&D project. As well as encouraging companies to develop their R&D capacities, this programme also helps tackle PhD unemployment by providing recently qualified graduate students with career opportunities.

As the programme has now been running for several years, significant experience has been gathered on its effects. The success of the programme to date has encouraged the Spanish government to expand its role in the new National R&D Plan. In the years 2004-07, grants within the programme will reach a total of some €100M, providing for approximately 1,500 new posts in firms and technology centres for PhDs and other research-trained graduates.

The grants cover a percentage of the direct labour costs (salary plus social security) and vary based on firm size and type of effort. For "New Product Development" type projects in large firms 25% grants are provided. For more research orientated early phase projects in SMEs grants of up to 75% are available. The funding is received annually for up to three-years– although the percentage given may reduce over the three years, and payment for the the third year is only made if the person supported is guaranteed a fulltime position.

### Key Principles

- The programme focuses on researchers in the early stages of their careers. Experience in Spain and elsewhere shows that more senior researchers are less flexible and therefore less likely to join mobility schemes
- Three years of funding provides sufficient support and also encourages the company to make the researcher's post permanent
- High SME take up rates suggests this is a good way to support these types of companies and encourage them to undertake research projects.

## Key Area Findings from Spain

| | Researchers | Organisation | Knowledge Exchange | Venture |
|---|---|---|---|---|
| Learning from OTRI and RedOTRI | Spain has emphasised provision of professional support to researchers rather than changing the culture of research *per se*. ( This is similar to the UK approach). | Spanish universities are legally bound to exploit their knowledge for the benefit of society. Most universities have a TTO that usually reports to the Vice Rector for Research. Universities have considerable autonomy in how these activities actually function. | Strong national organisation of networking activities creates critical mass. Note strong links to academic organisations.<br><br>RedOTRI has produced small but useful set of indicators for KT | In the future greater emphasis will be put on spin-off activities within the OTRI programme. |
| Learning from CAMPUS | Useful project for supporting a culture of entrepreneurship at universities. | By giving universities a commercial interest in the exploitation of their knowledge base, this programme creates a positive incentive | | The project clearly encourages spin-off activity – gives both educational as well as financial support. Region based approach to this is interesting as it encourages the creation of local jobs and engages universities |
| Learning from Torres Quevedo | by encouraging mobility this programme positively fosters industry links/mixed careers, particularly amongst younger researchers. | | PHD recruits are a key mechanism for knowledge transfer | |

# The Lithuanian Innovation System: Challenges and Responses

The fourth Peer Review visit was made to Lithuania. In recognition of the needs of Lithuania's research and innovation systems, this summary is structured differently from the other three (Sweden, Italy and Spain), and makes recommendations for supporting actions from the EU and other MS, rather than presenting "Learning Cases". The situation in Lithuania is similar to many other new MS, and the openness of the people we met with in talking about the challenges that Lithuania faces created a positive found for the development of supporting actions that could apply beyond Lithuania.

Since 2001, the Lithuania economy has shown healthy growth, with annual growth of GDP in the range of seven to ten percent. However, due to a more than 40% decline in GDP during the years of independence, Lithuania's GDP in 2005 will recover only to 1989-90 levels. Current forecasts suggest that growth over the next five years will be in the range of 5-10% annually, driven by growing domestic demand as a result of higher wages. Income from EU funds will play a substantial role; their contribution to Lithuania's national budget is estimated at some 20%.

Much of this EU inflow will target infrastructure investments in "hard" assets such as roads, energy systems, housing, etc. However, it is becoming increasingly obvious to planners and executive officials that targeted investments in "soft" infrastructure will also be needed to raise the level of Lithuania's knowledge-based economy to Western levels. It was apparent to the Peer Review team during its visit to that Lithuanian universities, research institutes and businesses should receive more and different types of support to ensure they become a firm basis for sustainable growth in Lithuania.

Targeted investment in Lithuania's knowledge infrastructure was identified as being vital in all the discussions held between the Peer Review team and Lithuania officials and business representatives. As a result of the continuing influence of the "Soviet style" planning systems and a "reactive" academic culture, which continue to influence attitudes, Lithuania's PROs are finding it difficult to adopt process orientated, proactive approaches to R&D systems within which innovation, knowledge users and knowledge flows are valued.

The Peer Review team concluded that by influencing the way that EU funds are targeted and directing to areas of knowledge creation and exchange, the Commission can become a force in the growth of Lithuania's knowledge economy.

Lithuania has many of the important elements of an innovation system, including universities, public research institutions, a business community, and a set of institutions aiming to support technology applications. However, it has not as yet managed to bring these elements together within a coherent and co-ordinated framework, and in a manner that links the public research community with the enterprise community. Many of Lithuania's organisational structures follow and even reinforce the old practice of separating rather than unifying innovation partners. In many cases the gap that exists between the public research community and the business community is too wide to allow the transfer of best practice from established EU countries. Increasing the role business in the governance of universities and PROs and allowing membership of their boards of governors, would be a first important step towards closing this gap.

A "White Paper" on Lithuanian Science and Technology (2002) and a World Bank report *Lithuania: Aiming for a Knowledge Economy* (2003) incorporate suggestions about how to build a **consistent arena** for the evolution of an innovation system managed by the Prime

Minister. This should be triple helix style, with representatives from business playing a much more important role than currently. This plan has finally been put into operation. An initial meeting was held in Spring 2005. It should enable shared appraisal of means and methods for practical collaboration within the research and innovation systems, enhancing the speed at which evolutionary developments in the knowledge-based areas of the Lithuanian economy occur. It is hoped that this initiative will become an important national vehicle for mutual learning, based on the same kinds of ideas underlying the Dutch Innovation Platform, to be led by the Prime Minister, with a panel of members from government, business enterprises and knowledge institutes.

This learning mechanism should be enhanced by collaboration with ongoing schemes in e.g. Sweden, Germany, England, Netherlands, Spain and Italy. One idea put forward by the Peer Group was for a "franchising" mechanism between, for instance, the German Fraunhofer system or the Swedish Competence Centre Programme, and Lithuania (as well as other comparable MS). Based on the evidence in other countries in terms of formulas established for knowledge exchange organisations, the learning process in Lithuania might become more effectivethrough the "sponsored transfer" of this model, which should effectively dispose of relics from the past. EU structural funds could be used also to cover the franchiser's costs and the idea could be extended to other new MS.

CREST Expert Group

# Encouraging the reform of public research centres and universities in particular to promote the transfer of knowledge to society and industry

## **ANNEX 2**: Example of Development of University KT Activities

Encourage the reform of public research centres and universities,
in particular to promote transfer of knowledge to society and industry.

# Modular Implementation Plan

The implementation plan is dived into two parts. In the first part the various models are outlined, providing a basis for their exploitation in other EU regions. The second part describes the recommended methods of transfer.

# Part 1 – presentation and selection of the model

Following the review and the discussions of the expert group, three models were highlighted. This section discusses the models identified as candidates for the transfer of good practice in relation to spin-off activity.

## The Models

*Helsinki University of Technology Model – brief description*[20]

The KTU plays an important role in the process of innovation in general, with some focus on spin-offs. It focuses on commercialisation, including agreements for profit sharing with researchers from the Helsinki University of Technology (TKK), and coordinates the policies and actions on spin-offs of the Otaniemi International Innovation Centre (OIIC).

The KTUs of the KTT and the OIIC support the measures and strategies of both organisations including support to researchers in commercialisation activities (the researcher receives 40% of the proceeds, the laboratory 40% with the remaining 20% being retained for the unit's expenses (TKK).

TKK also enters into agreements with the local stakeholders (OIIC) allowing for the formation and establishment of the different start-ups in the area and the spin-offs from the university (including alumni, local industry, international marketing activities, etc.). TKK's approach was described as:

***"The main point regarding the TKK was to show that it was a one stop shop, doing the evaluation of the IP, the strategy and actual protection of the IP, and the commercialisation. Special connections with investors, national programmes and VCs allowed the varied spin of activity (150 firms since 1998)."***

The model is based on and compatible with a profile of the model entrepreneur and his special qualities, and shows where the KTU needs to step in to assist and how the process is influenced by the model entrepreneur.

*The Leuven TT Model – Brief description*[21]

The KUl Leuven model is an emergent model that has been under development since1998 by the KU Lueven RTD Company and the university.

The model emphasises interaction between the university with the environment – the industry, the city, and the region. The model demonstrates the use of spin-off activity to attract foreign companies and increase collaboration with them (licensing, joint research, etc.), thereby improving the economic development of the area.

The Model comprises eleven main features:

1. Knowledge centres
2. Entrepreneurs
3. Money
4. Capital markets

[20] Dr. Veijo Ilmavirta Director of the Helsinki TKK presented the model to the group. This is a summary of the presentation.

[21] Dr. Martin Hinoul former Director of the KU Leuven RTD presented the model to the group and this is a summary of his presentation.

5. Infrastructure
6. Role Models
7. Cluster Policy
8. Presence of international companies
9. Networks
10. Government
11. Quality of Life.

It is understood that this model is being tested in Bohemia.

*Canterbury Enterprise Hub, University of Kent Model – brief description*[22]
The Enterprise Hub model should be seen within the framework of the hub system that has been developed in the UK in recent years, which includes industry, university, and local government. The activities examined involved firms in Kent, both in terms of Spin-Outs and support for SMEs. The model includes provision of mentoring and guidance in addition to financial support. The main aim of the Hub is to provide support for spin-out activity and particularly licensing as a means of TT;, there is recognition of the need for a specialised centre to focus that activity. The model depends on a supportive environment of VCCs, guidance, and mentors in the region. It is a hub that brings together these support mechanisms to create a positive environment for spin-offs . It should be understood that this model is applicable only in certain environments.

## Model Selection

Identifying how well the models identified as good practice are transferable is not straight forward, the three cases of good practice described are bound up to environments in which they are operating.

The Kent enterprise hub is part of a coordinated national effort which receives central government financing, for the promotion of the Spin-Off activity. It operates in an environment rich in VC and seed financing with the support of experienced entrepreneurs. This model is based on the coordination of collaboration and networking, and established practices and existing resources.

The UK is the leading EU country in terms of VC financing (over 50% of EU total VC funding) and entrepreneurship. This means the hub programmes do not have to expend effort on infra-structure formation, and resource creation. They have a pool of mentors among experienced entrepreneurs willing to teach others and pass on their expertise; the VC market is established and the university supplies the knowledge and technology and is a source of enthusiastic entrepreneurs. The hub acts to coordinate them; it must steer participants away from the "easy" solution of licensing.

This model can only be transferred to regions where a similar infrastructure is in place.

The Finnish model is also based on an established infra-structure and culture. The model compensates for the lack of second stage capabilities and some lack of the experience, which is achieved through a long period of support and advice, followed by long term incubation. It would probably be difficult to find similar environments to transfer this model.

[22] Ms. Rubenstein, manager of the Kent Hub, presented the model to the group. This is an interpretation of her presentation.

The KU Leuven starts from the construction of an infra-structure and therefore would be suited to transfer to countries where few or even none of the desired characteristics exist. It can thus be seen as a more robust model. The existence of an industrial infra-structure, and a KTU used to interaction with it are the only prerequisites for the transfer of this model. The universities should establish good relations with industry to add legitimacy to their activities. The KTU would be established on the basis of these interactions.
The KTU would put in place the infra-structure needed for successfully applying the KU Leuven model, by raising the required VC and networking with financial institutions. Application of the model requires nothing more from the surrounding environment
The 11 aspects identified in the KU Leven model do not necessarily have to exist; they can be created as part of the application of the Model:

1. Knowledge centres – this is the easiest component to transfer when dealing with a research university. All that would be required would be cooperation from the universities and their researchers.
2. Entrepreneurs – the identification of the potential entrepreneurs is basic to any successful spin-off model. The most likely source would be found in the universities.
3. Money –central government or regional authorities should be responsible.
4. Capital markets the KTU unit charged with performing this task would need to establish contacts with the capital markets, either national or international. How effective this would be would be dependent on the skills of the KTU.
5. Infrastructure – that point can present also difficulties in copying, and would again depend on the abilities of the body in charge.
6. Role Models – These would need to be identified by the KTU, with special appointments made where necessary.
7. Cluster Policy –many regions and countries are adopting such a policy.
8. Presence of international companies – This aspect would need to be worked on and efforts made to attract companies The KU Leuven Rtd. is still making efforts on this component.
9. Networks – These would need to be established and would need a supportive local culture.
10. Government – Government must actively support implementation of the model. The KU Leuven Rtd in the early stages required little government support and little government involvement. Too much government involvement would be damagingld hurt the model at the.
11. Quality of Life – The potential results of applying the model must be attractive to entrepreneurs, the capital markets, and international firms.

*Selection summary*
It is recommended that the KU Leuven model is the most easily transferable to other EU regions. The model is currently being transferred to Bohemia, but the results are not yet conclusive.

## Implementation Plan for the transfer of the KU Leuven model

The modular implementation plan described here following the order of the 11point model. The outline will describe the steps required to address each item which are designed to enhance economic development in the area, measured by number of new firms, number of square metres of research laboratories, number of foreign firms and the number of jobs created, directly and in-directly.

## Establishment of spin-off basis

The establishment of a Spin-Off basis is paramount for the model. It is made of several sub-stages all dependent upon the existing environment for the activity of university involved.

The university should be assisted and supported by government which should act as a facilitator for the legal and financial requirements. The university must demonstrate commitment to improving the economy, and to making the changes necessary to its structure, personnel and investment.

The university must have the research expertise to create centres of excellence in different technological areas. A university with a poor research base would not be a sound partner for involvement in a spin-off policy.

## Implementation steps

- The university should set up a unit (a KTU) to liaise with industry and with financial institutions. It should be able to act autonomously but still respect the academic principles of publication, freedom, etc.. The KTUs management should include a member of the university's management..
- The KTU should identify knowledge centres within the university and focus on developing their excellence. This will contribute to the technological base of the spin-off activity necessary to achieve competitive advantage and attract investment and international firm collaboration.
- The KTU must develop the ability to identify promising technologies developed within the university for possible spin-off activity.
- Creation of Spin Off capabilities within the KTU – the ability to identify potential entrepreneurs, and recruit them. The KTU will have access to the student body of the university; it should make presentations about entrepreneurship in the hope of identifying potential entrepreneurs for spin-off activity. It must make efforts to attract experienced entrepreneurs to act as spin-off leaders, and mentors.
- The raising of funding. The KTU/university should have sufficient confidence in the projects it spins off to invest in them. To enable this the KTU must set up a VCC of its own or establish access to VC funds on preferential terms. This will provide first stage and can be raised privately or publicly depending upon the availability of such funds and the development of the VC sector in the region. Here government support such as guaranteed loans, etc. can assist the KTU. The original KU Leuven model acquired finance from the private market, but this may not be possible in all countries

**External Example**
Torino Wireless (TW), a firm established in the Torino Technological district under the Italian Government's FAR programme managed to set up two VCCs to assist its spin-off activity. The funds which were not readily available locally, except for the Seed VC, were raised abroad, and even outside the EU. This demonstrates that the KU Leuven components can be copied and implemented in other areas.

- Capital markets. The original model was based on access to existing well developed local or very close capital markets, which may not be readily available in every region. This is not to say that in the current development of the financial markets that access to capital markets is difficult. It may be more difficult for inexperienced organisations with no track record m and this is where government support may be a deciding factor. Government could assist directly or indirectly with the access to local or international capital markets (see the above example of TW).

## Secondary Effects of Spin-Offs

The additional points in the original KU Leuven model are oriented towards increasing economic growth by building on spin-off results.

- Infra-structure –this is the key to further development. The ability to grow in terms of research, or industrial development, depends on the ability to generate high quality infrastructure to be competitive with other universities and other industrial areas. Here joint development programmes sponsored by the government can assist, as well as good relations with the capital markets – IMEC and KU Leuven managed to raise millions for new micro-electronics facilities from the European Commission and the European Development Bank.
- Role models –Role models will be created through successful activity over time. In the early stages international role models must be used to provide inspiration.
- Cluster Policy – the ability to understand and create clusters was an emergent process for KU Leuven. The importance of cluster creation lies in the ability to attract industrial firms to an area and to create a local critical mass to become the basis of a local sector strong enough to compete globally. The combination of expert, world class human resources and a basic research infra-structure, and the means to get the technology to market will attract good personnel and firms seeking technological advantage. The ability to create a cluster depends on the networking in the industrial sector and the ability to create the appropriate infra-structure and knowledge centres.
- Presence of international companies – the ability of the cluster, the knowledge centres, the spin-offs, etc. to attract foreign firms to the area will have a positive impact on the economic development of the region which can be enhanced by national incentives to attract international firms to establish units in the area which will employ large numbers of people
- Networks – the creation of networks is always important. The creation of knowledge centres, recruitment of foreign personnel, identification of funding sources, infra-structure, promotion of the Spin-Off firms, the recruitment of entrepreneurs and their actions, all lead to the creation of extensive network and to investing heavily in their creation and their maintenance. However, this point cannot be seen as a single step. This is a process that goes on and never ends. It is formalised at least at the point of the creation of the clusters, but it can go on forever unofficially all the times on all the other points.
- Government support is important at different levels. Government can encourage universities to establish KTUs, VCs, etc. It can be active in establishing the necessary contacts with the capital markets, assisting in supporting the creation of the infra-structure and in attracting foreign companies to the area. It is important that the government acts as a promoter and facilitator, not as a leader. The KTU and the university must be the leaders and take responsibility for the actions and the results. They can work in partnership with local authorities, and government, in its role of facilitator, should remove legal obstacles to such cooperation,
- Quality of Life –Improved quality of life is a strong motivation for the participation of various players. It cannot be copied or transferred but must be aspired to

## Recommendations

The first step must be the preparation of a detailed and a specific plan of implementation. Whenever possible, those originally involved in the Leuven model should be involved in the detailed planning and the process itself. It must be remembered that the KU Leuven model is an emergent process which is still not fully completed. Thus there are some limitations to the identification of the factors determining success. However, as the model was applied to a situation that had only a reputable university and a very active and capable KTU, it should be transferable to most regions in the EU. Those with more developed VC sectors or with a large presence of foreign firms would advance more quickly with the implementation. Involvement in the model of external stakeholders was initially limited but increased as understanding of their importance grew. New transfers of the model could allow for the involvement of stake

holders at an earlier stage, which should "speed up" the process (see the TW case, and the Kent Hub case).

CREST Expert Group

# Encouraging the reform of public research centres and universities in particular to promote the transfer of knowledge to society and industry

## ANNEX3: Glossary

**Core Government Funding -** Public funding received by a PRC as a grant, usually on an annual basis. This funding is often used to maintain facilities, cover labour costs and to invest in research without immediate commercial potential.

**External Funding -** This can include public funding won on a competitive basis, EU funding won on a competitive basis or funding from won on a competitive basis from industry. This funding is usually awarded in return for clear deliverables.

**Knowledge Transfer Activities –** They include technology transfer, commercialisation, consultancy, etc. but also those activities that benefit society and community en large.

**Public Research Organisation (PRO) -** An umbrella term referring to universities, public research centres including academies of science and other knowledge producers receiving significant public funding.

**Public Research Centres (PRCs) -** Whilst each country has its own forms of PRCs, they can be associated with mission-orientated R&D and, sometimes, specialist educational programmes. They can be classified in: 1) Large public research centres such as CNRS, CNR, CSIC, Max-Plank; 2) mission oriented institutes such as FdG, GTS, TNO; 3) research organisation in accession countries such as academies of science.

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# Encouraging the reform of public research centres and universities in particular to promote the transfer of knowledge to society and industry

## ANNEX4: List of Invited Experts

| **Name** | **Organisation** |
|---|---|
| Francesco BELTRAME | President CTS-MUIR |
| Gilles CAPART | Chairman of the Board - ProTon Europe |
| Adrian DAY | Policy Officer, Business and Community Policy, Higher Education Funding Council for England |
| Claudio GIULIANO | CFO Torino Wireless |
| Lisbeth Valantin HANSEN | Managing director of the Danish Toxicology Institute section within the Danish Hydraulic Institute |
| Björn HARSMAN | Royal Institute of Technology (KTH) |
| Martin HINOUL | CEO KU Leuven RTD |
| Staffan Hjort | Programme Director, Competence Centres – VINNOVA |
| VEIJO ILMAVIRTA | Director - Helsinki University of Technology - Otaniemi International Innovation Centre (OIIC) |
| M. JANECEK | Member of Czech government advisory committee for R&D |
| Dan-Anders LIDHOLM | Senior Scientific Adviser - Stockholms universitet Holding AB |
| Lesley Anne RUBENSTEIN | Director - Canterbury Enterprise Hub - University of Kent |
| Folke SNICKARS | Dean at The Royal Institute of Technology (KTH) |
| Peredy Zlotan | Chief Councillor to the National Office of Research and Technology |