Enhancing knowledge-based Growth and Competitiveness through ERA and Business – Academia Partnership

Analytical Compendium

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1. Role, Benefits and Impact of Business – Academia Collaboration

European universities and other research institutions are realizing their changing role in the globalized economy and have undertaken interesting initiatives. They realize that they are no longer simply providing the local area with graduates but that they find themselves competing on a global scale for students, researchers and industrial partners. In turn, they will need to open up to business and international collaboration, which may also help leverage new funds. Sharing knowledge in particular through R&D collaborations with business – while a potential source of income for research institutions – may well give an important boost to both quantity and quality of the research undertaken. (Improve knowledge transfer between research institutions and industry across Europe, pg. 7)

External factors influence the results of the co-operation process. The prevalent innovation policies in a given Region, the commitment of the financial system and the culture of entrepreneurship will all exert an influence on the success of the partnership. Shared programmes involving Industry and financial organisations allow greater control over these external factors and can therefore improve the results obtained. In concrete terms, co-operation enables highly skilled business people to pass on experience and skills to entrepreneurs, can spread the risk of investment and connect individuals with complementary interests. (R&D-Industry Co-operation to Foster Innovative Firm Creation, pg. 134)

It is particularly interesting to note the range of benefits which can be obtained by pooling patents between research institutions. A patent pool can help create a critical mass of intellectual property which is necessary for an innovative idea to be attractive to the private sector. If marketed properly, every relevant industry player could be made aware of the research centres that generated the IP and this would help catalyse links with industry. Furthermore, building a patent pool can lead to stronger relationships between knowledge transfer offices and provide a basis for further inter-institutional endeavours. Such pooling of resources appears to be particularly appropriate for those research institutions that do not have the scope and volume of exploitable research results to justify the establishment of a knowledge transfer office. (Improve knowledge transfer between research institutions and industry across Europe, pg. 9)

In addition to the knowledge transfer activities themselves, there are also indirect benefits and should be considered in the longer term:
- The development of mutual trust between the research institution and industry, beneficial to the establishment of long-term strategic partnerships (as opposed to one-off contracts).
- The enhancement of research institutions research activities (access to state of the art industrial equipment, improving research institution project management skills, complementing the research institution competence base by new skills and techniques developed in industry, improved understanding of market needs and of industry problems).
- Gaining status and prestige (resulting from successful partnerships and products).
- The enhancement of research institutions teaching activities (involvement of industry-based lecturers, enrichment of teaching contents and materials with practical examples, learning to apply skills and knowledge to solve real business problems, etc).
- The identification of potential new clients or partners for further research.
- Attracting, retaining and motivating good scientists interested in entrepreneurial aspects or in new professional career opportunities.
- Contributing to public authorities better recognising the socio-economic relevance of publicly-funded research, potentially leading to increased funding thereof.
- Facilitating exchanges of staff between the research institution and industry, or hiring new graduates from the research institution by industry. (Improving knowledge transfer between research institutions and industry across Europe, pg. 20)
Closer co-operation between the R&D system and industry aids the spinning-off process. New innovative firms that meet market needs and obtain profitable returns from the economic and human resources would be difficult to create by a sole organisation. The process becomes much more fluid and fruitful when undertaken in the context of collaboration between public and private institutions. *(R&D-Industry Co-operation to Foster Innovative Firm Creation, pg. 134)*

Networking between different agents opens up greater opportunities for innovation than the traditional approach based on a one-way transmission between ‘knowledge-generators’ (universities and R&D labs) and ‘knowledge-users’. In practice, knowledge is generated and used everywhere and the continuous flow of information through well engineered networks ensure that the right information reaches the right people at the right time. *(R&D-Industry Co-operation to Foster Innovative Firm Creation, pg. 135)*

There was a general feeling that technology transfer often lacked professionalism. Much of the blame for this was placed with the universities which are frequently ‘still run by professors’. It was stated that, whilst universities have successfully collaborated with industry with the support of policy frameworks, the necessary management skills are not ingrained in many universities themselves. Therefore, when they come to do it alone, there is a skills gap. However, it was not felt that ‘retraining professors’ was the answer. Rather universities need to train dedicated technology transfer people and recruit experts. *(Effective Collaborative R&D and Knowledge Transfer, pg. 26)*

One of the key problems within the university was that the technology transfer office is often not involved in the university’s strategy development, and universities often don’t have ‘innovation strategies’ – in this way they often lack direct support from the top. *(Effective Collaborative R&D and Knowledge Transfer, pg. 26)*

Consultancy is one of the simplest ways for business to interact with universities and draw on their research. SMEs can become involved for relatively low fees, and the terms are simple to arrange. For larger companies, consultancy offers the chance to get to know a researcher before deciding whether to set up larger research contracts. In particular, increasing consultancy may be one way to bring more companies into contact with universities. It may increase the volume of research collaboration, with many contracts originating from consulting relationships. It may also improve the effectiveness of technology transfer, as more than 50 per cent of licences go to companies known by the academic, and consultancy increases the pool of companies an academic is exposed to. *(Lambert Review of Business-University Collaboration, pg. 35)*

Partly in recognition of the number and complexity of these relationships, many universities have developed corporate or business liaison offices, with a specific remit to act as the interface with business. These offices have taken on an increasing number of tasks as universities' engagement with their wider community has developed. These include developing networks of businesses; marketing the research strengths of the university; advising on consultancy agreements and contract research; arranging complex collaborative research agreements or major joint ventures. *(Lambert Review of Business-University Collaboration, pg. 42)*

There is no single model for a university business or corporate liaison office. Some take in knowledge transfer and technology transfer activities, while others keep the two activities separate and have established specialised companies to manage technology transfer. The appropriate approach will vary depending on the needs of local business, the mission of the university, and the focus of the local economy. *(Lambert Review of Business-University Collaboration, pg. 42)*

Why should universities engage in knowledge transfer?
This fundamental question has been addressed in the past by the Commission, which has said that "many European universities still underestimate the potential benefits of sharing knowledge with the economy and society ". The benefits of knowledge transfer – in other words, the exploitation of research - go beyond simple financial return. In fact, even in the US, where knowledge transfer is more developed, only a fraction of such activities generate net profit. The benefit also lies in a number of other, less tangible benefits for research institutions, for industry and for the society as a whole, such as helping research institutions focus their research on the wider needs of society and industry.

Benefits for industry
More effective and systematic knowledge transfer in Europe would improve the ability of industry to tap into the knowledge developed by the public science base. Such links can for example be developed through collaborative and contract research. The development of long-term partnerships between industry and research institutions, with priorities jointly agreed and implemented will build trust, improve the contribution of the research organisation and result in a better alignment of interests and benefits.

Benefits for society
There are also benefits for public authorities who increasingly need to ensure that their investments in research have an optimal socio-economic impact, e.g. new products on the market (pharmaceuticals, etc.), new jobs and new companies. Moreover, knowledge transfer at the national or regional level potentially has a strong impact on local development.

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:

<table>
<thead>
<tr>
<th>University</th>
<th>Corporate</th>
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<tr>
<td>Social responsibilities</td>
<td>Organisation responsibilities</td>
</tr>
<tr>
<td>Basic research</td>
<td>Applied research</td>
</tr>
<tr>
<td>Create new knowledge</td>
<td>Develop new products</td>
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<tr>
<td>Pure scientific driven research</td>
<td>Specific objectives: products</td>
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<tr>
<td>Publications and collaborations</td>
<td>Ownership and secrecy</td>
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<tr>
<td>Sharing of information</td>
<td>Control of information</td>
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(The reform of public research centres and universities, pg. 24)

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. *(The reform of public research centres and universities, pg. 25)*

**Process**

The establishment of a unit / office within a university to serve as a Knowledge Transfer Unit (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. *(The reform of public research centres and universities, pg. 25)*

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 to 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 experts 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. *(The reform of public research centres and universities, pg. 25)*

**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. *(The reform of public research centres and universities, pg. 26)*

**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 spinoffs** 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. *(The reform of public research centres and universities, pg. 26)*

The experience of US universities demonstrates that **technology transfer is not usually a large revenue generator**. A number of US universities started with that aim, but found it impossible to make significant amounts of money and so changed their objectives. MIT, Stanford and Yale all now state that their main reason for engaging in technology transfer is to **improve the public good** – that is, to create the greatest possible economic and social benefits from their research, whether they accrue to the university or not. *(Lambert Review of Business-University Collaboration, pg. 49)*

Fostering an **entrepreneurial mindset** as well as the relevant skills among researchers can greatly contribute to the reduction of the **cultural divide** which exists between research institutions and industry. In order to foster interactions between them, researchers need to be provided with basic knowledge transfer and business skills. Entrepreneurship education should be offered to provide training on how to manage intellectual property, interact with industry, start and run a business. Although tertiary education is normally highly decentralised, there are examples of national strategies for promoting entrepreneurship in higher education (e.g. the Science Enterprise Challenge in the UK). To help address the question of content of such courses, **the Commission is currently funding a project to create a core set of training materials to raise awareness of the importance of IP management issues amongst a variety of actors.** *(Improving knowledge transfer between research institutions and industry across Europe, pg. 10)*

Many European universities still underestimate the potential benefits of sharing knowledge with the economy and society, while industry has not developed sufficient absorption capacity to harness the potential of university-based research. Consequently, the cross-fertilisation with the business community and with wider society remains difficult. This lack of openness to the business community is also seen in the career choices of doctorate holders, who tend to pursue their whole careers in either academic circles or industry, and not as entrepreneurs. *(“Delivering on the Modernisation Agenda for Universities: Education, Research and Innovation”, pg. 4)*

**Universities should be funded more for what they do than for what they are**, by focusing funding on relevant outputs rather than on inputs, and by adapting funding to the diversity of institutional profiles. Universities should take greater responsibility for their own longterm financial sustainability, particularly for research: this implies **pro-active diversification of their research funding portfolios** through collaboration with enterprises (including in the form of cross-border consortia), foundations and other private sources. Each country should therefore strike the right balance between core, competitive and outcome-based funding (underpinned by robust quality assurance) for higher education and university-based research. Competitive funding should be based on institutional evaluation systems and on diversified performance indicators with clearly defined targets and indicators supported by international benchmarking for both inputs and economic and societal outputs. *(“Delivering on the Modernisation Agenda for Universities: Education, Research and Innovation”, pg. 8)*

Programmes to support transnational collaboration between research centres, universities and companies have an observable impact on:

- The quality of research in Europe, which they are helping to improve, whilst increasing its visibility, in key areas for growth;
– The dissemination of knowledge and results within the Union, and the ability of researchers to become involved in high-level projects. *(Science and technology, the key to Europe’s future - Guidelines for future European Union policy to support research, pg. 5)*

University administrators, and their political masters, should set only one goal for the TTO: make money – as much as possible, as quickly as possible, for the sole benefit of the university. Let the head of the TTO choose the means. And then fire that person if the promised results aren’t delivered, and provide bonuses if they succeed (civil servants don’t belong in tech transfer offices). Social goals are right for the rest of the university. A simple financial goal is for the TTO. *(The Innovation Manifesto, 9 Ideas to bridge the gap between industry and academia – and make Europe more competitive in global technology, pg. 6)*

**Sub-optimal research collaboration** and knowledge transfer between Public Research Organisations (PROs), particularly universities, and industry are one of the weaknesses of the European research and innovation system. While a number of Member States have done valuable work in this area, they have often only considered the national perspective. As a result, current rules and practices in the EU are fragmented, especially those regarding ownership of publicly-funded research results and contractual arrangements between PROs and industry. More consistent rules and practices across the EU would foster PRO-industry links and maximise their impact. This will help create a level playing field for cross-border university industry research partnerships, and thus contribute to the European research and innovation area. *(More Research and Innovation – Investing for Growth and Employment: A Common Approach pg. 15)*

The proposed IP Charter should concentrate on highlighting out the issues that need to be addressed in a collaboration agreement and what the possible approaches and solutions exist …"

The online consultation also finds that:
- Research institutions should have IPR management systems + policies in place (95% agreement);
- Royalties should be shared with researchers (89% agreement);
- Public authorities should have a non-exclusive licence to use the results (60% agreement);
- Industry should refund the public contribution if they manufacture products outside of Europe (60% agreement);
- All income should be used for research and education (79% agreement);
- EU industry should be given preference when selling the results (60% agreement).

That said, the responses also make it clear that publicly funded results should not necessarily be owned by the research institution, that research institutions should be free to sell their results to industry and finally that SMEs should not be given preference when selling the results. *(The European Research Area: Green Paper Consultation, pg. 16)*

A stronger outward orientation of TTIs should facilitate closer collaboration between research and enterprises. Thus, the expert group encourages PROs and TTIs to pro-actively seek and foster contacts with enterprises. As good practice examples show, **institutionalising such contacts is helpful and can be instrumental in stimulating regional clusters.** *(“Improving institutions for the transfer of technology from science to enterprises – Conclusions and Recommendations”, 6 – 7 pp.)*

**Establishment of Technology Licensing Offices (TLOs)**

Over the past two decades, many universities and research institutes have developed institutional structures that are specifically in charge of handling every aspect of technology transfer activities. The specific institutional arrangement has varied greatly ranging from off-campus private sector technology brokers and technology incubators for university spin-offs, to university-managed units integrated to the overall university administration. The Technology Licensing Office (or TLO) in its broadest sense4, has emerged as an important player within universities and generally plays a crucial role in identifying technologies with a commercial potential, assisting researchers to patent their
inventions, packaging the technology appropriately so as to attract industry, developing a strategy to market such technologies, and leading the licensing negotiations with potential licensees.

It is important within this process that structures are in place to facilitate as much as possible the **procedures so that researchers are not discouraged.** The establishment of a structure with responsibility over technology licensing greatly simplifies the process of commercialization enabling the inventor/researcher to focus on the research side of the project and less on the related legal/business aspects for which they may not have the appropriate expertise.

Research is indicative of the positive impact and the **spillover effects of industry – academia linkages** through pronounced flow of knowledge and information between the two partners. This is believed to lead to considerable diffusion of scientific and technical knowledge, which in turn impacts economic development. According to a study sponsored by Alfred P. Sloan Foundation and the National Academy of Engineering, academic research in a single discipline often contributes to more than one industry and conversely, a single industrial innovation is usually a result of complementary advances in many fields of research. A major challenge for the universities is keeping pace with the rapidly changing research and human resource needs of the industry. (*Industry-Academia Convergence: Bridging the Skill Gap*, pg. 6)

Ensure curriculum adaptations moves as fast as the pace of Industry change;  
• Build up relationship with industry and career advisors;  
• Tailor make education for the unemployed in shortage areas, for Small and Medium size Enterprises (SMEs);  
• Collaborate to develop “Learning Models”;  
• Develop joint Academic – Industry Degree Models;  
• Development of research based teaching material;  
• Alumni networking and developing broad based relationships, not one of associations;  
• Mutually enabling processes for capacity building of the faculty, students and the companies; and  
• Explore possibilities of endowed Chairs in specific areas of management. (*Industry-Academia Convergence: Bridging the Skill Gap*, pg. 8)

**Industry – Institute interface** is a critical dimension for any management institute as this interface decides the extent to which the institute becomes an acceptable brand. Industry – Institute interaction has to be sustained and is beneficial for both. Industry can benefit from the knowledge base available with the management institutes and the management institutes can benefit from the field experience and the industry exposure through projects, guest lectures and update seminars.

It is necessary to have a **realistic understanding about the expectations of the industry** from management institutes to impart industry relevant management education in order to groom fresh graduates as managers.

The **industry interface** can also be through faculty exchange programmes – industry experts taking time off from the industry to **serve a term in the management institute** and / or the **faculty member joining the industry** to prepare case studies and conduct training programmes. Industry can also participate by sponsoring courses in the institute and participating in the research activities of the management institute. (*Industry-Academia Convergence: Bridging the Skill Gap*, pg. 15)

2. Constraints and Limitations of B-A Collaboration
Training is often not adequate for working in industry. Future researchers are generally trained for a career in academia and do not always possess the necessary skills to find a job in the other sector. Researchers in academia also need skills to work efficiently with industry. (Mobility of Researchers between Academia and Industry, pg. 10)

Personnel working on knowledge transfer must possess a wide range of skills in order to carry out their tasks effectively. However, relatively inexperienced staff is often appointed to many of the recently established knowledge transfer offices. Continuous professional development exists in a limited number of countries but is often inadequate in terms of cost and/or delivery. (Improving knowledge transfer between research institutions and industry across Europe, pg. 8)

Unilateral supervision from academic supervisors may lead to one-side view of research. Supervisors should also be trained to be more effective. (Mobility of Researchers between Academia and Industry, pg. 12)

Temporary mobility between sectors is often difficult or not possible: either the available positions are not largely publicised, or it is simply difficult to find the expertise needed. (Mobility of Researchers between Academia and Industry, pg. 12)

Often specialised skills are missing in a sector, while they exist in the other sector. (Mobility of Researchers between Academia and Industry, pg. 15)

Inter-sectoral mobility is frequently not taken into account during appraisal, and can in circumstances even have an unfavourable impact. A transparent and fair career appraisal with appropriate feedback should lead to personal and professional development (lifelong training), and facilitate mobility between sectors throughout the career. To this end, large companies can provide many good practices. (Mobility of Researchers between Academia and Industry, pg. 14)

Administrative barriers hamper academia from undertaking the above mentioned actions, especially with regard to recruitments. (Mobility of Researchers between Academia and Industry, pg. 17)

Academia-industry partnership can only materialize when interests are aligned between the two. (Mobility of Researchers between Academia and Industry, pg. 18)

Informal networks between SMEs and academia are difficult to create because SMEs have scarce financial and human resources to find research contact in academia. However, their development is essential for innovation in Europe. (Mobility of Researchers between Academia and Industry, pg. 20)

Academic staff is often trained for a career in academia and do not always possess the necessary skills to find a job in either the one or the other sector. They also need lifelong training to cope with their new environment (e.g. career appraisal) and changing functions (e.g. from professor to chancellor...). Researchers in academia also need skills to work efficiently with industry. (Mobility of Researchers between Academia and Industry, pg. 20)

Many EU relevant instruments ease obstacles to inter-sectoral mobility. These instruments are often not fully exploited. (Mobility of Researchers between Academia and Industry, pg. 21)

Rules relating to internships and labour-market regulation, in particular those dealing with social security and pension arrangements, can impede staff exchanges. Furthermore, in some countries, public – sector researchers are not allowed to work for industry on a part-time, consultancy or other basis. (Improving knowledge transfer between research institutions and industry across Europe, pg. 9)
Most interactions between research institutions and companies involve large firms. This is due to the fact that such collaborations are considered to be more durable and regular than with SMEs. *(Improving knowledge transfer between research institutions and industry across Europe, pg. 13)*

Monitoring knowledge transfer activities has several purposes including helping research institutions promote what has been achieved for the public good. While several university rankings exist, they mostly rely on academic indicators such as publications and numbers of PhDs, and do not consider performance in the exploitation of R&D results. There is evidence that the benchmarking of “innovation-related activities”, especially if conducted on the basis of comparable metrics across the EU, would allow research institutions to compare their own achievements at European as well as at national level. *(Improving knowledge transfer between research institutions and industry across Europe, pg. 13)*

Collaboration between university and industry is necessary for more reasons than one, one of them being the scarce human resources. Collaborating should be realistic; it is not unusual that senior academics (professors) commit themselves, meaning their research group, to a project and face the fact that they cannot find the necessary personnel (e.g. Ph.D. students) for the work. This is not solely the case for a university; also industry is faced with this problem, even in collaborating with a university. *(Effective Collaborative R&D and Knowledge Transfer, pg. 21)*

The weakness of demand from industry is a crucial matter, and is mainly (but not entirely) an SME issue. These smaller enterprises have significant impact on economy but tend to focus on short term solutions rather than longer term strategy/innovation. *(Effective Collaborative R&D and Knowledge Transfer, pg. 24)*

Perhaps the most universally supported issue was the need for alignment. The key barrier is different starting posts of university and industry. It was suggested (by the industrial delegates) that universities have an unrealistic view of what they can in with their IP. In turn, it implied (by university delegates) that industry often views university partners as sources of cheap labor easily exploited. *(Effective Collaborative R&D and Knowledge Transfer, pg. 25)*

The mismatch between industry and university timescales. There is also a general feeling that university and industry people ‘think differently’ and that this can often lead to a lack of trust. *(Effective Collaborative R&D and Knowledge Transfer, pg. 25)*

Consequently, through lack of communication and misunderstanding, it was felt that parties to collaborative projects often do not recognize their strategic differences and differing objectives. *(Effective Collaborative R&D and Knowledge Transfer, pg. 25)*

Industry representatives stressed that it is important for universities to deal with patents professionally and to understand the need for ownership in industry. Many felt that universities were too demanding about confidentiality agreements etc.; as one industry representative stated ‘it’s a nightmare working with universities’. The consequence of a lack of understanding in this area was illustrated with the Framework Programme, where networks of excellence are increasingly losing industrial partners because of IP issues. It was suggested that universities should consider mechanisms other than patents and licensing. *(Effective Collaborative R&D and Knowledge Transfer, pg. 27)*

Universities were also criticised for holding on to patents for too long and for patenting unnecessarily. Their professionalism in dealing with patents was also questioned. In particular, industry representatives often thought university patents to be often weak due to a high likelihood of academic publication at some point in the process (even if accidental).
In addition to this, students and postgraduates were often thought to be unaware of the conditions surrounding industrial collaboration and IP. (Effective Collaborative R&D and Knowledge Transfer, pg. 27)

The main barriers to greater consultancy in the UK seem to be the time limits set by individual institutions, the lack of reward structures for academics who bring in extra research income as a result of consultancy, and a general academic culture that does not recognise the value of this kind of work. (Lambert Review of Business-University Collaboration, pg. 36)

Increasing academic consulting activities will improve the links between academics and business, but the appropriate amount will vary according to the mission and strengths of the university. A single policy on academic consulting activities for all universities would not work. (Lambert Review of Business-University Collaboration, pg. 36)

When establishing collaborative research partnerships it is important to determine at the outset the ownership and exploitation rights for any intellectual property (IP) that may be generated. Business and universities both report that negotiations on the terms and conditions of IP ownership and exploitation can be extremely lengthy and costly. Small companies may be deterred from establishing research partnerships because of the legal costs and time involved. (Lambert Review of Business-University Collaboration, pg. 40)

Universities are complicated institutions, and businesses can find it very difficult to find their way around. SMEs in particular can be put off if there is no obvious point of entry to the university’s resources. (Lambert Review of Business-University Collaboration, pg. 42)

From the consultation, it is also clear that the regulatory differences between Member States can prove to be a disincentive for transnational collaboration. In particular, an element of harmonization of rules regarding Intellectual Property Rights ownership by PROs and joint ownership regimes of should be considered. (“Public consultation on transnational research cooperation and knowledge transfer between public research organisations and industry”, pg. 20)

Comprehensive education programs should be modular-based and must provide and/or improve the core-skills identified below:
- Business development
- Negotiating (internally & externally)
- Networking & interpersonal skills (communications & relationships)
- Marketing & selling
- Personal organisation (multiple projects & skills integration)
- Coaching / leadership
- Project management / finance
- IP management / legal
- Contacting
(Work stream 2, pg. 84)

According to the OECD, the European Union has about six full-time researchers per thousand people employed, compared with nearly 10 in the US and a bit more than 10 in Japan. Those researchers it has are sedentary: they don’t move as often as Americans from region to region, and if they have a post at a university they’re unlikely to risk it for a job at a corporate lab. (The Innovation Manifesto, 9 Ideas to bridge the gap between industry and academia – and make Europe more competitive in global technology, pg. 17)

In order to maintain its position and strengthen its role internationally, the Union needs a pool of top-level researchers/teachers, engineers and technicians. The university remains the focal point for training people. In terms of quantity, the Union is in the paradoxical situation of producing slightly more scientific and technical graduates than the USA, while having
fewer researchers than the other major technological powers. The explanation for this apparent paradox lies in the smaller number of research posts open to scientific graduates in Europe, particularly in the private sector: 50% only of European researchers work in the business sector, compared with 83% of American researchers and 66% of Japanese researchers. The situation in Europe could well get worse in the years ahead. The absence of career prospects will alienate young people from scientific and technical studies, while science graduates will look to other more lucrative careers. Furthermore, around one third of the current European researchers will retire over the next 10 years. As the situation is similar in the United States, the competition between universities internationally is set to become even keener. (The role of universities in the Europe of knowledge, pg. 19)

Universities in the US, Canada and many European countries have adopted a wide range of different policies on patent ownership and royalty-sharing formulas between researchers, the researcher's department, the technology licensing office and the university itself. Anecdotal evidence from a number of countries shows that lack of a clear policy on royalty-sharing and the exclusion of any benefit to the inventor/researcher or his/her department have resulted in a lack of incentive to patent and exploit inventions as well as, on occasions, university researchers patenting under their own name. ("Research and Innovation Issues in University – Industry Relations", pg. 5)

Lack of expertise is often perceived as one of the most limiting factors in managing the commercialization of IP by universities. Bernhard Hertel, managing director of Garching Innovation points out that “the right mixture of scientists, lawyers and businessmen and a well-organized back-office is the basis for success in technology transfer." This contrasts with many Technology Licensing Offices (TLOs) where emphasis was devoted to technical expertise at the expense of legal and business expertise. Limitations in terms of expertise and human resources often leads to the outsourcing of part of the work to patent agents, technology brokers, business consultants, etc. Studies in the US6 note that the vast majority of university TLOs outsource the preparation of patent applications to external patent agents in order to make sure that people with the appropriate technical expertise are selected to draft each patent application. ("Research and Innovation Issues in University – Industry Relations", pg. 6)

Conflict of Interests
The concern remains for many that a greater emphasis on technology transfer by universities will result in a deference of universities to the needs of the corporate world or in a move away from research projects that will not result in commercially viable technologies (e.g. basic research). According to Tsekouras et al., “the basic source of tension is the conflict between the public interest which is supposed to be behind the funding of public research and the commercial interest which needs to be taken into account if IP rights become a widely used strategy for PSR [public sector research institutes]". These are issues that need to be addressed in order to ensure the autonomy of the university and that efforts to facilitate technology transfer from universities to industry do not result in neglect for some of the basic functions of universities. In addition, it is generally necessary to address issues concerning the differences that are likely to arise between university departments with the ability to develop commercially viable technologies and, therefore, benefit from external financing and royalty incomes, as compared to other departments where research is of a more academic nature (e.g. the humanities). ("Research and Innovation Issues in University – Industry Relations", pg. 7)

Financial Resources
One of the problems faced by TLOs relates to the resources required for their functioning, particularly during the start-up phase. The expectation in most universities is that the TLO will ultimately be self-sufficient and would indeed provide substantial financial resources to the university once royalty streams from patent licensing begin to flow in. According to Lita Nelsen, director of the Massachusetts Institute of Technology's TLO, the reality is somewhat
different: “the direct economic impact of technology licensing on the universities themselves has been relatively small (…) most university licensing offices barely break even.”8 What this points to is perhaps not so much that TLOs are not economically viable, but that the initial optimism concerning the transfer of technology from university to industry is increasingly replaced by a more realistic approach. According to Bernhard Hertel “TT [technology transfer] is a long term process. A TT office should have a basis to survive at least for ten years. It is difficult to predict when you will get your big project. But when it comes you must have the skills to manage it and the resources to defend it if necessary.” In this light, private sector technology brokers have often come to be perceived as a possible alternative wherever the market for technology brokering is sufficiently developed. ("Research and Innovation Issues in University – Industry Relations, pg. 7)

One of the greatest limitations that has been noted in many countries or institutions following the establishment of TLOs is that inventions have been transferred from laboratory shelves to the TLO shelves without subsequent commercialization. The marketing of patented inventions is one of the most essential functions of a TLO but one that has often not received sufficient attention, as personnel has generally been recruited on the basis of their technical expertise rather than their business or marketing expertise. Web sites of TLOs advertising their licensable technologies may be successful where they belong to institutions with very high visibility and reputation but may not be the case for smaller TLOs. It is thus crucial for TLOs to have a clear marketing strategy and to establish fluid contacts with industrial partners. ("Research and Innovation Issues in University – Industry Relations, pg. 8)

Licensing or Spin-off Route
The commercialization of university research results follows two main routes (each one implemented in a variety of different ways): (1) the licensing of the invention to one or more existing companies for the purpose of its commercialization (2) the creation of a spin-off company that will commercialize the invention. Different institutions have favoured different routes and generally decisions are taken on a case-by case basis, including considerations on whether the university researchers themselves are willing to become involved in commercializing the technology through the creation of a spin-off company. The spread of incubators within university structures has been one way of facilitating the creation of spin-offs and in assisting the development of companies through its start-up phase. However, even when based within universities, incubators are generally not exclusively aimed at the commercialization of university research results but also accept extra-university start-ups. The existence of a well-developed venture capital market is also important for the establishment of university spin-offs. The Silicon Valley represents an example where the conjunction of universities with a high degree of technical expertise, technology incubators and ventural capitalists has facilitated the development of a large number of university spin-offs. ("Research and Innovation Issues in University – Industry Relations, pg. 8)

A piece done by The New York Times indicates that only one in four engineering graduate in India is employable, based on technical skills, English fluency, and teamwork and presentation skills. It is estimated that India will face a shortage of 500,000 knowledge workers by 2010, the BPO services sector alone will need about 350,000 workers by 2010. (Industry-Academia Convergence: Bridging the Skill Gap, pg. 6)

• Lack of Industry orientation – the essence of the system still follows examination based evaluation processes and not project based assessments;
• Rigidity – Since all educational institutions are under the ambit of UGC regulations the process of re-evaluation of course content becomes non-flexible;
• Lack of industry experience of the teachers themselves;
• Lack of attention towards pure sciences – Even countries like China and Vietnam have been concentrating on the same, rightly understanding the importance of the ITES in a post-industrial economy.
Besides these obvious technical preconditions necessary in a professional, there are various grooming and personality based qualities, which our education system does not address adequately. These include **language skills like diction and fluency; analytical abilities and basic logic;** as well as **cross-cultural sensitivity and customer service orientation and behavioral attributes.** (*Industry-Academia Convergence: Bridging the Skill Gap*, pg. 16)

It is also important to note that not all academia is interested in working together with industry, and vice versa. In fact, **only a minority of academics actually take special interest in working with industry on R&D.** Most are focused on the core business of academia, which is research (without the development or commercial aspect), teaching, and university administration. As a result, most academics tend to have a 'hermit' mentality and do not subject themselves to much team work. For this reason, Project Managers must take great care to nurture existing relationships or to create new linkages with academia, i.e. industry-academia R&D is no easy simple task, and takes plenty of persistence, convincing, and time to get things moving. (*Two cultures – Joint success*, pg. 3)

Despite the **plethora of collaboration models,** many of the most successful models do not provide open access to data or resource sharing. This protective approach to data management limits innovation. Although sharing data is part of the mission and culture of universities, it does not fit within the traditional competitive business models practiced by most companies. However, there are emerging examples of **new open business models** that support open innovation. The continued development of such open business models will be as crucial, if not more crucial, than technology development to sustain highly innovative collaborative structures between industry and academia. It is the hope that such open research collaborations will lead to the development of new paradigms to approach disease treatment, yielding high-value therapies and testing technologies that better define those patients who will benefit from a given therapy and therefore provide true value based on healthcare outcomes. (*Open innovation networks between academia and industry: an imperative for breakthrough therapies*, pg. 2)

### 3. General Regulatory Framework and Financial support for Business – Academia Collaboration (tax treatment of R&D Expenditures, IPR protection and use, other)

Cohesion policy’s main instrument, the **European Regional Development Fund (ERDF),** is used to support incubators and science parks (infrastructures and accompanying services) which are an effective means to spin-out knowledge into the market place and can help create better SMEs – university links. Well-run incubators and clusters have significant advantages which make them outstanding instruments of knowledge transfer, most notably for high technology. A distinctive feature is that services are available which increase the likelihood of knowledge transfer occurring successfully. However, as well as support for infrastructure, the ERDF provided co-financing of around €4 bn in the period 2000-2006 for innovation and technology transfer and for establishing networks and partnerships between business and research institutions. The ERDF therefore played a significant role in facilitating interaction between public research organisations and industry, both in terms of regional and trans-regional interaction. (*Improving knowledge transfer between research institutions and industry across Europe*, pg. 14)

The **European Social Fund (ESF)** provides financial support through the assistance to persons (training, guidance, etc.), and for the development and modernisation of educational structures and systems. In the new programming period (2007-13), there is an increased emphasis on strengthening research and innovation, particularly through knowledge transfer. (*Improving knowledge transfer between research institutions and industry across Europe*, pg. 15)
Transnational knowledge transfer has always been at the heart of the *Research & Technological Development Framework Programme* (FP). Indeed, most FP projects involve a mix of participants from the public and private sectors, from several countries. Certain thematic areas, such as the ICT sector, have been particularly successful in this respect: more than 90% of projects involve research institutions - industry collaboration. This clearly facilitates the development of technologies ready for commercial exploitation. As well as R&D projects, the FP also funds the intersectoral mobility of research staff, including university-industry exchanges. (*Improving knowledge transfer between research institutions and industry across Europe, pg. 15*)

The new *Competitiveness and Innovation Programme* (CIP) supports all forms of innovation, public-private partnerships and measures to improve access to finance including loans, venture capital, and "business angel" finance. It also funds novel ways to facilitate knowledge sharing between research institutions and companies, in particular for SMEs, as well as new trans-national clustering initiatives. In the area of eco-innovation, it in particular supports the market up-take of innovative technologies and practices through pilot and market replication projects. (*Improving knowledge transfer between research institutions and industry across Europe, pg. 15*)

Some favour co-location of researchers from academia and industry where mobility will naturally occur due to proximity and alignment of interests. (*Mobility of Researchers between Academia and Industry, pg. 18*)

**Joint funding:** favour collaboration by providing **jointly funded research grants and fellowships**. Joint funding will foster collaboration. Experience shows that companies (both large and SMEs), which contribute financially to training fellowships, tend to become more committed in the training of researchers, incorporating them in core projects of the company. (*Mobility of Researchers between Academia and Industry, pg. 18*)

**Awards and individual funding:** provide extra funding through **awards** for exceptional collaboration between the private and public sectors, e.g. rewarding "entrepreneurial academics". Develop new initiatives, e.g. **funding actions** for **retired people from industry**, who could bring their expertise to academia. (*Mobility of Researchers between Academia and Industry, pg. 18*)

**Performance indicators:** parts of the national public funding for academia should be linked to performance indicators based on allocating public funding in relation to, among others, the number and size of industry collaborations. (*Mobility of Researchers between Academia and Industry, pg. 18*)

**Continuity of funding schemes:** a certain degree of continuity of funding schemes and programmes is needed to allow recognition by both sectors. Renaming and multiplying funding instruments should be avoided in order not to confuse the potential applicants. (*Mobility of Researchers between Academia and Industry, pg. 18*)

**Knowledge transfer support:** support the establishment of interface offices between academia and industry that can take the form of knowledge transfer activities or others. The interface offices will increase awareness about the importance of cooperation with industry. In order to ease the process, governments should provide guidelines and codes that set the relationship between academia and industry for commercialisation of research results and to address ethical aspects of research. (*Mobility of Researchers between Academia and Industry, pg. 19*)

An example of existing good practice is the Netherlands' *innovation vouchers* scheme whose main objective is to enable SMEs to buy knowledge and strategic consultancy from research institutions through innovation vouchers (worth €7500) and thus to stimulate
interaction and **exchange between the knowledge suppliers and SMEs**. The knowledge supplier can then hand in the voucher to the Innovation Agency *SenterNovem* and receive payment. State aid rules allow supporting such consultancy with public funds. *(Improving knowledge transfer between research institutions and industry across Europe, pg. 13)*

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 Public Research Centres 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. *(The reform of public research centres and universities, pg. 18)*

Each research institution should develop and implement policies regarding at least the management of intellectual property, staff incentives and conflicts of interest. Thus regarding **Intellectual Property (IP) Policy**, the research institution should define and communicate a long-term strategy in relation to the management of IP and Knowledge Transfer (or more broadly innovation), including a strategy as to how these activities should be pursued. A written policy explaining how IP management relates to and supports the overall mission of the research institution should be developed, published and implemented. This policy should include guiding principles relating to the emphasis the research institution places on the financial and non-financial benefits of the effective management of IP exploitation of Knowledge Transfer. *(Improving knowledge transfer between research institutions and industry across Europe, pg. 6)*

It is considered a good practice that an adequate research institution **Intellectual Property policy** will:
- Ensure that inventions can be **identified easily** and, where appropriate, protected;
- Make the research institution a more attractive partner by providing evidence relating to the research institution’s expertise in IP management;
- Make inventions more visible to external stakeholders, in order to promote their exploitation (through licensing, etc.);
- **Promote the use of publicly-funded research results**, including the spinning out of new companies;
- Provide a formal incentive mechanism for staff who participate actively to knowledge transfer. *(Improving knowledge transfer between research institutions and industry across Europe, pg. 6)*

Although they vary from one research institution to the other, typical IP policies often covers the following issues:
- Ownership of research results and associated IP rights;
- Rules applicable to “non-employees” of the research institution such as a students;
- Management, protection, and promotion of the exploitation of IP rights;
- Negotiation of IP issues raised during interaction with industry (ownership of IP, confidentiality, etc.);
- Incentives for researchers who participate actively to knowledge transfer;
- Management of conflicts of interest;
- Monitoring and reporting of Knowledge Transfer activities. *(Improving knowledge transfer between research institutions and industry across Europe, pg. 6)*

**Intellectual property rights (IPR) constitute an important framework condition** for knowledge transfer. Commercialisation of research results through patents and licensing is important, although sometimes over emphasised. Proper treatment of IPR is a prerequisite of
collaborative research although their economic relevance differs greatly between different fields of technology. The legal framework at HEIs differ also. Specialised supportive infrastructure is a prerequisite for the successful use of IPR. (*Good practice in industry-science relations, pg. 35*)

**Governmental action should be subsidiary, integrating, catalysing** and always form **part of a greater strategy.** The actions that particularly pertain to the governmental arena require, in the main, a sustained, long-term effort. They range from actions that can form part of a specific policy to identify concrete needs to those that are more general in nature and that seeks to act upon the fabric of culture and society:
- Improving ICT networks across the region.
- Fostering seeds funds of a mixed public-private nature.
- Driving internationalisation.
- Facilitating contact between the offer and demand of technological, commercial and financial services.
- Simplifying administrative burdens.
- Promoting networking.
- Disseminating good practice in the promotion of new firm creation.
- Driving forward education and training.

(*R&D-Industry Co-operation to Foster Innovative Firm Creation, pg. 139*)

It is the **regions** however that have the **greatest opportunity to turn strategic policy into practical results** in the short and medium term. The concept of regional or local environment is important in the innovation process because it is geographically proximity, the nearness of the people that work in the firms, research centres and universities, sharing a common culture and a lifestyle that facilitates patterns of cooperation and interaction between firms, institutions and public administrators. (*R&D-Industry Co-operation to Foster Innovative Firm Creation, pg. 141*)

Several reasons why universities patent IP;
- Universities are not organisations to keep trade secrets.
- In order to protect its knowledge, universities should patent.
- At least in some sectors, the existence of a patent eases the negotiation process with industry.
- Universities patent inventions to increase the potential use.
- Universities patent for profit.
- Universities patent in order to facilitate the subsequent processes of spin out and value creation through acquisition.
- Universities should not patent their IP, but instead should establish the partnerships with firms that can manage the process professionally.

(*Effective Collaborative R&D and Knowledge Transfer, pg. 12*)

**Lack of clarity over IP ownership** increases the time and cost involved in negotiating research collaborations and prevents some deals being completed. Many universities and businesses say that disagreement over IP ownership is a major barrier to research collaborations. The costs of protracted negotiations in some cases can be high, both financially and in tying up staff. This in itself deters some organisations, especially SMEs, from trying to collaborate with universities in research. But more important, several businesses and universities have failed to reach agreement and walked away from collaborations because they found it too difficult to reach agreement on IP ownership. (*Lambert Review of Business-University Collaboration, pg.50*)

A number of businesses also comment that **some universities overvalue their IP.** This has stopped several businesses agreeing deals with universities. Increases to third stream funding announced by the Government will reduce the financial pressure on universities to make their knowledge transfer operations self-sustaining. But it is important that universities
do not overvalue their IP and as a result prevent deals from being completed. (Lambert Review of Business-University Collaboration, pg.50)

Maximum creative use of IP allows the full economic potential of a research collaboration to be unlocked. The business sponsor needs to have the rights that are required to bring the technology to the market. But universities also have important interests. Publication of their research results is of benefit to the wider scientific community. Continuing research in the same field may lead to new scientific developments. Universities may also want to explore other applications and uses of the IP in different scientific fields. Recent reports from the CBI, the Royal Society and the Patent Office confirm that these freedoms are important. If business negotiates full ownership of IP with strong restrictions on university use, this may reduce the total economic impact of the IP in the future. (Lambert Review of Business-University Collaboration, pg.51)

The Review has identified a number of objectives for improving the management of IP in research collaborations:
- It would be useful to establish a simple set of ground rules for IP ownership, which would be the default position on which to build most negotiations.
- There should be maximum flexibility in the use of IP, to stop it being locked up in a way that limits its exploitation across as wide a range of areas as possible.
- At the same time, the Funding Councils and Research Councils should make it clear to universities that public funding is intended to promote the public good rather than to raise revenues.
Academics should continue to receive incentives from universities to produce commercial IP.
- Companies should have secure rights to the IP they want to commercialise.
- Ownership should be proportionate: the party which makes the biggest contribution (intellectual as well as financial) should have first rights on the IP ownership.

The Review believes that the best way to meet these objectives is to introduce an IP protocol. This would provide simple ground rules for negotiations and encourage the flexible use of IP by both universities and business. In most cases universities make a significant contribution to collaborations, so the default position should be that they own the IP. But companies could own the IP whenever their contribution is significant.

It is unlikely that the protocol would affect negotiations for strategic relationships between large companies and universities. These are usually designed to benefit both parties, and involve significant contributions from each. The likely impact would be highest on SMEs and those larger businesses that have fewer relationships with universities, and on universities that have less developed industry research links. (Lambert Review of Business-University Collaboration, pg. 51)

Institutions should track their doctoral graduates to become significant drivers at institutional, national and international level and to inform doctoral candidates of their potential employment options. Support of governments as facilitators for university-business cooperation processes and growing awareness of IPR are important structural factors. (European University / Business Forum, slide 12)

If you are an inventor at, say, the University of Cambridge or Stockholm’s Karolinska Institutet, first you have to figure out who has the right to file for the patent: you, your university, the company that co-funded your research or some combination of the above. Then you have to figure out where to file: in your national patent office for something cheap but local; at the European Patent Office for something expensive but European (though not, despite the name, European Union); in Geneva under the World Intellectual Property Organization’s rules (which, again, despite the name isn’t really global); or country by country. Then the questions really start. How many languages must you file in? What if you disagree with the patent examiner? What court do you go to if someone steals your idea? (The
The European countries that have not done so already should consider enacting regulations on the use of the results of publicly funded research. The principle of assigning to PROs ownership of results and first right to inventions should be recognised as good practice. ("Management of intellectual property in publicly-funded research organisations: Towards European Guidelines", pg.2)

**Importance of intellectual property regulations** for the technology transfer from PROs to enterprises, the expert group underlines the need for a community patent. The expert group urges the Commission and the Member States to proceed with the establishment and implementation of the Community patent and to explore the possibilities to achieve better reciprocity between the European, US, Japanese, and other patent systems. ("Improving institutions for the transfer of technology from science to enterprises – Conclusions and Recommendations", 6 – 7 pp.)

Recognizing that reporting obligations of PROs on their transfer activities would raise PRO’s awareness of the importance of this function and that reporting, thus, could be an appropriate lever for the installation of appropriate transfer mechanisms, the expert group recommends the Commission together with the Member States to explore the possibilities for a general reporting system building on the experience of the presently employed reporting systems. While such a system should be adjusted to national needs, a number of common indicators should be applied in all countries in order to facilitate benchmarking processes between Member States. These indicators should include performance indicators such as revenues from contract research, patents filed and granted, licences and revenues from licensing, number of active contracts, number of client enterprises (including SMEs) and number (and development) of spin-offs, but also more qualitative information such as transfer strategies and kind of institutions employed for this purpose. ("Improving institutions for the transfer of technology from science to enterprises – Conclusions and Recommendations", 6 – 7 pp.)

The expert group concludes that as far as end-users are concerned, successful knowledge and technology transfer depends less on the particular type of TTI than on the ease of access, visibility and efficiency of the system used and, thus, recommends Member States and PROs to stimulate, implement and organise technology transfer in a way which corresponds best to the needs of the respective enterprises. ("Improving institutions for the transfer of technology from science to enterprises – Conclusions and Recommendations", 6 – 7 pp.)

**National Policy Framework**

The existence of a national policy framework is generally the crucial first step. The impact of the Bayh-Dole Act in the US in providing a national framework with a clear set of rules concerning the ownership of IP rights by universities as well as other non-profit organizations. A national (or regional) strategy is required that clarifies issues of ownership under different scenarios in particular whenever research is publicly funded. Conditions and criteria on exclusive licensing of such technologies also need to be considered as well as broader issues concerning the role of universities in science and technology policy, on the one hand, and educational and cultural policies on the other. The necessity to view the issue from a broader perspective is also driven by the need to address potential conflicts of interests that may exist between universities’ efforts to facilitate the exploitation of their research results with their other educational and research objectives. ("Research and Innovation Issues in University – Industry Relations", pg. 4)

Institutional policy on IP for universities should also consider issues relating to IP ownership within collaborative research programs and/or other contractual agreements with various partners (including other universities, sponsors, companies, public sector bodies, etc.). ("Research and Innovation Issues in University – Industry Relations, pg.5")
In many institutions, TLOs also play an active role in sensitizing researchers and students on the existence of the office, on the benefits of considering exploitation of their research results and on the appropriate procedures for disclosing inventions, patenting and licensing. Training and awareness raising therefore constitutes an important added function of the TLO. (“Research and Innovation Issues in University – Industry Relations”, pg.6)

In all Member States there are schemes to promote intersectoral mobility and training in industry; however, a few good practice examples as regards public to private sector mobility can be identify. In Italy, for instance, academic researchers can be seconded to industry at low costs to the industry and with financial support from the ministry to replace such researchers. The French law on innovation and research of 1999 provides some measures to facilitate mobility from academia to industry, including the possibility to create or to be associated with the creation of a spin-off company exploiting the research, without losing the status of civil servant for up to six years and taxation relief for companies employing young PhDs. Austria is moving towards a system where researchers in the public sector are no longer civil servants and therefore not part of the specific civil service pension system. Some countries have developed significant opportunities for start-ups and spin-offs. For example, in the Netherlands, a large programme has been created in the area of life sciences. In any case, efforts to increase networking between industry and academic institutions should continue. (“Raising EU R&D Intensity, Direct Measures”, pg. 68)

In the area of “Incubator”, “Bridge” or “Conversion Gap”, lessons from past experience and emerging good practice suggest that policy makers need to:

- **Recognise an important gap** in the technology transfer process, not restricted to specific regions or countries, between the completion of a grant-funded research project in a university or research institute, and the development of a high-growth business start-up proposal, based on this innovation, that should be capable of attracting outside risk capital investment on reasonable terms.
- **Establish programmes** that have secure financing and realistic expectations of costs and revenues, including adequate public or educational sector sponsorship. Their continuation should not depend on generating investment returns or private-sector fundraising that can distort project selection and divert management time.
- **Utilise private sector commercial management** to select much less narrowly than would an early-stage investor from individual research projects with some definite commercial potential. (“Raising EU R&D Intensity, Risk Capital Measures”, pg. 22)

Supporting RTD are:

- **Direct Measures**, i.e. measures involving the direct transfer of financial support from the public to the private sector via grants, loans etc.;
- **Fiscal Measures**, i.e. measures whereby the public sector foregoes tax income from the private sector in exchange for approved R&D investment behaviour;
- **Risk Capital Measures**, i.e. public measures affecting the flow and use of risk capital for innovation-related activities likely to increase R&D investment levels;
- **Loan and Equity Guarantee Measures**, i.e. measures whereby the public sector tries to encourage additional investment in R&D by offering to share part of the risk involved in the provision of support for innovation-related activities. (“Raising EU R&D Intensity, Fiscal Measures, pg. 1)

Proprietary information could, in turn, be divided into two separate subgroups—information that should be safeguarded and information that can be disclosed without damage—using the sort of valuation processes that companies already use to determine the value of patented discoveries and inventions. Information that is not central to a company’s business, such as data derived from toxicity assays, could then be sold to other companies or academic research institutions at market value. Any company that fears giving its competitors an advantage could delay selling the data until it is entirely safe to do so,
although it should bear in mind that the value of its research could depreciate over time. 
(Open innovation networks between academia and industry: An imperative for breakthrough therapies, pg. 5)

4. Specific B-A Collaboration Support Instruments:

For Public Research Organisations (PROs)
Without abandoning the Open Science Model, PROs should seriously consider taking a proactive role in the innovation process by managing IPR arising from research results. This is an important strategic decision, which requires establishing a clear mission, realistic objectives, appropriate resources and a dedicated professional transfer office.

Industry and PRO associations should develop and implement by mutual agreement voluntary codes of conduct and guidelines to optimise the opportunities for a range of strategic relationships that can be entered into. Both of these key stakeholders should recognise the mutual benefits that such interactions can yield.

(“Management of intellectual property in publicly-funded research organisations: Towards European Guidelines”, pg.1)

Provide incentives for inter-sector mobility through internal academic appraisal systems, or better working and salary conditions. However, inter-sectoral mobility shouldn’t be enforced. Criteria for appraising inter-sectoral mobility should be linked to the benefit for the host institution, the researchers’ group, or the individual researcher. Example of criteria: co-publications with the industry partner (publications are important for industry reputation), list of contacts, launching of cooperation projects, commercialisation, IPR knowledge or IPR co-ownership, start-up or spin-off experience even for failures. A sabbatical can be appraised through a report written by the researcher that lists the added value of the mobility (this is common practice in many countries). A researcher pursuing a career in the other sector may need tailored criteria in order to benefit from the principle of equal opportunities. (Mobility of Researchers between Academia and Industry, pg. 14)

Develop fair and transparent career evaluation processes as recommended by the European Charter for Researcher and the Code of Conduct for the Recruitment of Researchers. The career evaluation process should cover all stages of the research career, providing checks and balances, feedback, counselling and appeal process. The objectives as well as the list of criteria and their respective weightings should be defined and be well-known in advance, and should be gender and family neutral. (Mobility of Researchers between Academia and Industry, pg. 15)

Regular career orientation should occur (e.g. every 5 years). (Mobility of Researchers between Academia and Industry, pg. 15)

Provide training and standardised procedures to evaluators. Review effectiveness of the evaluation as a form of training. Develop transparency of the evaluation mechanism in a manner that evaluations are comparable and well-motivated. (Mobility of Researchers between Academia and Industry, pg. 15)

Include various evaluator profiles, gender balance, and external evaluators, including international experts, in the evaluation committees. The committees should also take part in the definition of criteria. (Mobility of Researchers between Academia and Industry, pg. 15)

As part of the package earmarked for research, provide funding for setting up training programmes in order to ensure adequate training for employability in both sectors and at all levels of responsibility. (Mobility of Researchers between Academia and Industry, pg. 20)
Introduce substitution to legal barriers such as insurance negotiated with private companies that can follow the researcher when moving (including pensions) or “intermediary bodies” (public or private) that can take financial, legal and operational responsibility for the mission of researchers outside their host institution. (*Mobility of Researchers between Academia and Industry, pg. 21*)

Raise awareness in the widest sense (e.g. information, training, etc.) among public and private research bodies and researchers, in particular in the New Member States, about the existence and impact of EU relevant instruments on inter-sector mobility (Directive on Fixed-term Contracts, Recommendation by the Commission on the European Charter for Researcher and the Code of Conduct for the Recruitment of Researchers, Entry conditions for third country researchers, social security rules, RTD funding schemes, etc.). (*Mobility of Researchers between Academia and Industry, pg. 21*)

Raise awareness on compatibility of complementary pension schemes between academia and industry in light of relevant existing and future EU legal instruments for the acquisition (“waiting and vesting” periods), preservation and transferability of such rights. Take into account inter-sector mobility in other EU instruments such as the current review of the Community Framework for State Aid for R&D or the forthcoming communication defining guidance to bring about a more effective, stable and concerted use of R&D tax incentives across Europe. (*Mobility of Researchers between Academia and Industry, pg. 21*)

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 reform of public research centres and universities, pg. 18*)

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. (*The reform of public research centres and universities, pg. 18*)

The government should set clear, long-term goals specifically related to Public Research Centres’ 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. (*The reform of public research centres and universities, pg. 19*)

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. *(The reform of public research centres and universities, pg. 19)*

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. *(The reform of public research centres and universities, pg. 19)*

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. *(The reform of public research centres and universities, pg. 19)*

**Knowledge transfer units (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). *(The reform of public research centres and universities, pg. 21)*

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. *(The reform of public research centres and universities, pg. 21)*

**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 and referrals among KTUs, thereby **reducing costs and inefficiencies** (a KTU specialised in spin-off could assist another specialised in knowledge transfer.

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. (The reform of public research centres and universities, pg. 22)

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. (The reform of public research centres and universities, pg. 22)

When the KTU requires an efficient and active presence in the industry to find the best licensee 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. (The reform of public research centres and universities, pg. 23)

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.). (The reform of public research centres and universities, pg. 23)

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. (The reform of public research centres and universities, pg. 23)

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 for spin-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 reform of public research centres and universities, pg. 23)
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. *(The reform of public research centres and universities, pg. 24)*

Alignment of interests;

- **Strategic collaboration** is a deal as any other and both sides must strive to achieve a ‘win-win’ situation. Each party must clearly state their objectives, their understanding of the collaboration strategy, and their own position in it. If the goals are clear, then at least the partners can attempt to find a solution. Unless both parties are happy with the terms of the collaboration – each should be willing to say ‘no’ to the project. *(Effective Collaborative R&D and Knowledge Transfer, pg. 25)*

- The details of the deal (including technical annexes, research strategy, re-negotiation clauses etc.) must be explicitly stated and set out with the help of experts.

- To enhance understanding of the ‘different starting posts’ of university and industry it was proposed that there should be increased interaction between university and industry in the form of forums for discussion and conferences.

- Universities should strive to better understand industry by installing industrial representatives on the board of the university.

- At grass roots level, links between industry and graduates / postgraduates should be encouraged (student sponsoring, sandwich courses with a year in industry, etc). these can be good breeding grounds for long term relationships. *(Effective Collaborative R&D and Knowledge Transfer, pg. 25)*

The expert group encourages PROs to establish recognizable portals on the Internet and in their physical organisation. This portal should facilitate easy access by enterprises of all sizes, but also reach out to the PRO’s own personnel, and efficiently direct them to the appropriate transfer services, which provide the various services such as patenting, licensing or contract research in the science areas the PRO covers. (*"Improving institutions for the transfer of technology from science to enterprises – Conclusions and Recommendations", 6 – 7 pp.)*

The measures referred to would include the following:

- Introduce sweeping changes to current regulations and bylaws, to reduce red tape that impedes the process. To be effective, these changes have to be recommended by the University administration, mandated by the Government, and overseen by joint committees.

- **Encourage faculty members (expats and nationals alike) to reach out to the industrial sector** to cultivate meaningful contacts, develop (one on one) connection with their counterparts, and search and find potential areas for collaboration, within their field of specialization. This would invariably result in faculty members gaining relevant experience that would eventually be passed on to students.

- Institute a **Faculty Fellowship Program**, where tenured or tenure-track engineering faculty could spend 10 weeks, a semester, or an academic year, gaining valuable industrial experience(on site) in their field of technology, or in an allied area, compatible with the interests of the Industry and the College.

- Set up advisory boards to: facilitate collaborative efforts, provide logistical support and resources to collaborators, and monitor progress of joint activities. *(On Industry-Academia Relations in the Arab Gulf States: Steps toward Building Strategic Partnership, pg. 5)*
4.1 Collaborative Research

Use funding schemes to develop informal networks and activities between SMEs and academia. Create informal networks with a view to respond to local needs. Informal networks will enhance inter-sector mobility by creating contacts through meetings, events, conferences, job fairs, etc. SMEs will be easier to involve through national industry federations, or other representative organisations, such as clusters of SMEs or forums. *(Mobility of Researchers between Academia and Industry, pg. 20)*

Adequate mechanisms and professional resources must be in place if Knowledge Transfer activities are to take place effectively – preferably through the creation of a Knowledge Transfer Office (KTO), either for individual institutions or clusters thereof. Although many variations may be encountered, a typical KTO:
- Is staffed by professional knowledge transfer experts, including – or with access to – legal, financial and intellectual property (IP) advisors.
- Develops and executes the research institution’s strategy in respect of working with industry and users of research results, and the exploitation of intellectual property.
- Helps identify, evaluate and – where appropriate – protect intellectual property.
- Advises on commercial and IP issues, in particular in the negotiation of research contracts.
- Promotes the use of inventions and other R&D results, in particular by negotiating technology transfer agreements or facilitating the creation of spin-offs.
- Disseminates information – in particular to potential users – regarding what intellectual property the research institution owns and what is available for licensing.
- Administers license agreements and equity participations, collects and distributes the revenues.

If an institution creates a new KTO, it is recommended that it be empowered first as a service organization and only if required and presumed it is capable, as a strategic exploitation office. Once it has necessary experience and capacity to fulfil its function, it could be authorised to generate, protect, and enforce IPR. *(Improving knowledge transfer between research institutions and industry across Europe, pg. 26)*

To perform knowledge transfer activities effectively, research institutions need to have sufficient autonomy to recruit experienced knowledge transfer staff on a competitive basis. Increased mobility between the public and private sectors will help research institutions’ researchers and managers identify shared needs industry. *(Improving knowledge transfer between research institutions and industry across Europe, pg. 9)*

There is also a need for existing resources to be made more accessible. This can be partially achieved through co-ordination. At present, certain research institutions have staff who actively pursue links with industry, but who do not interact amongst themselves. By pooling their knowledge transfer competencies, they can ensure that such skills are made more widely available throughout the research institutions. Furthermore, significant benefits may arise by outsourcing certain specialised functions or by pooling resources or R&D results (and associated IP rights) between several research institutions15. Examples of pooling resources between several knowledge transfer offices include the patent marketing and knowledge transfer agencies established in Germany, the North of England Science Initiative or the Belgian VIB16. Alternatively, such pooling can address a single industry sector (for example the White Rose Consortium17) or a single knowledge transfer activity. *(Improving knowledge transfer between research institutions and industry across Europe, pg. 9)*

Resources are scarce and, as such, the decision on which research area they should be focused in order to obtain the best results for society is one of the most difficult and important for policy makers at all levels. One of the best ways to optimise public investment is to identify areas in which there will be the greatest number of beneficiaries – it frequently
Setting-up research-based spin-offs within such an area has a series of positive effects that include the continued revitalisation of both cluster and the university/R&D centre from which the spin-off emanates. The firms can benefit from the ready-made network of potential clients and mentors, the university can benefit from the practical data obtained from placing the research on the market and new jobs are created that keep knowledge workers in the region. (R&D-Industry Co-operation to Foster Innovative Firm Creation, pg. 136)

This feedback process also generates new services offered by the university itself that strengthen its work and can lead to the birth of a particular technology cluster that could elevate the research institution to international levels more rapidly. And, indirectly, the process enhances the professional opportunities available to students through the growth of the regional economy as a whole. At a regional level, the ability to identify emerging sectors can help to direct resources to support the creation of high-growth enterprises that have the greatest impact on the socio-economic well-being of the region. (R&D-Industry Co-operation to Foster Innovative Firm Creation, pg. 137)

The new applied research groups should ideally be located on or close to existing HEI campuses. It is crucial that they have distinct governance that ensures their autonomy and protects their distinct mandate and culture of applied research. The relationship with the HEI can be defined by a Memorandum of Understanding (MoU) or legal agreement which would among other things spell out arrangements for both sides to have access to each other's facilities. They will need strong professional management with a commercial background as well as operational independence from the HEI but the potential for recruiting researchers with the right profile and the ability to link with academic researchers. (Promoting Enterprise-Higher Education Relationships, pg. 25)

Large companies are consolidating their relationships with university research departments. Whereas in the past they may have had scores of short-term research contracts with different departments across the country, today many prefer a small number of substantial longterm collaborative research partnerships. (Lambert Review of Business-University Collaboration, pg. 38)

Collaborative research often involves academic researchers working alongside company employees on shared projects. The contributions of each side to the partnership will vary, but the company may provide long-term secure funding along with company data, staff and equipment. In return the university department will offer access to skilled researchers and an international network of academics. A pioneering example of this type of relationship is the Rolls-Royce network of University Technology Centres (UTCs). Many other multinationals, for example British Nuclear Fuels, BAE SYSTEMS, and GlaxoSmithKline have also developed this type of longer-term strategic relationship. (Lambert Review of Business-University Collaboration, pg. 38)

Awareness in the academia (PROs) as well as in industry must be created regarding the meaning and importance of “academic freedom” and working together. Too quick and too easy a decision is made, that in a partnership the concept of academic freedom is violated. This hampers two ways an intended partnership. (Effective Collaborative R&D and Knowledge Transfer, pg. 20)

The expert group recommends PROs and TTI managers to establish appropriate communication between technology transfer functions and researchers to increase internal visibility.

PROs should in addition implement and improve incentives for researchers to engage and cooperate in technology transfer: These incentives should include a fair share of the financial rewards, but also extend to other aspects, such as professional career and advancement.
Conduct evaluation of teams/groups and institutions with a view to give credit to academia-industry collaborations. As science is more and more team-based, evaluation of groups, research teams or institutions provides incentives for joint experiences. Evaluate positively academia that includes industry representatives in its organisation structures and decision making-bodies, for example by participating in the management board, advisory committees, or in the design of programmes, etc. (Mobility of Researchers between Academia and Industry, pg. 19)

4.2 Consultancy Work

Develop the concept of consultancy by academic staff as one of the simplest ways for academia to interact with industry and exchange research expertise. The legal arrangement terms of short employment contracts are relatively simple in comparison to other short term mobility. For large companies, consultancy offers a chance to get to know academic researchers, while SMEs can benefit from consultancy for a relatively low cost. Consultancy is often seen as a first step towards other collaboration. Much collaborative research in academia originates from consultancy relationships. (Mobility of Researchers between Academia and Industry, pg. 13)

A company can enter into an agreement with a researcher that he supplies certain services on a consulting basis. This counts as a bilateral contractual relationship between the company and the scientist. Sideline activities should not limit the scientist’s capacity to work for the university, and use of university infrastructure, materials or equipment should not be part of the agreement, but should be agreed directly with the university as revenue-funded activities. (Contacts, contracts and codices, pg. 32)

As the company finances the assignment, the normal procedure would be that the company has the full right of disposal over the results of the project. But the consulting assignment is only a sideline for the scientist. His main activity is at the university, and he is therefore comprised by the Inventions Act and the university’s guidelines for researchers’ sideline activities. Accordingly, the university should approve any agreements on rights emanating from inventions made during the consulting assignment. (Contacts, contracts and codices, pg. 33)

A discussion may arise as to whether the scientist only makes personal knowledge available that has nothing to do with his main activity, or whether this is knowledge that the scientist, the institute and the university have developed through research. The importance of this definition becomes particularly relevant if patentable inventions result from the consultancy. (Contacts, contracts and codices, pg. 33)

Bilateral consulting services have only limited relevance when the service lies within the main research area of the scientist. The university ought to be involved, and it will most often be an advantage to see the project as commissioned or co-financed research. The researcher should inform his superiors about private consultancy contracts. A similar duty to inform ought to apply in connection with scientists’ participation on boards, on advisory boards or in managements of private companies. An information principle further serves the purpose that potential conflicts of interest can be dealt with beforehand. ((Contacts, contracts and codices, pg. 34)

The Danish Rectors’ Conference and DI recommend that all universities formulate a policy for sideline activities of their scientists. Such policy should include guidelines regarding:
- Duty of notification and scope. When should a scientist inform his superiors of duties he assumes outside his main activities. How much sideline activity can he have beside his research job.
- Handling of IPR. Under which circumstances can the university claim rights that result from researchers’ consulting services. (*Contacts, contracts and codices, pg. 34*)

When academic consultancy or contract research is carried out on behalf of industry, universities must adopt clear policies to avoid conflicts of interest. **Publicly-funded research must not be compromised in a bid to secure a consultancy agreement or contract research.** (*Lambert Review of Business-University Collaboration, pg. 37*)

Behind the formal procedures such as joint supervision or placements in business, successful long-term university-business cooperation processes are holistic, – i.e. the soft part of the relationship is very important and continuous face-to-face experience is mandatory to build trust and durable partnerships. (*European University / Business Forum, slide 12*)

### 4.3 Tax incentives for Corporate R&D Expenditures

Fiscal R&D incentives allow companies to reduce their tax payments as a reward for carrying out innovative activities. Most EU-15 countries operate some form of tax measure to stimulate business enterprise R&D, as do Australia, Canada, Japan, the US and China. The use of fiscal incentives for R&D has increased in recent years. Some examples of the types of schemes employed are given in the following table.

<table>
<thead>
<tr>
<th>Overview of types of fiscal schemes</th>
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<tbody>
<tr>
<td><strong>Corporation Tax Schemes</strong></td>
</tr>
<tr>
<td>Volume based</td>
</tr>
<tr>
<td>Italy: (only for firms in Objective 1,2 and 5b areas)</td>
</tr>
<tr>
<td>United Kingdom: (separate schemes for SMEs and large firms)</td>
</tr>
<tr>
<td>Canada (federal and state level schemes)</td>
</tr>
<tr>
<td><strong>Corporation Tax Schemes</strong></td>
</tr>
<tr>
<td>Incremental</td>
</tr>
<tr>
<td>Belgium (per additional member R&amp;D staff)</td>
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<tr>
<td>France, United States, Japan, Korea</td>
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<tr>
<td><strong>Corporation Tax Schemes</strong></td>
</tr>
<tr>
<td>Mixed systems</td>
</tr>
<tr>
<td>Austria (three parallel schemes), Portugal, Spain (national level and some regional fiscal schemes), Australia</td>
</tr>
<tr>
<td><strong>Schemes based on employers’ share of wage tax and social contributions</strong></td>
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<tr>
<td>Netherlands</td>
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<tr>
<td><strong>Fiscal schemes to attract foreign “key personnel” * through personal income tax</strong></td>
</tr>
<tr>
<td>Finland, Sweden, Denmark, Netherlands (all have favourable income tax rates)</td>
</tr>
</tbody>
</table>

* These schemes are not exclusively for R&D staff but for all “key personnel” which could also include other staff e.g. management, engineers.

(*Raising EU R&D Intensity, Fiscal Measures*, pg. ix)

Clarifying the legal conditions for Member State R&D tax incentives arising from EU law notably relevant European Court of Justice (ECJ) jurisprudence on the EU Treaty freedom and State aid rules;

Highlighting general design features for R&D tax treatment and incentives based on expert analysis of good practices (*Towards a more effective use of tax incentives in favour of R&D*, pg. 3)
When assessing an R&D tax incentive that constitutes State aid in accordance with Article 87 (1) of the EC Treaty, the Commission will look particularly at the following elements:

– The R&D tax incentive applies to one or more R&D categories defined in the Framework (i.e. fundamental research, industrial research and experimental development);
– The R&D tax incentive relates solely to certain eligible R&D costs listed in the Framework; and
– The aid intensity of the R&D tax incentive can be established and does not exceed the maximum threshold established in the Framework.

The R&D&I framework furthermore states that when doing so, the Commission will assume that on the basis of evaluation studies presented by Member States, R&D tax incentives have an incentive effect by stimulating higher R&D spending by enterprises. ("Towards a more effective use of tax incentives in favour of R&D", pg. 7)

To enhance the effective use of R&D tax incentives and improve R&D tax treatment in the EU, there are a number of other specific tax issues that need to be addressed in a consistent way, on top of the basic design principles outlined above (i.e. compliance with EU law and learning from Member State good practices). Some of these issues are research-related aspects of the general taxation system while others concern R&D issues of common interest.

Member States are invited to discuss the initiatives proposed in this section at EU level and consider them when reviewing their tax policy. ("Towards a more effective use of tax incentives in favour of R&D", pg. 9)

Tax incentives targeting Young Innovative Enterprises as introduced by some Member States can have a positive effect on R&D activities and said companies’ growth. They can take the form of a corporate tax exemption or a time-limited exemption on social security payments associated with the employment of highly qualified personnel (e.g. researchers and experts), thereby lowering the costs for young R&D–based businesses. Member States are invited to consider offering specific tax incentives for this strategically important category of enterprises.

A further way of promoting European R&D investment could be to improve the tax treatment of philanthropic entities funding research, e.g. foundations and charities (research foundations). Research foundations are private entities with the aim of enhancing scientific knowledge by funding R&D activities in public-benefit organisations, typically universities and public research centres. However, although some large research foundations exist, this source of funding is under-exploited in Europe when compared to the US, and certain formal and informal obstacles appear to inhibit both donations by individuals and corporations on the one hand and the flow of funds to research on the other.

There is therefore a need to improve the tax conditions for cross-border donations and foundation activities to create a level playing field in the EU. Agreeing upon a common definition of public-benefit purposes, or a move towards the mutual recognition of public benefit organisations entitled to tax relief, would be an important step to facilitate cross-border funding. Such an approach can be found in the European Foundation Centre’s proposal for a European Foundation Statute, which also advocates a non-discriminatory approach to the tax treatment of such foundations and their donors and beneficiaries.

Member States are invited to support a common approach regarding i) the tax treatment of the foundations themselves, irrespective of where they are established in the EU, and ii) the definition of public-benefit organisations. ("Towards a more effective use of tax incentives in favour of R&D", pg. 10)

Some Member States (e.g. France, Spain) allow firms to request a certificate recognising their capacity to perform R&D. Such certificates facilitate the application of R&D tax incentives and are valid for several years. They are used by tax authorities to streamline the
processing of tax relief claims. To avoid territorial discrimination in cases of cross-border outsourcing of R&D, Member States implementing such processes are invited to extend them to R&D performing firms established in other Member States. ("Towards a more effective use of tax incentives in favour of R&D", pg. 11)

VAT on R&D costs incurred by taxable persons is deductible where the goods and services in question are used for VAT-taxable transactions. The current rules of the 6th VAT Directive concerning exemptions, public authorities and subsidies may affect this deductibility and hence place an unnecessary burden on certain research activities. The Commission has committed itself to reviewing these three issues, which need to be modernised. When reviewing the legislation, the Commission will critically examine the restrictions on the recovery of VAT on R&D expenditure. It will also consider to what extent the current rules on public authorities and subsidies hamper the creation of public-private partnerships and cost-sharing arrangements, including in the research field where such structures are increasingly being used to conduct R&D efforts requiring the pooling of resources from public and private entities or the outsourcing of research by private entities to public ones (contract research). ("Towards a more effective use of tax incentives in favour of R&D", pg. 11)

In the longer term, it is desirable to seek an EU-wide tax definition of R&D and innovation and to give such expenditure favourable tax treatment in the common consolidated corporate tax base (CCCTB). The Commission will include this in the relevant working group discussions with Member States, with a view to defining a coherent and well-balanced solution in line with other possible incentives within the CCCTB. ("Towards a more effective use of tax incentives in favour of R&D", pg. 12)

There is a need for complementary actions to make firms ware of the opportunities and threats, but also the necessity, of innovation and going ‘international’ and of measures to encourage their entrance to new, more innovation-demanding markets. Without these, direct R&D-supporting measures to encourage them to be involved in R&D and innovation, collaborate with research organisations, and the like, or indirect measures such as tax incentives, may still have limited results in terms of increasing the private investments in R&D. ("Raising EU R&D Intensity, Direct Measures", pg. xiv)

Generalisations concerning the efficacy of different types of R&D tax incentive schemes are difficult to make in the absence of extensive evaluation studies of fiscal schemes and the methodological difficulties associated with many of the econometric studies undertaken in this area. Nevertheless, the following tentative conclusions can still be drawn:

- **If well designed, fiscal incentives can stimulate business R&D.** It has proven difficult, however, to evaluate the amount of additional R&D generated per unit of tax income forsaken by the public sector. The few tentative evaluations that exist show positive but moderate levels of leverage and additionality, and the possibility of externalities (R&D spillovers) strengthens the likelihood of fiscal incentives having positive impacts;
- **There is a clear need for more formal evaluations** to establish the effectiveness and impact of fiscal incentives, and for greater efforts to improve the methodological tools needed to conduct them;
- **Better micro-level data sets are needed** to understand the long-term impact of fiscal incentives on business R&D;
- **Existing evaluations of fiscal R&D incentive schemes in different countries cannot be compared due to the use of different methodologies, incommensurable data sets and dissimilar time periods. Coordinated, cross-country comparisons of the efficacy of different types of scheme using similar methodological approaches are needed.** ("Raising EU R&D Intensity, Fiscal Measures", pg. x)

There are a number of clear design principles that Member States should use to review their current fiscal mechanisms and design new ones:
- **Simplicity.** Schemes should be transparent and easily accessible to a broad spectrum of firms;
- **Low administrative and compliance costs.** For firms, it should not be complex and time consuming to apply for and receive a tax credit/allowance. For administrations, the auditing systems needed to check on the eligibility and validity of claims should be effective without being onerous for all concerned;
- **Reliability.** Firms should be able include fiscal allowances or credits in their forward plans with a fair degree of certainty. Receipt or non-receipt of tax incentives at any point in the future should not depend on concurrent levels of profitability;
- **Stability.** The rules of the game should not be changed too often, since this reduces the ability of companies to budget for future tax benefits when making R&D investment decisions. Greater certainty in the long term allows firm to forecast the cost of their R&D projects more accurately. ("Raising EU R&D Intensity, Fiscal Measures", pg. xi)

Assure re-fundability (cash refund) of tax credits or tax allowances in cases where companies make losses (and, therefore, would not be able to benefit from a reduction of corporate income tax liabilities). For large firms this could be dealt with by using carry-forward / carry backward arrangements. For small firms a cash refund is preferable since it will have an immediate effect on their cash flow. ("Raising EU R&D Intensity, Fiscal Measures", pg. 34)

A clear definition of R&D is essential for deciding in a cost-effective manner what are the eligible R&D costs and which activities count as R&D. We recommend that the definition used in Member Countries should be based on the international standard defined in the Frascati Manual of the OECD. ("Raising EU R&D Intensity, Fiscal Measures", pg. 35)

There is a need for an optimal policy mix regarding business R&D. Tax incentives should be used when governments want to reach a broad range of firms involved in R&D activities. Direct government funding of business R&D should be targeted towards the fields of research were the gap between private and social rates of return is large. ("Raising EU R&D Intensity, Fiscal Measures", pg. 36)

Policy makers need to ensure that fiscal measures and direct government funding of business R&D complement each other. This would be achieved only through an effective co-ordination mechanism between the public institutions (ministries and agencies) involved in the stimulation of business R&D. ("Raising EU R&D Intensity, Fiscal Measures", pg. 36)

Fiscal incentives using personal income tax breaks, if appropriately formulated, could effectively attract researchers from abroad. The expert panel finds that there is insufficient information to assess the consequences and effectiveness of these schemes at this stage. It is recognised that personal income tax break may induce potential distortions within the EU labour market. ("Raising EU R&D Intensity, Fiscal Measures", pg. 37)

### 4.4 Staff Exchange Programmes and Industry Placements

The Commission has been an active proponent of through the "Marie Curie Industry-Academia Strategic Partnership" scheme which supports the development of such long-lasting collaborations via the exchange of researchers. The new research, development and innovation State aid framework has also introduced a measure on aid for the loan of highly qualified personnel from research institutions (or large companies) to SMEs. (Improving knowledge transfer between research institutions and industry across Europe, pg. 10)

In order to better answer to future employers’ needs, graduates and early stage researchers should be trained adequately, providing them the appropriate skills for their
future profession of researcher in both sectors, in particular the private business sector. *(Mobility of Researchers between Academia and Industry, pg. 10)*

Develop graduate and **doctoral programmes in partnerships with the business community**, including with SMEs, as programmes jointly developed will better suit future employers’ needs. Industry involvement in defining and reviewing academic training programmes will also help adapting them to constantly changing market needs. *(Mobility of Researchers between Academia and Industry, pg. 10)*

Provide **entrepreneurship training** to nurture a new category of researcher: the “entrepreneurial academic”. Entrepreneurial skills allow researchers to exploit their knowledge and develop the commercial of their work. Senior researchers should also be trained or retrained in this sense. Set up **technology, innovation and research management training programmes** in order to equip experienced research with strategic and organisational skills. *(Mobility of Researchers between Academia and Industry, pg. 11)*

**Recognise merits** of early stage and experienced researchers in both sectors with for example a “**skills portfolio**”. The portfolio should record courses taken and experience acquired by the researcher, including in industry. For early stage researchers, such a portfolio approach could be considered as a valuable addition to the diploma. *(Mobility of Researchers between Academia and Industry, pg. 11)*

Provide **doctoral candidates with two supervisors**, one from each sector or alternatively a supervisor from academia and a supporting mentor from industry and set up an agreement between the supervisors on their respective responsibilities towards the doctorate. *(Mobility of Researchers between Academia and Industry, pg. 12)*

**Prepare supervisors** for their **supervision** responsibilities with **ad-hoc training** by professionals including receiving an accreditation. *(Mobility of Researchers between Academia and Industry, pg. 12)*

Develop **inter-sectoral mobility opportunities** via staff exchanges, part-time positions, sabbaticals, honorary positions, or financial or statutory incentives, offered to both early stage and established researchers. *(Mobility of Researchers between Academia and Industry, pg. 12)*

Ensure transparency in recruitment procedures in both sectors by **advertising positions** through well-known channels such as the Researcher’s Mobility Portal **ERACAREERS** ([http://ec.europa.eu/eracareers](http://ec.europa.eu/eracareers)). Organise **placements and internships in industry**, especially in SMEs. Such schemes already exist, however the aim should be to include placements/internship in researchers’ curricula as it is the case with most engineer and business schools in Europe. A minimum period of six months should be ensured. Early stage researchers should be trained for being effective in their search of internship. Academia alumni could provide assistance for finding suitable internship positions. *(Mobility of Researchers between Academia and Industry, pg. 13)*

Increase **inter-sector mobility** by providing researchers industry relevant **expertise online** in an easy accessible format, to allow industry to find appropriate contacts in academia, i.e. individual technical expertise or expertise of a group. This could help SMEs to connect with the academic world by finding the expertise needed, especially at the regional level. Alumni networks should be developed in order to tap researchers working in industry. *(Mobility of Researchers between Academia and Industry, pg. 14)*

**Academia should recruit professional managers** and experienced staff from industry. Provide leadership at top managerial levels in order to foster efficiently the cultural change, and link it to an institutional strategy. Different profiles should be included in the management
committee, including industry representatives. (Mobility of Researchers between Academia and Industry, pg. 15)

Employ staff specialised in industrial relations. Partnership between academia and industry can only flourish with staff specially designed to take care of the relations with industry, while working in academic premises. This can take many forms such as Technology Transfer Offices (TTO), or development or liaison offices. This is especially important for establishing cooperation with SMEs, which have not often established direct contacts with academia. For further information go to http://www.eif.int/tech_transfer/ (Mobility of Researchers between Academia and Industry, pg. 16)

Provide the necessary autonomy to institutions so that they are able to combine staff with experience in both sectors and to recruit on a competitive basis. Offer the possibility to recruit managers or researchers with experience in industry. (Mobility of Researchers between Academia and Industry, pg. 17)

Legally endorse the possibility of part-time professorships in academia for researchers working in industry. National legislation should allow researchers in academia to work for industry on a part-time, consultancy, or other basis. Legal status should permit and encourage “posting” researchers from academia to industry and vice versa for a limited period of time. Researchers from public institutions should also be able to benefit from leave of absence such as a sabbatical leave to start-up a company. (Mobility of Researchers between Academia and Industry, pg. 17)

Joint research programmes, which promote direct collaboration between industry and science, are a well-established policy intervention mechanism, which has a significant effect upon the level of industry science relations (ISR). In this area, good practice particularly refers to thematically focused programmes which apply a bottom-up approach of defining joint research themes, have a long-term perspective of cooperation and rely, at least partially, on an ‘infrastructure’ approach, i.e. the establishment of institutions and/or facilities that are operated both by enterprises and science institutes and maintain cooperation after funding has ended. With respect to such programmes, a competition-based approach of allocating funding has proved to be effective. Such an approach stimulates the involvement of a large number of applicants but restricts funding to promising ‘best practice’ cases, which may serve as orientation points for other actors. (Good practice in industry-science relations, pg. 13)

Fostering the direct commercialisation of research results in public science is an important policy issue especially in fields such as biotechnology, genetic engineering, new materials, and new information and communication technologies. Good practice in commercialisation covers, amongst others: the provision of a supportive infrastructure that reduces transaction costs and information asymmetries in using IPRs (patent licensing offices); advisory support and pre-seed capital for start-ups; and several awareness measures that raise the perception of researchers in the commercial potential of the research results they have achieved. (Good practice in industry-science relations, pg. 20)

The reform of institution settings in public science are particularly successful when the following issues are considered: implementing ISR as part of the institutions’ mission; considering ISR activities in evaluations; providing both individual and organisational incentives; and linking industry and science through advisory boards. A special approach is to introduce new, flexible organisational units that particularly focus on industry-related research and education, including a strong involvement of industry both in financing and strategy development. (Good practice in industry-science relations, pg. 25)

In many countries, a successful way of strengthening ISR is to establish transfer-specialised institutes either in universities or within public research laboratories. Key success factors in these institutions include: keeping together basic and applied research
within a research team; regular auditing of the research strategy in order to cope with changes in the economy and society; direct transfer between researchers and industry (i.e. avoiding intermediaries); and individual remuneration of successful transfer activities. (*Good practice in industry-science relations, pg. 29*)

The need for greater professionalism in managing and handling collaborative R&D and knowledge transfer requires that universities train people accordingly. Both students and academics need this training. Basic IP course (single modules or greater depth) should there be offered as a standard part of degree programmes and as on-the-job training. (*Effective Collaborative R&D and Knowledge Transfer, pg. 17*)

Collaborative projects should be managed professionally from both sides, respecting each other's skills and expertises. Although a split in responsibilities between the scientific and project management is recommendable, it is also recommendable that the scientific project leader has a basic understanding of managing a project. A (short) training course to this end should be developed focussing at researchers (both in academia and industry). (*Effective Collaborative R&D and Knowledge Transfer, pg. 21*)

Consultants can be key knowledge transfer parties for technical knowledge and management process skills. They are also active with Business Schools and some technical groups, but their role can be a blind spot to universities and governments, for example as formative training ground for new graduates. (*Effective Collaborative R&D and Knowledge Transfer, pg. 24*)

There may be a conflict between the company’s need for confidentiality and the Ph.D. student’s need to show as many aspects of his work as possible to his tutor and the examiner in order to support his conclusions. In addition, doctoral dissertations must be defended at a public, oral presentation. Company, tutor and Ph.D. student should discuss which information that can/should be included in the dissertation and defence and, if need be, how confidential information can be coded. The student's tutor should be made aware of his duty of confidentiality regarding company-specific information that will come to his knowledge during the project. Some let individual researchers enter into individual confidentiality agreements, while others enter into confidentiality agreements between the company and the university. The examiner is obliged to keep the information that he receives through his examination activities confidential. (*Contacts, contracts and codices, pg. 37*)

Doctoral programmes and knowledge transfer are intrinsically linked. Schemes with business participation are a strong vehicle to enhance university-business mobility and the necessary evolution in “mindset change” in all stakeholders. (*European University / Business Forum, slide 12*)

Geographical and inter-sectoral mobility needs to increase substantially. The proportion of graduates who have spent at least one term or semester abroad or with experience in industry should at least double. This is even more true for researchers. All forms of mobility should be explicitly valued as a factor enriching studies at all levels (including research training at doctoral level), but also improving the career progression of university researchers and staff.

National grants/loans should be fully portable within the EU. Full portability of pension rights coupled with the removal of other obstacles to professional, international or inter-sectoral mobility is needed to foster staff and researcher mobility and hence innovation. (“Delivering on the Modernisation Agenda for Universities: Education, Research and Innovation”, pg. 5)

Member States should build on initiatives such as that taken in France to make employment contracts for researchers in publicly funded institutes flexible to allow their reasonable
participation in spin-out companies. (“Raising EU R&D Intensity, Risk Capital Measures”, pg. 24)

4.5 Funding the Commissioned Research

Promoting innovation and disseminating new knowledge can be successful as long as intellectual property issues are understood and managed professionally. Interaction on these points can be facilitated by tools such as the CREST decision tree, model contracts such as the UK’s Lambert agreements, or guidance such as the Danish document on Contacts, contracts and codices, as well as through awareness initiatives by the European and national patent offices. The Responsible Partnering initiative, developed by 4 major European university and industry associations (EIRMA, EUA, PROTON, EARTO), presents key insights into how effective research collaboration can be created. Member States have a role in the development and delivery of such initiatives and should support them actively. (Improving knowledge transfer between research institutions and industry across Europe, pg. 10)

Although in certain cases formal protection (e.g. design rights, patents or material transfer agreements) may be necessary if a product is to be brought to market successfully. It is therefore important to ensure that researchers are aware of the benefits of both approaches and that decisions are made on the basis of socio-economic impact. Given that the rules governing the ownership of publicly-funded R&D results still vary across Europe, it may be appropriate to revisit in the near future the question of a single European ownership model for publicly funded research. (Improving knowledge transfer between research institutions and industry across Europe, pg. 10)

In many countries, research institutions have created reward systems whereby the inventor receives a share of any profits made when licensing or spinning off inventions. An illustrative model is one where profits are split evenly between the researcher, the research institution and the business partner. However, although some financial incentives may apply, many staff remain reluctant to take part in such activities, especially as they are not taken into account for career progression. It is therefore important that the appraisal criteria also take into account other activities such as patenting, licensing, mobility and collaboration with industry. (Improving knowledge transfer between research institutions and industry across Europe, pg. 11)

Member States should make full use of the available funding sources, and encourage research institutions to do so. Cohesion policy funding (the European Regional Development Fund and the European Social Fund), national funding in line with the new Community framework for State aid for research and development and innovation (RDI), and the European Framework Programmes should all be used to leverage more links between industry and research institutions. (Improving knowledge transfer between research institutions and industry across Europe, pg. 11)

Continuity is critical for the accumulation of skills and the achievement of the necessary competence. It can only come from having core group on long-term career contracts rather than being assembled only for a project term. An important part of continuity is technical sustainability. The Applied Research Groups should therefore have some links with academic research to avoid senescence. (Promoting Enterprise-Higher Education Relationships, pg. 25)

From the university’s perspective, contract research can lead to longer-term collaborative research projects. It also helps university researchers to keep up-to-date with the latest developments in professional practice and to gain external research income. From the business perspective, many large companies have cut back their corporate R&D laboratories and smaller businesses often have limited financial resources to conduct their
own R&D. Contract research in universities can be a flexible and cost-effective way for companies to undertake research. *(Lambert Review of Business-University Collaboration, pg. 36)*

The main question about contract research concerns the price that universities should charge business for such work. This issue was thoroughly examined by the Transparency Review which established a methodology to determine the full costs of research and other publicly funded activities in higher education. This Review supports its recommendation that universities should implement robust costing mechanisms. This will enable them to identify and charge at least the full economic costs for the contract research that they undertake for business. *(Lambert Review of Business-University Collaboration, pg. 37)*

### 5. Other Recommendations

Key employment skills should include **industrial needs and experience**, complementary to **tradition of academic training**. This includes:

- Research skills and techniques
- Communication skills: including reporting and writing techniques, oral presentation skills, and effective support to teaching researchers (teaching, mentoring, or demonstrating activities)
- Interpersonal skills: e.g. accepting responsibilities, working in teams, networking etc.
- Awareness on Intellectual Property Rights (IPR): i.e. patents, copyrights, designs and trademarks
- View on private sector constraints: e.g. time constraints and engagements, mainly for delivering
- Career management: e.g. writing a CV, applying for jobs, submitting funding applications, planning a career, etc.
- Broaden scientific expertise with experience in other research domains, in particular for researchers who are likely to work in multidisciplinary teams. *(Mobility of Researchers between Academia and Industry, pg. 11)*

Policy makers are well advised to improve industry-science relations by taking up good practice examples, putting them into the context of their respective national innovation systems and integrating ISR into the broader policy context with the objective of improving the overall system. *(Good practice in industry-science relations, pg. 39)*

**Rolls Royce's University Technology Centres** illustrate how having Centres of Excellence in specific technology fields, concentration of activity into fewer and larger centres, based around groups with proven track records (can work successfully). With 5 year rolling contract covering business and technical goals, high quality staff, formal IPR agreement, formal performance review every 2 years, close working enables effective technology transfer, staff exchanges and secondments. *(Effective Collaborative R&D and Knowledge Transfer, pg. 10)*

Funding of new initiatives, whether applied research groups or new centres, should be based on **award through open competition** among the full range of providers – universities, institutes of technology, national and international research providers. The Groups should be well resourced with facilities and equipment of a high standard, awarded following a competitive process open to organisations nationally and internationally. The Strategy for Science, Technology and Innovation 2006-2013 allocates close to €400 million over the eight year period to support for enterprise collaboration with Higher Education. The development of applied research groups should be funded from this source. *(Promoting Enterprise-Higher Education Relationships, pg. 25)*

**Insularity:** European higher education remains fragmented - between and even within countries – into medium or small clusters with different regulations and, naturally, different languages. It needs to become “readable” in the world if it wants to regain its position as the
leading destination of mobile students - a privilege lost to the US in the 1990s. It also remains largely insulated from industry, with limited knowledge-sharing and mobility. As a result, too many graduates – even at the highest level - lack the kind of entrepreneurship and skills sought on the labour market. Most universities are strongly dependent on the state and ill prepared for worldwide competition over talent, prestige and resources. (“Mobilising the brainpower of Europe: enabling universities to make their full contribution to the Lisbon Strategy”, pg. 4)

**Human resources** are a core determinant of quality in higher education and research. Universities must therefore work to enhance their human potential, both qualitatively and quantitatively, by attracting, developing and keeping talent in the teaching/research career. Excellence can only emerge from a favourable professional environment based in particular on open, transparent and competitive procedures. Vacancies, at least for rectors, deans, professors and researchers should be advertised publicly, and where possible internationally. Researchers should be treated as professionals from the early stages of their career. Physical and virtual mobility (whether across boundaries or between university and industry) and innovation leading e.g. to university spin-offs should be encouraged and rewarded. Compensation should reward quality and achievement in the performance of all tasks, including a share of income from research contracts, consultancies, patents, etc. These measures would over time reinforce world-class excellence at European universities, thus reducing the attractiveness gap with other world regions and benefiting all of Europe through highly qualified graduates moving or returning to more regional universities, whether immediately or later in their careers. (“Mobilising the brainpower of Europe: enabling universities to make their full contribution to the Lisbon Strategy”, pg. 6)

European universities also need to become more attractive partners for industry. Lasting partnerships are a condition for structured staff exchanges and for curricular development responding to industry’s need for well trained graduates and researchers. But the development of commercially relevant training/retraining, research and consultancy services demands investment over some years before these activities start paying for themselves – all the more so if public subsidies are correspondingly reduced. This means that the development of sustainable partnerships with industry may well hinge (initially, at least) on the availability of tax incentives. (“Mobilising the brainpower of Europe: enabling universities to make their full contribution to the Lisbon Strategy”, pg. 9)

The Commission should use its resources to call for and fund proposals for new trans-European, co-ordinated incubator/pre-seed fund activity. Criteria for proposals should include a need for experienced, properly-remunerated private management who understand both technology transfer and investment processes. Proposals should be consistent with activity already existing at national and transnational levels and should be of sufficient scale to ensure cost-effectiveness (i.e. regional or more concentrated level). Proposals could be geographically or technology-sector based. ("Raising EU R&D Intensity, Risk Capital Measures", pg. 23)