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2009 Expert Group on Knowledge Transfer

Final Report - 30 November 2009

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EUROPEAN COMMISSION

2009 Expert Group on Knowledge Transfer

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Background

DG Research decided to set up an expert group on the basis of a specification in the 2008 work-programme of the Seventh Framework Programme's "Capacities" programme, which states that:

"Building on the findings and recommendations of a first exploratory expert group set up in 2007 in connection with both the Commission Communication on knowledge transfer and the Commission's Green Paper on the European Research Area, and on the outcomes of the ERA conference held in Lisbon in October 2007, the first cycle of a multi-annual **University-Industry Knowledge Transfer Forum** will be launched, bringing together in regular meetings representatives of all relevant stakeholder groups (universities and other public research organisations, industry, public authorities, etc, .) to identify and address emerging issues regarding to knowledge transfer between the public and private sectors, review progress and develop joint actions."

As a follow-up of the IP Recommendation endorsed by the EU Council in May 2008, DG Research has convened a "university-business cooperation thematic forum on knowledge transfer" ("the KT Forum"). The KT Forum, part of a broader Commission initiative on university-business cooperation, brings together university/PRO and business stakeholders, national policy makers and the Commission, to discuss the implementation of the Code of Practice, to monitor its take-up, identify best practices on IP management in knowledge transfer activities and discuss possible follow up activities including further guidelines on identified issues.

In order to support the discussions taking place in the KT Forum, six independent experts were asked to study six particular areas related to knowledge transfer.

Summaries of Expert Group Studies

Study 1: A comparison of different exploitation methods (eg licensing, selling and spin-outs) as means to extract value from research results (McFadzean)

Value, which we expect to be quantifiable, is, in the context of research results and their exploitation, actually very subjective. This paper reviews some of the factors that influence the perceived value to be gained from exploiting research results and the risks that accompany different exploitation routes. It explores the influences that determine why people or organisations choose certain routes for the exploitation of research results and makes some recommendations to improve understanding of different motivations.

Some of the main conclusions of the study are that:

- Although there are many formulaic methods to value intellectual property those are often adjusted, or ignored, because of more personal perceptions of value, and of the risk associated with different exploitation options.
- There is no single 'best practice' model for the exploitation of research results. It is important for the research institution to define at a strategic level how it wishes to extract value from its research and rank the different options in order of importance.
- Successful institutions and companies remain flexible and adopt and deploy a range of approaches and methods for IP creation and exploitation. However these can be and are affected by personal considerations resulting in a much more ad hoc approach based on context and the circumstances and personalities engaged in each opportunity.
- At individual level motives can be quite complex but they can also be unpredictable, changing with circumstances which may or may not be known or admitted. This needs to be recognised and accommodated.
- Alongside this risk is a factor that influences the perception of value and its role needs to be better understood.
- Legal approaches to the assessments of risk can and do inhibit knowledge transfer. When assessing risk, knowledge transfer offices should give as much consideration to the business risks, eg the loss of a market opportunity, as to the legal risks.

Study 2: An evaluation of different methods of improving access to research results, including a comparative analysis of different models of Knowledge/Technology Transfer Office: European, National, Regional and Private (Brisson)

This study presents the different methods of accessing to research results from Public Research Organisations (PROs), evaluating their effectiveness and produces a comparative analysis of the various models of Knowledge Transfer Offices (KTOs) adopted by European Member States, US and some other identified countries. The choice has been made to focus on countries where transferring knowledge and technologies is part of the public strategy for producing visible commercial benefits from very high public expenditure. Many reports, surveys, publications, official public road maps for transferring knowledge have been analysed covering more than 1500 European entities or institutions claiming knowledge transfer activities. The study starts by analysing the various methods of accessing the research results produced and concentrates on the active dissemination which is today the main tool used by KTOs. The study is then focusing on the KTO models presenting in details the range of services provided and benchmarking it at world level.

A proposal is also made concerning an *ideal KTO* incorporating all functions and resources identified as mandatory to be able not only to access what has been produced by researchers but to translate it in a format potential customers from the non academic world can understand and adopt.

Some of the major points of the study are that:

- Public Research produces excellent results.
- Access to the public research results is still very difficult because the scientific community is still sceptical about the *Knowledge Transfer Concept*.
- Knowledge transfer is a very important task to be undertaken by professionals having background in business and marketing.
- Communication is one of the key elements for a successful strategy in a PRO to transfer knowledge to the socio economic world.
- Clear and fair relationships between PROs and industry is mandatory, it must be a win-win situation.
- IPR and access to IPR are important elements in the relationships between PROs and industry.
- Knowledge transfer is in two directions and mutual benefits must be achieved from collaborative research taking into account the inventive aspects of the collaborating parties.

Study 3: An evaluation of incentives and policies that affect research institutions' knowledge transfer activities, at researcher and management level (Bekkers)

This study addresses the effects of incentives and policies on transferring research results from Public Research Organisations (e.g. universities, public research centres) to industry. By examining more than 150 recent academic studies and reports, this paper attempts to facilitate informed policy-making by forming a link between two areas that until now have been relatively unconnected. The study starts by presenting insights into the relative importance that university researchers and industry researcher attribute to the large array of different knowledge transfer channels, based on a large-scale survey. It then continues by focusing in more detail on policies and incentives for five selected channels: publications, patents, spin-offs, collaborative research, and "innovation vouchers" (the latter not being so much a technology transfer channel in itself, but a policy that creates incentives for smaller companies to get involved in knowledge transfer).

Some of the main conclusions of the study are that:

- Academic studies have found a number of incentives to increase involvement in knowledge transfer, but their functioning is often dependent on the features and attitude of the individual, as well as (national) culture.
- The most appropriate knowledge transfer channel for a given situation is strongly dependent on the specific context, prompting for a holistic view and a consistent set of incentives so individuals and organisations get engaged in the transfer channel that is most appropriate in a given context.
- University-industry knowledge transfer is far from a one-time, linear, one-way knowledge flow process and is better to be understood as a continuous, bi-directional knowledge exchange, benefiting not only private companies but also or university researchers.
- Knowledge transfer policies should be complemented by policies that ensure a good absorptive capacity at private companies and ensure a high quality academic staff in the longer term.

Study 4: A study of the factors which affect knowledge transfer activities between European and non-European partners, focusing on collaboration with partners in "emerging economies" (Ganea)

The study examines the environment for knowledge transfer between the EU and the largest emerging economies Brazil, Russia, India and China (BRIC). Such environment is, inter alia, comprised of the

R&D structure of the observed country, e.g. whether R&D is carried out by public institutes or research areas in which a country has particular strengths.
Another element of the knowledge transfer environment is the degree of state interference, e.g. state control of the inflow and outflow of knowledge or the general stability of institutions in the course of knowledge transfer administration.
A third important element is the legal protection of intangible assets such as patented subject matter or technological secrets (Know-how) and of contractual agreements. Hereby, the practical application and enforcement of the laws deserve special attention.

The conclusions drawn from the country observations serve as basis for recommendations to European PRO and other institutions regarding activities in the BRIC economies, and to the European Commission regarding a suitable approach to BRIC economies to foster the exchange of knowledge.
The conclusions/recommendations can be summarized as follows:

- For Brazil and Russia, the most promising partners and locations for knowledge transfer can be found in the public sector, whereas China and India have a strong private sector. Moreover, each BRIC economy has particular strengths in certain areas. The European Commission could foster private-public collaboration in some BRIC economies, by launching a dialogue between European enterprises and PROs and research institutions from the observed countries.
- Regarding the institutional environment and the stability of the law, European research institutions should be aware that in some BRIC economies (especially in China and Russia), recent history and cultural peculiarities cast their shadows on daily administrative practice and on the enforcement of legal rules. Therefore, they are well advised to anticipate that in case of an unforeseeable event, they may not easily resort to a public authority which will protect their rights and interests and to take the necessary precautions. The European Commission is, inter alia, advised to rethink its present practice of imposing European IP protection standards on third countries in future economic partnership agreements.

Study 5: An analysis of the effects of European and national guidelines on the implementation of new knowledge transfer policies at institutional and Member State Level (Balling)

This study presents a survey on the extent to which universities and other Public Research Organisations in the Member States have implemented new knowledge transfer policies. Primary umbrella organisations of universities and other Public Research Organisations in the Member States as well as national Knowledge Transfer Networks have been approached and asked to provide input on behalf of their member institutions. The respondents cover 537 universities and other Public Research Organisations, located in the following 16 Member States: Austria, Denmark, the Czech Republic, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, the Netherlands, Slovenia, Spain, Sweden and the United Kingdom.

The conclusions drawn from the study serve as a basis for recommendations to the European Commission regarding implementation of new knowledge transfer policies in the Member States:
It is recommended:

- To carry through a more comprehensive study on the implementation of operational principles for setting up institutional policies and knowledge transfer systems at universities and other Public Research Organisations to confirm or disconfirm the findings and trends of the present survey.

- That the Commission encourage further implementation on operational principles for setting up institutional policies and knowledge transfer systems, particularly regarding institutional management framework and long-term strategies as well as Conflict of Interest policies.
- That the Commission support a study on existing national Intellectual Property Portals and Intellectual Property Pools for universities and other Public Research Organisations in order to develop best practice, and to encourage Member States to support the implementation of

such Intellectual Property Portals. Member States should also be encouraged to support Intellectual Property Pools where research institutions do not have the scope and volume of exploitable research results to justify the establishment of a Knowledge Transfer Office.

- That the Commission encourage universities and other Public Research Organisations to use Knowledge Transfer Managers to secure contractual responsibilities for the institution towards third parties. Universities and other Public Research Organisations should also be encouraged to review Knowledge Transfer Office processes and procedures on a regular basis to secure optimal professionalism.

Study 6: Options for a European-wide model agreement for contract research / collaborative research (Schöpke)

The paper addresses the use and content of model agreements for research collaborations between the private and the public sector by analysing underlying scenarios of collaborations, the potential impact of different national legal systems and different industry sectors as well as critical and controversial issues involved in contract negotiations to examine the feasibility and options for European-wide model agreements for contract and collaborative research.
The goal of European-wide model agreements for contract and collaborative research is ultimately to strengthen collaborative research and knowledge transfer and to improve its effectiveness in line with the Code of Practice.
The ambition is to build trust and to establish mutually beneficial relations, while respecting each other's core interests.

Some of the main conclusions of the study are that:

- The pivotal challenge of model agreements is to find a balanced solution for diverging interests. If a model agreement does not mutually balance the diverging interests of the partners it does more harm to the stakeholders than any good.
- As a rule, negotiations must be based on interests and shared objectives, not on positions.
- Model agreements must provide proposed solutions for different scenarios of research collaboration. Where scenarios and optional clauses cannot be agreed upon due to opposing interests of stakeholders which cannot be solved to the satisfaction of all stakeholders, guidelines could be provided instead.
- The impact of different and complex legal systems of the member states and different industry sectors do not seem to present a major hurdle regarding the development of pan-European model agreements.
- European-wide model agreements should be developed by a stakeholder driven process. An equal number of representatives of different member states of the public and private sector, as well as of different industry sectors should be represented in the stakeholder group.
- If the assigned stakeholder group would not be able to agree upon standard scenarios of collaboration and/or optional provisions to balance critical diverging interests the development of European-wide model agreements for contract and collaborative research should not further be pursued by the Commission. In such case, a set of guidelines including model clauses, links, tools and the like could instead be developed in the light of the IP-Recommendations and the Code of Practice as well as the principles of Responsible Partnering for support of the European research community.

Study 1: A comparison of different exploitation methods (eg licensing, selling and spin-outs) as means to extract value from research results: Why do people or organisations choose certain routes for the exploitation of research results?

Gillian McFadzean

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Definitions

The definitions used in this paper are those used by the Expert Group which reported on Knowledge Sharing in the ERA (April 2008)[1] and are given as Appendix A to this paper.

[1] "Report of the Expert Group on Knowledge Sharing in the European Research Area". See

http:// ec.europa.eu/research/**era**/pdf/**era**-gp-eg4_en.pdf

1 Executive Summary

Why do people or organisations choose certain routes for the exploitation of research results? What influences their choices? This paper reviews some of the factors that influence the perceived value to be gained from exploiting research results.

Value, like beauty, is in the eye of the beholder. As a result the evaluation of an exploitation option is not necessarily based on the likely rewards but brings into consideration a variety of complex, and complicating factors. Such a situation can become even more complex in research institutions where academic values and priorities may be applied to what is essentially a business decision. On occasion such values, which may vary from discipline to discipline or indeed individual to individual, can dominate and overrule the experience and advice of the knowledge transfer office staff.

Despite the numerous reports and proposed methodologies there is no foolproof method of valuing Intellectual Property (IP). Research organisations often face the issue of trying to value IP at a very early stage when deciding whether to patent or not prior to a publication by a researcher whose work may have been publicly funded or who is expected to publish for career development. It is difficult to value IP when no market has been identified and assessed. Industry, although able more often to keep secret new ideas until there has been some investment in development, still faces situations of uncertainty due to contributing factors such as the disruptiveness of a discovery, the timing, and the context and in some sectors the dynamic nature of the sector.

Valuation of IP must be governed by pragmatism according to circumstances. This is particularly relevant to research organisations such as universities that should be seen to do deals, to effect a transfer and so cannot overvalue their offerings and thus fail to find a market. IP is only worth what someone will pay for it.

The different exploitation options considered in this report are commercial exploitation (through licensing, selling and spin-outs), other industry interaction (through consultancy, CPD, technical services, collaborative and contract research and personnel exchanges) and reputation-enhancing (through publications and presentations). Each of these can be managed through the principles set out in the 2008 Commission Recommendation on the management of Intellectual Property and the associated Code of Practice.

The Commission Recommendation on the management of IP and the related Code of Practice should be a starting point for development of policies and strategies in support of a more sophisticated approach to evaluation of the options but the importance of education in developing a more sophisticated understanding should not be forgotten.

The Commission should improve dissemination of extensive range of Crest tools.

Value, which we expect to be quantifiable, is, in the context of research results and their exploitation, very subjective. Individual and organisational value, which we expect to be quantifiable, is, in the context of research results and their exploitation, actually very subjective. Individual and organisational perceptions and motivations significantly influence the value of any exploitation route. Tools do exist to quantify value, and even to methodically calculate some of the intangible influences on value, and those are used by both companies and by knowledge transfer offices (KT offices) in research institutions. But there are a great many other factors with which those making the decision have to deal with. Among these will be their own targets and perceptions of “success” and the influence of powerful figures in the organisation. In institutions especially the effect of a powerful researcher and their expectations, perceptions and motivation can be very significant.

Although there are both valuation tools and sector norms that may be deployed these are often tools used once the initial decision on the route has already been taken. Perception of value, but also of risk plays a major role in assessing the preferred route for exploitation.

Often, motives can clash or be misinterpreted. They can also change according to the current context. A research institution which has an overall strategy in KT of wanting to create local (regional as opposed to national) employment for its graduates or to achieve local recognition/relationships with

industry may not prioritise retention of IP ownership, or a high financial return from IP. It will however invest in and actively pursue the creation of relationships which bring more diverse but equally valuable returns to the institution. Such an over arching strategy may fit with research and regional objectives but is often at odds with the actions of the KT office which is isolated from the overall university strategy and has been given financial targets to achieve in order to ensure its survival and institutional investment in its resources and activity.

There is no single 'best practice' model for the exploitation of research results. It is important for the research institution to define at a strategic level how it wishes to extract value from its research and rank the different options in order of importance. Successful institutions and companies remain flexible and adopt and deploy a range of approaches and methods for IP creation and exploitation.

Personal ambitions among senior managers in research institutions can also be much more influential than those in a company where checks and balances to power, and an understanding of conflicts of interest, may be more established. This is particularly true in KT where the allure of mixing with CEOs, of being seen as relevant and as a contributor to economic development, of talking about large investment deals from financiers, can be a heady mix.

At individual level motives can be quite complex but they can also be unpredictable, changing with circumstances which may or may not be known or admitted. There are researchers – who usually work in a system that has little or no hierarchy and thus allows their views to be accommodated - who believe in academic freedom and access to research results. There are others who want status in both academic and social circles, which comes from a mixture of financial income and reputation (but reputation that gains public acclaim rather than solely peer acclaim). Some may seek independence in their research programmes from institutional management by establishing close long term relationships with companies who will provide funding streams for research which release them from dependence on the institution for funds. There are examples across Europe of senior researchers who effectively run private fiefdoms within their institutions because their character needs to retain control of their work and the outcomes and benefits from those outputs. The important thing is to address these different scenarios in a balanced way. Incentives and rewards are considered in another paper but carrots and sticks work best together and at all costs instruments used by research organisations should be used with an eye to enhancing, not inhibiting, disclosure of ideas to the KT office.

Research institutions should
- develop greater understanding and awareness in their research communities of the actual costs of research disseminating the work undertaken by the European Universities Association and by universities in some Member States.
- be aware of the pros and cons of the options and fully consider those in the context of a wider strategy of engagement with third parties.
- clarify the value of the different exploitation routes, in the context of the overarching strategy, through the rewards and incentives for researchers.
- encourage their KT offices to take more risk in adopting new or additional mechanisms for knowledge transfer.

When looking at potential value industry is often looking at the financial costs and balancing those (which are easier to measure) against the intangible longer term benefits of a relationship that will allow them to shape and influence the research agenda. This will itself produce costs, and produce those before the benefits are realised in financial terms. Industrial representatives may be focused on the immediate costs of development and marketing and, while wanting to establish a relationship too, do not want to overpay for the initial piece of IP – the hook that leads into a relationship. They do not want to invest upfront in establishment of the relationship. This is often true where a company wishes to establish access over the long term to specific researchers or research groups and their international collaborators. In some sectors, usually service sectors, researchers will be offered retaining fees in return for access to their knowledge (law, finance and management are prime examples of this) but in most associated with science and engineering or medicine the relationship tends to be built through a series of "deals". This makes the relationship vulnerable to perturbation through changes in company personnel and the perceived value to both parties of the latest such "deal". One element of this problematic approach to relationship building may be simply that at

personal level the company negotiators (and KT office staff) do not want to lose face by agreeing a more flexible deal, by accepting a “loss leader” strategy.

This is not always the case but it is mostly in the larger companies that there is the possibility of a well developed strategy of engagement that truly reflects the principles of open innovation. A company may need a supply of graduates, preferably from courses into which the company has had some input, but their negotiators may have different targets and no ability to “discount”.

Industry and research institutions both need to
- be more open and flexible in partnerships.
- align the activity of the negotiators and their targets with the objectives of the organisation.

Companies generally would benefit from an understanding of the costs, including opportunity costs and how those are presented in negotiations

Risk is a factor that influences the perception of value and its role needs to be better understood. Research organisations are evolving; they are moving slowly from the original 1980s concept of “technology” transfer through the generally accepted “knowledge” transfer which is much wider and more inclusive towards a flow of knowledge from “knowledge exchange”. Their mindset, particularly in the appointments made in KT Offices needs to reflect this; they need have more of a business oriented decision process than a legal one and this can be fostered by lessening the reliance on legal knowledge when making KT staff appointments.

Legal approaches to the assessments of risk inhibit knowledge transfer. Assessment of business risk should carry equal or a little more weight in the decision-making of KT offices than legal risk.

Many policy makers have economic development goals rather than cultural or societal goals. They want job creation via new companies and licenses versus job retention and company growth through capacity building – quick wins versus long term goals.

There is evidence also of government policy instruments influencing the behaviour of publicly funded research organisations with a detrimental effect. An example might be where government policy changes and expects rapid responses and outcomes such as the moves to make universities more self-sustaining by generating more income from industry. This may result in both overvaluation to extract most value and also may damage the potential development of long-term relationships which would produce more of a flow of knowledge between the sectors rather than a single, closed, transfer from one to the other.

MS government policy instruments need to take account of the long term benefits of knowledge flow and to avoid unintended consequences.

Member States (MS) also develop and implement frameworks and instruments which work against each other and cause confusion. Government at all levels needs to be clear and consistent about its expectations AND even handed in treatment of all parties when developing instruments to support exploitation.

At MS level government and its agencies
- need to be realistic in the expectations of increased income for institutions from KT.
-support and encourage SMEs to understand the benefits of a longer term approach to investment in relationships
- clarify their expectations of their research institutions and align both policy and funding streams to ensure that expectations are matched by funding streams
- consider investing in programmes to support SMEs in developing and resourcing relationships with research institutions and thus give them confidence through understanding.

MS, and the Commission and EURAB should
- seek to harmonise the regulations governing funding
- simplify the funding streams available, or at least the application process and the funding sources.

This confusion of intent is not seen in the US where league tables may be dominated by license income and numbers of spin-outs created, but the league tables are created by the universities. Licensing and company creation is an expectation of receipt of research funding but the research itself is where the government money is invested.

2 Different exploitation models and likely types of return from each.

There are a number of ways in which research results can be exploited. Not all will result in direct income, but as mentioned earlier that may not be the objective of exploitation. Also, with income generation there are different levels of risk and rates of return which need to be considered. For example as a simplistic illustration, equity in a new company created on the basis of research results is attractive to a research institution or an investor but carries a high level of risk and a return, On the other hand, licensing the intellectual property arising from the research results to a third party is relatively quick, and can produce a royalty income stream soon after licence, but arrangements for collection of royalties, and indeed for protection of the IPR need to be put in place, and compliance with these arrangements assured.

This Chapter looks at the different exploitation models, the selection criteria typically used for deciding which to use, the benefits and drawbacks of each exploitation method, how (and when) returns are generated, along with a discussion of the differing nature of the costs involved eg time, money.
Public discussion tends to focus on the exploitation of protected IP, but when considering the exploitation of research results thought has to be given to the intangible value of releasing the results into the public domain. This may be by providing open access to either/and results and publications based on those results or by simply broadcasting for marketing purposes the potential societal or economic benefits of the results if applied. This may require protecting the IP first (e.g. through patenting) and then release of results into the public domain to achieve broader value.

The different exploitation options considered in this report are commercial exploitation (through licensing, selling and spin-outs), other industry interaction (through consultancy, Continuing Professional Development/short courses for industry (CPD), technical services, collaborative and contract research and personnel exchanges) and the indirect income that is the result of enhancement of reputation through publications and presentations.

2.1 Exploitation of protected IP

Although business considerations are important, for a research institution these are normally part of a broader set of reasons for commercialising, which include:

- Utilise IP for the public good and benefit[2]
- Develop the technology to its full potential
- Benefit the local economy and Europe
- Reward, retain and motivate inventors
- Revenue generation
- To induce closer ties to industry
- Raising and publicising the profile of the institution

A research institution should be approaching the process of exploitation of research results with a clear idea of what its priorities are. This may involve more than one criteria from the above list, but it is important that researchers and managers of the exploitation processes are in accord about the most appropriate route to take and the reasons for doing so

For industry the business considerations can be expected to dominate with less tangible considerations holding little or no sway over decisions. Basic operational issues of cost benefit analysis used in industry do not always arise in the deliberations of an institution.

This is particularly overt in institutional behaviour when the costs of both protecting IP and of then finding a market and proceeding to provide resources for marketing it are identified. There are many examples across Europe where the protection costs far outweigh any likely return but the institution – usually through the KTO – has not undertaken a basic cost-benefit analysis. Equally, there are

[2] This may be releasing research results that will affect or influence the public good and those who contribute to it, or in increasing cases, especially in medical-related sectors it can mean putting conditions on the application of the IP – eg licenses to pharma companies which require sale of the resulting products at cost in developing companies.

examples where patent filing is an activity conducted in isolation from market identification, drawing on different budgets, with different criteria for the success of the unit.

If we put aside graduates whose learning was informed by research results the most common structured exploitation routes in use for research institutions alone or in combination (creating an "Open Innovation" system where an institution will be open to adopting more complex, overlapping and interacting types of knowledge transfer which are non-linear but together provide a bundle of exploitation options) are:

- Creation of new companies
- Licensing of intellectual property or know-how
- Joint exploitation ventures as evidenced in the UK by universities partnering with investment and management providers.
- Sales of expertise or services (consultancy; CPD; technical services)
- Contract research
- Contributing background IP to collaborative research projects
- Exchanges of personnel
- Publication/dissemination

If we group the first four of this list as those most likely to produce a financial return we can see that in general, the potential risk and reward increases as shown in Figure 1:

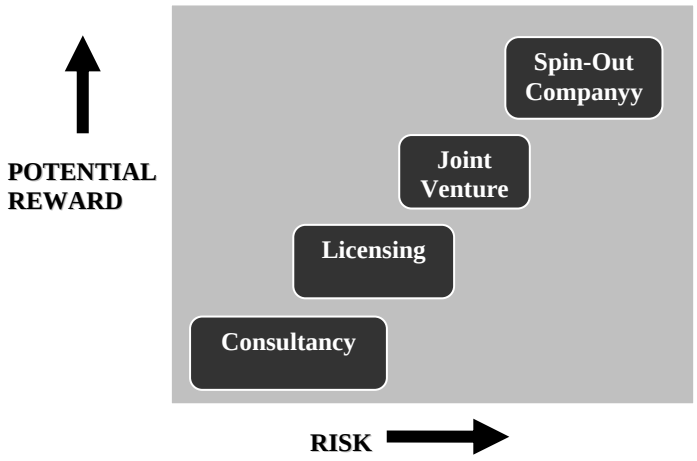

Figure 1: Potential Reward vs. Risk

Looking specifically at choices between licensing and creation of new companies the potential (financial) rewards of both are very skewed and unpredictable, but for institutions the positive outliers for licensing seem to be higher than the positive outliers for spin/offs. The positives for both government policy and for individuals may be rather different and favour spinning out.
There are also some basic questions to be asked about the business proposition before deciding on an exploitation route. In general, evaluation of an invention or technology or novel step involves consideration of the following criteria:

- Can it be clearly defined?
- Can a unique selling proposition be written, ideally in a single sentence?
- How sustainable is the competitive advantage?
- What is the likely financial return?
- Can it be protected?
- Who owns the invention?
- Does it have potential commercial value?
- How could it be commercially exploited?
- What upfront resources are required to commercialise it?
- What do the researchers want to do?

Sales of services through consultancy, technical services or delivery of CPD to third parties is an option and remains one of the most effective and pervasive routes to exploit research results. As noted in the AURIL publication[3] "*Consultancy is a prominent example of 'third mission' activity, through which higher education institutions promote and support productive interaction with business and industry*" Institutions can derive valuable benefits by offering consultancy services, including generating external income, enriching the experience of staff and contributing to teaching and research. However, it is an activity that requires effective management to ensure that institutions are not exposed to financial and other risk, and their staff to conflicts of interest. It also can be undervalued both in financial terms but also as an activity for researchers to undertake.

If the institution puts in place an appropriate framework defining its objectives and expectations sales of services can be an excellent route to transfer research results to users. Sales of service combine theory and practice in addressing both immediate and longer term, often business critical, issues that are constraining growth or may have actually stopped production.

At a practical level steps need to be taken to ensure IP protection where that is helpful or essential (eg protection of novel processes for problem solving) to prevent IP leakage and to ensure recovery of costs, including those of any IP protection and opportunity costs. Expectations of researchers, limits on the time they can devote to providing services, what if any rewards they may receive need to be laid out clearly in guidelines. Standard contract clauses need to be explicit about what the client and the research institution are contracted to provide and deliver.

Management of sales of services is an issue with many institutions where historically academic freedom has been interpreted quite loosely. However increasingly institutions have become more aware of the potential risks to reputation, to financial health and of course to life and limb. At heart though sales of services activity, while difficult to manage without clear and enforceable frameworks, are relatively straightforward transactions complicated only by the human factor.

2.2 Licensing versus company creation

If the decision is not to go with sales of services, or indeed to combine that with licensing or company creation – a model that is used increasingly in order to retain and reward research staff - we can then focus on and examine the options of licensing or creating a new company. Within this a joint venture company with a third party may be the most appropriate commercialisation route if the preferred way forward is formation of a spin out company. Ina joint venture a third party would bring key skills or resources to the enterprise (e.g. established market, sales, or distribution route, complementary technology/products, spin out management experience, etc).

[3] "Optimising Consultancy" AURIL/UUK See: http://www.auril.org.uk/pages/publications.php

ASPECT	SPIN-OUT Favoured by	LICENSING Favoured by
1) Technology • Stage of development • Uniqueness • Stand alone product or part of a system	Unique, sustainable, stand alone product which satisfies an unmet need	Unique product which adds value to an existing system
2) Intellectual Property • Patented • Know-how • Copyright protection • Design protection	Patented product or a process relying on know-how or patent protection	Patent in place.
3) Manufacturing • Capital Expenditure • Use of existing equipment • Volume required to achieve financial projections	Lower upfront capital requirement. Low volume high value product	High upfront capital requirement. High volume requirement. Low cost Manufacturing base requirement.
4) Market • Fragmented or concentrated • Few or many key companies • Global or few countries • Few or many customers • Established or new market • Route(s) to market	Relatively easy to access customers & accessible route to market	Fragmented market serviced by existing sales forces. Supply deals in place. Difficult to access route to market.
5) Competition • None or well established • Differentiated or "me too" product	Well differentiated product which satisfies an unmet need	Highly competitive cost conscious area. Differentiation slight. Well established competition.
6) Team • Experience • Inclination	Experienced & committed team. All skills present or accessible	Inventor does not wish to leave university.
7) Environment • Buoyant or depressed • Availability of funding	Funds available from VC's, etc	Funds available from licensee. Funds from VC's, etc restricted

Table 1: Guidelines for Spin-out Company vs. Licensing

An agreed route to commercial exploitation is required before the invention is taken forward for commercialisation.

2.3 Exploitation through contract and collaborative research

Research activity, and thus external funding for that activity, is the lifeblood of a research institution. For that reason many are happy to engage with industry on collaborative or contract research projects where the background intellectual property protected or not is contributed to the project. In return most will expect to retain the right to publish the outcomes of the joint project albeit after allowing the industrial partner a reasonable time to review and comment on the draft publication. It is difficult to find examples where companies have with held the right to publish when challenged, and where the researcher was willing to "gloss" over some of the more sensitive commercial intelligence.

Nevertheless as governments expect research institutions to gain financial value for the knowledge they are often introducing the concept of a license for background material into discussions and all the issues about ownership and rewards come into play. The recent introduction and the application of Codes of Practice at Commission and MS level will serve to ameliorate some of this tension but more could be done through increased understanding and cooperation to resolve difficulties before they arise. Collaboration and contract research remain one of the best ways to exchange information and to achieve the strategic objectives of the partners and the evidence from both Europe and the US is that the value in financial and relationship terms of these modes of exchange is slowly coming to be recognised by all parties.

One serious management issue that remains in many European research institutions is the interpretation by individuals and by the institutions that research contracts with industry can be negotiated by the individual or by their local head or research group or area without reference to the institutional position on exploitation. In some instances this results in funding for research but all too often, as much through default as deliberate act, not only the exploitation rights to the foreground knowledge created are signed away, but all too often background rights can be appropriated inhibiting future research int his area. In extreme instances the rights of students and other third parties are also signed away, all in the belief that "academic freedom" is paramount and includes the right to naivety in negotiation.

There is no doubt that practices in authorising research contracts vary both across institutions and between institutions, and that the terms of private sector funders will vary between sectors. It is something that all institutions should review, if only to be aware of the levels of risk – legal, financial, reputational, moral - that are being incurred in their name.

2.4 Exchanges and free flow of people

Other than in the form of graduates whose learning was informed by research results knowledge flows most easily through people, preferably through placements and exchanges, and through publication of the results in both academic and more accessible outlets which in turn enhances reputation and thus attracts income indirectly.

There is no doubt that both of these options are the most successful with end users who are attuned to them.

The ideal situation would be the easy flow of staff between research institutions and industry but in Europe that remains largely an ideal. There is no doubt that where staff do move, or do bring to a new position knowledge of the culture and objectives of another sector their impact is considerable in strengthening the links effectively. There are many short term schemes to promote such movement but too many good initiatives founder when the individuals seek promotion, or review pension options and discover that employment in one sector is not considered valuable by employers in another. The issues have been well rehearsed, not least in the discussion about academic mobility across national boundaries, but much more needs to be achieved both in cultural and legislative/fiscal change before Europe manages the easy interchange over a lifetime that appears to work successfully in the USA between academia and industry. The ability of a sector to value and to absorb different experiences and expertise, and to identify and utilise the benefits of wide experience still seem very limited in both industry and academia in Europe, but the structural barriers of process and legislation do not help.

2.5 Open access to research results

The ability of Japanese companies to monitor research publications and adopt new ideas, techniques or reengineer technologies is legendary. Regrettably, SMEs and many other companies in Europe do not have the resources to scan, and to decode/translate the contents of academic publications and researchers often lack the ability to translate their work into "popular" terms. As a result the value of access to non-patented results is not as great as it might be to mid-sized and small European companies that have not, or cannot invest in scanning the field of relevant publications. Recent advances in providing access to patented results by the European Patent Office and national IP offices has helped in that arena but more still needs to be done to increase the foresighting abilities, including scanning research results, of most European companies. Moreover, access to the researcher is often necessary to implement the concepts in an academic paper and while this is possible through consultancy arrangements most companies seeking a competitive edge will prefer to have control of the information that forms the publication in addition to access to the original thinking. Open access to knowledge has its benefits especially for those in the research world but the value of it is still to be considered and as the only option it does not appear to be in Europe's best interests for either social or economic development.

For the purposes of this paper "open access" is defined as publication of research results in a manner that could be accessed by the general public. It does not address the discussions about when access to research findings might be permitted.

Researchers depend for their credibility on demonstrating through publication the outcomes of their work. Publication is essential for their career development but also in many instances for the reinforcement of their perception of self-worth. The result is a huge number of academic publications each year to which any determined person may gain access after publication. The researcher sees impact on their community, notably through citation of the work but also in requests to collaborate across research groups, in the attraction of research students and junior staff to the group (or individual) and in what is loosely termed "peer esteem" – invitations, awards, recognition.

At present most researchers also work within systems which reward them primarily for publication. Their sector may value financial return but many of those who enter the sector enter for the acclaim and recognition first and foremost.

For companies this need to publish is becoming better understood and both the researchers and companies and institutions are becoming more effective at supporting timely publication which does not give away intellectual property rights. This can be managed through the adoption of improved internal review and approval processes coupled with better communication across all parties about publishing intentions and timelines. Much more could be done by all to improve on the processes of protecting valuable IP while publishing – even without a grace period for patents - but the signs are that progress is being made. If that can be managed effectively there is then the added value to the company of being able to draw on the name of the researcher and the institution. That in turn creates a snowball effect as access to other researchers attracted by the publication to enter into dialogue with the researcher can then be incorporated into the ambit of the company. Networking is often abetted by pre-existing contacts and reputation. Thus it is not a truism to assert that reputation of the university lures more contacts and opportunities, and such "branding" has a snowballing effect which generates income indirectly.

2.6 The importance of reputation in evaluating options

The most important asset a research institution has is intangible. It is its reputation for delivering credible research results and taking forward exploration in its chosen fields, for developing the discipline. Added to that is the wide spread need to be known to be ethical in the undertaking of research for good, usually public good.

For a company, especially smaller ones, the ability to say that they are working with, or their product was developed with, or is based upon, knowledge from a specific university is invaluable.

As a result research institutions are risk averse when developments seem likely to affect their reputation. Equally they recognise the value of good publicity and enhancement of their reputation

and may be willing to offset that against financial or immediate returns. Increasingly safeguards to protect intangible assets such as reputation are appearing in contracts for both research and the exploitation of results and there is considerable evidence that researchers who damage an institution's reputation by their behaviour or by specific gainsaying of institutional regulations are dealt with swiftly. The concomitant of this is however that the value of reputation, of lending the name of the institution (and its employee the researcher) to a product based on research results from that institution is appearing as something that can be quantified in contract negotiations. Public recognition of what in the art world would be termed "provenance" is playing some role in negotiations.

Limited work has been done on the value of intangible assets and most KT offices and researchers would say that it is a matter of perception, and often the researcher's self-perception may be inflated. However there is a clear need in many research institutions and companies for understanding of the wider dimensions of the term "intellectual assets".

2.7 Leadership and management influences

As part of their overall strategy, research institutions will have thought about knowledge transfer activity, what benefits they wish to gain, and how they will measure their success. The answers to these questions will help to determine their policies and priorities. There is a contrast between, for example, a primarily opportunistic commercial rationale (more income, diversification of income sources), which may indirectly benefit teaching and research, and a policy of supporting the exploitation of research results as a core activity because of the direct benefits to teaching, research and staff development.

Over and above the stated policies however it is crucial to have full support at senior levels within the institution. This must be support that demonstrates that the transferring of research results by whatever means is effective in the circumstances is in itself a valued activity. Senior university managers sometimes provide support that may be more rhetorical than real. Exhortations to transfer research results may not be reflected in career development or review processes; high profile launches of spin-outs which generate costs only to crash and burn may be more lauded than day-to-day sales of services which enable companies to grow and create jobs, but do not generate publicity. To move towards good practice there may well be a need for internal cultural change at the institution level, beginning with senior management.

This in turn will affect development of the policy context in which research results are exploited, which can have a significant impact on the perceived value of the activity by individual researchers. Given the importance of the cooperation and engagement of researchers in any exploitation route the policy framework must incentivise them as well as making cooperation mandatory. Unwilling cooperation is as damaging as non-cooperation.

While not wishing to go into the detail of rewards and incentives that will be covered in another paper it is essential that such management policies are put in place for all types of exploitation and are accepted as equitable and just by the researchers; which would include not discriminating against those who exercise their academic freedom by opting out of direct engagement with exploitation themselves. The incentives may be career progression as a result of prestigious or ground-breaking publications releasing results openly, or they may be financial in the outcomes of service provision or the transfer/sale of IPR, or they may be rewards which hold potential (which may or not be achieved) such as equity in new companies. Rewards and incentives there must be if researchers are to see the value of exploitation of research results, and the rewards must be aligned with and reflect the institution perception of value. This consideration shows itself most acutely in institutions where sales of services are rewarded with direct financial benefit, and no or few constraints are put in place to ensure that other activities that benefit the institution in the longer term, such as research or acceptable levels of teaching, are undertaken.

3 IP valuation methodologies

3.1 Why set a value on IP

There are a number of reasons to set a value on IP, including the need to value a company where the main asset is its know-how or its technology and of course when settling an infringement dispute but for the purposes of this paper we will take the core reasons as

- the wish by a laboratory to sell a particular item of technology or part-develop product to a company able to take it to market
- the need to establish whether an investment in commercialising a technology is worthwhile, and what the contribution of the technology owner is worth

The initial thought of the inexperienced will always be to develop a price based on costs incurred, directly and indirectly. This is a serious error of judgement, not only because quantifying the costs that were incurred in educating, training, providing for a researcher up to the point at which a piece of knowledge attracts a direct financial return is a thankless task that produces a frightening total cost. Even where only the immediate costs are quantified this is dangerous; cost recovery should be part of the discussion on whether or not exploitation is worthwhile, not part of establishing a value. Value in the market place is the only rational measure to be used when setting a price.

The approach adopted all too often in valuing IP for licensing is for a member of the KT office to study the market through published market surveys and databases (if the market exists), estimate the likely share of the market that the IP can capture, identify target companies which might be interested in licensing , dream up a price based on market ”norms” or advice from someone who had concluded a deal with the target company, and the wildly optimistic calculation of likely market share, draft a rough outline of the technology (but not necessarily how it will benefit the company’s business), and go ask them to agree to terms. If this approach works it is more down to luck than to science. There are more considered approaches, many of which have absolute faith in market research based on published sources – and thus out of date but there are also some simple questions to be asked, such as: “*Does the Invention have Potential Commercial Value?”*

At the early stage of an invention it is usually difficult to obtain an estimate of potential commercial value. However some estimate of the value of that particular opportunity is required for the business case. Generally an order of magnitude estimate of value is sufficient at this stage. Typically, estimates of overall market value and size are of limited use.

Potential sources of information to base an estimate of opportunity value on are:

- Internet search of market
- Information from industrial contacts of inventor(s)
- Market research reports/databases
- Market knowledge of inventor(s) and colleagues

General trends to also look for are:

- Is this a growing or shrinking market?
- Is the potential market local or global?
- Is there an opportunity to value price (i.e. charge what the product or service is truly worth) or is there significant pressure on prices in this market
- Would an anticipated competitive response to the entry into the market of this new product or service be to lower prices?

Provided the invention is considered to have reasonable commercial value, the precise estimated amount is not a pass or fail criterion. Rather, the estimated value of the invention will influence the justifiable upfront cost that can be incurred to investigate and pursue the opportunity.

There are however more sophisticated tools which are enthusiastically supported by adherents, and there is continuing review and exploration of examples of these as they develop and become more sophisticated in various editions of the Licensing Executive Society’s journal “Les Nouvelles”. There are also some excellent discussions in the IP Handbook of Best Practices[4] .

[4] IP Handbook of Best Practices, MIHR/PIPRA. See: http://www.iphandbook.org/

Some will be sector specific but all give a process which is expected to lead to a relatively accurate valuation.

Two of the most favoured ones, for our purposes are one based on value price theory and one on financial calculations or rules of thumb. Value price aims to reflect the true value to your customer or to the end user, producing value through saving time, people, alternative approaches, or complying with regulations. It requires uniqueness and sustainability, and of course the sustainability of a value price over time. Financial calculations are more scientific in approach taking account of industry standards, rating/ranking, rules of thumb, and on occasion incorporating more theoretical approaches such as discounted cash flow and real options. Often too the research institution will calculate the cost of all the investment in producing the research results, going back to the fitting out of the laboratory and including all the competitive funding that supported research up to the point at which the "valuable" results were achieved. In this way some spin-out concepts with no investment and no product can easily be worth several million euros on paper!

It is much easier for more developed companies to calculate value based on revenues because they actually have revenues. Or to calculate discounted cash flow because they actually have cash flow. Usually however new spin-out companies have nothing. They are effectively making calculations based on wishful thinking. As a result there will be no meeting of views over the negotiating table. So, new companies need to test their market position by networking with as many industry experts as possible and running traditional calculations in addition to applying any methodological approaches to valuation.

Even having done that the message is that while these blunt tools are useful they must be used in conjunction with understanding and intelligence as well as market intelligence; value will remain in the eye of the beholder and so the seller and the buyer must agree on some core points such as costs and likelihood of success. A proposal from Dr Richard Reeve highlights this very effectively.[5]

Stage	Idea	Proof of Principle	Product prototype	Production Set up	Market Launch	Success
Cost	1 euro	10 euros	100 euros	1,000 euros	1,000 euros	
Chance of going ahead	50%	50%	50%	50%	50%	
Value	?	?	?	?	?	50,000 euros

Figure 2: Reeves Model

They should use the available systems and processes advocated but they should also take some simple steps to look at the health of their market, to look at the real difference the IP will make (including likely costs of changing production systems), they should test their concept, and they should consult colleagues, competitor companies in the sector, inventors in the topic area and anyone who might ask "is it worth it?" before setting price expectations.

[5] "*A model for valuing an invention" Richard Reeves Cranfield University, UK*

4 Perception of value in specific exploitation routes

4.1 The value of experienced KTO staff

The most important factor in realising value from research results is likely to be the judgement of experienced KTO staff in identifying and implementing the most appropriate route, conducting negotiations with the knowledge creator(s) and the knowledge user. A myriad of technical and interpersonal skills are needed to regularly deliver robust outcomes but the most useful, the most valuable, may be the ability to recognise the value of the research results to both creator and user and to balance both of these while ensuring that progress is made that results in the transfer of knowledge in a way that satisfies all parties and encourages future positive dialogue.

4.2 Open Innovation[6] and networking

This term can be expanded to mean developing personal relationships and exploring opportunities without pre-judging the options but this does not capture the full impact on the relationship of what is meant when both parties are exploring and open to cooperation and the exchange of knowledge in any form and through any vehicle that is appropriate for the circumstances. Many also fail to recognise that it does not necessarily mean "free access" and there is some scepticism about the true degree of adherence by many companies to the principles.

Often research institutions and industry partners fail to recognise the true value of such relationships and concentrate too much on the apparent "waste" of time which does not result directly in a deal being struck and income generated or product developed. Nevertheless relationship building through networking and socialising is seen in the most successful industries and research institutions as a way to strengthen and deepen existing relationships, bolster embryonic ones, and offer the possibility of new relationships to be developed. As some companies have come to realise there are also benefits to be gained from interacting, often in events facilitated by research institutions, with other industrial participants who may be either competitors or elements of the company's supply chain. This may not only lead to new collaborations and sources of expertise, but also enables domestic companies to be aware of the competitors. It is also one route for SMEs to gain access to networks that largely involve research intensive universities and companies and there are successful examples through the work of the various "Connect" organisations across Europe.

Such relationships can be strengthened through formal networks or through more social events and in Europe the importance of this is often downplayed and undervalued. The opposite is evident in the US where several universities have invested heavily in recent years in establishing relationships with no expectation of an immediate return[7]. In fact these universities have recognised the value of industry funding of research, of posts and of students and in most cases have come to see the financial benefits through investment in research quite quickly. Recognition of this as a route to exploit research results has perhaps taken longer to embed in the psyche of senior managers of either university or company but there are clear signs that across the US this option is being incorporated into exploitation strategies. Similar movement is occurring in the UK, supported by government policy to encourage interactions of this type, and by the allocation of Structural Funds to support the building of relationships with SMEs and their engagement with the larger company partners of the universities. In more forward thinking regions or around some cities with high levels of research activity (Cambridge is a good example but also Edinburgh) the relationships and networking organisations include business angels and venture capitalists, in addition to a range of industrial representatives. The obvious merit in this practice is that it provides a wide array of expertise and sources of potential exploitation. Networking, however, requires both skill, experience, stamina, and resources and these, particularly the latter, are often limited by the costs in staff resource and in time.

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[6] **Open Innovation** is a term promoted by Henry Chesbrough, a professor and executive director at the Center for Open Innovation at Berkeley. The central idea behind open innovation is that in a world of widely distributed knowledge, companies cannot afford to rely entirely on their own research, but should instead buy or license processes or inventions (e.g. patents) from other companies. In contrast, closed innovation refers to processes that limit the use of internal knowledge within a company and make little or no use of external knowledge. See http://en.wikipedia.org/wiki/Open_Innovation

[7] EC / US visit report "Experiences on the US knowledge transfer and innovation system" April 2007

Clustering in geographic terms, as well as sectoral terms can be highly effective and more perhaps needs to be undertaken to recognise the value of this, through impact on the economic and intellectual health of a region as well as a stimulus to intellectual capacity through attracting students and staff to the institution(s). For instance, Microsoft has located its European R&D centre in Cambridge where high tech companies and researchers from universities come together and create an environment that has come to be known as the "Cambridge effect"; a cluster in a region which stimulates research and the cross transference of ideas into applications, providing an intertwined bundle of valued outcomes in academic, personal and industrial perspectives.

4.3 Collaborative research

Collaborative research is valued by research institutions as an activity that funds research and the costs associated with it. The financial commitments of the institution to staff costs, to development and maintenance of facilities and to research programmes themselves can be underpinned, if not significantly alleviated by, external funding. Understanding of the role of collaborative research as a route to exploitation of research results has been slower but is now fully accepted by both industry and research institutions including researchers themselves. What is not fully accepted as yet is the costs to both parties of undertaking collaboration, and this, coupled with the inability of many institutions to identify costs as fully as they might, can lead to tension or the breakdown of potential long term relationships. This is exacerbated by researchers themselves who do not acknowledge, or indeed fully comprehend, the full range of costs to the institution in undertaking the work. Actual staff costs, equipment purchase and depreciation costs and direct consumable costs still tend to be the only recognised costs and all too often the consumables or some staff resource are already available and thus not recognised as a cost. However, even where institutional costs are identified this can lead to as many challenges by the external partner, not least on the basis of "we have already paid taxes".

Researchers and their institutions engage with industry in collaborative projects certainly to gain funding for projects[8] but they also engage for a variety of reasons that may have no direct financial benefit but do lead to financial and reputational benefit through informing academic publications. These reasons can include exposing students to industry expectations and behaviour in preparation for employment, accessing equipment or facilities that industry alone can provide or simply accessing industrial, and ideally sector thinking on some of the grand challenges that the industry participants foresee (ie ideas for future research programmes. Reasons can be truly altruistic with the desire to assist a company develop or in some cases they may be because the researcher or the institution has a specific relationship with the company that it wishes to reinforce, a relationship which may or may not result in financial gain.

Most often however the underlying purpose of conducting such research can be summarised as keeping abreast of industrial research, increasing the applicability (and thus exploitability) of university research and obtaining access to research expertise in industry.

While research institutions and industry do value, or are coming to place more value on, relationships across sectors and with communities within sectors there remain great gulfs in the perception of actual value in specifics. Universities in particular during commercial negotiations are sometimes accused of overvaluing their intellectual property (IP).

An independent report to the DIUS Funders' Forum in the UK [9] found that negotiations between universities and companies could take up to 18 months, partly because both sides overemphasise the importance of IP in product development. Increasingly though realistic assessment by a research institution will show that it should not expect large financial returns from research, even if some discoveries eventually lead to lucrative commercial successes.

The over-riding financial value of collaboration is best illustrated in the UK's

[8] EC Expert Group on "Diversified funding streams for university-based research: impact of external project-based research funding on financial management in universities" See: http://ec.europa.eu/invest-in-research/pdf/download_en/eg_external_funding_final.pdf

[9] Streamlining University Business Collaborative Research Negotiations: An Independent Report to the "Funders' Forum" of the Department for Innovation Universities and Skills' (www.berr.gov.uk).

Higher Education Business and Community Interaction survey for 2006-07[10] which put the total value to the UK higher education sector of collaborative and contract research at £1.45 billion, compared with a little over £40 million from IP alone.

There is evidence both in the US and in Europe nevertheless that collaborative R&D (or research) projects are coming to the forefront as the preferred route for both industry and research institutions, not least because they establish longer term relationships for industry and allow influence of the research agenda by industry. Increasingly too, as can be seen by the development of standard contracts at national levels (Lambert in the UK but also Ireland, Portugal, Denmark) the points of dispute are being smoothed out as both sectors come to a common understanding of what is realistic and of course of what each other's purpose and goals are.

Increasingly, where problems or difficulties may arise there is a willingness to accept the assignment of the joint IP ownership and the negotiation of subsequent licences that emerge from these joint research activities. The most common solution in joint ownership that may arise from the collaboration, particularly in the case of third party funding is straight forward – the commercial partner either gives easy licensing terms to the University but retains the right to use the IP non-exclusively, or *vice versa*. In other cases the industrial party allows the University a licence to exploit the IP but outside the area of the company's business area.

Collaborative projects and partnerships can be small scale but still be valued and provide excellent value for money. For instance, collaborative projects under the European Commission Framework programmes have been an important channel to bring together European researchers at all levels, and non EU Member States, such as Israel, Australia, Canada and the U.S.

4.4 Consultancy

Undervaluing the financial aspects is readily addressed by improved costing along with market testing of prices and there are plenty of good examples across Europe of how to price sales of services and recover both actual costs and a profit or appropriate fee for the researcher. The historic attitude of industry or other users of research results that the public purse should enable them to purchase services at less than cost no longer holds good and most companies whether multi-national or SME do, or can be brought to, understand the levels of expertise and resources required to provide good quality services from research institutions. It is notable however that day rates for engineers and scientists remain relatively low – under €2,000 whereas management advice from high profile academics can command five or more times that. Many companies are coming also to realise the value of leverage through consultancy; the access, at short notice, to the combined knowledge of many minds across the world via a single researcher or research group.

Undervaluing the financial aspects for academic or societal reasons is much more difficult to address. Balancing intangible returns against financial returns should be a managerial, or possibly institutional decision and many institutions set guidelines on the charges for staff time but all too often a price will be agreed by a researcher who either does not value their own expertise or perhaps not recognise its value, or on occasion who sees other benefits to be gained by undervaluing this particular deal with this particular client. The important thing in such situations is, as with supermarket offers, to understand the level of discount and the value of the benefits to be gained by offering it. As more institutions come to understand the real costs of undertaking work it is likely that this will become one of the most contentious areas of KT within institutions and one of the most difficult to manage.

4.5 Patents & licenses

Here more evidence for international comparisons exists. The EC visit to the US[11] found extensive anecdotal evidence which is reinforced by research, that the Bayh-Dole Act of 1980 stimulated dramatically the increase of university patenting and licensing. All the evidence pointed to this combination of carrot and stick (universities in receipt of government funding for research ha d to put in place procedures for exploitation of the results) stimulating universities to increase patenting in

[10] Higher Education - Business and Community Interaction Survey 2006-07', UK funding councils, July 2008 (www.hefce.ac.uk).
[11] EC / US visit report "Experiences on the US knowledge transfer and innovation system" April 2007

those fields, which in turn had potential to be licensed for further development and commercialisation. This was very effective and highly valued by all parties, not least because the conditions of licenses and issues of IP ownership were set out in the regulatory framework around the Act.

However, as the visit report notes, since industry as a whole does not value patents as the most effective route to transfer research results and they are an end in themselves; they lead neither to relationship building nor to future investment by industry in research, US universities have moved in the last 4-5 years to strengthening those other "softer" exploitation routes in return for investment in either research or, in many cases, potential employment of graduates. This view of the value perception by industry in the US is reinforced by a study by Cohen et al. (2002)[12]. In a survey of R&D managers of firms in the U.S. manufacturing sector, the authors find that respondents ranked patents and licences near the bottom of the list as ways in which industry could learn from academic research. They also find that in most industries, the channels reported to be most important are publications, conferences and informal information exchange. These are where information flows freely and there are no structured negotiations nor institutional expectations to be managed and thus no likelihood of access to knowledge being inhibited or prevented while the value in financial terms is disputed.

Many KT offices and research institutions themselves will acknowledge that while a patent filed (or preferably granted) may be seen by a researcher as having value as an output of the research, and thus an end in itself for the institution the patent is merely a tool that leads to a license agreement and financial returns. In many cases the cost of patenting in both Europe and the US is such that a KT office will not file until after they have identified a potential licensee. Of course the US does benefit simply in the fact that the "national" market is on a somewhat different scale from that in a European country and therefore the opportunities to license before extensive fees are racked up are much greater. There is anecdotal evidence that in both Europe and the US patents may be dropped if a licensee is not found within the first 12 months. But the odds of success in the US are much greater as a result of the size of the potential national market.

A study by Colyvas, Crow et al (2002, 66)[13] found that where inventions were "ready to use" out of the university laboratories there was less interest by firms to commercialise them because of perceived competition for such technologies. As a result there may be a higher success rate if a KT office does identify and contract with a licensee in the first 12 months.

Understanding motivation remains of paramount importance. For example, a university may opt to license in order to build a longer term relationship with a licensee to support research staff and activity although holding equity in a spin-out built around the IP may produce greater financial returns. A company may choose to develop a stronger supply chain by spinning out new companies that support different aspects of its core business but are not in themselves core to the business. The reasons may not be obvious but to the organisation, in context, they are quite sensible.

Another aspect that influences negotiating stances is that of sector norms for royalty rates. These are widely available but all too often are taken as fixed rates when in fact they are starting points to get a negotiation started. The end result will depend on a great many other factors, not least the current and projected state of the market. These are useful tools, but over dependence on them can, and does lead often to over-negotiation and a failure to understand the purpose of negotiation.

4.6 Cultural and legislative values: the US versus Europe

The U.S., on the whole, has a long and well known history of working and collaborating with industry. This can still be undervalued in Europe where many researchers see taking funding from industry, or indeed solving the more immediate industry problems as somehow "dirty". In the UK and elsewhere policy measures, above all government funding as a reward, have been instrumental in encouraging universities to develop a more "open" attitude toward working with industry, as well as undertaking technology transfer. It is also for this reason that many European countries have now reformed the laws and frameworks governing university IP regulations to encourage academic entrepreneurialism. Governments could move more decisively to demonstrate that they value the dissemination and application of research results.

[12] Cohen, W., Nelson, R., & Walsh, J. (2002). Links and Impacts: The Influence of Public Research on Industrial R&D. Management Science, 48(1), 1-29.

[13] Colyvas, J., Crow, M., Gelijns, A., Mazzoleni, R., Nelson, R., Rosenberg, N., et al. (2002). How do University Inventions Get into Practice? Management Science, 4(1), 61-72

Undertaking consultancy assignments is a frequent practice among U.S. university researchers. As with European researchers, these consultancies are with the public and private sectors. Provision of executive-type training courses is also common among universities in the US but in Europe tends still to be restricted to the large business schools.

What is however not as widely practised in Europe as it might be as a way to generate greater understanding of the perceptions and the values attributed to activity and to outcomes is the mobility of researchers between industry and the public sector. U.S. faculty members can spend a few years in government or the private sector with no negative impact on or stigma to its academic career when the ex-academic returns to academia. Even without moving employment steps are taken by US institutions to create social opportunities for their researchers and industry personnel to mingle and to develop relationships based on shared values and social activity, viz the multi purpose golf course developed by North Carolina State University for research and social purposes on its Science Park[14]. Furthermore, in the US faculty members who move into the private sector carry with them their "university-generated IP," which also could be used productively for innovation activities. In Europe the pervasive view is that once out of research in academia there is no way back. This is changing notably in the UK universities where many senior academic leaders are coming in from industry, often overseas industry, but it is still seen as a one way move and returning to industry is not seen as an easy option.

4.7 Relationship of cost recovery to the perception of value

Cost recovery, or indeed sunk costs where no direct recovery is expected, is often overlooked in the process of developing a budget for an exploitation option. Too often the focus will be on making income without relating that to costs incurred. In some instances a budget is not established and no record kept of the direct costs incurred but more often it is the outlay in staff time that is not considered when the strengths of an exploitation route are being considered. As mentioned above, cost recovery can form part of the process of establishing value but that process needs to be realistic about which costs are included (and whether they were a good investment and will result in both cost recovery and some additional return). Again, experienced judgement in KTO staff is required, indeed it might be termed "invaluable".

The most obvious costs are those required for the exploitation process for IP. These direct costs should then be reflected in the return on the exploitation, whether through an increase in the equity holding, an increase in the royalty rate or indeed in a direct repayment within the terms of the license or the incorporation agreement. On occasion an element may also reflect the level of KT office staff effort required to take the exploitation forward, but equally returns should reflect the level of investment required by the licensee or the company to develop the product based on the IP.

Exploration and progression of commercialisation of an invention should be undertaken wherever possible in phases, so that the cost of investigating the next phase is minimised, with the ability to terminate activity at any phase. This approach is appropriate since in the early stages the commercial opportunity is generally somewhat unclear and the risk of an unsuccessful outcome is high. The justifiable upfront costs expended in investigating a commercial opportunity depend on the estimated size of the opportunity, as summarised in Figure 3.

[14] EC / US visit report "Experiences on the US knowledge transfer and innovation system" April 2007

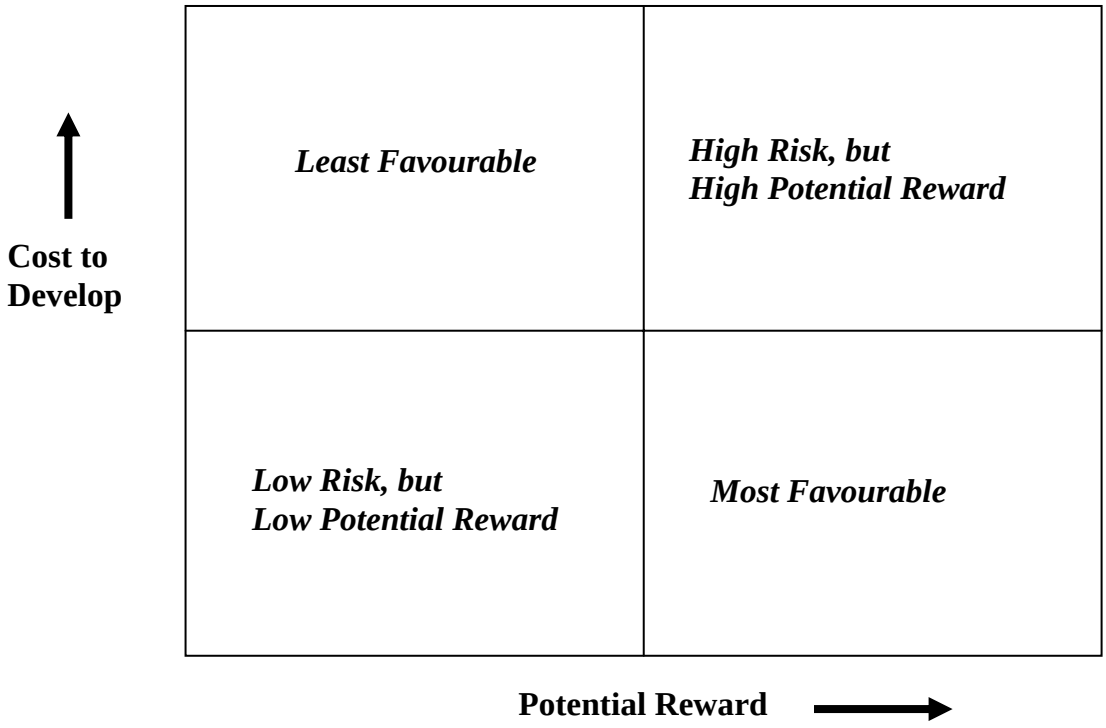

Figure 3: Cost to Develop / Potential reward matrix

4.8 Licensing

Most KT offices in research institutions have adopted a general approach to investigate the commercialisation of an invention via licensing which, roughly, will be as follows:

- If patenting is the preferred IP protection option, the KT office patent lawyer (in-house or outsourced) writes the patent with the inventor(s) and files a national patent application at a relatively insignificant cost. However, if an external patent lawyer or agent is used costs must be monitored as they can escalate rapidly to levels which are often not recoverable in 2-3 years.
- The KT office staff, with input from the inventor and ideally access to market research databases and other sources, investigate the commercial opportunity within the timescale of the national patent protection.
- If the commercial interest is low and no potential licensee has been identified within this time period then the national patent application is withdrawn and commercialisation activity ceased.
- If commercial interest has been expressed and a potential licensee has been identified, then the patent is extended into the PCT phase (retaining the national priority date). This usually involves the use of an external patent agent at a typical initial cost of 5000 – 6000 euros but may be considerably more depending on complexity of the IP, the sector and of course management by experienced KTO staff of the interaction with the external agent..

If the IP is protected by know-how then this general approach can still be used, ensuring that discussions are held under appropriate confidentiality agreements and taking care over the release of information.

It is critical to be able to co-ordinate patenting with commercial exploration of the opportunity in order to make an informed future decision on whether to maintain patent cover. This is summarised in Figure 4.

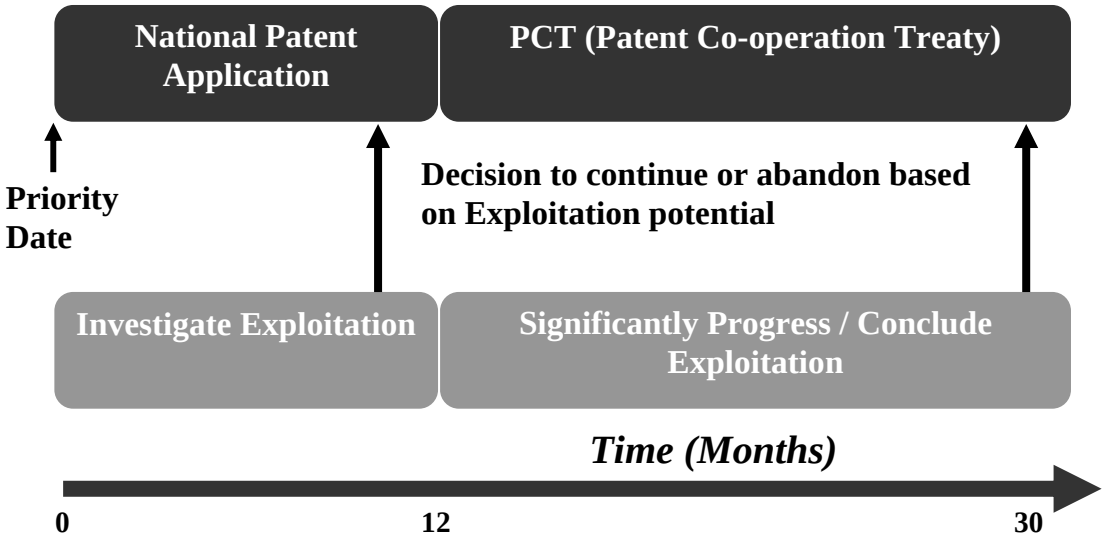

Figure 4: Coordination of Patenting and Commercial Exploitation

If this low cost route can be followed then the financial risk is minimised in the short term but in every instance it is good practice to review the potential market, take a realistic view of possible earnings from exploitation and then decide whether an increased initial cost of employing an experienced patent agent would be a worthwhile investment to ensure a robust and defensible patent. Each case may be different and there are compromises which are effective and minimise the external costs. The market sector being targeted, and its attitude to patent litigation will influence the decision here – which of itself demonstrates the need not simply for a business decision over a "can it be patented" process decision, but also the need for experienced KTO staff who can assess complex situations.

However, KT Office personnel time is still taken up, which has an indirect cost (and is also a lost opportunity cost if other inventions are consequently not progressed) which is a consideration, particularly when competing priorities are present. If external patent agents need to be used to write and file the patent application this is an upfront cost that must be taken into account. Essentially, the upfront cost should be minimised consistent with an effective exploration of the commercial opportunity. If the upfront cost is considered too high because of the absolute amount involved, the high level of risk involved in commercialisation, or the relatively low estimate of the value of the opportunity, then commercialisation of the invention should not be pursued.

4.9 Spin out Company

Cost recovery from a spin-out company is more straightforward in that it can be built into the incorporation agreement. Costs are likely to be auditable costs incurred through the use of third parties, and most importantly perhaps the larger elements of them have been incurred in discussion and consultation with those who will invest in and manage the company so disputes are minimised (at least over costs). In, for example, Heriot-Watt University the criteria and processes for supporting the creation of a spin out company are detailed in Regulation 42[15]and include detail on cost recovery. Interestingly the regulations, which are published on the University website for staff and form part of the terms of employment for all staff, include provision for the surrender of equity should a researcher delay the company formation process.

The important aspect in all matters of cost is to know what the costs are, and to differentiate between sunk costs (non-recoverable) and those that you hope to recover. Without an audit trail clearly linking costs incurred to the exploitation option, and preferably an audit trail demonstrating agreement to those costs being incurred there is the potential for heated and damaging debate. At present in too many labs putting a single prototype together has no obvious costs so the researchers not only fail to

[15] "Regulation 42 Formation of New Companies" Heriot-Watt University 2008

understand the real costs but fail to recognise the costs of scaling up to enable viable levels of production. This can cause the breakdown of negotiations with established companies, but it is also a frequent reason for the demise of a newly incorporated spin-out; the business plan has no sense of reality. Is it any wonder that researchers overvalue their IP yet undervalue the development costs if they have no sense of the actual costs in any process?

5 The impact of perception of value and of risk

It is increasingly recognized that value can often simply not be predicted. This can be seen in larger firms, who chose to start a number of research lines, knowing that most will eventually fail to bring useful results but hoping that one very valuable one might take out (in a similar way VC's will invest in a number of firms, knowing that the majority will probably fail, but hoping that this is offset by one or more well/performing ones). In a more general way, this phenomenon of unpredictability – and the need to take some risks and not to be afraid to touch the uncertain. Therefore perception is extremely influential in behaviour and in reactions to options.

The perception of value will differ between stakeholders (e.g. university, government, inventor) and may also be influenced by timing. What seems "right" at one point may not be appropriate at a different point in the implementation of a strategic plan. For instance, value to a university can be extracted in a number of ways, including financial income, reputation and motivation / attraction/retention of academic members of staff. For them, their researchers and companies the timing of the opportunity in the context of the organisation can, and does influence both expectations and value. For example, in times of economic confidence a government may wish to see institutions supporting company growth and development through the collaborative research often part funded by government. In a less stable economic context a government's priorities are likely to be job creation and company survival through the creation and licensing of IP. Similarly, an institution may take a different perspective according to its current situation and often its considerations are not immediately obvious i.e. issues about retaining staff by offering them opportunities to generate financial income or policy incentives from government to work with SMEs in preference to working with large companies. For an institution the value of KT may be in the perceived impact that KT has on the local economy and the public acclaim for so engaging locally. Community support may outweigh the financial value of looking further afield for financially robust deals. There is possibly a need to ask those research groups which undertake studies of the impact of organisations on their locality to develop a methodology for the local impact of KT. Preferably of course, a methodology that did not involve surveying companies and gaining "letters of endorsement".

Companies themselves do on occasion have different perceptions of value as their strategies change. A company which wishes to attract skilled staff may opt to work more collaboratively in order to gain access to graduates or to young researchers in the labs, using the collaboration to assess and evaluate both the skills they might need and those possessed by the individuals prior to making an offer of secondment or employment. At other times the company may decide that a straightforward license deal is in its best interests given the current status of either the competition or of product development.

In all cases the value of leverage, of access to knowledge around the project, of access to people who are not directly engaged but who influence thinking in the project should not be underestimated. For industry contact with a single researcher often provides access to a worldwide network of their peer group, and to all the publications and theories posited that that single person has access to and is influenced or challenged by. For a research team access to thinking on sector-wide issues or to long term foresighting of market developments can result in exciting new research directions. No "value" can be attributed to these but each knows how to balance what exists with the potential for new knowledge in the current context and time and, often, point of career development.

More entrenched is the perception of companies of the value of research costs, whether those that the company is expected to contribute to collaboration or those that have gone into developing a research output that is being sold. As universities improve their own understanding of costs this may change and the arguments for cost recovery get more convincing but it is likely that the real value of these costs will only be acknowledged if all parties see the process as one of equals exchanging knowledge; if universities do not overvalue their contribution and companies learn to understand that research

institutions are no longer “free goods” from the tax payer. Again, as always, perception needs to change.

A related point is that there is a real gap in many areas about the costs of development. This is only compounded when an attempt is made to apply a rule of thumb about development costs in one sector to another sector. As a generalisation costs in technological sectors, for example tele-communications, are well recognised. The same cannot be said about sectors which work with advances in medicine or pharmaceuticals, or increasingly those interdisciplinary and emerging areas where there is cross over between “biological” and “technological”. There is a real need here, as the disciplines come together to work on the same topics, for much greater understanding of how costs might be incurred, and how they can escalate. Education by companies who are at the forefront of the exciting new developments in products and processes will be essential – coupled of course with education for the general public in the significance of those advances to the public’s health and welfare.

In more traditional sectors greater clarity about development costs and their role in research and exploitation funding negotiations would also be beneficial. The question does arise as to whether large companies use as a blunt stick the perception that development costs will be high and that they must therefore get favourable terms. Would they accept the same terms from their suppliers?

Alongside the targeted incentives such as the rapidly spreading use of innovation vouchers for SMEs to engage with research providers there does appear to be an educational element that is needed for both researchers and companies to understand the true costs of both research and development, and to recognise that those costs are real; they cannot be waved aside as something nebulous that is met either from taxes or from company profits.
MS could look at ways to educate SMEs to increase their understanding but also to increase their ability, and thus their confidence, to engage in an informed way with the publicly funded research base.

5.1 Perception of Risk

Perception of risk is an area which requires more exploration in the context of how different parties evaluate exploitation routes.

Much has been written on how the private sector/ industry analyses and quantifies risk to the business in adopting (or not) new processes or products or business models, and what protective steps can be taken.

In the research community the question of risk is not addressed so openly and often the full range of potential risks are not identified. There is a belief that research institutions are risk averse and certainly not willing to share risk with partners. The assumption appears to be, with some justification, that the research institution cannot evaluate and manage risk and so seeks to avoid it. One manifestation of this is the way that many research institutions boast of the success and value of a new company (as shown by investment usually, not book value) but decline to include even a ‘snapshot’ of the value of their equity holdings in their formal accounts.

This is probably an oversimplification. The research institutions are addressing the risk they perceive and that includes avoidance of the charge that they are risking tax-payers money. The damage to the value of their reputation allied with potential financial loss in their view far out weighs the possible benefits – usually financial – of engaging in high risk activity.

As a result for many research institutions their investment in the high risk route of company creation will be in “sunk costs” which have produced research results and publications and influenced teaching, with the company almost as a by-product. Very few will invest additional funds in a new company. Yet they will, and do, invest time and private facilities – things that do not show on a balance sheet and which can not easily be quantified as “loss”. As more research institutions become more experienced at quantifying costs its will be interesting to see how the issues of staff time and access to facilities and resources are addressed when the value of equity holdings, and licence income, from new companies are calculated and risk considered.

One of the most significant risks to a research institution is also that which often makes a new company attractive to investors; the experience and name of the lead researcher. Many institutions have taken some years to realise the negative impact on their research programmes of distracted or absent lead researchers who are busy establishing new companies. The loss in income to support research, the loss of prestige through the slowing down or cessation of publications, the loss of income from students are not often quantified but they must form part of the decision-making process when an exploitation route is being considered. Increasingly there is anecdotal evidence (e.g. the Enterprise Fellowship Scheme in Scotland) that junior researchers are taking the active roles with lead researchers providing technical advice to a new company and associating their name with the company but all too often (see discussion of reputation and status) this is not being managed as effectively as it might and the science base is damaged.

Licensing is seen as much lower risk, even than sale of services where there can be issues of insurance, professional indemnity, loss of reputation etc.

Licensing as a result is often seen as a 'safe' option and research institutions try to impose all sorts of safeguards for reputation, financial investment and financial expectation and ownership and access to intellectual property. All too often minimising risk is then the driver which inhibits the ability to maximise income, without any consideration of the potential value of the licence and the effect of constraints on the ability to realise income. There are research institutions which are becoming more sophisticated about managing risk while still approaching it in an entrepreneurial way. Many of these have addressed the issues around potential waste of taxpayers money by creating, or accessing independent investment funds. Many more still need to develop risk management strategies and to become more realistic about accepting risk as part of any exploitation route and certainly as part of any partnership with the private sector. Care in particular must be taken with the warranties and liabilities granted in licensing contracts, which will expose the research institution to future risk.

5.2 Individual Risk

Perceptions of value do not appear to be closely linked to perceptions of risk in the minds of individuals. The only exploitation routes which are seen as creating risk for individuals – risk which cannot be covered by the institutions resources or insurance – are in
a) publishing research results which may expose one to comment and judgement by peers. This is part of a researcher's life and most surmount any fear of risk.
b) creating a new company and holding a senior role in management and equity. Here, the perception of value is three-fold: reputation, status, and financial benefit.

Interestingly the potential damage to reputation and status if the company fails is not an aspect often addressed by researchers. Financial exposure is however. Rare is the researcher who commits personal financial investment to a new company to which they may have pinned their name. Very rare are those who will put up personal collateral against loans. Equity investment, possibly seen initially as a grant, is seen as being successful in competition, a role most researchers are familiar with. Obtaining a loan against collateral is quite different.

One outcome of this is that a researcher overvalues both the IP that may be used to support the establishment of the company and their own role in the potential success of the company. The urge to be the most important element of a new company and the role it plays in influencing a researcher's choices for exploitation routes should not be underestimated. Especially in universities where researchers perhaps play a more prominent role in management and strategy decisions the personal wishes of a prominent researcher, their perception of the value to them of the opportunity may overwhelm good business sense in a KT Office. If the option on offer is to designate oneself as "Chief Executive Officer (CEO)" the attractions of a safe income from an almost anonymous licence often seems quite slight, it seems.

It is easy to dismiss this personal influence as a management issue, in particular for universities, but to do so is to ignore the situation of universities where the most precious assets are the academics. Balancing that with strong business principles is a difficult task for the KT office but also for many in senior university management, and does impact perceptions of value.

Personal perceptions of value are quite idiosyncratic, but can and do have a significant impact in many institutions on the choice of exploitation routes. Most KT offices work to match their evaluation of value with the personal perceptions of the researcher, and there is some evidence that the business drivers are prevailing, but this is by no means universal. It seems that until the role of the researcher in the institution is better defined, the influence of individual researchers on the choice of exploitation route and the need to gain their co-operation, as opposed to expecting it, will continue to be reflected in the final choice of exploitation route.

This is not to remove or decry the right of a researcher to decline to participate actively in the exploitation of their research results. That is merely a management issue and an effective KTO working within an institution with a robust KT policy framework will be able to develop arrangements for those results to be transferred in other ways or by others in the research area. Not every researcher has the capacity or the desire to be entrepreneurial but if there is a possibility it is part of the role of the KTO is to provide the opportunity. To do so requires the institution, and the KTO, to be willing and able to develop the entrepreneurial skills of researchers.

There is a real need for investment in awareness and understanding, a need for KT offices to educate and influence academics by engaging with other professional services to develop and deliver programmes of education and understanding. Institutions should be encouraged to implement such programmes and MS should be encouraged to invest in development and delivery of such programmes.

Examples of perceived risk and how these might arise and be managed are given in Table 2.

Risk	**Reason to Manage**	**Steps to Mitigate**
Loss of researchers	No researchers = no research = loss of income and reputation + costs of employing replacements	Reward mechanisms which allow researcher to remain in the institution and to participate in KT but provision of, or identification of, resources and people to deliver the KT objective
Failure to recoup "sunk" costs	KT becomes a "money-pit" with no returns	Managing costs by exercising judgement on value before costs are incurred.
Minimising risk itself	Can lead to stasis which in turn inhibits KT activity	Define parameters of risk whether financial or other. Put policy and process framework in place to manage risk, including the risk of no action.
Personal financial exposure	Bankruptcy and loss of home and family	Realistic business plans; professional KTO support; willingness to exchange equity for investment.
Overvaluation of IP	Institution gains reputation for being "unreasonable" and both research funding and KT engagement reduce, damaging cash flow and reputation	Robust KTO policies and processes coupled with experienced judgement within the KTO and support from senior managers of the institution
KT not recognised as researcher role	KT needs champions and researcher engagement if it is to be successful	KT embedded in employment and reward policies; programmes of training in KT awareness and entrepreneurship; culture and ethos encourage KT
Engagement in KT not rewarded	Potential loss of reputation and funding from companies. Researchers move job.	Rewards and incentives policy and process in place and implemented. Engagement in KT recognised as well as rewarded.
Engagement in KT rewarded	Over-engagement for personal gain damages other activities	Staff management processes ensure balanced portfolio of activity and delivery

Table 2: Risk Drivers and Steps to Mitigate

6 Impact of policy differences in regulatory frameworks.

There is little doubt that for research institutions the incentives that government puts in place for public sector organisations influence perception of value. Eg Bayh Dole[16] in the US encourages licensing even at low rates whereas in Scotland company (and job) creation is seen (every 5 years) by government agencies as most important (highest value) outcome. In Europe the availability of Structural Funds to support work with SMEs has created a situation in some regions where the value of the input in no way reflects the returns, financial or otherwise to either the institutions or the companies.
For companies the value of such incentives are less obvious but there is little doubt that the introduction of some frameworks, around standard contracts and codes of practice have reduced the time and effort required of companies in negotiations with research institutions and have therefore delivered real value by releasing staff time to grow the business.

6.1 Codes of Practice

The Republic of Ireland was one of the first countries to introduce a Code of Practice for the Management of IP from publicly funded research[17] and the Dutch are the most recent (December 2008).

However, many European countries manage the overall position through laws governing in particular the universities, and have done so for many years. Although most address the issues of ownership of IP there are examples where the purpose indicates the value placed on the IP by the government. For example in Denmark in 2000 the Danish Law on University Patenting (LUP) transferred patents previously owned by the scientists or jointly owned with industry to the university. The Law was aimed at ''...ensuring that research results produced by means of public funds shall be utilized for the Danish society through commercial exploitation''. The principal instrument of effecting this was to allocate ownership to the universities. The Law also mandated that ownership of inventions resulting from collaborative work with third parties, such as firms, would be assigned to universities, unless prior agreements were made to renounce in full or in part the right to the inventions. However, the university will consider renouncing ownership if the invention is completed in cooperation with or is financed in full or partly by a third party.

As early as 1995 a Decree in Flanders underpinned how Flemish universities conduct their exploitation activities and where costs should fall. It states that the contractor is responsible for all costs directly linked to the execution of contract research, namely the use of infrastructure, services or personnel from the university The Decree also mandates university ownership of the IPR of research undertaken by university researchers, unless the university fails to exploit these results within a time span of three years or rejects the researcher's request for filing a patent. Furthermore, it determines the criteria that need to be fulfilled before a university can invest in spin out companies. The university will only invest if the spin out has a clear marketing plan to exploit its technology/product/process.

These are a couple of examples and in other countries different instruments are used but it is useful to look at the principles underpinning the Commission's Recommendation on the Management of intellectual property in knowledge transfer activities and its Code of Practice for universities and other public research organisations[18].

6.2 Standard Contracts

This tool has started to develop more widely as the returns from the first, those developed by the Lambert group in 2004 in the UK have been followed by other countries, including most recently Portugal.

[16] The Bayh-Dole Act 1980 allows universities to retain ownership of the IP generated from federally funded research in return for which they must file for patents and collaborate with businesses to promote commercial application of the inventions

[17] "National **Code of Practice** for the Management of **IP** from Publicly Funded Research" **2004**
www.forfas.ie/icsti/statements/icsti040407/icsti040407**_ip**_report_intro.pdf

[18] "**COMMISSION RECOMMENDATION** on the **management of intellectual property** in knowledge transfer activities and Code of Practice for universities and other public **"**
ec.europa.eu/invest-in-research/pdf/**ip_recommendation_**en.pdf

Usually developed in consultation a set of standard agreements which address issues of ownership and liability for costs are undoubtedly useful starting points for negotiations. More work needs to be undertaken at MS level to encourage adoption, and understanding of these, and improved dissemination of the CREST decision-making tool would be helpful. Development of pan-European norms for such standard contract tool sets is probably timely now that there is a critical mass in existence at MS level.

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Wigzell, H (No date)	"Does it matter who owns university research?"	Presentation, Karolinska Institute, Stockholm, Sweden
Williams, E (2008)	Are Universities Contracting-out because they are hopeless at doing it themselves?	University of Warwick
WIPO (2002)	Regional seminar on the benefits of Intellectual Property System for Universities, University research and research and development organisations	World Intellectual Property Organisation
WIPO (No date)	Creating and imbedding intellectual property rights	World Intellectual Property Organisation
WIPO (No date)	Guidelines on developing IP policy for Universities and R & D organisations	World Intellectual Property Organisation

.

8 Appendix A: Definitions

an assignment	a transfer of ownership
the Bayh Dole Act	The United States University and Small Business Patent Procedure Act 1980
B2B	business to business
a business angel	an individual or organisation who provides capital to a company, usually in return for shares or debt convertible into shares
collaborative research	where at least two partners participate in the design of the project, contribute to its implementation and share the risk and the output of the project
contract research	where the PRO renders a service against payment of an adequate price and the industrial partner specifies the terms and conditions of this service - typically, the industrial partner will own the results of the project and carry the risk of failure
the Commission	the Commission of the European Communities
DG	Directorate General
the ERA	the European Research Area as proposed in the Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions (COM(2000) 6 final, Brussels, 18.1.2000
the EU	the European Union
the European Council	the Council of Ministers of the European Union
the European Parliament	the European Parliament, as established by the Treaties of Rome
the European Patent Convention	the 13th Edition of the Convention on the Grant of European Patents
the European Patent Litigation Agreement	the draft agreement on the establishment of a European patent litigation system, European Patent Office Working Party on Litigation, 16.2.2004
a first to file system	a system under which the intellectual property rights in an invention belong to the first person to apply for a patent for that invention
a first to invent system	a system under which the intellectual property rights in an invention belong to the first person to make the invention
full economic costs	the full economic cost of undertaking a research project, including all direct and indirect costs for the research project, such as space/estate charges, depreciation, an adequate recurring investment for infrastructure, equipment, consumables, travel and the cost of all staff working on the project (including principal investigators, technical and administrative staff)
funder / funding agency	an organisation funding research, generally a public or quasi-public body, but also including charities and private bodies
a grace period	a period during which publication by an inventor is disregarded for the purposes of ascertaining novelty and inventiveness in respect of any patent application for an invention described in the publication
an HEI	A higher education institution
intellectual property (rights)	patents (and utility models in some countries); know-how, trade secrets, copyright, database rights, design rights (registered and unregistered), and registered and unregistered trade marks
an invention	a new product or process
IP(R)	intellectual property (rights)

knowledge	intellectual property rights and related know-how, information, data and other intellectual assets
knowledge sharing	is used in the same sense as knowledge transfer in the Communication on improving knowledge transfer, i.e. it involves the processes for capturing, collecting and sharing explicit and tacit knowledge, including skills and competence. It includes both commercial and non-commercial activities such as research collaborations, consultancy, licensing, spin-out creation, researcher mobility, publication etc.
a knowledge transfer office	the department in a PRO responsible for managing the transfer to a commercial environment of knowledge that result from research conducted by that PRO (or possibly at other PROs)
the London Agreement	the London Agreement on the application of Article 65 of the European Patent Convention
a licence	a permission or the grant of a right to use an intellectual property right
metrics	datasets used to measure performance according to pre-defined criteria
mobility	the ability of people to move between employment relationships, both within a field, and between fields
a Member State	a Member State of the European Union
OECD	the Organisation for Economic Cooperation and Development
open access	free access for anyone to scientific or scholarly materials
open source software	Computer software for which the human readable source code is made available on terms that permit the user to modify the software and redistribute it in unmodified or modified form
a peer reviewed publication	a scholarly publication which has been scrutinised by experts in the field
PoC	the proof of concept programme, administered by Scottish Enterprise, which provides pre-commercialisation funding to develop novel products and processes
philanthropic funding	the provision of funding by private individuals or private organisations
prior user rights	the rights of someone who independently develops or uses the subsequently patented invention, in good faith, before the patent's filing date
a PRO	a Public Research Organisation, is used in the same sense as research organisation in the Commission Communication on improving knowledge transfer, i.e. any higher education institution (e.g. a college, university or polytechnic), and any public research organisation, establishment or centre
Professor's privilege	the right of the professor, rather than his institution, to own the intellectual property rights in the results of research
a provisional patent application	an application for patent registration filed without a formal patent claim, abstract or prior art statement, providing the means to establish an early effective filing date for a subsequently filed non-provisional patent application
raw data	unprocessed data generated as a result of research
R&D	research and development
a royalty	a regular payment made to the owner of intellectual property rights in return for a licence
SBIR	Small Business Innovation Research, a program in the United States that encourages small businesses to explore their technological potential and provides the incentive to profit

	from its commercialisation
a seed fund	finance raised at the outset of a new venture to allow for development
small entity	a small business concern, or nonprofit organisation, as defined in the United States Patent Office Manual of Patent Examining Procedure (MPEP), Eighth Edition, August 2001, Latest Revision September 2007
SMART	SMART: SCOTLAND, a Scottish Government funding scheme designed to help small and medium-sized businesses develop new, highly innovative and commercially viable products or processes. The scheme provides individuals and SMEs based in Scotland, or planning to set up in Scotland, with support for technical and commercial feasibility studies lasting between 6 and 18 months. The maximum award is £70,000 representing 75% of the eligible project costs. A research and development grant of 35% of eligible project costs, up to a maximum grant of £600,000, is also available to SMEs to develop a pre-production prototype. Projects must last between 6 - 36 months. Work funded must involve a significant technological advance for the UK industry or sector concerned.
an SME	a small or medium sized enterprise
a spin-out	a new organisation set up by an existing organisation for a specific purpose, in which the creating organisation holds shares
State aid	any form of assistance from a public body, or publicly-funded body, given to undertakings on a discretionary basis, with the potential to distort competition and affect trade between Member States, and fulfilling the conditions of Article 87 (1) of the EC
a structural fund	financial support provided by the European Union main instruments for supporting social and economic restructuring across the European Union
technology transfer	see knowledge sharing
a third country	any country except a Member State
a trade secret	information relating to a commercial activity held in secrecy, including processes, recipes and business information
venture capital	business start up or growth funding provided by an organisations which manages funds on behalf of private individuals or organisations, usually provided in return for shares or debt convertible into shares

Study 2: An evaluation of the effectiveness of different methods of improving access to research results, including a comparative analysis of different models of Knowledge/Technology Transfer Office: European, National, Regional and Private.

Dr. Pierre Brisson

Table of Contents

Definitions

The definitions used in this paper are those used by the Expert Group which reported on Knowledge Sharing in the ERA (April 2008).

1 Executive Summary

Public Research Organisations (PROs) produce knowledge which can be published and acquired by the international scientific community, the first objective of the mission, but which can and should be adapted and potentially adopted by the non academic world.
In Europe the 27 Member States concentrate their research activities in 500 institutions compared to 625 in the United States of America and more than 1500 European Entities are claiming technology transfer activities.

The report will analyse the various methods of accessing the research results produced and the effectiveness of the multiple ways identified and listed.
This accessibility is one of the main challenge knowledge transfer professionals are faced when trying to understand and transfer the results to the industry for example.
Among the different ways listed, dissemination has been analysed in details compared to more traditional activities like Open science exchange of staff, Collaborative & contract research, …

The traditional passive dissemination is today facing lack of pro activity and more active dissemination is the tool that KTOs are today predominantly using;
It is evident that the notion of marketing is slowly entering the academic world and that scientists very often do not really understand the importance of "packaging" the research results to be able to attract interest from the "outside world" i.e. the socio economic world.
Politicians have realised that the huge amount of money invested in public research needs to benefit to the community;
Public research results have always been behind a lot of innovations leading to new products and services but the lack of connection between two different worlds need to be analysed.

Very high public expenditure are producing few visible commercial benefits.
The effectiveness of different methods is then described and improvements are suggested taking into account the specificity of PROs and Member States.
One important aspects highlighted here is the necessity to identify clear KT Metrics which can help the various actors to monitor and benchmark their efforts to first improve the accessibility to research results and second to increase the effective transfer in commercial products and services.

The main part of the report, the chapter 4, is concentrating on the various Knowledge/Technology Transfer Offices models presenting in details the differences in services provided and benchmarking the models at world level.
The number of TTOs in Europe is increasing every year and today more than 1400 TTOs have been identified in the European Union.
Roughly we can say that TTOs employ less than 10 persons on average and offer multiple services and the most frequent type observed is the department type compared to the subsidiary and the independent organisation types.

The European and the US models have been described highlighting the less dependence of the US TTOs vis-à-vis the political aspects.
It has been observed without surprises that the most often provided service is spin-off support and the last frequently supplied service is spin-off financing.
Here again the difference between European and US TTOs demonstrates the strong links with industry and the Venture Capitalists and Business Angels in the US.
However the number of spin-offs per TTO in the US is rather similar to that in the EU.

Finally the chapter 4 is presenting a dream for the TTO where all elements which characterise a TTO are part of the assets of the TTO and where all necessary parameters are taken into account eg the technical knowledge , the marketing expertise, the business development expertise, the critical size linked to the number of scientists, the professionalism of the staff with IPR experts, spin-offs support and licensing experts, communication specialists, strong strategy towards scientists, students but also administrative and technical staff which can be key elements in the knowledge transfer success!

Various annexes will provide information on the ProTon Europe annual survey, Indicator analysis produced by the KT Metrics working group set up by the EC in 2008, various examples of TTOs and as a specific case the example of the technology transfer approach in Germany.

2 Introduction

Industrial competitiveness is today increasingly dependent on the generation, unfortunately not spontaneous, of new **innovative products and services**, many if not the majority, having their origins in the research undertaken by universities and other public and private research organisations.

Innovation knows no boundaries and is not very often the direct result of a very well structured and planned programme of work!

Innovation and invention is overwhelmingly a high income country activity.

Most **innovations** bring small, incremental changes to an existing process or product. Technology evolution is following well known curves called existing technology curve with incremental innovation moving along it, disruptive innovation which moves to a new curve the new technology curve. The interaction which can be not only encouraged but also institutionalised among university or any Public Research Organization, industry and government is one of the main key to innovation and growth in a knowledge-based economy. One of the main **competitive advantage of the University** over other knowledge-producing or source of new knowledge institutions is de facto its **students** who regularly enter the system continuously bring new ideas, concepts, fresh air…*This being in contrast with research & development entities within companies which sometimes forget the time and the evolution of time…*

Today one of the biggest challenge Public Research Organisations have to face is to be able to transfer what has been developed with public money to the socio economic fabric.

Knowledge Transfer Offices are at the heart of the mechanism to fulfil these tasks of providing access to the technological and research results; The fundamental element of the process needs professional staff, strategic guidelines and among others political support!

3 Evaluation of the effectiveness of access to research results

According to ERAWATCH (2008), the **27 Member States of the European Union have an estimated 864 public and 54 private universities (for a total of 918) and 1,850 other tertiary education institutions such as technical colleges**.
Research activities are concentrated in **less than 500** of these institutions, most of which are public universities.
The same report estimates that there are **625 universities in the United States** that perform research and experimental development (R&D).
Knowledge - the triangle of education, research and innovation - has been recognised as one of the priority areas of the renewed Lisbon strategy.

Accessibility to research results *is one of the key challenge to transform ideas into innovations and* ***effective knowledge transfer*** *is the tool which is becoming more and more crucial for turning academic, fundamental, technological and scientific research into innovations that improve the quality of life and enhance industrial competitiveness.*

The research, development and knowledge transfer activities of **Public research organisations (PROs)** and **Private companies** underpin the vitality of our societies and the need has been stressed to improve the commercialization of **research and technology results** from ”public science” institutions such as universities and various government research institutes.
It became along the years very clear that **monitoring knowledge transfer** activities has several purposes including among others helping research institutions to **promote what has been achieved for and through the public good.**
While several university rankings exist, the most famous one being the ***Shanghai Ranking***, they finally, in Europe, mostly rely on so **called academic indicators** such as **publications and numbers of PhDs** and **don’t take into account the transfer of research results to the society.**
Sometimes **Patents** are also taken into account for example in France they are equivalent to one academic publication which has boosted the activity in some PROs.

3.1 The multiple ways and effectiveness to access research results

Accessibility to research results through Knowledge transfer or Knowledge exchange actions takes place in channels of interaction between PROs and other actors. Knowledge, or results of research, can be produced, mediated, reproduced, acquired, and transformed in and between the different forms through various ways:

1- *Interactive learning process*
2- *Open science*
3- *Formal relationships*
4- *Dissemination*
5- *Promotion (Even if it is a bad "word" for academic community, …)*
6- *Marketing*
7- *Customer*
8- *Packaging the "offer"*
9- *Educate researchers, "train the trainer"!*
10- *Mobility, exchange of staff*
11- *Incentives*
12- *Policy at Member State level*
13- *Collaborative research, IPR*
14- *Contract research, IPR, licensing*
15- *Professionalism, …*
16- *Networking*
17- *Spin-Offs*

This understanding is in line with modern views of innovation as mostly **interactive learning processes** where learning includes the generation of new knowledge as well as the integration of knowledge from external sources.
Industrial fabric acquire ***research results*** through mainly, but not only, two pathways: **freely available "open science"** accessed by reading (and hopefully understanding) journal articles, attending academic conferences, or informal contacts between researchers in academia and business, and through **formal relationships** such as contract research, licensing, exchange of staff, associated professors from industry, …
With the exception of citations to scientific articles in patents, the **use of open science by firms to develop innovations rarely leaves a visible trace** that can be readily identified and measured.
But there is an evident **need for "offering" the available research results to the potential "customers" through** the **effectiveness** of different interventions to **enhance research results impact** and of specific factors which may help or hinder their success.
Mechanisms through which they aim to enhance research impact:

• **Dissemination** - provision and re-presentation of research findings, both written and oral, including guidelines;
• **Educational interventions** - increasing knowledge and understanding of research;
• **Social influence** - using the influence of others to inform and persuade, for example opinion leaders;
• **Collaborations** between researchers and users - including the institutional co-location of researchers with practitioners and policy makers, and interventions which enable practitioners to "test out" research findings in local contexts;
• **Incentives** – financial (but not limited to) incentives to change behaviour and research funding practices to encourage impact activities;
• **Reinforcement** of behaviour, such as through audit and feedback and reminders;
• **Facilitation** - interventions which provide practical, technical and financial assistance to support research-based change;
• **Multifaceted interventions** deploying two or more of the above practices.

We will **concentrate here on dissemination** because the other mechanisms are either policy oriented eg "Educational Interventions", "Social Influence" where there is a fundamental responsibility of the Member State to develop ways of presenting why research is important for the society, eg "Collaborations", "Facilitation", "Reinforcement of behaviour" where the need for increasing

collaborative research will be analysed later, eg “Incentives” which is a fundamental tool in TTOs strategy.

3.1.1 Dissemination

Dissemination is the circulation and/or re-presentation of **research results** or research findings, orally or in a written format. It involves the provision of information on research, in more or less tailored form, and includes guidelines and guidance.

3.1.1.1 Evidence of effectiveness

Definition:
« Adequate to accomplish a purpose;
Producing the intended or expected result… »

Two forms of research dissemination:

A- Passive dissemination: unplanned, untargeted, ad hoc forms of communication, such as publication in academic journals;
No evidence as to the effectiveness (or “real” effectiveness) of passive dissemination of research.

1- lack of access to research findings, including poor or distant library facilities and limited circulation within organisations;
2- lack of time to access or read research;
3- lack of skills to interpret research findings;
4- sheer volume of research literature;
5- scope and presentation of findings not being "user-friendly".

Potential “customers/users”, and in that sense they act as **“real customer”**, want findings to be provided in clear, jargon-free language, in summary form, and drawing out the key implications for users, potential or simple “receivers” who want to know what is produced without automatically any idea about the use, appropriation, adaptation, adoption of the research results in new products or services.

B- Active dissemination: tailoring research findings to a target audience and a dynamic flow of information from the source.
It is important to ***“translate” research into formats tailored to potential consumers***, the provision of consensus recommendations could bring about a change in attitudes. However, simply presenting findings in different formats appears unlikely to change behaviour!
For example systematic reviews from healthcare give robust evidence that the provision alone of consensus recommendations, educational materials and guidelines is usually insufficient to change practice. Guidelines were found to **effect practice change only when supported by active implementation strategies, specifically reminders, incentives, peer review, marketing and educational interventions.**

Marketing is also very new in the academic community, but more important should be what does it mean exactly to “market” a research result?
The problem is not only to **“package”** something which could be marketed but also to train, not to “teach”, researchers on how to present what they produced if they want, accept, it to be “offered” to other communities!

The **mass media** can also be used to disseminate research, through television, newspapers, magazines (publishing and reading through scientific and popular media), internet, radio and video, ***this new way of disseminating research is seen today as the most powerful in potential returns.***
Other channels to access research results may include movement of people (recruitment, temporary secondment, **double positions in industry and PROs**, student placement, etc.), and sharing of facilities.
It is also customary to distinguish between ***informal*** **channels**, such as networking, access to publications, and recruitment of personnel, and *formal* channels (involving a contract between the

PRO and the firm), such as secondment, paid projects (collaborative research, contract research, consulting, etc.), licensing, and ventures (spin-offs).
Most PROS through their own Technology/Knowledge Transfer Offices (TTOs) provide a range of services and can provide reasonably good quality data on public science discoveries that might have commercial potential (**through counts of invention disclosures and patents**) and on the actual use of public science outputs by commercial firms, either through licensing or the establishment of spin-offs.

A typical (but not exhaustive) **classification** of **various channels** listed below, named after activities or ***mechanisms* of knowledge transfer** is of particular interest because it stems from a recent consensus exercise between universities, funding agencies and the business community on the development of metrics for knowledge transfer, commissioned by **UNICO** in the UK (Holi et al., 2008) and looks completely coherent with the various ways identified above:

- *Promotion*
- *Networks*
- *Continuing professional development*
- *Consultancy*
- *Collaborative research*
- *Contract research*
- *Licensing*
- *Spin-outs*
- *Teaching*
- *Other measures*

It seems today that the benchmarking of "innovation-related activities", especially if conducted on the basis of **comparable metrics across the EU**, would without any doubt, allow research institutions to compare their own achievements at World, European as well as national level without forgetting the regional level…
It exists within Europe however a perception that Europe as a whole has failed to benefit from its very substantial investments in public research, in contrast for example to the ***US experience, where university research results are typically and unanimously believed to lie behind the creation of several globally competitive firms and blockbuster products ranging from pharmaceuticals to computer hardware and software***.

3.2 Effectiveness, evidence and suggestions for improvements

Very high public expenditure on research with apparently **few visible commercial benefits** is very often the poor image which is conveyed when talking about "concrete results" or as Ch. de Gaulle, former French president, was saying when he was talking about research in France "*I don't want only researchers I want people, of course if they are researchers I would be more than happy …, who find something*, …".

If we look carefully to the facts, one of the explanation for this poor performance was the **failure of public science institutes in Europe** to actively commercialize their discoveries.
The identified or potentially identified causes of this failure have been linked to a wide range of factors, including a **lack of entrepreneurial spirit among scientists**!
Did it really change today in 2009…, barriers to the ability of public **sector scientists to move to the private sector on a temporary basis** to be able to develop their discoveries, did it change drastically today …, and to poor intellectual property rights for university inventions (Claimed or not claimed…).
Efforts to enable public research institutions to develop more effective links with industry, in particular SMEs, have been at the core of Member States and community cooperation activities to **implement the famous 3% R&D target** of the EU's Growth and Jobs strategy.

These co-operation activities will continue and results should feed into Member States action to **improve Knowledge Transfer/Exchange, and research institutions - industry links.**
Formal **contractual relationships between firms and public science** leave visible traces such as licensing or contract agreements that are more easily measured than open science.

These traces are also directly relevant to current policies to encourage academic entrepreneurship and to **permit public science institutes to obtain intellectual property rights (IPR) for discoveries with commercial potential.**

Another advantage is that indicators for the commercial potential of public science discoveries (invention disclosures and patenting), plus indicators for the use of public science outputs by firms (licensing, start-up establishments), can be obtained from a comparatively small number of technology transfer offices (TTOs) that serve public science institutions, rather than needing to survey a large number of firms about their use of the results of public science.

If we want to **perform an evaluation of the effectiveness of different methods of improving access to research results** we need to identify the factors which contribute to the efficiency of technology transfer institutions and how can we identify strategies to improve the quality of TTOs.
As mentioned before they are instruments to improve industry-science interaction and to stimulate innovation.
In order to meet this objective, they usually have to fulfil two functions.

First, they have to **support their respective university (PRO)** in identifying the research capacity and the accessibility to the research results, intellectual property, stimulating invention disclosures, helping in filing for patents and the commercial assessment of inventions. Also the support provided to university personnel in the course of the formation of spin-off companies or the management of research contracts is part of these more inward-oriented activities.

The second, **outward oriented function requires marketing the intellectual property of the PRO to industry**. They need to establish good contacts with the business community, continuously assess the needs of enterprises and of the socio-economic fabric, facilitate co-operation between enterprises and researchers and communicate the availability of technology and research capacities (research results).
Their business oriented services include licensing agreements, liaison for and management of research contracts.

Apart from the particularities and complexities of commercialising technology and the demands of highly specialised services such as licensing and patenting, the tasks of a TTO do not fundamentally differ from those of marketing firms or departments in the private sector or non-profit organisations!
The higher age of a TTO certainly indicates a history of at least moderately successful activity and survival. Also **trust** and **visibility**, which are important success factors and which need time to develop, correlate with age.

As illustrated by the example of **Stanford**, which is one of the **most successful TTO in terms of licensing income**, it took a long time to build up a large portfolio of patents and generate high yearly licence revenues.
The success is also related to the **accumulation of knowledge**, some of it tacit, and the development of a **social network.**
A recent survey in Ireland showed that 50 % of researchers within the universities were not at all (23 %) or only “hardly” (27 %) aware of the TTOs at their PRO!
Other research has pointed out that too much time is spent in identification and support of invention disclosures.

Recent studies in the **UK** differentiate “research consultancy” as a specific service which can also be used to establish more substantial co-operations with enterprises and may be a comparatively inexpensive opportunity for SMEs to establish contacts with PROs.
One factor frequently mentioned by experts as regards efficiency and performance of TTO is **professionalism** i.e. the quality of services building on the expertise of personnel and on its management.

Technology transfer services to be effective **(Effectiveness)** require a bundle of technical, legal and business administration skills including for instance:

- **technical knowledge and understanding** in order to facilitate communication with the researchers *(You access research results if you can understand it, …);*
- **marketing expertise** and a good understanding of the innovation process at enterprises;
- **expertise in invention disclosure, patenting, licensing, the establishment of spin-offs, the financing of spin-offs, and/or the management of research contracts;**
- **business development expertise** in order to support the creation of spin-offs and a more efficient approach to collaboration with industry.

Another tool which could improve the effectiveness is the **Proof of Concept funds** which has been identified as the **missing link** in the technology transfer process.
This new form of public investment allows researchers and Technology Transfer intermediaries to validate commercial viability of project.
It also allows to investigate the best route to market for a new technology development or idea at this very critical stage in the transfer process where no private funding is still available.
In **Belgium** for example a scheme based on **vouchers up to 5KEuro** has been put in place where SMEs can initiate collaborative research with PROs and only pay 20% of the total vouchers, the other 80% being paid directly by the Regional (or national) Fund to the University.
This has an enormous success allowing SMEs to really be in touch with public research and initiating new relationships.
Technology transfer also requires excellent communication skills and social abilities to establish and maintain networks.

Individuals and especially researchers will seldom have the necessary combination of skills and frequently lack the communication and business administration skills.

Thus, **strategies for a division of labour**, either by employing specialised personnel or outsourcing certain tasks, must be employed to improve the **effectiveness** of access and transfer of research results.
They will depend on the particular **combination** of services, the size of the institution and the availability of personnel.

A proper division of labour is easier to achieve if the TTO reaches a **critical size**, which allows the employment of specialists for various tasks.
Of course, this also requires a critical mass in terms of technologies to be transferred and in terms of demand.
The **critical mass argument** suggests that independent TTOs which serve a number of PROs may have an advantage.

Networking of TTOs (PROs) may also lead to a structure where department-type TTOs at various research organisations delegate certain tasks to an independent and highly specialised TTO. However independent TTOs tend to have the disadvantage of less intensive relations with the researchers at different PROs.
Today, technology transfer personnel is **mostly trained "on the job"**, some training being provided by professional networks of technology transfer managers or institutions such as the AUTM in the US or EARMA, TII, ProTon Europe, ASTP and similar organisations in Europe.

3.3 Effectiveness through KT Metrics

All existing surveys, up to now, have been collecting data on **research expenditures** and on **three output indicators** for **the commercial potential** of public science discoveries (*invention disclosures, patent applications and patent grants*) and on three indicators for the **use of public science by firms** (*licenses executed, start-ups established, and gross license revenue*).
The **United States** has an estimated **2,500 universities**, but many are liberal arts colleges that are unlikely to develop patentable discoveries.

The US based "Association of University Technology Managers (AUTM)" has surveyed **American universities, hospitals & research institutes on their formal knowledge transfer activities** and published annual data for fiscal years (FY) 1992 to 2006 inclusive.

*Two separate surveys by **ASTP and ProTon** Europe have collected data from multiple European countries*.

For example, the ASTP FY 2007 survey obtained responses from public research organisations in 22 European countries, while the ProTon Europe FY 2006 survey covered four countries extensively through collaboration with national networks and also obtained responses from PROs in several other European countries.

One of the best way to quantify the effectiveness of ways to access research results is to measure through dedicated indicators the "performance" of TTOs!
The Expert Group (*EC KT Metrics working Group, 2008*) proposed **seven (6+1) core performance indicators:**

- **One** indicator for the number of **research agreements** between PROs and firms (or other private and public sector users of research, but not counting contracts only with funding bodies that do not use the results themselves!);
- **Three input** (or leading) indicators for the potential commercialisation of public science: *invention disclosures, patent applications, and patent grants;*
- **Three output** indicators for the actual use of public science discoveries by the business sector: *licenses executed, spin-offs established, and license revenue earned.*

Their main function is clearly to identify the **production of knowledge** with potential commercial value and to assist analysis of the **factors that increase the efficiency** with which public institutions (through their affiliated TTOs) transfer knowledge to the business sector. For example, the **percentage of patents that have been licensed** is an indicator of efficiency.
The three output indicators are more valuable for policy because they are closer to **measuring the commercialisation of public science results**.

A comparison of national performance on these three indicators is consequently of greater interest than a comparison of performance on patent applications or patent grants.
In countries such as **Italy where patent rights are held by the inventor (with some exceptions)**, the TTO may not be aware of all patents linked to a university invention.
Furthermore, as European TTOs develop expertise over the time, the share of university patenting that they are aware of is likely to increase.

4 Knowledge/Technology Transfer Offices (KTOs/TTOs): A comparative analysis of different models

This chapter will give a picture of the TTOs (*we'll use in this chapter the acronym TTO because the vast majority of TTOs, a reality with different models & specificities according to individual Member States in Europe don't yet call themselves KTOs…)* in Europe at national, regional and private level when it was possible to access reliable data but also outside Europe as a comparison for example in US, Canada, …

4.1 Number of TTOs, size and TTO's "intensity" in the EU

4.1.1 Number of TTOs in the EU

1,596 European institutions were identified in Europe as claiming Technology Transfer Activities of which **1,400 qualified as TTOs**.
The remaining institutions are contract research organisations (CROs) which had either no separate *transfer organisation* or provided only services such as information brokering or consulting.
Some institutions such as science parks or business incubators fall into a *grey* area, as they may offer transfer services but only occasionally.

Even though some institutions may have been omitted and the coverage in some countries may be lower than in others, we can say that the identified 1,400 institutions cover the majority (more than 90%) of TTOs in the EU.

*Number of TTOs in some EU Member States (*ITTE-Survey 2003)

BE	DK	DE	EL	ES	FR	IE	IT	LU	NL	AT	PT	FI	SW	UK
17	25	334	22	165	209	26	93	7	20	31	20	27	58	165

4.1.2 Size of TTOs in Europe and outside of Europe

TTO, on average, employ 10 persons (in full time equivalents or FTE), which shows that a few large TTOs are responsible for the higher average and that 50 % employ 6 or fewer persons.
Subsidiary-type (Definitions will be given later) tend to be considerably larger than other types, with an average employment of 16 and *Department type* are slightly smaller.
European TTOs are on average and in terms of persons engaged per TTO larger than US (department-type) TTOs, which on average employ fewer than 7 FTE!

The difference in size between EU and US may be attributable in part to the fact that US PROs tend to employ two kinds of institutions i.e. for the management of the Intellectual Property and an ILO (industrial liaison office) for the management of collaborative research.
However, this is also true for several European PROs.
Given the higher R&D expenditure in the US, one could conjecture that European TTOs provide a broader spectrum of services than their US counterparts.

4.1.3 TTO's Intensity in the EU

For an evaluation of their "intensity", TTOs have been related to the number of PROs per country, indicating that PROs incorporated technology transfer as part of their mission creating specialised institutions to perform this function in a systematic and continuous fashion.

The average ratio observed of *0.5-0.6* suggests that many European PROs have not established a systematic and identifiable transfer function.
While in the UK, France, Spain, Ireland and Denmark, TTO "intensity" exceeds *0.7-0.8*, indicating a good if not complete coverage, the ratios for Italy, Portugal, the Netherlands, Finland, Germany and Belgium are below the EU average.
In exceptional cases, non institutionalised transfer activities may substitute for TTOs, reflecting a lesser concern for technology transfer and the commercialisation of intellectual property.
Ireland, Spain, Greece and Portugal have an above average number of TTOs relative to their R&D expenditure.
In the case of a weak R&D base, high TTO "intensity" may suggest an over-investment in transfer institutions.
Experts from most EU countries do not perceive the number of TTOs in their country as too low or problematic for the technology transfer process, even if there is indication that in some Member States the transfer function is less "institutionalized".
The situation in the "new Member States" is different with a number of TTOs as too low in relation to industry demand where general R&D levels are low and where few patents are filed by PROs.

4.2 The European and US Models of TTOs

The policy framework and support programs are the **most important external factors** which stimulate (or force) PROs to engage in technology transfer and to establish technology transfer offices.
Two basic models for the establishment process of TTOs reflect traditional perceptions and highlight a possible European preoccupation with institution building as compared to a more output oriented US approach.

It is however important to note that **both models have been employed on both sides of the Atlantic** with significant variations in their implementation.
It is also important to note that there is **no real opposition** between the two models but it is evident that in Europe there is a tendency to use the so called European Model up to now.

• **The "US model"** follows a more *bottom-up approach*.
Policy focus is on creating requirements and incentives for PROs which stimulate them to intensify their commercialization efforts. PROs are **completely free** to choose the form, strategies and also the types of TTOs they view as most appropriate under prevailing circumstances; **US universities, traditionally and historically**, have closer relations to industry than their European counterparts, and a larger share of their funding comes from private sources.

• The "European model" is more *top-down approach*.
Governments may have a tendency, fortunately not systematically to involve themselves directly in the establishment either by financing and/or legislating of particular types of TTOs.
The form of incentives for PROs to engage in technology transfer affects not only the likelihood and efficiency of technology transfers but also its orientation and the channels used for this purpose.

4.3 The common Types of TTOs

4.3.1 The Department type

In Europe and the US alike, **the most frequent type** of TTO is the **department type**.
53 % of the 714 European institutions for which such information was available belong to this group.
A department TTO designates organisational units or specialised departments which are **organisationally and legally part of the PRO** and have no or little institutional autonomy, good overview of the actual R&D capacities and results.
They can be established fairly easily and at a low cost. On the other hand they are **less outward oriented** and their transfer function may sometimes be adversely affected by other tasks.
Their lower level of "institutionalisation" may reflect a lesser commitment towards technology transfer by the PRO.

4.3.2 The Subsidiary type

The least frequent type of TTO are the **Subsidiaries**, **wholly owned by one PRO**, accounted for 14% of all TTOs and enjoy greater institutional independence.
In this case the University decided, very often for administrative reasons, to set up a "daughter" entity, with a private status (SA or SARL in France), managing the financial and administrative parts of **all industrial contracts** and **relations** of the university.
The objective is to use private practices to speed up the various processes of invoicing, reporting, consultancy, etc, …
The subsidiaries (eg daughter companies) report to the PRO and transfer after invoicing the pre identified part of the contract eg on 100 Euros invoiced to the industrial contractor between 10-20% margin is kept by the daughter company, then 90-80% is invoiced by the PRO covering ALL the dedicated human resources (man.months) to perform the contract plus all the expenses associated to the contract concerning materials, equipments, external expertise, …

4.3.3 The Independent Organisation type

Independent organisations accounted for 33 % of the surveyed TTOs. They are frequently established on a policy initiative and tend to manage technology transfer **for more than one PRO**.
Co-operative or collaborative research institutions, usually set up subsidiary or independent TTO in a joint effort by universities, a particular industry or trade, and public authorities.
They are frequently targeted at SMEs and do not usually have a separate transfer function as their transfer services are closely interwoven with their research activities.
There is a stronger presence of independent TTOs in the new Member States, favouring the establishment of independent TTOs for the support of several PROs with weak R&D base.

4.4 Services provided by TTOs

Across all 3 identified types of TTOs, 4 clusters have been characterised by particular service combinations:

• The **first cluster** called **contract research provider** offer contract research support, patenting and/or licensing services but very seldom spin-off support or financing to spin-offs;
• The **second cluster** called **Specialist** is concentrating on one or two services, usually patenting, licensing, or spin-off support. They seldom engage in contract research;
• The **third cluster** which regularly combines contract research and spin-off support and only rarely provides other services;
• The **fourth cluster** and last group can be named **full service providers** as they **combine** patenting, licensing, spin-off support and financing and contract research activities.

Full service and contract research providers are the prevalent clusters.

Among subsidiary-type TTOs, "specialists" are more frequent; fewer subsidiaries combine contract research and spin-off support. Independent TTOs frequently belong to the full service, contract research/spin off, or the contract research provider clusters, which together amount to almost 50 % of independent TTOs.

Independent TTOs (to some degree also subsidiary-type TTOs) are seemingly better suited than department-type TTOs for the provision of specialised services.

As a rule, each University has its own budgets for all services needed.

For several sectors, e.g. services for inventors, patenting and for consultancy on licensing there have been (from about 2002 on) and there are still limited funds for the Universities from State Ministries of Education, State Ministries of Economics and the Federal Ministry of Economics and Technology.

The most often provided service is spin-off support, closely followed by liaison for contract research.
In the EU, spin-off support, contract research, patenting and licensing are each offered by 54 to 63 % of TTOs.
The by far **least frequently supplied service is spin-off financing**.
A comparison with the **new Member States** suggests that licensing, patenting and collaborative research are offered much less frequently (between 19 and 32 % of TTOs) in these countries while spin-off support is offered by a slightly higher percentage (68 %) of TTOs. **This could be interpreted as a stronger focus on start-ups because of a weaker industrial environment, especially as regards (high) technology based enterprises.**

TTOs frequently provide also other services for example the **Chalmers School of Entrepreneurship in Gothenburg, Sweden**, which has been successful in the creation of spin-offs, possibly because of the unique approach to combine spin-off support with entrepreneurship training.

Specialisation of TTOs into different fields of science reflects the scientific orientation and capacity of the respective PROs.
Overall, about 80 % of TTOs specialise in particular areas of science, but only one third of independent-type TTOs.

4.5 A need for simplification

The diversity of European TTOs is sometimes confusing, reducing transparency, adding confusion and complicating the access of enterprises to PROs' research results and capacities and frustrating them.
Even centrally designed structures such as those in France, which may have the advantage of uniformity, cannot guarantee transparency; furthermore, uniform solutions will not always correspond to the locally (region) available research capacities or industry demand, which might be better served by tailor-made offices.

The concentration on particular forms of TTOs may be also an inappropriate approach to improve technology transfer, while they are instrumental for better cooperation between industry and science, policy intervention which determines the **"when, how and in which form" seems not very productive**.

Subsidiarity would suggest that such choices be made at the local level, by the PRO or, in case of regional actions relating to more than one PRO, by the group of stakeholders concerned.
In order to secure the engagement of PROs in technology transfer and to provide them with the necessary support, appropriate policies and incentive structures must be in place that clearly signal the need for technology transfer.

4.6 The role of support programmes

Incentives or stimuli for PROs to engage in technology transfer can take various forms such as legal requirements of commercialisation, financial support of transfer activities, or direct financial contributions to the establishment of certain types of TTOs.
Intensive interaction with industry brings also its own benefits such as additional revenues, exchange of experiences, access to laboratories, increased possibilities for students and graduates to find jobs, etc.

However, these benefits are frequently insufficient to overcome barriers such as
bureaucratic procedures in the administration of additional funds, or the **inertia** of **researchers** who may have limited incentives and motivation to engage in industry co-operation.
Public financial support to transfer activities and awards of research grants can be an important motivator for PROs to engage in technology transfer, especially if they are granted on the basis of proposals containing credible strategies or the success of existing strategies.
Rewarding the successful PROs would in addition stimulate more competition between PROs for such funds.
The competitive nature of the funding that is made available under **HEIF (Higher Education Innovation Fund)** and similar funds in UK is driving the quality upwards consequently only the better TTOs receive funds, and only the best survive.

Performance indicators related to science areas indicate that TTOs **specialised in medical sciences or natural science perform better** in regard to licensing, patenting and spin-off formation, while the ones which are not specialised and those which are specialised in natural science perform best in collaborative research, followed by those focused on engineering and natural sciences…

4.7 The need for monitoring

As a way of permitting a periodic appraisal and adjustment of such policies, it is vital to provide for their appropriate **monitoring**.
Regular reporting on KT would also allow a better analysis of transfer activities and raise the awareness of PROs on transfer issues.
In 2000, the US legislature passed the **Technology Transfer Commercialization Act**, which requires **regular reporting** on the implementation of the Bayh-Dole Act and the Stevenson-Wydler Technology Innovation Act (both 1980).

The reporting concentrates on patenting and licensing activities, but also refers to cooperative research and to transfer strategies and institutions employed at the respective PROs.
Another example of regular reporting is the "higher education-business interaction survey" in the UK. The survey takes a wider approach and provides a wealth of information.
It is a good practice which could be adapted and used as a basis for the establishment of a mutually agreed set of questions and monitoring in the EU Member States, which would facilitate cross country comparisons and the exchange of experiences.
In 2002, the average revenue per European TTO amounted to less than a quarter of the revenues in the US!
Average revenue in Europe amounted to about Euro 4.7 million, which compares to about Euro 20 million in the US.

This is partly due to a fundamental difference in total research expenditure between the US and Europe. The **underperformance** in transfer activities however also has an impact on the availability of research funds, as successful transfers generate additional research funds.
It could be argued in particular that the lower licence revenues of European TTOs have to be put in perspective with a longer tradition of licensing in the US, as the development of patent portfolios and of licences which generate high revenues requires a very long time on average.
However, the difference in TTO revenues between Europe and the US extends beyond lower licence income in Europe and is evident also in contract research and other areas.
The average number of active licensing contracts amounted to about 120 in the US, while in Europe it had on average only 17 active contracts.
The number of spin-offs per TTO in the US is rather similar to that in the EU.

Although more spin-offs per TTO or per university were created in the US, the number of spin-offs relative to R&D expenditure is more favourable in Europe.
In the comparison of 164 UK universities and 142 US universities mentioned above, the difference is even larger as **industrial research funding** in the UK only amounts to less than 12 % and licence income to less than 5 % of the respective US values!
On average, European TTOs had 83 clients, 50% had fewer than 21 clients, 61% SMEs.
The low number, especially if compared to their average size, indicates that they are not very outward oriented nor particularly successful in their marketing and communication strategies.

There is a potential and natural conflict between academic achievement criteria and commercialisation activities. The **majority of researchers perceive academic publications as the most important measure of success**, while only a minority see commercialisation as important. Financial incentives are seemingly not sufficient to guarantee researchers' motivation, but need to be accompanied by other incentives such as professional recognition, career advancement, or benefits in the form of extended infrastructure or personnel for further research.
There is however evidence that financial incentives must also be improved, by guaranteeing researchers a (larger) share of licence fees or by preferential tax treatment of such income.

Although different types of TTOs may require different strategies, low visibility to industry reflects insufficient outward-orientation and failed communication strategies. The small average number of clients per TTO reflects weaknesses in marketing.
Lack of transparency in supply structures, the great variety of TTOs, or a diffuse organisational set-up, which makes it difficult to recognize the transfer institution as part of the PRO add to the lack of visibility.

4.8 The "Dream" for TTO

All the TTOs which have been analysed in Europe, and outside Europe, try to propose not only the maximum of support to their researchers but also to promote their KTO's potentialities to the "outside" world (i.e. the "non academic world").
The ideal TTO could be described as follows and it would constitute the "Dream" of TTOs!

A- Basic Parameters

Innovation knows no boundaries and is not very often the direct result of a very well structured and planned programme of work, or everybody would be able to innovate!
Technology transfer & exchange is all technology related interaction that aims at making available the product of R&D and other creative activity (in this case from public sector) in new commercial and non-commercial applications and/or in new markets.

The "Dream's TTO" needs:

A- **Technical knowledge (**Of course, this also requires a critical mass in terms of technologies to be transferred and in terms of demand) **and understanding** in order to facilitate communication and intensive relations with the researchers/scientists with 8 professional staff;

B- **Marketing expertise** and a good understanding of the innovation process at enterprises & **commercialisation** with 3 staff coming from industry (10 years experience);
C- **Expertise in invention disclosure, patenting, licensing, negotiation, the establishment of spin-offs, the financing of spin-offs, and/or the management of research contracts with 3 staff (10 years experience);**
D- **Business development expertise** in order to support the creation of spin-offs and a more efficient approach to collaboration with industry with 4 staff (preferably former Start-Up & Spin-Off creators).
E- **Management** with 3 staff (Director with 10-15 years experience minimum, assistant coming from competitive environment and a communication officer);
F- **In total a critical size** of a minimum of 21 staff , specialised personnel (We assume an average size of 10 000 students in the PRO, if more than 10 000 students the number of staff would increase accordingly) with a strategy for a division of labour, either by outsourcing certain tasks to improve the effectiveness of access and transfer of research results.
G- **A number of active licensing** contracts amounting to about 120.
H- The number of **spin-offs created** around 20 per year;
I- A **revenue** above 20 million Euros per year;
j- At least **150 clients**;
K- Strong **communication** strategy;
L- Serve **different PROs;**
M- **Subsidiary** type!

B- Awareness

Awareness, which is critical, concerns on the one hand technology transfer & exchange in general, and on the other hand the visibility of technology transfer "institutions" for the personnel which is an important requirement to ensure operational efficiency.
Nothing can be done without a strong appropriation by the PRO's scientists & researchers of the function of transferring knowledge!
As far as end-users are concerned, successful knowledge and technology transfer depends on the ease of access, visibility and efficiency of the system used!

C- The students!

One of the main **competitive advantage of the University** over any other knowledge-producing or source of new knowledge institutions is de facto its students who regularly enter the system continuously bring new ideas, concepts, fresh air…
The TTO must develop a strategy dedicated to students through Knowledge Transfer seminars, dedicated courses, entrepreneurship sessions, IPR formation and special IPR conditions for students.

D- Career recognition & Incentives

Europe is changing too, researchers in universities find it sometimes difficult to combine the three fundamental functions of teaching, research and technology transfer.
There is a potential and natural conflict between academic achievement criteria and commercialisation activities and a lack of entrepreneurial spirit among researchers,
And students, …
Financial incentives are seemingly not sufficient to guarantee researchers' motivation, but need to be accompanied by other incentives such as professional recognition, career advancement, or benefits in the form of extended infrastructure or personnel for further research.

E- Research results accessibility

The main criteria for success in potentially transferring or exchanging knowledge or technology is the availability of high-quality research results or technologies!
Potential "customers/users", and in that sense they act as "real customer", want findings to be provided in clear, jargon-free language, in summary form, and drawing out the key implications for

users, potential or simple “receivers” who want to know what is produced without automatically any idea about the use, appropriation, adaptation, adoption of the research results in new products or services.
However, these benefits are frequently insufficient to overcome barriers such as
bureaucratic procedures in the administration of additional funds, or the inertia of researchers who may have limited incentives and motivation to engage in industry co-operation.

F- Activities to be performed

To provide a range of services and good quality data on public science discoveries that might have commercial potential and on the actual use of public science outputs by commercial firms, either through licensing or the establishment of spin-offs.
To have a permanent good overview of the actual R&D capacities and results with
contract research providers;
Full service providers combining patenting, licensing, spin-off and contract research activities.
Mentoring and guidance of inventors, acquisition of third-party-funds for R&D, licensing, services for spin-offs and/or start-ups, etc, ...
Seed money to support ideas of transfer, concept of new products/services, pre-prototyping, pre-marketing study, patent analysis, travels, customers identification, bibliography, expert advices, pre-business studies, under the entire responsibility of the TTO Manager!!
Spin-off financing through seed capital fund, 2nd round table, 3rd round table Capital Funding, …
Other activities to be performed:

- *Promotion*
- *Networks*
- *Continuing professional development*
- *Consultancy*
- *Collaborative research*
- *Contract research*
- *Licensing*
- *Spin-outs*
- *Incubator facilities*
- *Teaching*
- *Other measures*

G- Additional Funds

It has also been demonstrated that **Proof of Concept funds are** the **missing link** in the technology transfer process.
HEIF (Higher Education Innovation Fund) and similar UK funds is driving the quality upwards consequently only the better TTOs receive funds, and only the best survive.

H- Monitoring

Regular reporting allows a better analysis of transfer activities and raise the awareness of PROs on transfer issues; Indicators and methodologies of relevance to the commercialisation of research or technological developments and results which support the research range from very simple citations to the scientific literature to business patents demonstrating huge economic impact in terms of cash flow, turn-over, job creation or job maintenance.
Formal under contractual relationships between firms and public science leave visible traces such as licensing or contract agreements that are more easily measured than open science.

4.9 The Technology/Knowledge Transfer Offices “reality”

TTOs in general do not handle the full range of formal technology transfer activities.
66% offered spin-off assistance, 60% handled contract research, and only 50% handled patenting and licensing.
Slightly less than one-third of TTOs in Europe also manage seed capital funds and incubator facilities.

Furthermore, many TTOs might not handle all of the patenting activities of their affiliated universities, particularly when the inventor owns the right to the intellectual property, as in Italy (Lissoni et al., 2008), or when the filing is left to collaborating firms. And some PROs don't have specialised TTOs because they were designed to be interfaces between universities and industry in the first place, focusing on applied research projects.

Another problem occurring in some countries more frequently than in others arises when legally separate institutions, which can be private entities acting as subsidiarities of PROs, are constructed which in fact are managed by the same people and located in the same place (For example in France Ecole des Mines, UTC Compiègne, INSA, etc, …, have created **subsidiarity entities "fully or 66% owned" by Grandes Ecoles or University** eg ARMINES, UTeam, INSAVALOR, …).

In the last decade, policies concentrated on start-ups support and attempts to create industry or technology clusters (technology/science parks, incubators etc.).
For example in Estonia the number of TTOs is still not sufficient today, in addition to structures inherent at R&D institutions and universities there are today one technology park, one science and one biotechnology park in Estonia, plus five business incubators, some of which are incorporated in the aforementioned parks.
There is a great variety of TTOs in the Member States as the result of policies which support their establishment aiming to increase the transfer activities of PROs, to improve the regional coverage of innovation support services, to address the needs of particular target groups such as SMEs or to provide a particular service such as patenting support.

PROs tend to be more competitive and industry contacts are a defining factor for their attractiveness for students and researchers. Although the situation in Europe is changing too, researchers in universities find it sometimes difficult to combine the three fundamental functions of teaching, research and technology transfer.
This cannot be resolved by just the establishment of a TTO as the success will always and mainly depend on the engagement of researchers at the PRO.

On the other hand, the diversity also reflects the capacities and motives of the different stakeholders (PROs, industry, consulting firms and public authorities) and differing degrees of commitment to technology transfer.
Although few data are available which would allow a deeper analysis, evidence suggests that differences between the institutional settings of PROs explain the different approaches to technology transfer.

Today and for a couple of years a number of surveys are currently carried out in Europe regarding mainly **KT activities** of PROs, whether at a regional, national level or by European Technology Transfer associations such as the very professional **ProTon Europe** (Annex 1) and **ASTP.**
It should be noted however that these surveys usually did not, up to now, but thanks to EC initiative in launching the KT Metrics working Group, it looks possible to combine a set of indicators which could be accepted by at least ProTon and ASTP during their annual surveys, rely on the same set of **indicators, methodologies and definitions**, which makes it some times difficult to compare or combine their results in order to obtain a Europe-wide overview, if possible, of knowledge transfer activity.
Potential indicators of relevance to the commercialisation of research or technological developments and results which in many case support the research by public science institutions range from very simple citations to the scientific literature to business patents demonstrating huge economic impact in terms of cash flow, turn-over, job creation or job maintenance.
Economic impact indicators could be seen as one of the most useful of all measures, but they are very difficult to obtain, difficult to assess and again very often suffer from long lag times between public investment and outcomes.

The **optimal indicators** which could be of value for example to policy makers must be capable of measuring the commercial potential of public science and technology results or, preferably, the current use of the **outputs (research results) of public science and technology** by industry or services sectors.

The ITTE study identified close to 1,400 technology transfer offices in Europe, which probably gives a maximum estimate of the number of TTOs that would need to be surveyed to capture the knowledge transfer activities of universities, other higher education institutions, research hospitals, and other public research organisations.
Another measure of US success in commercializing public science is the substantial licensing income that universities such as Stanford, Columbia, MIT and the University of Florida have earned from patenting their inventions.

5 Conclusion

One **particular success factor** for the Technology Transfer Organisations (TTOs) is the **awareness of researchers** at the PRO.
Awareness, which is critical, concerns on the one hand Knowledge/technology transfer/Exchange in general, and on the other hand the **visibility** of technology transfer "institutions" for the personnel which is an important requirement to ensure operational efficiency.

The **single most important condition** for successful technology transfer is the **availability of high-quality research results or technologies**, first to be accessed, and easily accessed, then potentially to be transferred, by adapting and adopting its main characteristics in a new environment i.e. products, methodologies, services, systems, …

The potential of a PRO can however be fully exploited only if researchers are conscious of potentiality of **commercialisation** of what they have been developing to support their research as technological advances or innovations or the result of their research itself!
It is easily understandable it is a world in itself requiring experts to perform the right tasks associated with a successful commercialisation of a technology, methodology, product based on "research performed in the PRO" .

They must also have sufficient incentives, clearly promoted in the PRO, to engage in ***commercialisation and industry co-operation***, and thus actively disclose inventions, contribute to the patenting process, and engage in contract research at collaborative or under contractual level.
Lack of transparency in supply structures associated with the great variety of TTOs or a diffuse organisational set-up, which makes it difficult to recognize the transfer "institution" as part of the PRO unfortunately add to the lack of visibility.

Marketing requires as an evidence a proper understanding of the market, an appropriate portfolio of services, and an adequate pricing and **communication** strategy.
TTOs face similar challenges as enterprises and de facto should employ similar instruments, even though their main objective is to **achieve the maximum of technology transfer/exchange and not automatically to maximize economic returns!**

As far as end-users are concerned, successful knowledge and technology transfer/exchange depends less on the particular type *of TTO than on the ease of access, visibility and efficiency of the system used.*

6 Annex 1: The ProTon Survey

Introduction

Since 2003 Proton Europe has been running a survey about the activities of Technology/Knowledge Transfer Offices (TTOs or KTOs) in European universities and other public research institutions. This is therefore the fourth consecutive report and it refers to Fiscal Year (FY) 2006.

Proton Europe considers this kind of direct collection of data from universities and Public Research Organisations (PROs) a particularly relevant activity. In fact, despite the high attention and intense debate about the valorisation of the results of public research in Europe and worldwide, empirical evidence about the specific activities and outcomes of KTOs is relatively scarce. In the present survey, data have been collected through a questionnaire which has been slightly modified year after year, but which maintains a core of common questions. Data collection took place during summer 2007.
In order to minimize the administrative burden on KTOs Proton Europe works closely with national networks or associations which often collect their own data and contribute it to the ProTon Europe survey. This we believe is the most effective and least onerous system for those countries where data collection at national level is well established. It is noticeable that PROs' interest in reading extensive reports about KT activities in other countries, in order to carry out benchmarking exercises, has been growing in the last years.
From a methodological point of view, the important choice in compiling the present report has been that of describing with extreme precision the number of respondents for each question. Too often, in fact, we read reports about KT and other topics, where data are presented only in percentage, without precise reference to the number of participants and respondents to each question. We think that ***our survey should be used, among other purposes, for policy objectives and in order to allow PROs to make benchmarking exercise, and this is why complete information is provided***.

Respondents by country and type of PROs

Table 1 - Response rate by country

Country		2003		2004		2005		2006	
		n	%	n	%	n	%	n	%
Austria	AU	0	0.0%	3	1.7%	5	1.3%	1	0.3%
Belgium	BE	1	1.1%	3	1.7%	4	1.0%	4	1.2%
Czech Republic	CZ	2	2.2%	1	0.6%	1	0.3%	1	0.3%
Denmark	DK	0	0.0%	1	0.6%	22	5.6%	24	7.4%
Estonia	EE	0	0.0%	0	0.0%	1	0.3%	2	0.6%
Finland	FIN	1	1.1%	5	2.9%	2	0.5%	1	0.3%
France	FR	3	3.3%	0	0.0%	73	18.6%	0	0.0%
Germany	DE	7	7.6%	16	9.3%	8	2.0%	3	0.9%
Greece	EL	0	0.0%	3	1.7%	7	1.8%	0	0.0%
Hungary	HU	0	0.0%	1	0.6%	1	0.3%	0	0.0%
Ireland	IE	0	0.0%	1	0.6%	0	0.0%	1	0.3%

Israel	IL	0	0.0%	1	0.6%	0	0.0%	0	0.0%
Italy	ITA	18	19.6%	44	25.6%	52	13.3%	61	18.8%
Netherlands	NL	2	2.2%	3	1.7%	1	0.3%	1	0.3%
Norway	NO	0	0.0%	0	0.0%	1	0.3%	1	0.3%
Poland	PL	0	0.0%	11	6.4%	4	1.0%	1	0.3%
Portugal	PT	3	3.3%	14	8.1%	7	1.8%	1	0.3%
Spain	ES	48	52.2%	54	31.4%	57	14.5%	61	18.8%
Sweden	SE	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Switzerland	CH	0	0.0%	1	0.6%	0	0.0%	0	0.0%
UK	UK	7	7.6%	10	5.8%	146	37.2%	162	49.8%
Total		*92*	*100.0%*	*172*	*100.0%*	*392*	*100.0%*	*325*	*100.0%*

325 PROs have participated to the last Proton Europe Survey (FY 2006).

In general, with regard to single PROs rather than single countries, it emerges quite clearly that about one third of respondents can be considered as newcomers in the club with 85.9% of respondents working for a general university and 7% for a technical university.
The institutions which have participated to the survey are rather large with an average of 1,800 people, and exactly 1,247 academic staff and 547 research staff.

PROs' academic and research staff (n=128)

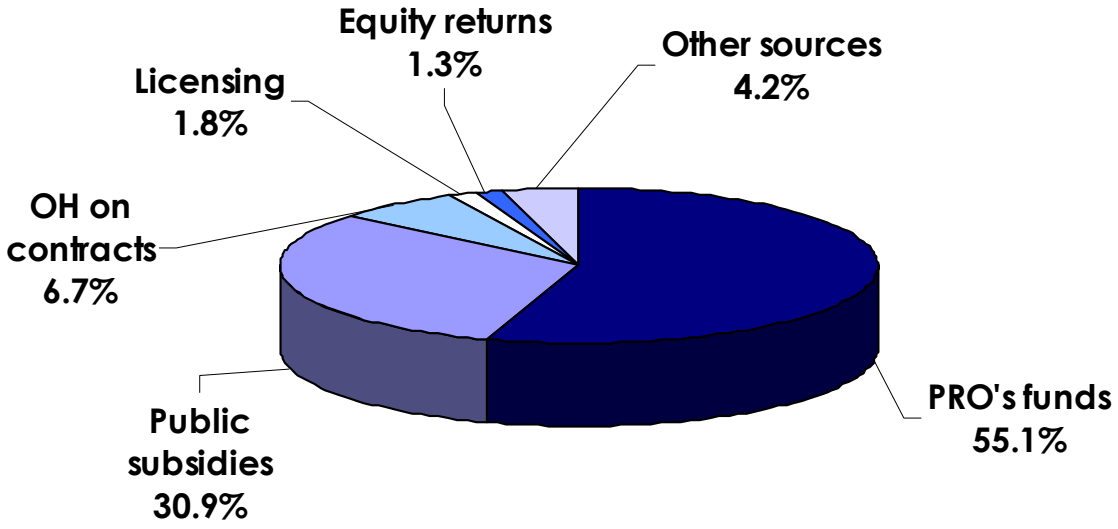
Typology of PROs' staff	Total number of FTEs	% of FTEs	Average number of FTEs per PRO
Academic staff (FTEs)	159,625	69.5%	1,247.1
Research staff (FTEs)	70,009	30.5%	546.9
Total academic and research staff (FTEs)	*229,634*	*100.0%*	*1,794.0*

The starting point of any effort to transfer research results is obviously that of investing in research activities. With regard to the 117 respondents average expenditure in R&D has been equal to 265 million Euros. More precisely, almost 42% of respondents invest less than 10 million Euros, about 25% between 11 and 25 millions, and 10% invest between 26 and 50 millions. About 23% invest more than 50 million Euros per year.

Characteristics of the KTOs

Similarly **to the typology of PROs served,** 92% of respondent KTOs are not dedicated to specific areas or disciplines of science and can be therefore considered as the “traditional” type of KTOs, which are usually found in generalist universities.
The best indicators to assess the maturity of the KTO structure is the number of total staff. With regard to 2006 data, the **average number of staff (in FTEs) was 8.3**.
Regarding annual KTOs’ budget, this was equal to 437KEuros (1/3, more than 300KEuros).

Financial sources of KTOs' annual budget (n=93)



Inventions

A further indicator of the intensity of the KT activities in a PRO is represented by the number of invention disclosures. These surely represent a relevant quantitative indicator, although a high number of disclosures does not necessarily imply a high quality of inventions. On average every PRO has 18.3 disclosures. The number of invention disclosures has been growing in the last two years from 15.3 to 18.3.

Patents

A further step in the KT is represented by priority patent applications. These are not necessarily linked to invention disclosed in the same year but, rather, to inventions disclosed previously. About one third of total PROs did not apply for any patent during 2006. About 30% made 1-5 applications and about 25% made between 6 and 20 applications. The remaining 10% made more than 20 applications, 2% of PROs which made more than 60. The average number of applications per PRO is 8.7.
The number of priority patent applications extended in 2006 by KTOs normally includes all the **Patent Cooperation Treaty (PCT) procedures**.
In 2006, a total number of 292 priority patent applications were extended by the responding 69 KTOs. The average number is 4.2 patent extensions per KTO. In 2006, a total number of 687 patents have been granted to the 280 responding KTOs. On average, each KTO obtained 2.5 patent grants, whereas the average number of patents granted in 2004 was 2.1.
In fact, the 284 respondents to the present survey totally hold 11,628 patents, with an average number of about 41 patents (including 106 PROs with no patents at all).

Licenses

Beyond the number of invention disclosures and/or patent granted, what really matters about KT activities by PROs is their capacity to transfer invention to the realm of industrial applications. In FY 2006 more than 55% of PROs executed at least one license agreement. 284 PROs executed 3174 licenses, for an average of 11.2 per PRO.
Most licenses regarded patents (73%), and the remaining 26% regarded software.
In general, KTOs acknowledge the fact that their responsibility is to bring inventions to applications and not necessarily (only) to bring relevant revenues to their PRO.
Nonetheless, the amount of licensing revenues certainly is a relevant indicator to consider when assessing the efficiency and the impact of KTOs. With regard to 2006, the total amount of licensing revenues for 273 respondents (45,8% of which had no revenues at all) was 2,8 billion Euros. About 30% of KTOs had revenues superior to 100,000 Euros, with almost 10% of the total with revenues of more than one million Euros.

Spin-off companies

Another traditional activity performed by KTOs is assistance in the creation of spin-off companies. Considering the 200 KTOs which provided this kind of information, the total number of spin-off was 1,642, for an average of 8,2 companies for each PRO. One third of KTOs did not generate any spin-off company, and about another third generated between one and 5. Another 24% generated between 6 and 15, and more than 15% generated more than 16, with 3 PROs (1,5%) which gave origin to more than 60 companies.
The average number of companies started by each PRO is 1,6. Slightly more than half PROs did not start any spin-off company, about 40% started between one and 4 companies, and 4% more than 7 companies.

Conclusions

The survey confirms the existence of a vibrant system of PROs which are active in the field of KT and use state of the art practices to transfer their results towards the realm of industrial applications. Networking activities, at both European and national levels, represent the main instrument through KTOs share experiences and learn how to provide services to their PROs and to society in general in an effective way. Secondly, it is evident that different situations in Europe do exist, but that the whole system is characterized by high dynamism. Qualitative information as well as meetings all over Europe tell us that these PROs are willing to play seriously and are slowly, but steadily, obtaining the knowledge and resources they need. A group, about 15% of respondents, is regarded as “leading”, KTOs with consolidated experience, play with large numbers and sometimes have implemented innovative solutions, for example in serving more than one institution. All this seems to confirm the importance of networks able to joint together numerous PROs, at both national and European level, so that they can exchange good practices – as well as learn from mistakes – both within single countries and across countries (think for example of new member).

7 Annex 2: Indicators Analysis

Discussion

The **six performance indicators** include three indicators for the potential commercialization of public science, **invention disclosures, patent applications, and patent grants**; and **three indicators for the actual use of public science discoveries by the business sector: licenses executed, start-up establishments, and license revenue.**

The value to policy of the three commercial potential indicators is not very high because they do not measure the actual uptake of public science results by firms. Their main value to policy is to determine the factors that increase the efficiency with which public institutions (primarily through their affiliated TTOs) transfer knowledge to the business sector. This requires econometric analysis of data at the level of each institution, which requires access to such data. This information is reported in the AUTM study for many of the respondents and has been extensively analyzed. Phan and Siegel (2006) provide a thorough review of this literature and find, not surprisingly, that efficient knowledge transfer depends on the characteristics of the institution, such as its research focus, the incentive structure, and organizational characteristics of the TTO. Of this group, the most valuable indicator is for patent grants, particularly if combined with additional questions on licensing practices, as discussed below.

The three indicators for the use of public science by firms are inherently more valuable for policy because they are closer to measuring the commercialization of public science results. A comparison of national performance on these three indicators is consequently of greater interest than a comparison of performance on patent applications or patent grants. Although subject to many problems of comparability, results intriguingly shows that the United States is the leader on indicators for commercial potential, particularly patent grants, but that its relative performance is more mixed for the three indicators for the use of public science by firms, particularly for the number of licenses executed and the number of start-up establishments.

The results for the three indicators for the use of public science by firms also suggest that we need to take a much more critical look at European assumptions about the causes of the "policy paradox". Europe performs better than the United States on two of the three knowledge transfer indicators for all types of public science institutes combined. The marked weakness for European universities for license revenue compared to American universities is partly due to the fact that European TTOs that serve universities are much younger than their American counterparts and have had less time to develop a licensing portfolio.

In the ASTP study, older TTOs affiliated to universities earn more license income than younger TTOs. Furthermore, the AUTM sample is likely to contain a higher percentage of the top performing institutes than the ASTP sample, so we would have expected the AUTM sample to have better performance than the ASTP sample on most indicators.

Some of the differences between the performance indicators for Europe and the United States could be due to differences in incentives or 'environmental' factors.

The higher rate of start-up formation in Europe could be due to low royalties for academic inventors. This would provide an incentive for academics to establish a firm to exploit their discovery. Whatever the cause, the high rate of start-up formation in Europe suggests that European academics might not be less 'entrepreneurial" than their American counterparts.

Indicator improvement

The development of internationally comparable indicators for the commercialisation of public science will require the use of standard definitions for output variables and for denominators such as research expenditures, similar target populations and survey coverage, and greater transparency in the treatment of missing values. In addition, to solving these problems, the time causality problem also needs to be addressed. Using research expenditures and outputs for the same year implies that the outputs are directly due to the reported research expenditures. This is not likely to be the case, with many outputs due to research expenditures over several years. This can particularly apply to patent grants, which could be due to research conducted several years previously. One possibility is to construct indicators after using different lag times for research expenditures, but this might be

unnecessarily complex. An alternative for the future is to average research expenditures over the previous three years.
The construction of high quality comparable indicators requires a high coverage rate which is likely to raise serious problems of confidentiality. Many public science institutions with poor performance could be reluctant to respond if they believe that their results will be made publicly available, possibly leading to a reduction in future funding. Yet a failure to include poor performers in surveys will bias the results and reduce their value for policy.

Other indicators for policy

The six basic indicators given here can be obtained in a one or two page survey questionnaire. The first area is to collect data on the number of researchers, preferably in units of time devoted to research, to provide an alternative denominator to research expenditures. Units of research time could be more comparable internationally than units of research expenditures, which are affected by how expenditures are defined and by a lack of purchasing power parity (PPP) currency equivalents for research. **The second area is to collect data on *who* licenses public science inventions – firms based within the home country or abroad, in order to construct an indicator for the percentage of licenses that are given domestically. This would serve a basic policy interest in encouraging knowledge flows that support domestic economic activity.**

This question is particularly relevant for exclusive licenses, since the main justification for non-exclusive licenses is to raise funds for the public institute.
Third, the role of non-exclusive licenses is an important policy issue by itself.
Although non-exclusive licenses can maximize income for the research organization, they could be less effective in transferring knowledge and technology to the business sector than publications that make the results freely available to all. Conversely, exclusive licenses for some inventions could be absolutely necessary for a firm to invest in developing the invention into a commercial product. The disadvantage is that inefficient use of exclusive licensing could slow down technical developments and possible social benefits. Indicators for the share of exclusive licenses, particularly by technology field, would help policy makers determine if the rate of exclusive licensing is above or below the international norm.
Fourth, there is no point in a public science institution applying for IP rights, particularly a patent, if the invention is never licensed. This will only increase costs to the institute and theoretically, albeit under the unlikely assumption that no firm will infringe the patent, prevent firms from using or further developing the patented technology. For this reason it is worthwhile to collect data on the percentage of patents that have ever been licensed in order to track changes over time and benchmark national performance.
Last, non-patented inventions account for a significant share of licensing activity, even though IP policy frequently stresses patents or the need for other strong forms of IP. The OECD study (OECD, 2003) found that approximately half of all licenses did not involve a patent.
In order to keep the role of patents in perspective, it would be worth collecting data on the share of licenses and license income that does not involve patents.

Conclusions on indicators

It is possible to obtain internationally comparable indicators for the commercialisation of public science with relatively simple agreement over definitions, improved survey coverage in Europe. In addition, the policy relevance could be improved by adding a few additional indicators for who licenses, licensing exclusivity, the share of patents that have ever been licensed, and the share of licenses and license income from patented and non-patented inventions.
It is important not to lose sight of the fact that the visible and easily measurable output of public science institutions, such as patents and licenses, form only part of a large number of activities that can lead to commercialisation and social benefits.
As noted earlier, useful knowledge can be transferred from universities to firms through open science methods such as publications, conference presentations, and informal contacts.
There is a serious danger that only providing indicators for formal methods of transferring knowledge could encourage the policy community to promote formal methods at the expense of open science.
An increase in professional activities by TTOs could lead to a fall in informal or 'bypassing' linkages between academics and firms. They also report that bypassing activities were "associated with more valuable discoveries and heightened entrepreneurial activities".

This suggests that the policy community needs to find the optimum balance between promoting formal technology transfer methods based on IPR and licensing and the informal methods of open science. In this respect, it would be worth developing better comparable indicators for the role of open science in the innovative activities of firms.
The European Community Innovation Survey (CIS) can provide relevant indicators, such as the percentage of firms that give a high importance to knowledge obtained from public research organisations. These types of indicators would need to be given equal billing with indicators of formal knowledge transfer activities. Perhaps we might find that the cause of any "European paradox" is not due to the formal transfer of public science discoveries to firms, where European performance appears to be acceptable, but to problems with the system of open science.
As far as end-users are concerned, successful knowledge and technology transfer depends less on the particular type of TTO 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.
It would be recommended to review support programs for technology transfer (institutions) and to explore the possibilities to employ result oriented schemes.
Ideally, TTO set-up, service orientation and science focus should correspond to the particular requirements and demands.
If such an orientation is not in line with a particular type of TTO promoted by support programs, loss of support or inefficiencies may result. This suggests that policy should concentrate on establishing the conditions for transfer services rather than stimulate the formation of a particular type of TTO.

Table 6.5 summarises the characteristics of recent KTO surveys in Australia, Canada, the United States, and in eight European countries (Denmark, France, Ireland, Italy, Norway, Spain, Switzerland, and the UK); Gulbrandsen and Rasmussen (2008) provide results for Norway for 1998 to 2004 combined, but only note that the data were collected from a 'number of different sources'.

Table 6.5: Periodic or potentially periodic surveys of knowledge transfer activities in public research organisations (PROs)

Country	Most recent survey title	Survey organisation	Publication year	Reference year[1]	First year data available[2]	Responses	Units surveyed		
							Universities	Other PROs	Hospitals
Denmark	Public research commercialisation survey - Denmark 2007	DASTI	2008	2007	2000	13	✓	✓	✓
France	Les activités de valorisation dans les établissements universitaires français - Enquête 2005	CURIE	2006	2004	2000	74	✓		
Ireland[3]	University collaboration on technology transfer: An all-island feasibility study	Inter-Trade	2006	2004 - 05	2004 - 05	8	✓		

Table 6.5: Periodic or potentially periodic surveys of knowledge transfer activities in public research organisations (PROs)

Country	Most recent survey title	Survey organisation	Publication year	Reference year[1]	First year data available[2]	Responses	Units surveyed		
							Universities	Other PROs	Hospitals
Italy	La valorizzazione della ricerca nelle università italiane	NetVal	2007	2006	2003	61	✓		
Norway	Indicators for the commercialisation of research: The case of Norway	NIFU STEP	2008	1998 - 2004	1998	16	✓	✓	
Spain	Informe de la encuesta RedOTRI 2007	Red-OTRI	2008	2007	2003	60	✓		
Switzer-land	Swiss technology transfer - report 2006	swiTT	2008	2006	2005	19	✓	✓	✓
UK[4]	Higher education-business and community interaction survey 2006-07 (HE-BCI)	HEFCE	2008	2006 - 07	1999 - 2000	162	✓		
UK[4]	Fourth annual survey of knowledge transfer activities in public sector research establishments (PSRE)	Technopolis for DIUS	2008	2006 - 07	2003 - 04	138		✓	✓
Australia	National survey of research commercialisation 2003 and 2004	Austra-lian Gov't[5]	2007	2004	2003 - 04	138	✓	✓	✓
Canada	AUTM Canadian licensing activity survey: FY2007	AUTM	2008	2007	2000	40	✓		✓
USA	AUTM U.S. licensing activity survey: FY2006	AUTM	2008	2007	1991		✓	✓	✓
Europe	The ProTon Europe fourth annual survey report (fiscal year 2006)[6]	ProTon Europe	2007	2006	1991	189	✓	✓	✓

Table 6.5: Periodic or potentially periodic surveys of knowledge transfer activities in public research organisations (PROs)

Country	Most recent survey title	Survey organisation	Publication year	Reference year[1]	First year data available[2]	Responses	Units surveyed		
							Universities	Other PROs	Hospitals
Europe	Final results of the ASTP survey for fiscal year 2007	MERIT for ASTP	2008	2007	2003	325	✓	✓	✓

8 Annex 3: Examples of KTOs

MRC (Medical Research Council) Technology Ltd. in London serves a number of MRC establishments in various locations which obviously makes it more difficult to ensure sufficient visibility and to develop close co-operation with researchers.
Therefore, MRCT has designated a member of staff per MRC establishment, who through regular informal visits and meetings with staff creates an easy and user-friendly access to the services of MRCT.
MRCT supports researchers by assessing the commercial potential and prospects at various stages of the process and includes an assessment of competing technologies. Information about such competing technologies again originates most frequently from MRC researchers. There is also a clear policy on royalty sharing, splitting proceeds between the inventor, the PRO and MRCT.

One of the key features of the **University Extension Centre of the Vienna University of Technology** in Austria has been the introduction of technology consulting days, where by cooperation with respective trade associations new contacts to mainly SMEs are made, which are followed up by direct contacts between researchers and enterprises.
KU Leuven R&D in Belgium has through the installation of Leuven INC (Innovation Networking Circle) built a bridge between research and technology based entrepreneurs in the region of Leuven.
A stronger outward orientation of TTOs should facilitate closer collaboration between research and enterprises by pro-actively seeking and fostering contacts with enterprises.
As most PROs, in particular universities, are better known to the wider public and enterprises than the TTOs, a web-portal and a users' reception desk at the PRO could facilitate an easier first contact and access of enterprises to the respective technology transfer functions.
Some relations between service portfolios and performance of TOs have been naturally highlighted:
• Liaison services for contract research are typical for TTOs with a higher revenue;
• TTOs which provide liaison services for contract research also report higher numbers of patents;
• Patenting services help TTOs to be more effective in gaining revenues from licensing. Usually when patenting becomes routine, a number of other processes are also developed that significantly increase the productivity of the system. Consequently, they have a higher number of patents that can enter into licensing. Examples of such productivity enhancing processes are: systematic invention disclosure; economic assessment before patenting; coverage of the patenting cost; or a transparent arrangement for IPRs. Furthermore, collaboration between the staff working for patenting and those working for licensing becomes easier, and the effectiveness of claims to patents and the success of licensing negotiations tends to increase;
• More spin-offs are established when patenting, licensing or spin-off financing services are offered.
Financing is more important in cases where venture capital (pre-seed, early-seed capital) markets are less developed. However, it is paramount that financing is provided in a competitive and professional manner. Such seed financing should actually ease the entry of the firm into the venture capital market and legitimate its bid for capital for expansion.
A high degree of specialisation – as for instance on patenting and licensing only – may be less successful than the provision of a bundle of services, e.g. if the TTO also provides contract research management.
Empirical evidence suggests that most patents (licences) need further (applied) research before the technology is fully applicable in the production process.
Thus, collaborative and contract research also has a complementary function.

Otaniemi International Innovation Centre (OIIC) at the Helsinki University of Technology (HUT) is an example of a TTO with 20 employees which provides a large number of services, acting as a "one-stop shop" benefiting from the synergies between the various activities.

These services are:

• National and international technology transfer cooperation
• Management of R & D contracts of HUT
• Licensing and selling of IPR owned by HUT
• Personnel administration management and international correspondence
• Financial issues related to EU-funded R&D programmes and contract research
• Guidance on cost statements

• Filing and recording of domestic research contracts
• Financial administration
• Counselling on preparation of proposals and project management for EU projects and search of partners
• Counselling on preparation of projects between university and private companies
• Legal counselling on R & D contracts
• Search, identification and commercialisation of inventions
• Consultation on intellectual property (IPR) issues
• Consultation on starting a business
• Consultancy and information on domestic and international practical training at HUT
• Coordination of Alumni issues

An example of facilitation of Knowledge Transfer

The i-techpartner project has the objective to facilitate knowledge transfer, partnering, and collaboration between innovative SMEs and public research organizations and universities. The mission is to bring together European academia and research with SMEs and investors and help building value-creating relationships.
Goals of the project are to:

- facilitate technology scouting and the development of collaborations of SMEs and entrepreneurs with research leaders throughout the participating regions;
- provide participating SMEs with international visibility and attract partners such as private corporations, venture capital and investors;
- identify, develop and deploy effective tools and resources that facilitate technology transfer to and innovation within European SMEs;
- identify, refine and promote research collaboration projects involving research leaders of the participating regions and corporate partners;
- be a main driver in the economic development of participating regions and national governments through promoting entrepreneurship and innovation.

The project aims at the following stakeholders:

- entrepreneurs or senior managers of start-ups and SMEs looking for innovative technologies or competencies, research collaborations and investment;
- research leaders in advanced technologies from universities or public research;
- organizations seeking business, research or investment partners;
- innovation experts, technology transfer professionals, business incubation managers and regional developers representing public agencies or private consultancies;
- corporate or venture capital investors with international networks and a focus on relevant technology sectors.

Project Activities

The objective to facilitate knowledge transfer between PROs, universities, investors and SMEs is supported by the following set of tools and processes:

- the organization of Academies in the 11 participating regions where opportunities for technology transfer are collected from regional universities and SMEs in the fields of biotechnology and ICT, screened, and presented in one-day conferences in each region;
- the organization of Forums by the 7 large participating regions where the offerings and requests from all regions are grouped by subject matter (7 or 8 clusters) in order to facilitate matching;
- development of a portal with the url http://www.i-techpartner.eu to promote the events, collect offers and requests for technology and facilitate matching (development of this tool to be provided by the AIMES Institute in Liverpool);
- logistics and marketing are provided by Europe Unlimited, following their model and experience with Venture Academies for the funding of new companies.

With the objective to bring together the community of researchers, entrepreneurs and investors, the i-techpartner project organizes a series of regional coaching events (Academies) and sector-specialized matchmaking events (Forums). i-techpartner is supported through innovation agencies and organizations in 13 countries and regions (Sweden, Italy, Central & North Portugal, Madeira, Valencia,

Rhône Alpes, UK NorthWest, Flanders, Sealand, Southern Great Plains of Hungary, Cyprus and Central Macedonia).

9 Annex 4: Technology Transfer in Germany

Technology transfer in Germany is feasible through many different ways and by using several institutional intermediates, some of them being practicable in conjunction, others with the exclusive use of specific channels.

***Ways*:** The most important ways are:

1. **Contractual R&D:** In principle feasible between any Public Institution with another Public Institution (e.g. University, University of Applied Sciences, Public Research Institute) or with any Company or Firm. A special form is practiced at the so-called "An-Institutes" which are R&D-Institutes located at/within the Universities and operated mostly by university personnel in dual role (but legally as independent entities). They are managed and operated as private companies (with all conceivable advantages, implications and discussions about their status). IPR are assigned to the partners according to the individual agreements.
2. **Cooperative R&D:** Similar to 1, but the assignment of IPR to the partners is in part ruled by the general business terms of the partners. Public funding is ruled by many special and individual regulations and duties (e. g. from the German Ministry of Education, the Ministry of Economics and Technology, the corresponding State Ministries, the German Research Association, the Confederation of Industrial Research Associations, etc.). There is no uniform and binding regulation (although there are many recommendations) concerning IPR; most of it can be assigned to the parties by ways of the individual agreements.
3. **Collaborative R&D:** Same as 1 or 2, but as a rule only practiced among the major players (e.g. Research/Excellence Universities jointly with large Companies, frequently institutionalised in the University-Industry-Research-Centers, in many cases also exploiting the EU 7th Framework Programme or research funding of the Ministry of Education, etc.). There in no uniform regulation concerning IPR yet, although there are continuous discussions on the topic.
4. **Endowed Professorship or/and Personal Transfer:** As a rule these are limited to 5 years; the sponsors being foundations, charity groups, companies or even private persons. Personal Transfer is commonly practiced by exchange of scientists between Industry and Universities, usually with fixed-term contracts or secondment agreements. There are no general rules on the assignment of the emerging IPR.
5. **Spin-offs and Start-ups:** Usually the have their roots within Universities and they emerge from the cooperation between professors and/or researchers, together with academics from industrial engineering and/or business departments. Quite frequently external services and funding are required (e.g. EXIST-Programme of the German Ministry of Economics and technology, High-Tech-Gründerfonds, etc). IPR and patent rights usually belongs to (or in the beginning they are transferred to) the Spin-off/Start-up.
6. **Clusters:** These are regional aggregations with participation of all kinds of Institutions and/or Companies having common innovation interests, mainly in related technologies, but always with the aim of improving regional competitiveness, either economic or as members in the network of the scientific community (e.g. "Innolab" at the University of Heidelberg, "Cluster" at the Karlsruhe Institute of Technology, etc.). IPR assignment is very variable and in many cases unclear due to "open innovation".

***Institutional Intermediates*:** The following departments, offices or agents are involved in technology transfer from Universities and/or Public Research Institutions to Industry/Economy:

1. **SIGNO:** This programme was initiated about 2 years ago by the German Ministry of Economics and technology. Formerly similar programmes had been coordinated by different ministries (e.g. the Ministry of Education in the case of Universities, etc.). Today there are three sections: SIGNO-for-Companies (mainly patent protection for SMEs), SIGNO-for-Universities (mainly patenting and patent exploitation) and SIGNO-for-Inventors (mainly

support for individual inventors or groups of inventors). SIGNO offers limited funding for patenting and general patent management (see also below, Point 4). There is no special regulation about the assignment of IPR to the partners.

2. **Departments of Technology Transfer of the Universities:** Without few exceptions each University has such a department (with a staff ranging from 3 to 30 employees). Among their tasks are: mentoring and guidance of inventors, acquisition of third-party-funds for R&D, licensing, services for spin-offs and/or start-ups, etc). There are no uniform structures in these departments; moreover, their tasks and their competences greatly vary. The Universities of Applied Sciences do not have, except in few cases, own departments of technology transfer. Funding can be very different, too. As a rule, each University has own budgets for all services needed. For several sectors, e.g. services for inventors, patenting and for consultancy on licensing there have been (from about 2002 on) and there are still limited funds for the Universities from State Ministries of Education, State Ministries of Economics and the Federal Ministry of Economics and Technology. There are no uniform regulations throughout the German States, except for the contributions of Federal Ministries to individual projects, so that the situation is rather disoriented, involving very many special Federal and also State Regulations.

3. **Departments of Technology Transfer of the Large Research Associations:** all large organisations, eg. the Fraunhofer Association, the Max-Planck Society, the Helmholtz Community and the Leibniz Community have own departments of considerable size, as small departments in the individual institutes, and additionally with a central department linked to the headquarters of the organisations. As a rule they are funded by the corresponding organisation itself.

4. **Patent Exploitation Agencies/Offices:** In 2001 the German Government created within a big project at least one of such agencies in each State of Germany (at the moment there are about 24 agencies in Germany). Some of them (e.g. TLB in Baden-Württemberg, TransMIT in Hessen, TuTech in Hamburg) were founded several years before, and since they had already performed similar tasks they were integrated in the 2001-projec, too).

5. All these agencies are supposed to jointly cooperate with the Departments of Technology Transfer of the Universities in order to jointly promote inventions at the Universities' Institutes, manage patenting and carry out exploitation of patents as well as of IPR. There are several ways of exploiting IPR, e.g. licensing in behalf of the Universities (who are the owners of all IPR, at least in the beginning), supporting Spin-offs/Start-Ups, and helping to raise third-party-funds through cooperation agreements. There is quite a lot of competition between the encharged Patent Exploitation Agencies and the Departments of Technology Transfer of the Universities because of the overlap and interference of tasks. The Universities of Applied Sciences rely for themselves almost entirely on the services of the Patent Exploitation Agencies. The Agencies are funded in part by the SIGNO-Programme of the German Ministry of Economics and Technology, and in some States also additionally by the local Ministries, at least temporarily (major funding is expected to end in 2010). IPR remains almost without exception at the Universities, who are free to license or to sell it to Industry.

6. **Innovation Relay Centers**: The network of IRCs is widely used by all Technology Transfer Departments and Patent Exploitation Agencies for business contacts and for starting negotiations. Focus is on SMEs, and assignment of IPR is regulated by the specific contracts for licensing individual technologies.

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11 Definitions

Research is an organized and systematic way of finding answers to questions! *SYSTEMATIC* because there is a definite set of procedures and steps which you will follow. There are certain things in the research process which are always done in order to get the most accurate results. *ORGANIZED* in that there is a structure or method in going about doing research. It is a planned procedure, not a spontaneous one. It is focused and limited to a specific scope. *FINDING ANSWERS* is the end of all research. Whether it is the answer to a hypothesis or even a simple question, research is successful when we find answers! Sometimes the answer is no, but it is still an answer… *QUESTIONS* are central to research, if there is no question, then the answer is of no use. Research is focused on relevant, useful, and important questions. Without a question, research has no focus, drive, or purpose.

Basic, or fundamental, research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, **without any particular application or use in view**.

Research and experimental development (R&D) *(Frascati Manual Definition) R*esearch and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to **increase the stock of knowledge** of man, culture and society, and the **use of this stock of knowledge to devise new applications.**

Applied research is original investigation undertaken in order to acquire new knowledge. It is however directed primarily towards a specific practical aim or objective.

A **collaborative research** involves different partners associated with the public research organisation through its laboratories i.e. its researchers working together toward a common goal, supported by the private sector and the public sector sharing ,not only the knowledge accumulated before the project but within the project.

Technology transfer is all technology related interaction that aims at making available the product of R&D and other creative activity in new commercial and non-commercial applications and/or in new markets.

Technology includes among others products, production technology, technology based services and software. It does not include activities in basic research but it does include demonstration and adaptation to specific market and applications. For the recipient, the “technology receiver”, compared to the “technology offerer”, efforts in technology transfer aim at developing an improved or a new feature of his commercial or non-commercial activity, as such it is part if the recipient’s innovation process.

Support to technology transfer on the side of the technology owner includes all support actions and instruments that aim at accelerating the application and diffusion of a specific product of R&D and other creative activity. For a technology recipient support to technology transfer includes all efforts and instruments related to the definition of a technology need, the sourcing of solutions and their assistance to implementation. Support to technology transfer is a subset of actions in support to innovation.

A **Patent** is an intellectual property right relating to inventions in the technical field. A patent may be granted to a firm, an individual or a public body by a patent office. An application for a patent has to meet certain requirements: The invention must be novel, involve a (non-obvious) inventive step and be capable of industrial application. A patent is valid in a given country for a limited period (20 Years). *Sometimes Patents are also known to be imperfect solutions to the market failure associated with the creation of knowledge since they create deadweight losses associated with charging monopoly prices for goods whose marginal cost is close to zero (OECD, STI Working Paper, 2006/2);*

A **License** agreement formalizes the transfer of technology between two parties, where the owner of the technology (licensor) permits the other party (licensee) to share the rights to use the technology. An option agreement grants the potential licensee a time period during which it may evaluate the technology and negotiate the terms of a licence agreement.

Marketing is the management process responsible for identifying, anticipating and satisfying customer requirements profitability. It also can be defined as satisfying needs and wants through an exchange process. Marketing is not about providing products or services it is essentially about providing changing benefits to the changing needs and demands of the customer.

Knowledge transfer is a concept that directly links to persons (knowledge holders) and aims at making available all types of knowledge (codified, traditional, experience, technical, social) in another than knowledge holder's normal working environment. Knowledge in that respect is not limited to scientists and is not, and can not be, limited to technology information.

Effective knowledge transfer is a critical part of Europe's innovation pipeline.Today for any European business to stay not only ahead of the competition but to go beyond and be able to anticipate the market "after tomorrow" they have no choice except to permanently innovate.

12 Summary of the present state of KT

It became along the years very clear that monitoring knowledge transfer activities has several purposes including among others helping research institutions to promote what has been achieved for and through the public good.
Access to research results through Knowledge transfer takes place through a lot of different channels of ***interaction*** between Public Research Organisations (PROs) and other actors such as companies or any socio-economical player.
Knowledge, or results of research, can be produced, mediated, reproduced, acquired, exchanged and transformed in and between the different forms through these various channels.

This understanding is in line with modern views of innovation as mostly interactive *learning* processes where learning includes the generation of new knowledge as well as the integration, adoption or adaptation, of knowledge from external sources.
Even if each European university would be served by their "own" *Knowledge Transfer Office (KTO),* **almost all knowledge transfer by universities** through formal methods such as licensing Intellectual Property (IP) could be captured from a comparatively small survey of a maximum of **500 KTOs**.

Various studies have up to now identified close to **1,400 technology transfer offices** (TTOs) in Europe, or officially recognised or "registered" as TTOs.
This probably gives a maximum estimate of the number of KTOs that would need to be surveyed to provide a clear and accurate picture of the knowledge transfer activities of universities, other higher education institutions, research hospitals, and other public research organisations.
One particular success factor for the TTOs is the awareness of researchers at the PRO.
Awareness, which is critical, concerns on the one hand technology transfer in general, and on the other hand the **visibility** of technology transfer "institutions" for the personnel which is an important requirement to ensure operational efficiency.

Nothing can be done without a **strong appropriation** of the function of transferring or exchanging knowledge produced under public funding by the producers themselves!
The most important condition for successful technology transfer is the availability of high-quality accessible research results or technologies to be transferred.

The potential of a PRO can however be fully exploited only if researchers are conscious of **commercialisation**, have sufficient **incentives** to engage in commercialisation and industry co-operation, and thus actively disclose inventions, contribute to the patenting process, and engage in contract research.

In simple terms, appropriation is the key requirement associated with **recognition** of the research results producer, recognition in terms of career development in the university or through various schemes to develop personal projects based on research results.
Another requirement is the right level of incentives available for researchers who produce transferable and transferred results. Another important requirement is the availability of **funds** for proof of concept, patent protection and **seed funding** for start-ups or pre-start-ups.

The **lack of transparency** in supply structures, the **huge variety of TTOs**, or unclear structure and organisations makes it difficult to recognize the transfer entity as part of the PRO add to the **lack of credibility**.
Marketing requires by definition a proper understanding of the market itself, an appropriate portfolio of services, and an adequate pricing and communication strategy.
TTOs face similar challenges as companies and must employ similar instruments, even though their main objective is to achieve the maximum of technology transfer and not (up to now in most of the cases) to maximize economic returns.

As far as end-users are concerned, successful knowledge and technology transfer depends less on the particular type of TTO than on the ease of access, visibility and efficiency of the system used!

Study 3: An evaluation of incentives and policies that affect research institutions' knowledge transfer activities, at researcher and management level

Rudi Bekkers[19]

Paper commissioned by the European Commission, DG Research, as part of work by the Expert Group on Knowledge Transfer 2008/2009.[20]

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The background study underlying this report is available from:

http://home.tm.tue.nl/rbekkers/bekkersbodas_EC_expert_background.pdf

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Management Summary

This paper addresses the effects of incentives and policies on transferring research results from public organisations (e.g. universities, public research centres) to firms. The views in this paper are, for a large part, based on the findings of an extensive survey of academic papers and reports (this background study is available; see Section 1). By reviewing the academic literature, this paper attempts to facilitate informed policy-making by forming a link between two areas that until now have been relatively unconnected.

General observations on the effectiveness of knowledge transfer

The most important message is that top-quality research (accompanied by top-quality publications) is a key condition to have top-quality knowledge transfer. This is particularly the case with very visible routes of patenting and spin-offs. Here we touch upon the widely-used concept of the European Paradox, which holds that EU countries play a leading global role in terms of top-level scientific output, but lag behind in the ability to convert this strength into wealth-generating innovation. Recent studies, however, have shown there is very little empirical evidence for such a view. This does not mean Europe would not benefit from improvement in technology transfer - on the contrary. It means, however, that it is at least as important to focus on Europe's research performance as on the absorptive capacity of its industry. Networks of Excellence (NoE) are a means of fuelling research performance as well as networking and learning processes among researchers. National programs to stimulate promising individual researchers—such as Marie Curie actions—are also very welcome. Great improvements can be made, such as removing obstacles to labour mobility (influx from other parts of the world).

It is advised that European policy focuses on further improving research performance and on further improving the absorptive capacity of European industry; technology transfer complements both but does not replace them.

An incentive is understood as any factor (financial or non-financial) that enables or motivates a particular course of action, or counts as a reason for preferring one choice to the alternatives. It is a known fact that academics are particularly sensitive to so-called moral incentives, such as peer recognition and the incentive to solve complex puzzles. Concerning knowledge transfer involvement, the effectiveness of incentives is strongly dependent on the attitude and view of the individual and certain incentives may even have an opposite effect. It is vital that a sensible set of incentives is created for those members of the academic staff who have a positive attitude towards getting involved in a wide range of different channels of knowledge transfer (depending on the context), while allowing others to focus on publication-driven research. This could be done by promoting technology transfer performance as *one* of the criteria for job assessment and promotion, while allowing scholars to achieve similar scores if they focus on publication instead.

Some researchers are more than willing to work with and for industry, and efficient incentives should be addressing that group to get them (even more) engaged in knowledge transfer. Policies should not jeopardize those that are more inclined to publish - and are often simply better at it.

Not only is there great heterogeneity among individual researchers, there are also many differences between universities, disciplinary areas, economic sectors, and countries. As a result, a 'one-size-fits-all' policy is very unlikely to work. Various knowledge transfer channels are complementary and have a different role and function over time in a sustained, long-lasting relationship between a university and a firm. For instance, consultancy activities and contract research may alternate with collaborative research, while at some point the firm might be willing to make funds available for Ph.D. or postdoctoral researchers. In other cases, a patent owned by the university or by the firm may be appropriate.

Policy makers should develop a holistic view of the various technology transfer channels, understand how they complement each other, and provide a consistent set of incentives to get engaged in the transfer channel that is most appropriate in a given context. Isolated policies that focus on one single channel (e.g. patenting, or spin-offs) are likely to fail to improve technology transfer in the broad sense. Likewise, the use of performance metrics relating to a single channel, however tempting, is

likely to lead to unbalanced (or even perverse) incentives and may actually result in a drop in effective knowledge transfer.

Just as innovation studies have moved away from the oversimplified 'technology push' and 'market pull' views, also technology transfer should not be seen as a simple, linear process. It involves knowledge *exchange*, where university researchers also receive valuable knowledge and insights from industry, for their own benefit.

University-industry knowledge transfer is far from a linear, one-way knowledge flow process and is better to be understood as a continuous, bi-directional knowledge exchange, also at the benefit or university researchers.

There is a rich stream of research on technology transfer. Conferences like Triple Helix focus entirely on this topic, whereas conferences/programmes such as DRUID, DIME, Schumpeter and others have considerable track records. The Journal of Technology Transfer is fully devoted to this subject, while other journals pay considerable attention to technology transfer, including Research Policy (published a special issue), Scientometrics, the Journal of Industrial Organization, Management Science, the European Journal of Innovation Management, Policy Studies Journal, the Journal of Economic Issues, and the NBER working papers series, to name a few. Contributions to this debate come from scholars from various disciplines, including economy, business studies, sociology and political science. The views and insights developed by these scholars are invaluable for policy-making. Also, we believe it is important that policy makers in this particular field understand and speak the language of scientists. When developing policies for researchers, what could be better than using their own methods, ethics, and scrutiny?

To arrive at informed policy-making based on facts, evidence or reasoned argument, we strongly advise that all the different sets of valuable insights from academic research undertaken in the area of technology transfer are taken into consideration.

Particular attention should go to the inflow and training of the academics of tomorrow. With the current, generally unattractive working conditions for Ph.D. candidates and entry-level positions, we are in great danger of losing the prospective top performers of future decades. In the EU, there is a tendency not to define Ph.D. tracks as jobs, allowing employers to ignore laws on minimum wages, unemployment rights, and pension build-up. It is paradoxical that the intellectually most talented in our society, dedicated to knowledge development to benefit the whole society, often do not manage to obtain a permanent work contract until they are in their forties, and continually have to bear in mind the prospect of re-location, with serious consequences for family planning, buying a house, getting a mortgage, etc. Compared with the conditions these people are offered outside academia, it will come as no surprise that universities have serious problems attracting sufficiently capable candidates for Ph.D. positions. Also at more senior academic job levels there is a considerable brain drain to other parts of the world.

Improving working conditions in academia for Ph.D. and other entry-level positions is key for attracting and training the top performers of the next decades. Improvements in this area are urgently needed.

Despite a large body of literature, there are also many country-specific differences in practices in university-industry knowledge exchange, differences in the way incentives are perceived by individual researchers, and barriers they experience. Such aspects have been studied for single EU Member States, but a complete and reliable cross-country study is still lacking. Therefore, the EC is advised to perform such a study. The existing single state studies may serve as an example there. (In some countries, research teams have already requested funds to replicate this study, but a more structured coverage of EU countries would be desirable.)

The European Commission is advised to commission a EU-wide, empirical study that would reveal country differences in the actual use of knowledge exchange channels, their appreciation by university and industrial researchers, their sensitivity to incentives, and the perceived barriers. The results will aid the Commission to ensure its policy vis-à-vis the various Member States is well-focused and proportional.

Now we turn to the five technology transfer channels highlighted in this position paper: publications, patents, spin-offs, (publicly funded) collaborative research, and vouchers.

Publications are consistently found to be the most used and highest rated knowledge transfer channel, both by universities and by industry. Publications also have an important signalling function for other knowledge transfer channels. Several studies report that academics with better publications are the ones who are able to attract more public and private research funds. Industry looks for collaboration with high quality universities, which are the ones with recognised research productivity and well-trained students. It is now widely established that, on the individual level, patenting performance and publication performance go hand in hand and do not negatively impact each other. An often-overlooked aspect of technology transfer policies is that writing publications is not necessarily an activity that takes place in full isolation from industry. Often there has been tight interaction, and in some top performing university departments, as many as 25% of all publications are co-authored with industry. Even at a regular university, the number of publications with industry involvement will be typically much higher than the number of patents or spin-offs.

For publications to impact on businesses, they need to be (1) accessible, (2) understandable and (3) usable in the context of the firm. There is a great deal of debate on the accessibility of academic journals, and prices of both journal subscriptions and catalogues / search systems (e.g. Scopus, ABI inform) are believed to be prohibitive for many firms. Considerable progress has been made, including so-called open journals and depositories. Though many scholars are 'locked-in' by the existing journals with high(er) impact rating, also quite a few publishers have relaxed their copyright transfer agreements, now allowing authors to include their published papers on personal or university websites (provided they do not use the journal's layout). Despite this progress, the accessibility of academic journals can still be regarded as a considerable obstacle to knowledge transfer, especially for SMEs.

Publications are consistently found to be the most used and highest rated knowledge transfer channel, both by universities as well as by industry. Publications also have an important signalling function for other knowledge transfer channels. Co-authorship of university and industry researchers demonstrates that publications are not necessarily written in isolation (though their occurrence is very different between Member States). Access to academic publications by industry and also by smaller universities and other organisations is an area where significant improvements can be made. Particular attention should be paid to access for SMEs.

Concerning incentives, the EC is advised to promote university-level and national-level incentives for such co-authorships (in terms of research assessment, for instance) as they contribute significantly to university-industry knowledge exchange.

IPR policies / university patenting. Without doubt, university patenting is one of the hottest topics on the research commercialisation/valorisation agenda. Many policies and efforts have gone into measuring and improving disclosure rates, the total number of patents (applied or granted), the number of licences executed, and the revenue derived from these patents. More important, however, are questions on whether patents are the most effective instrument to achieve goals such as successful technology transfer, and whether university patenting is already at a desirable level or not. To start with the last question, there is a widespread belief that European universities are contributing less to patents than their American counterparts. However, this belief is based on data that looks solely at the *assignment* of patents, i.e. university-owned patents - data that is relatively simple to collect. Given the legal context in the USA, where universities are not allowed to renounce ownership of patents on their staff's inventions, university patents are indeed well identified as such. In Europe, however, recent large-scale studies have identified large stocks of patents which have a university staff member as (one of the) inventors, but whose ownership does not reside at the university. If we also take these 'university-invented' patents into account, Europe's university patenting performance is roughly equal to that of the USA.

There are serious doubts about how effective university-owned patents are in transferring technology. The economic rationale offered by various proponents is shaky, at least. Of all the justifications, the 'downstream investment' argument[21] is probably the most convincing one, but it is hard to determine

[21] This argument holds that no companies will be prepared to make the necessary investments for further product development if a university puts its knowledge in the public domain—think of clinical trials for medicines.

whether the necessary conditions that come with this argument are met in any specific case. Furthermore, this argument implies that patents are licensed on an exclusive basis only (which is often not the case with university patents, for a variety of reasons). Also, information asymmetry is considerable, making it hard to come to smooth, efficient transactions. Finally, patents represent several types of value to their holders. A famous study terms these values, in decreasing order of importance, as 'prevent copying', 'blocking', 'prevent suits', 'for use in negotiations', 'enhance reputation', and 'licensing revenue' (Cohen, 2000). University-owned patents can only offer the last two values.

In any case, however, universities should receive a fair compensation for their efforts, regardless of the patent being university-owned or not. This compensation may be in monetary terms, but also in terms such as creating or funding Ph.D. or postdoctoral positions, access to scarce research facilities owned by firms, and so on.

Finally, the fund-generating opportunities for patents are poor. This is clearly demonstrated by experiences in the USA, where university (owned) patenting is much more prolific than in Europe. The low–average prospects are due to the highly skewed distribution of licensing income from university patents. Most universities will have no real revenue from patents, and for those few universities that do, only a handful of patents account for all the income. An example is Columbia university, where 94% of its frequently quoted patent revenues of US$ 30 million in 1995 originate from only five patents (understandably dubbed 'golden eggs'). Finally, patents come with considerable transaction costs for both parties.[22] This creates the risk that many patents will remain unlicensed (or licensed to fewer parties than those that would have otherwise adopted the technology), obviously resulting in sub-optimal access to knowledge developed by public funds.

While studies focusing on the USA have shown that financial incentives do work (e.g. disclosure volumes increase when researchers are given a larger share of the patent revenue), studies in Europe have been consistent in concluding that other incentives such as enhancing prestige or reputation and looking for new stimuli for research are more important than financial incentives.

Contrary to popular belief, there is no real difference between Europe and the USA concerning the contribution of universities to patents. Although one might be tempted to encourage an increase in the ratio of European university-owned patents, there is little evidence that this will lead to more efficient knowledge transfer. In fact, there are many reasons to believe that it is more desirable to have the ownership of university-invented patents at companies (as is often the case in Europe). In any case, however, universities should receive a fair compensation for their efforts, regardless of the patent being university-owned or not. If universities, having obtained reliable evidence which withstands scrutiny, decide to patent at a serious rate, they should be prepared to subsidize this activity, as patenting will be a loss-making activity for all but a few exceptions.

Whereas financial incentives to faculty have proven to increase patenting rates at US universities, studies conducted in Europe point in the direction of researchers being more susceptible to the enhancement of prestige and reputation and being less driven by individual financial gains. Further study is needed on the sensitivity of European researchers for the various incentives.

Spin-offs. Why should universities create companies from research? There are several answers to this question, but perhaps the most important ones are (1) to contribute to national competitiveness and thus fulfil the university's third mission, (2) to create local or regional jobs, and (3) to generate financial return for the university. University spin-offs are an interesting means of technology transfer, because alongside the 'codified' knowledge, also tacit knowledge is transferred to industry. Examples from the USA and Canada have shown successful cases including leading biotech firms such as Genentech, Amgen, Biogen and Chiron, as well as information technology firms Cisco, Cirrus Logic, Akamai, Silicon Graphics, and Netscape.

However, the economic impact of spin-offs is not evenly distributed over the whole economy. Instead it is mainly confined to the area of life sciences (in the USA over 50% of all university spin-offs), and information technologies. This is easier to understand if one knows that the creation of most spin-offs

[22] These include costs for drafting the patent, application and renewal fees, costs for possible litigation, but also costs for both university and the company for negotiating a licensing deal.

is prompted by particular technological opportunities, and such opportunities appear to be very unevenly distributed over economic sectors. As a result, the economic impact may be considerable in a few sectors, but almost absent in most others.

When assessing the potential of university spin-offs as an efficient means of knowledge transfer, it should be noted that they are usually based on a service-driven business model e.g. offering consultancy services. Although useful, such spin-offs obviously do not have the growth (employment) prospects and economic impact of product-driven business models.. Also, university spin-offs are generally unlikely to generate revenue for a university.

Most relevant for this paper is that there is a clear relationship between TTO policies and activities, and the success of spin-offs. For Europe, Mustar, Wright and Clarysse (2008) examined the effects of various TTOs and national policies relating to spin-offs, and stress the great heterogeneity of this phenomenon regarding objectives, types of companies, teams, parent institutions and TTOs. Despite the provision of substantial sums of support funding, they conclude that results across Europe are disappointing. The key to success is that TTOs need to make a number of considered choices, like the degree of selectiveness (support any spin-off idea or concentrate on a few promising ones instead), and focus on either spin-off creation or spin-off development. These choices have to be considered, and a TTO must have the capacity and skills to match the chosen line - which was often found not to be the case.

University spin-offs do contribute to the local economy and are a functional channel for knowledge transfer. Their economic impact, however, is mostly restricted to a few sectors, which means they only complement other channels. At the TTO it is crucial that objectives, budget, level of selectiveness, and operational activities are well aligned. Here there is still considerable room for improvement. Also, it is important to accept, that from the perspective of the university, spin-offs are very unlikely to develop into revenue-generating activities. It is also noted that there are substantial national/regional differences in important factors such as individual drivers, availability of venture capital, and presence of key research or industries in the key sectors, among other things.

Concerning incentives, we note that most of the incentives and drivers for entrepreneurship are endogenous, i.e. are not influenced by external factors. If universities want to create incentives for the group of individuals that already has the right characteristics, it bests created prospects that will enhance the academic position of the individual, as well as further research funds for his or her group.

Publicly funded collaborative research. University-industry collaborations have a number of strengths. They facilitate the transfer of tacit ('sticky') and complex knowledge. They provide firms with informal access to students and direct personal links with top professors. Funds for such collaboration support the development of long-term university-industry relationships. Within universities, these collaborations make seasoned researchers work together with (post)doctoral students and master students ('mentor model'). Moreover, European and national funds for collaborative research projects have been found to both enlarge the network of contacts as well as to support the development and learning of collaborative culture. Importantly, recent studies agree that funds for collaborative research hardly crowd-out private investment. In other words, firms do not reduce their own R&D investment when they receive government funding.

One challenge that policy makers face is how to cater for both basic research and applied (or experimental) research. Basic research may lead to unexpected fruitful scientific and technological developments, with high spillovers to other fields, whereas applied research is more likely to benefit participating firms on the short term but have fewer spillovers. Here, policy makers could be advised to develop differentiated programmes, ensuring that both types of research are promoted in a balanced way.

Further challenges include dealing with the differences in the mindset and objectives of both parties, particularly in the area of knowledge sharing, appropriability, and applicability, as well as the unclear or unrealistic goals, unmet expectations, and lack of trust, honesty, commitment, communication, and openness. Various national programmes have introduced interaction frameworks including user committees which have proven to be successful in mitigating these problems.

Public funds for collaborative research between universities and industry are some of the best performing knowledge transfer channels. Thanks to the EU's Framework Programme, collaborative research including both university and industrial partners has taken off considerable, and these partners come from nearly all EU Member States. Policy makers can further improve them by developing differentiated programmes for both basic and applied research, and by adopting experiences in national programmes that help to align the focus and expectations of all partners involved.

Concerning incentives, universities may increase the weight of involvement in collaborative research in assessments and research ranking.

Voucher schemes. Albeit relatively new, voucher schemes are already proving to be successful in addressing a gap in current knowledge transfer: the involvement of SMEs. Experience at national level shows that vouchers have a large degree of additionality (they activate SMEs that otherwise would not have interacted with universities). Moreover, this method greatly complements other means of knowledge transfer.

For most technology transfer channels, SMEs are at a disadvantage compared to large firms and multinational corporations. Vouchers are a promising method of catalyzing technology transfer to SMEs and definitely deserve further consideration and study.

In fact, vouchers systems are incentives themselves, so we do not list further incentives here.

1 Introduction and methodology

In the past decades, more and more attention has been focussed on the way universities and other public research organizations contribute to economic growth. At European, national, and institutional level, various policies have been introduced to improve knowledge transfer between research and industry. These policies address, directly or indirectly, a wide variety of channels for knowledge transfer, ranging from publications to intellectual property rights. There is ongoing debate on the relative effectiveness of these different policies. This paper aims to evaluate those incentives and policies that affect the knowledge transfer activities of individual researchers as well as research institutes such as universities and Public Research Organisations (PROs).

In order to do so, we firstly discuss the various knowledge transfer channels, and the relative importance scientists and industry attribute to them (Chapter 0). We continue by discussing the various relevant policies and incentives (Chapter 0). We focus in more detail on five selected knowledge transfer channels: publications, patents, spin-offs, (publicly funded) collaborative research, and vouchers (Chapters 0 to 0, respectively). We end the paper by revisiting the so-called 'European Paradox' (Chapter 0) and the interdependence between knowledge transfer channels (Chapter 0). As a summary and recommendations have already been provided in the extended management summary, there is no separate concluding chapter.

This position paper is predominantly based on a review of existing literature, focussing on studies that provide factual evidence. Data was collected between February and March 2009. The selection of papers was done as follows: Initially, papers were identified and chosen by querying a set of keywords using Scopus. Preference was given to papers in journals with relatively high impact factors. Additionally, one journal was selected on the basis of its direct relevance to this topic, the Journal of Technology Transfer. Recent volumes of this journal were scanned entirely. From here on, the snowball method was used to identify other relevant literature and seminal contributions to this field of research. As much as possible, findings were collated on the basis of evidence and measurements (preferably quantitative), not on unproven expectations. As a consequence of the availability of material, a rather large part of the input relates to the USA, where many more studies have been performed. This does have consequences for the generalization of the findings. Fortunately, there have also been good European studies, notably in Italy, Spain, the Netherlands, and in Scandinavian countries.

The full literature survey prepared for this study is available as a background paper and can be downloaded from http://home.tm.tue.nl/rbekkers/bekkersbodas_EC_expert_background.pdf.

Some further notes:

- In many areas, different, though related, terminology is used. For instance, in the field of spin-offs, there are also start-ups, spin-outs, IPR-based spin-outs, and New Technology Based Firms (NTBFs). Typically, authors have ascribed various meanings to these (which are not necessarily consistent). Although we do discuss various definitions where relevant, for reasons of accuracy we use the original wording of the author when we present their findings.
- Most studies in this area focus on knowledge transfer at universities, and only to a lesser degree on knowledge transfer at Public Research Organisations (PROs) and Higher Educational Institutes (HEIs). It is likely that a number of findings would also be valid for PROs and HEIs, but this is not necessarily so.
- This paper talks of knowledge transfer towards *industry*, since this is the usual term in this field of research, but generally the same holds for knowledge transfer to other economic sectors such as services. For similar reasons, technology transfer equals knowledge transfer.

2 Knowledge transfer channels and their relative importance

The existing literature is quite consensual that knowledge transfer between university and industry occurs through a diversity of channels. Some studies have analysed the importance of a very extensive list of channels; an example is shown in Table 1, where both university research staff (the 'senders' of knowledge if we adopt a linear view) and industrial R&D researchers (the 'receivers' of knowledge) were asked to rate the various knowledge exchange channels they utilised themselves (Bekkers and Bodas Freitas, 2008). Other studies have found similar ratings (Cohen et al., 2002; D'Este and Patel, 2007). The wide range of channels can however be reduced to a handful of groups: publications, labour mobility, informal contacts, collaborative and contract research, spin-offs, patents and licensing.

Table 1: Percentage of industrial R&D staff and by university research staff that rate a given knowledge transfer channel as 'important ' or 'very important' [23]

Form of knowledge transfer from universities to firms	Industrial R&D staff (n=575)	University research staff (n=454)
Scientific publications in (refereed) journals or books	76%	90%
Other publications, including professional publications and reports	82%	81%
Patent texts, as found in the patent office or in patent databases	71%	38%
Personal (informal) contacts	73%	91%
University graduates as employees (B.Sc. or M.Sc. level)	69%	77%
University graduates as employees (Ph.D. level)	62%	89%
Participation in conferences and workshops	67%	89%
Joint R&D projects (except those in the context of EU Framework Programmes)	60%	80%
Students working as trainees	63%	63%
Joint R&D projects in the context of EU Framework Programmes	49%	65%
Contract research (excl. Ph.D. projects)	44%	55%
Financing of Ph.D. projects	37%	76%
Sharing facilities (e.g. laboratories, equipment, housing) with universities	33%	44%
Staff holding positions in both a university and a business	36%	63%
Flow of university staff members to industry positions (exc. Ph.D. graduates)	35%	47%
Licences of university-held patents and 'know-how' licences	32%	33%
Temporary staff exchange (e.g. staff mobility programmes)	27%	43%
Personal contacts via membership of professional organisations	32%	41%
University spin-offs (as a source of knowledge)	32%	47%
Consultancy by university staff members	35%	55%
Specific knowledge transfer activities organised by the university's TTO	15%	26%
Contract-based in-business education and training delivered by universities	14%	36%
Personal contacts via alumni organisations	10%	23%
Total Average	*46%*	*59%*

Publications and informal contacts are found to be the most important form through which university knowledge serves as an input to industrial innovation. It is through scientific publications that industry identifies the streams of university research they need and the people they need to contact (Narin et al., 1997; McMillan et al., 2000; Cohen et al., 2002, Bekkers and Bodas Freitas, 2008). In particular, knowledge accessed through publications was found to be concerned either with the properties, characteristics or composition of materials and components, or with laws, theories, and general principles (Gibbons and Johnston, 1974). Informal contacts are both a crucial driver and an outcome of academics' interaction with industry. The more informal the contacts, whether of a personal or professional nature (previous work experience, student supervision), the more an academic is expected to engage in collaborative research projects with industry (D' Este and Patel, 2007; Ponomariov and Craig, 2008).

Labour mobility (i.e. flows of university staff members to industry positions, staff holding positions in both a university and a business; temporary staff exchange) seems to be an important form of transferring knowledge between university and industry, especially if breakthroughs are expected and knowledge is not likely to be written, published or fully embodied (Bekkers and Bodas Freitas, 2008). The employment of university researchers is described as an effective way to transfer knowledge from universities to firms, especially for the successful application of university patents and spin-offs in

[23] Answers are based on a 4-point Likert-like scale, with values ranging from 1 ('of very little importance') to 4 ('very important'). Respondents who indicated they did not use a channel were excluded for calculating these averages.

commercializing products and surviving (Zucker, et al., 2002; Gübeli and Doloreux, 2005; Bercovitz and Feldman, 2006). In this paper, we also consider staff mobility as postgraduate students doing projects with industry because in many European countries, doctoral students are also considered as university staff. These students are a particularly important channel of knowledge transfer because they are already connected to inventions through academic activities (Lam, 2005; Balconi and Laboranti, 2006; Lockett et al.,2008).

Collaborative and contracted/consulting research seems particularly important for transferring written and published as well as systemic and interdependent knowledge because university and industry join and overlap research efforts to develop innovations, experiment with products and concepts, and solve complex problems (Kline and Rosenberg, 1986; Pavitt, 1998; Bekkers and Bodas Freitas, 2008). Indeed, collaboration with universities allows firms to have person-to-person interaction with scientists, who play the important role of 'translating' information from scientific journals into a form meaningful to the industrial 'problem-solver' (Gibbons and Johnston, 1974, p.236). Collaborative research is a main form of interaction with large, knowledgeable firms (Tether, 2002; Bodas Freitas et al., 2008).

Patents and licensing are important channels for the transfer of more applied or experimental research rather than of basic research findings, particularly in biology, chemical engineering, and material sciences (Agrawal and Henderson, 2002; Bekkers and Bodas Freitas, 2008). National science policies have been increasingly focusing on the commercialisation of university knowledge through the promotion of university patenting, licensing and spin-offs. However, the evidence is compelling; these channels are among the least used and the ones found less important for transfer knowledge. In particular, Agrawal and Henderson (2002) show that patents account for only around 10% of all knowledge transfer activities in mechanical and electrical engineering at the Massachusetts Institute of Technology (MIT). This is the perspective of both scientists and industrial researchers (Bekkers and Bodas Freitas, 2008; D'Este and Patel, 2007; Cohen et al., 2002).

3 Policies and incentives

Generally speaking, an **incentive** is something that motivates or encourages one to do something. In economics and sociology, an incentive is any factor (financial or non-financial) that enables or motivates a particular course of action, or counts as a reason for preferring one choice to the alternatives. It is an expectation that encourages people to behave in a certain way.[24] There are several types of incentives:

- remunerative incentives (e.g. direct and indirect financial incentives);
- moral incentives (e.g. seeking self-esteem, approval or admiration; sense of guilt; or condemnation); and
- coercive incentives (if there is a risk of pain, punishment, imprisonment, confiscation or destruction of possessions.

In this position paper, we aim to understand the role of incentives and policies in relation to knowledge transfer. It may be a well considered fact that academics, in addition to financial incentives, are particularly sensitive to moral incentives. Peer recognition is arguably one of the main driving forces for academics to perform and to get engaged in any activity. For that reason, we will take a broad approach when discussing incentives.

Policies are deliberate plans of action to guide decisions and achieve rational outcomes. In this context, EU member states and the EU itself have developed policies in order to promote knowledge transfer, mostly aiming at universities but sometimes at individual researchers as well. Also universities themselves, to a differing degree, have introduced policies to incite their staff to get engaged in knowledge transfer.

For the purpose of this study, we will analyse individual and institutional incentives to interact with industry, making use of the six (groups of) channels mentioned previously. Table 2 summarises individual incentives to transfer knowledge using these six main channels, as well as governmental and institutional policies that can influence scientists' individual incentives to use these channels.

[24] http://en.wikipedia.org/wiki/Incentive. This definition is based on Sullivan, Arthur; Steven M. Sheffrin (2003). Economics: Principles in action. Upper Saddle River, New Jersey: Pearson Prentice Hall.

Table 2: Incentives and policies targeting individuals

	Incentives	University/PRO Policies	National/EU policies
Academic and professional publications	* Recognition by peers * Personal motivation Fulfil job tasks Job promotion Conference participation	Output requirements Budget/resource planning (incl. teaching load) Job requirements (institute level) Career planning rules Making conference budgets available	Job requirements (public calls), Career planning rules (NL: UFO) Travelling funds Funds for individual or group research projects (NL: NWO/ STB, IT:FIRBE, PT: FCT)
Informal contacts	Social recognition Networking Access to resources Identifying promising research areas Stepping stone for other TT channels	Travelling budgets Guest lecturers from industry Allowing part-time positions	Funds for conference participation
Labour mobility	* Change in jobs/activities * Desire for applicability * Diversity in work * Complementarily of work Financial/salary Resources/facilities at firms Identifying promising research areas	Career planning rules Allowing part-time positions Allowing/encouraging traineeships at firms Staff mobility programmes Budget/resource planning (incl. teaching load) Prevent outflow of staff (negative incentive)	Reducing bureaucratic barriers Individual funds (Marie Curie) Funds for labour mobility work (Marie Curie) UK funds for mixed uni/firm Ph.D. Allowing part-time positions
Collaborative and contract research	Funds for own research or for group (also: Ph.D. / postdoc funds) Resources/facilities at firms Recognition by peers or industry Maintaining contacts Fulfill job tasks Job promotion	TTO activities and supports Budget/resource planning (incl. teaching load) Encouraging/requirements to attract funds	Funds for contract research (e.g. Innovation voucher) National funds for collaborate research EU funds for collaborate research (e.g. FP7)
Spin-offs	Job opportunities / hopping Funds for own research or for group (also: Ph.D. / postdoc funds) Desire for applicability Entrepreneurship	TTO activities Encouraging spin-offs Financing/equity in spin-offs Allowing temporary leave or part-time position	Allowing temporary leave or part-time position Funds for entrepreneurship
Patents and licensing	* Pleasure of being an inventor * Recognition by peers or industry Income (private) Career opportunities Funds for own research or for group (also: Ph.D. / postdoc funds)	Revenue sharing rules Career planning rules Disclosure rules TTO activities Encouraging to attract funds	Revenue sharing rules Rules of funding agencies on IPR (NL: STW) University patent legislation Recognition of past patenting performance by funding agencies

*: Intrinsic motivation, not directly addressed by incentives or policies

University researchers are motivated by several different and possibly contradictory incentives to allocate their time to teaching, personal long-term curiosity-driven research, participation in collaborative research projects, and technology transfer activities. In particular, they are motivated by curiosity, reputation, career (in particular to secure a tenure position), access to research resources and personal financial gain (Lee, 1996, 2000; Geuna and Nesta, 2006; Crespi et al, 2006). University researchers' performance criteria increasingly include good scientific productivity of peer-reviewed publications, participation in high-quality, multi-disciplinary and multi-team collaborative research projects, and good student evaluation. Moreover, political and institutional discourse puts more and more pressure on scientists to become involved in technology transfer, to foster research applicability and be entrepreneurial.

Given the personal and professional incentives on the one hand, and the policy-making incentives on the other, scientists face a trade-off between producing traditional university outcomes (good research, skilled students) and being entrepreneurial and producing applied research outputs (patents, spin-offs, and industrial contract research). According to some authors, the relative productivity of researchers in fundamental and applied research will affect their time allocation decision, and consequently their response to policies encouraging patenting (Beath et al., 2003; Jensen and

Thursby, 2004). However, the rise in applied research might not lead to less basic research, as there is no evidence for substitution, or crowding-out between patenting and publishing activities (Agrawal and Henderson, 2002; Jensen and Thursby, 2004). Indeed the most productive researchers in terms of publishing are also those with the most patents, although this is likely to differ significantly across scientific fields (Geuna and Nesta, 2006; Stephan et al., 2007). Moreover, researchers who combine research and industry interaction obtain higher funding from competitive public sources than those who only engage in research (Bozeman and Gaughan, 2007; Manjarres et al., 2007).

Nevertheless, increased pressure for applicability and university patenting raises issues concerning the disproportionate incentives for short-term research and the quality of education provided to students (Geuna, 2001; Beath et al., 2003). Especially the quality of teaching might be compromised due to less time allocated by scientists to it as well as over-emphasis on short-term specific skill needs at the expense of a broader education (Dosi et al., 2006). Scientists end up only being involved in short-term research, and not being able to maintain a personal line of research, in case they are not able to frame their basic long-term line of research to the sequence of the collaborative and contract research projects they are involved in (Bozeman, 1994; Geuna and Nesta, 2006). Indeed, Manjarres et al (2007) show that university-industry relationships have a positive effect on university scientific productivity only if they are based on the development of R&D contacts and if the funds obtained through these activities do not exceed 15% of the researcher's budget. When interaction with industry is based on low scientific technological content — technology support and consultancy as well as specific training contracts — the activity may reduce productivity. In particular, the productivity of high-performing scientists decreases when involved in long-term relationships with one specific industry-related sponsor (Goldfarb, 2008).

In the same vein as above,
Table 3 summarizes incentives and policies that target institutions (as opposed to individuals). Again, we look at the six identified groups of knowledge transfer channels.

Table 3: Incentives and policies targeting institutions (universities and PROs)

	Institutional Incentives	**National/EU policies**
Academic and professional publications	* Attracting high-quality staff and students Ranking and scoreboards Level of government funding (UK: RAE) Attract contract/collaborative research	Funding system (UK: RAE) Benchmarking exercises Funds for individual or group research projects Recognition of past publishing performance by funding agencies
Informal contacts	Improve performance level of staff (creativity, new horizons) Access to resources	Promote networking
Labour mobility	Improve performance level of staff (creativity, new horizons) Industrial applicability of research Prevent outflow of staff Attract contract/collaborative research	Allowing part-time positions Reducing bureaucratic barriers Post-graduate scholarships (individuals) UK funds for mixed uni/firm Ph.D.
Collaborative and contract research	Ranking and scoreboards Attract research funds Resources/facilities at firms Networking Identifying promising research areas	Funding system Benchmarking exercises Funds for contract research (e.g. Innovation voucher) National funds for collaborate research EU funds for collaborate research (e.g. FP7)
Spin-offs	Ranking and scoreboards Financial benefits (e.g. equity)	Benchmarking exercises Funding policies?
Patents and licensing	Ranking and scoreboards Financial benefits (licence fees)	University patent legislation

University institutions are confronted with a trade-off between short-term and long-term objectives in research and teaching. On the one hand, the quality of the university relates to the quality of the research done by its staff, and consequently by the publication productivity of scientists as well as by level of students it is able to attract and the jobs their students are able to get after graduation. On the other hand, increasing short-term financial constraints and national policies create incentives in

universities to raise the level of collaborative and contract research along with commercialisation of research results, applicability, and spin-offs.

The literature is not consensual on the importance of institutional differences in the level and intensity of scientist interaction with industry. Some authors, especially those focusing on the US context, find that institutional differences in the level of industrial financing and quality of university are good predictors of the involvement of scientists with industry rather than the level of intensity of that interaction (Ponomariov, 2008). Other authors argue that the institutional characteristics of UK universities are not important when individual characteristics of scientists are considered (D'Este and Patel, 2007). Moreover, Bozeman (1994) argues that there is no relationship between effectiveness of technology transfer activities and organisation of departments.

With changes in the funding structures of university research, and the new industrial revolution in the 1980s based on the development of science-based (biology and electronics) technologies, there has been a transformation in the attitude of faculty members towards recognition of industry interaction as valid university activity (Hagedoorn, 1996; Lee, 1996, 2000; Azagra et al, 2006, Manjarres et al, 2007). Some authors even claim that science and industrial research worlds have been developing flexible organisational structures to facilitate knowledge development; consequently, they are always less dissimilar (Lee and Gaertner, 1994; Lam, 2005). Indeed, several authors show that interaction with industry is widespread (D'Este and Patel, 2007; Bekkers and Bodas Freitas, 2008). Moreover, universities, industry and policy-makers are changing their view of postgraduate students as recipients of knowledge to considering students part of the knowledge transfer process (Horowitz Gassol, 2007; Lockett et al. 2009).

However, not all collaborative and contract research is equal in terms of scientific content and impact on researchers' productivity. In particular, high-scientific interaction with industry, when maintained as a minor activity of scientists, increases the productivity of scientists (Manjarres et al, 2007). Therefore, collaborative research contracts, licensing and business start-ups are perhaps of greater importance to the university than performing specific intermittent services, not only because of their high income-generation potential, but because of their high innovation-generation potential (Horowitz Gassol, 2007). Still, universities benefit very little from technology transfer activities (Bozeman, 1994; Geuna and Nesta, 2006).

In summary, individual and organisational capabilities and incentives are not similar and interchangeable (Gittelman; 2006, p. 1067). Therefore, policies that promote higher involvement of universities in industry research by focusing on a reduced number of channels, and at same time making the financial support of universities increasingly less structural, are most likely to be unsuccessful. In order to succeed, policies need to address a wide variety of channels to support research, quality of teaching, and high scientific content interaction with industry (Crespi et al., 2007; D'Este and Patel, 2007; Manjarres et al, 2007).

4 Publications

Publications are consistently found to be the most used and highest rated knowledge transfer channel, both by universities and by industry (see, among others Bekkers and Bodas Freitas, 2008; Cohen et al., 2002; D'Este and Patel, 2007.

Publications also have an important signalling function for other knowledge transfer channels. Several studies report that academics with better publications are the ones that are able to attract more public and private research funds. Industry looks for collaboration with good quality universities, which are the ones with recognised research productivity and well-trained students. Moreover, evidence is consensual on the strong correlation between the importance of scores of publications, informal information exchange, and joint R&D projects (Bekkers and Bodas Freitas, 2008; Bozeman and Gaughan, 2007). In particular, Cohen et al. (2002) show that industrial R&D personnel seek out academics, search the literature, or form cooperative ventures with public research institutions more commonly to address particular needs or problems than to generate new project ideas.

In the past decade, many scholars in the field of innovation studies were intrigued by the question of whether activities such as patenting have a negative impact on the publication records of scientists or

not. One possible argument is that patenting competes for time and focus. Nowadays, there is robust evidence that both activities are mainly complementary (see Stephan et al, 2007). In other words researchers who patent, publish more, not less. This seems to apply to top scientists in particular, but might be less the case for younger scholars. Carayol (2007) observes that older researchers are more likely to patent. He suggests that this might be linked to the relative window of opportunity for publishing on the one hand and patenting on the other. Young researchers tend to focus more exclusively on publishing as that is more valuable for their career at that point. Older researchers switch to focussing more on patenting as the expected pay-offs are more immediate that those from publishing, and may provide a source of income beyond retirement. Although Carayol confirms earlier findings on a correlation between patenting and publishing, he argues that it might not be at laboratory level; the probability of patenting is found to be greater in large labs.

One often overlooked aspect of technology transfer policies is that writing publications is not necessarily an activity that takes place in full isolation from industry. Papers that have co-authors both from university and industry illustrate a tight interaction, for instance. In the Eindhoven University of Technology, for instance, an average of 10.3% of all publications is co-authored with industry, and in selected disciplines this number rises to as much as 25% (Tijssen, 2009).[25] Although this particular university ranks top of the league in this respect, the numbers in other universities are considerably higher than the number of patents a university owns or the number of spin-offs.

For publications to have an impact on firms, they need to be (1) accessible, (2) understandable and (3) usable in the context of the firm. There has been a great deal of discussion on the accessibility of journals, and prices of both journal subscriptions and catalogues / search systems (e.g. Scopus, ABI inform) are believed to be prohibitive for many firms. There is considerable progress in this area, including new, better accessible journal titles and open depositories, but many scholars are 'locked-in' by existing journals with high(er) impact rating. Also many regular publishers are relaxing the terms in their copyright transfer policies (increasingly they allow scientists to include published papers on their own website, provided they do not use the journal's layout). Accessibility of journals, especially for SMEs, is still a major obstacle. Although the situation is improving, much can still be done.

Now we know about the role of university publications, we will focus on the incentives. What incentives are at work to make academics publish? Given the established design of academic careers, emphasising fundamental research and recognition by peers, publication of research results represents to scientists both the fulfilment of their job tasks and the possibilities for job promotion and tenure (Dasgupta and David, 1994; Rosenberg and Nelson, 1994). Besides these inherent job related incentives, publication of research results may also be a way in which academics can feel personally rewarded by diffusing the theoretical and technological puzzles they solve, in the hope of supporting the improvement of existing technologies and social or technical practices. However, the distribution of publications is found to be skewed across disciplines as a small proportion of academics produce the great majority of all publications (Lotka, 1926; Merton, 1968).

Institutional and governmental efforts to redesign the academic career in terms of the quality and quantity of output requirements, as well as the definition of teaching loads, may have an impact on researchers' publication output. In each country, the responsibility for academic career design is shared differently between national governments and university departments. Therefore, in some countries, the potential for some career design changes rests with governments in others with universities.

Governmental policies relating to the amount of structural funding of research as well as the relative size of structural to competitive funding of research also affect the incentives for researchers to publish, as they can change the relative cost of performing research and teaching (Beath et al., 2003; Jensen and Thursby, 2004). Structural funds for university research have been decreasing and partially substituted by competitive funds allocation (Geuna, 2001). This change is expected to make researchers more entrepreneurial, dynamic and motivated to set up research proposals and apply to public and private tenders. Evidence supports that these policies may increase the concentration of resources and capabilities in a small group of researchers (Bozeman and Gaughan, 2007; Manjarrés et al., 2008).

[25] The CWTS Ranking data used here is largely based on the "ASSIST" project funded by the European Commission, DG-R.

National research grants for individual and group research projects exist in almost all European countries. They usually grant sponsorships based on the quality of the proposal and on the curriculum of their proponents. By providing funds for research, these grants are creating the short to mid-term resources for academic researchers to focus on research activities and to publish their results. Moreover, these competitive public funds for research not only create incentives for publication, as the publication record of proponents is significant for attracting sponsorship, but also for the output performance assessment of the sponsored projects. Indeed, several studies report that academics with better publications are the ones that are able to attract more public and private research funds (Bozeman and Gaughan, 2007). However, the maintenance of long-term research agendas financed by industry-related grants is found to only improve the productivity of the least productive scientists (Goldfarb, 2008).

5 Patents

Undoubtedly, university patenting has been the hottest topic of discussion on the commercialisation/valorisation of public research, and in the more general discussion on knowledge transfer between universities and industry. Growth in university patents has been a very visible phenomenon, particularly in the USA and to a lesser degree in Europe and other parts of the world. Over the years, various university patenting policies have been introduced. Some aim to achieve their objectives by imposing obligations and rights, others try to change behaviour by providing or strengthening incentives, or raising awareness. Firstly, there are national or regional policies that target universities and PROs or individual researchers. The US Bayh–Dole Act is the best known example. In Europe there are currently no comparable policies, but there have been policies / legislative changes relating to the ownership of university patents (see below). Secondly, some institute policies address individual researchers. In the USA, Bayh–Dole obliged universities to implement strict policies, whereas also in Europe and elsewhere, institutes introduced various policies relating to invention disclosure and royalty sharing.

Firstly, we will focus on **the current level of university patenting in Europe**. Here, many policy makers have been eagerly looking at the ratio of US university patents compared to the total number of patents in that country. It is believed that Europe is lagging far behind. This perception was well illustrated by the talk that Michael Porter delivered for Dutch governmental and industry leaders (Porter, 2001). He presented the supposedly low ratio of university patents as one of the key reasons why Europe, and the Netherlands in particular, are lagging behind in university-industry relations. He based his observations on a list ranking Dutch owners of US patents, granted between 1996 and 2000. *'The top US university produced 1585 patents, while the top Dutch university produced just 13.'* (Porter, 2001, page 38). The view expressed by Michael Porter aligns very well with the view of the European Paradox, which maintains that Europe is good in basic research but the public research sector fails to commercialize its knowledge and get it across to industry.[26] However, when assessing the number of university patents, we also need to ask ourselves the question whether the data being used (in some regions more anecdotic than representative) is actually a reliable indication of university involvement in patenting. In recent years, significant new insights have been gathered on this, showing that the 'official' numbers on university patenting are seriously biased downwards. The key is that not all patents invented by university faculties are eventually assigned to (i.e. owned by) the university. There is a tendency for researchers/professors to let ownership of the patent be assigned to the company that financed the research project, but to be included in the list of inventors or to apply individually as patent assignees. Therefore it is useful to distinguish between university-owned and university-invented patents. Studies in Belgium, Finland, France, Germany and Italy - by Balconi et al. (2003), Meyer (2003) and Saragossi and van Pottelsberghe de la Potterie (2003), all in Geuna and Nesta, 2006 - provided clear empirical evidence that the number of university-invented patents is much higher than the number of patents owned by universities. This was confirmed on a larger scale by PATVAL, a large scale survey among patent inventors conducted by the DIME Network of Excellence (see Giuri et al, 2007 for an extensive report on the study, and Verspagen (2006) on the findings related to university involvement). This survey provided a database of more than 9000 valid responses from France, Germany, Italy, the Netherlands, Spain, and the UK. When taking the university-invented into consideration, the total number of university-involved patents jumps up

[26] EC (2006) puts it as follows: '[The European paradox denotes] that Europe is unable to sufficiently turn research results into globally competitive products.'.

considerably. As reported by Verspagen (2006) on the basis of this data: *'In Germany, France and Italy, university-owned patents are a very minor fraction of the total (<0.8%), but the fraction of non-owned, university-inventor-involved patents is larger than 2.5% in all three cases.*' From this, it can be concluded that university plays a considerably more important role in patenting than what is often assumed. In summary, it can be argued that university involvement is substantially higher than most 'official' data suggests and arguably is not much below the US level.[27] Many patents with academic inventors are assigned to companies, and this is arguably even a more successful means of technology transfer than university-owned patents.

Patents have value for their owners in several ways. The 'classic' values are the (1) the temporary monopoly for using the patented knowledge for a product, service or process, and (2) the option to charge licensee fees to others and thus generate licensing income. Over time, however, other values of patent have become more important. These include - among other things – patents as (3) a defensive means in case of accusation of infringement of another patent and a tool for dispute settlement ('if you sue me, realize I can also sue you'), (4) bargaining chips to get access to a technology field and enter into cross-license agreements, (5) signaling devices (you can see from my patent portfolio that I occupy an important position in this technology space), (6) a means to discourage entry by others in a technology field in which the focal firm operates – for instance by creating a patent thicket, (7) slowing competitors' efforts to patent in similar areas and build similar products, and (8) blocking alternative technology routes (other than the ones the focal firm uses itself. A famous study by Cohen (2000) on US manufacturing firms shows that generating licensing income is conceived to be the least important reason for firms to patent. It is, however, the only one well aligned to the model of university-owned patents. It may thus be argued that university-owned patents are sub-optimal.

To understand how patents do help effective knowledge transfer, it is necessary to understand the **underlying economic rationale of university patents.** Like the economics of patents themselves, this is a relatively complex area. Patents are in fact instruments designed to address the market failure when actors are unwilling to invest in research and when competitors would be able to benefit from their efforts without paying, by copying the innovation. As such, patents provide an incentive to perform research. Patents are one of the three 'Ps ' - Property Rights, Patronage, and Procurement, all alternative policies that aim to address the same market failure (see David, 1993). The issue with university patenting is that the incentive to conducting research at universities has already been addressed by an alternative mechanism: patronage. In this mechanism, governments take financial responsibility for the development of new knowledge, by means of instituting a publicly financed system of research aimed at generating and diffusing new knowledge (Verspagen, 2006). This makes it hard to consider university patents in a regular way, as providing incentives to research. Some have addressed this by claiming other, specific arguments why universities should patent. The most important one is that university patents may help effective knowledge transfer to industry. The argument here is as follows: basic inventions may require substantial further investment to develop them into commercial products. Even (and especially) when the basic invention is brought into the public domain, firms will not be willing to invest in necessary further research if they do not have the exclusive right to do so, facing the prospect of deterring possible imitations by competitors. This downstream investment argument, however, implies at least two assumptions. Firstly, the additional investments needed for these 'embryonic' inventions should be non-trivial (in contrast to 'off the shelf' inventions, that may be implemented with little cost). Secondly, there should be no prospects of further (patent) protection during this further investment period. Thirdly, for obvious reasons, the university patent should only be licensed on an exclusive basis. One can certainly think of situations in which all three conditions are likely to be satisfied (for instance some pharmaceutical inventions, where substantial clinical trials are needed). It is unlikely, however, that these necessary criteria will be met on a large scale. In fact, recent evidence from the USA shows that only about half of all university licences are non-exclusive (Thursby and Thursby, 2007). This poses serious questions about the policy objective of having university patents facilitating knowledge transfer. Mazzoleni (2006) also follows this line of reasoning and argues that in the area of biomedical technologies, university patenting and licensing restrictions are a hindrance to downstream R&D, rather than a stimulus.

[27] It is hard to compare Europe with the USA because in the latter country, universities are not allowed to leave the ownership of the IPRs of their inventions to firms. Nevertheless, Thursby et al (2009) report that in a sample of 5811 US patents with faculty as an inventor, 26% were solely assigned to firms. This indicates that also in the USA, there might be some downwards bias, but this is likely to be much, much lower than in Europe.

Further justifications for university patenting are also offered. We will briefly mention four of them (*see background report for more details*): (1) patents might help to create feasible spin-offs or start-ups (again, an exclusive licence is indispensable); (2) patents might raise awareness of commercially useful research; (3) patents may prevent 'pirating', applications of inferior quality, or unethical use; and (4) patents may act as 'exchange chips' ensuring access to IPR owned by others. All in all, the rationale for these other justifications is even shakier than the one for the downstream investment argument.

One often heard motive for university patenting is the opportunity to generate **additional income or funds, possibly to be used on basic research**. It is certainly true that some universities attract substantial funds with their patents. Typically, universities license their technologies to private and public firms, usually in exchange for the reimbursement of patent costs, an up-front licensing fee, and a percentage of product sales. However, the revenue generated by universities has a very disproportionate distribution. It is disproportionate at institute level: a very small number of universities receive a very large share of the total revenue from university patents. In 1995, the University of California (UC), Stanford and Columbia University earned 60, 36, and 31 million US dollars from licensing respectively (Mowery et al, 2001). Stanford's recombinant DNA gene-splicing patent earned US$ 143 million (Baldini, 2008). In comparison, roughly half of all US universities had a licensing income below 1 million in that year. The distribution is also skewed at the level of the individual patents: within those successful universities a very small number of patents provide the largest share of the total revenue of that institute. In the three universities mentioned above, the revenue share of the top five patents was 66%, 85% and 94%. Within the area of biomedical innovations (the most significant area in this field, accounting for more than 60% of all disclosures at UC), this percentage went up to 100% for two of these universities. For most universities, licensing is a loss-making activity if the costs incurred are also taken into account. The 2003 OECD survey on university patenting showed that the majority of surveyed universities and PROs gained little or no income from their IPR. Most universities' budgets for their TTOs outweigh the income generated by commercialising their IPR (Bekkers and Sampat, 2003), and Nelson (2001) states that it is a myth that universities may expect a lot of money from licensing activities. Licensing is not profitable for most universities, though some do succeed in attracting significant revenue. (Geuna and Nesta, 2006). Similarly, Thursby and Thursby (2007) conclude: 'licensing for many if not most universities is a net drain on university resources'. Altogether, this source of finance has characteristics that are quite similar to a lottery and it is hard to imagine that licensing income can turn into a stable source of finance for universities (Verspagen, 2006). One cannot expect to hit the jackpot too often.

Studies have delivered insights into **incentives for patenting.** US studies show that such incentive schemes work. Lach and Schankerman (2008) demonstrate that US universities which provide stronger royalty incentives to faculty scientists generate greater licence income, controlling university characteristics. They observe that faculty responds to royalties both in the form of cash and research lab support, indicating both pecuniary and intrinsic research motivation. Link and Siegel (2005) conclude that universities that allocate a higher percentage of royalty payments to faculty members, tend to be more efficient in technology transfer activities. Within the European context, however, Baldini (2007), studying a large sample of Italian faculty members who are inventors of university-held patents, concludes that personal earnings do not represent a main incentive for these people. Instead, his findings show that respondents get involved in patenting activities to enhance their prestige and reputation, and look for new stimuli for their research. In a later paper, the same author concludes that the effect of incentives on the commercialisation of university research depends on individual characteristics, which makes it hard to derive clear policy implications (Baldini, 2008).

Concerning the percentage and quality disclosures, the US context (where Bayh-Dole actually obliges researchers to disclose any intention) provides interesting insights. Jensen, Thursby and Thursby (2003) report that many TTO directors believe that substantially less than half of the inventions with commercial potential are disclosed to their office. They also believe that some of the best inventions may not be disclosed because the most productive faculty is less likely to want to take the time to disclose inventions, much less work on further development. Paradoxically, these directors believe that many of the inventions disclosed to them are of questionable value. In their discussion, they reveal what can be considered as a significant negative incentive: getting involved as a researcher in patenting means that very often (71% of cases), the researcher needs to spend time on further research that is necessary to achieve commercial success.

6 Spin-offs

Formerly, universities sought to sell licences for their patents to existing, larger firms. Now, universities increasingly transfer appropriate technology (patented or not) to a start-up company. Why create companies from research? There are several answers, but perhaps the most relevant ones are (1) to contribute to national competitiveness and thus fulfil the university's third mission, (2) to create jobs locally, and (3) to ensure financial return for the university. An underlying rationale is that a great deal of knowledge developed at universities is tacit (and uncodifiable) and the transfer of that knowledge requires the direct involvement of researchers (Zhang, 2009). In fact, as has been shown in the previous section, in almost three quarters of the cases where universities sell licences to larger firms, the involvement of the original scientist(s) is still needed in order to transfer tacit knowledge.

There are several types of such companies. If a new company is founded by faculty members, it is often called a spin-off or, more specifically, an IPR-based spin-off as there is a patent involved. The patent, which is transferred or exclusively licensed, is one of the most important assets of this new company. In Britain, companies using university IP are usually called spin-outs. Spin-offs that are not based on a patent may well include new companies that provide consulting services or other similar business models. There is a large variety in type and definition of spin-offs. The new company might be founded by university employees, bringing their (tacit) knowledge and experience to the firm. These are often called spin-offs, while some use the term 'academic entrepreneurship'. In other cases, faculty members may serve on the scientific advisory board of a new company, without actually moving there (note that in some countries it is not allowed or usual that a faculty member works part-time in a commercial company as well). Student-started companies are often called start-ups, particularly in Britain.

Table 4: Grouping of spin-off model (based on O'Shea et al. 2008, who adapted it from Nicolaou and Birley, 2003)

Orthodox	Both the technology and the academic inventor(s) spin off from the institution
Hybrid	The technology spins out from the institution but the academic inventors' place in the university is retained and they may hold some other part-time position in the company
Technology only	The technology spins out and the academic inventor(s) maintain no connection with new firms but may have equity.

Typically, new firms that are not created by faculty members but nevertheless rely particularly on a university invention, are called start-ups, although some scholars also refer to these as 'spin-offs'. IPR-based spin-offs are a special category, and bringing the IPR (or the exclusive licence for it) into the new firm provides it with a valuable asset. IPR-based spin-offs, however, only account for a minority of university spin-offs, equalling approximately one-third in the USA (Fini, 2008).

How can we recognise potential or 'typical' university entrepreneurs? Which types of universities are most successful in bringing them forth? In which environments do they flourish? The background literature survey has identified a number of determinants of spin-offs and their entrepreneurial founders. These are summarized in Table 5 (for sources, please refer to the background document).

Table 5: Determinants of spin-off activity

Level	**Determinants**
Individual characteristics	Academic entrepreneurship is determined by a number of individual characteristics, such as outgoing, extrovert personalities, higher age (than average firm founders), and previous work for industry Academic entrepreneurs are mainly driven by prospects that will enhance their academic position and further research money for the group. Financial incentives are less and often even have an inverse effect on founding decisions The typical successful academic entrepreneur is someone who built up a brilliant scientific record earlier on.
Institutional determinants	The 'right' mix of governance structures, processes, and context. However, that mix is hard to find and few TTOs manage to make clear choices concerning their goals and objectives, and are able to equip an office that is capable of fulfilling the necessary tasks Being selective is one way to spin out firms that are more valuable (proxied by the chance of going public), but at the obvious price of having a lower number of spin-offs

	In the eyes of academic entrepreneurs, the role and quality of many TTOs are disappointing. TTO offices with highly paid staff (and thus likely to attract higher qualified staff) produce more equity licence deals and more start-ups Historical reasons and long-standing features and cultures at universities seem to determine entrepreneurship to a large degree, making it unlikely that new policies by TTOs and governments will quickly result in strong growth of academic entrepreneurship.
Environmental determinants (e.g. region)	Start-up decisions seem to be largely based on specific technical opportunities that happen to arise in a limited number of fields, namely biotech and information technology The local/regional economy is a strong determinant of spin-off rates and success rates. Southern California (Silicon Valley), Route 128/greater Boston, and Cambridge (UK) are very atypical and can hardly be imitated.

Most relevant for this paper is that there is a clear relationship between the policies and activities of the TTO and the success of spin-offs. For Europe, Mustar, Wright and Clarysse (2008) examined the effects of various TTO and national policies relating to spin-offs and stress the large heterogeneity of this phenomenon, both at the level of the objectives, types of companies, teams, parent institutions and TTOs. Despite the provision of substantial sums of support funding, they conclude that results across Europe are disappointing. The key to success is that TTOs consider all the options thoroughly, such as the degree of selectiveness (support any spin-off idea or focus on a few promising ones instead), and focus on creation or development. It is important to make the right choice and a TTO must have the capacity and skills to match the chosen line - which was often found not to be the case.

Universities and governments share one motivation for promoting spin-offs: their contribution to the local, regional or national economy. This aspect has been emphasized by some very visible and successful spin-offs. These include leading biotech firms such as Genentech, Amgen, Biogen and Chiron, as well as information technology firms Cisco, Cirrus Logic, Akamai, Silicon Graphics, and Netscape (the last two founded by serial entrepreneur Jim Clark).[28] Examples of the economic impact of spin-offs are:

- A study from Band Boston reveals that MIT graduates had founded 4,000 companies by 1997, creating 1.1 million jobs worldwide and generating annual sales of $232 billion (O'Shea, 2008).
- According to the Association of University Technology Managers, spin-offs from American academic institutions between 1980 and 1999 have contributed 280,000 jobs to the US economy and $33.5 billion in economic value-added activity (O'Shea, 2008).
- In Canada, the approximately 1200 university spin-offs that have appeared in the past 20 years together employ some 21,000 people, and have a revenue of 3.6 billion Canadian dollars (Niosi 2006).

However, the economic impact of spin-offs is not evenly distributed over the whole economy, but mainly confined to the areas of life sciences and information technologies. For instance, life sciences (mostly represented by biotechnology), account for nearly 50% of all spin-offs in US and Canadian universities and almost 50% of all patents and licences, for that matter (Niosi 2006). This is linked to the finding that many spin-offs are prompted by technological opportunities, which appear to be very unevenly distributed over economic sectors.

Are university spin-offs performing better than other types of start-up firms? This is not easy to study, as it would be unfair to compare a patent-based university spin-off with an average start-up, say, a bakery. However, there are useful research findings when one restricts the analysis to new firms that received venture capital (and are thus much easier to compare). Out of all US start-up companies founded between 1992 and 2001 that are backed by venture capital, 11% were founded by university entrepreneurs (Zhang 2009). Also, university spin-offs or academic start-ups with venture funding have a higher survival rate than other new firms with venture funding.

Besides their attractive aspects, university spin-offs as a technology transfer instrument also have some restrictions and limitations. The most relevant ones are:

[28] Ironically, the ICT industry also provides famous examples of university drop-outs as successful founders, including Bill Gates, Steve Jobs, and Michael Dell.

- Many university spin-offs employ a service-driven business model (e.g. offering consultancy services). Although useful, such spin-offs obviously do not have the large growth potential (employment) and economic impact of product-driven business models (Bekkers, Gilsing & van der Steen, 2006).
- University spin-offs often suffer from a lack of certain competencies in the area of finance, marketing, manufacturing, and general management.
- Many university spin-offs have a tendency to 'stay local', i.e. they typically remain located close to the campus of their parent. The relative lack of entrepreneur-like attitude results in spin-offs that are not very market-oriented, rather stay located at the campus, and have limited growth opportunities.
- There are examples where universities created significant revenue by selling their equity share in spin-offs or IPOs of their spin-offs. However, in most cases, they are a very unpredictable source of income. Like university patents, the income distribution is very skewed. Given the need for highly qualified TTOs, and depending on their spin-off policy goals, it is more likely that universities need to budget for such activities instead of deriving revenues from them.

7 Publicly funded collaborative research

Since the 1980s, public funds for university-industry collaborative projects have multiplied in Europe and USA, aimed at improving the competitiveness of national industries by supporting the development of national innovative competencies and the growth of a number of high-tech industries. The first EU 'Framework Programme', supporting collaborative R&D projects, was launched in 1983, and despite the relatively small size of the European science and technology budget compared to national budgets, the successive Framework Programmes have developed a collaborative culture in Europe and a comprehensive network of partnerships involving universities, research organizations and firms (Laredo, 1995, 1998; Grande and Peschke, 1999). The EU activities are complemented by a large number of national funds that promote or require collaboration (*see background document for details*).

University-industry collaboration has a number of strengths. It facilitates the transfer of sticky and complex knowledge and consequently the utilization and transfer of academic knowledge. Collaboration with university allow firms to access new knowledge, ideas and technologies and make progress in the development of new products and processes, as well as providing firms with informal access to students and direct personal links with top professors. Furthermore, the scientist plays the important role of 'translating' information from scientific journals into a form meaningful to the industrial 'problem-solver'. Within universities, these collaborations make seasoned researchers work together with (post)doctoral students and master students ('mentor model'). In addition, direct collaboration seems to enable building future possibilities of interaction and knowledge transfer. Because academic and industrial researchers develop direct personal links through participation on the same collaborative project, in the future they might be more willing to interact to get information, to solve problems or cooperate in other research projects. In particular, these funds seem to support the development of long-term university-industry relationships. Moreover, European and national funds for collaborative research projects have been found to both enlarge the collaborative network contacts as well as to support the development and learning of collaborative culture (Laredo, 1998).

One important question when granting public funds for such collaborations, is to what extent such projects may crowd-out private investment (i.e. firms reducing their own R&D investment when they receive government funding). Nowadays, there is consensual evidence that this is hardly the case. Most evaluation studies find that the public sponsoring of collaborative R&D makes a difference in supporting promising R&D projects that would not otherwise go forward, or would only be pursued at a lower scale of effort (Davenport et al. 1999; Feldman and Kelley, 2006). Some studies show that a great part of the non-awarded firms continued their research plans, but most of them conducted R&D at a smaller scale in the absence of government funding. Indeed, even when awards were given to established collaboration, participants on the projects state that they might not have started the project or certainly not at the same scale, if the project had not been awarded (Davenport et al. 1999; Feldman and Kelley, 2006). These findings are compatible with those from studies based on innovation survey data, which show that firms which collaborate, especially with universities, are the ones that invest more in internal R&D, and consequently the ones that have higher research capabilities (Tether, 2002; Fontana et al., 2006).

One challenge that policy makers face in this area is how to cater for both basic and applied (or experimental) research. In such collaborations, basic research usually occurs in university-driven projects. Although these are more risky and troublesome, they may lead to unexpected fruitful scientific and technological developments, with high spillovers to other fields. When compared to product development investments, basic research might result in new knowledge that opens up much broader avenues of research and applications. An applied focus is more often found among industry-driven projects, and these projects are more likely to benefit participating firms but have fewer spillovers (Bekkers and Bodas Freitas, 2009). Policy makers could be advised to develop differentiated programmes, ensuring both types of research are promoted evenly.

Another challenge lies in problems during collaborative research projects caused by the different organisational incentives and objectives frameworks in university and industry; especially their different attitudes towards knowledge sharing, appropriability, and applicability, but also with unclear or unrealistic goals, unmet expectations, lack of trust, honesty and openness, hidden agendas, lack of commitment, lack of communication, and misunderstandings between partners (Davenport, et al. 1999). Parties with little previous experience of such collaborative programmes are more prone to such problems. Various national programmes have introduced an interaction framework (including user committees, among other things), which is proving to be successful in mitigating these problems.

Coming to incentives, it has been found that universities and firms that tend to 'win' funding programmes, have certain characteristics. Generally speaking, they are large firms with considerable technical capabilities, a relatively open attitude towards sharing results, and a large network. SMEs benefit to a much lesser degree from such programs (apart from spin-offs, obviously). Laredo (1998) also finds that collaborations involving SMEs seem less quick in making progress and achieving results than collaborations involving large firms.

8 Voucher systems

Innovation voucher schemes are policies that aim to build links between knowledge providers and small businesses (SMEs). In fact, they are an incentive system by nature, not really a separate knowledge transfer channel like the channels discussed in the previous sections. Vouchers build links by setting up a program in which SMEs with a research question can apply for a cheque, which can be used to 'buy' knowledge at universities or PROs. Innovation vouchers are relatively new, though there are other (older) schemes with similar properties that do not always bear the same name. One of the first larger innovation voucher schemes, and arguably one of the best known, is that in the Netherlands. Given its pioneering role, we will go into some more detail on that scheme. The Dutch voucher scheme started with three pilots in 2004 and 2005, and from 2006 onwards, it has been available as a regular policy instrument. Its main objectives are to lower the thresholds for SMEs to seek contact with universities and research institutes, and to help them to become more demand-oriented. The current system includes so-called small vouchers, worth 2,500 Euros each (a total of 3000 available). Large vouchers are worth 7,500 Euros each and assume 33% matched funding from the application (3000 in total). Although the amounts are not very high, several SMEs may bundle their large vouchers to a total of 75,000 Euro. Another interesting aspect is that vouchers may be used at universities and PROs, but are also allowed at larger firms with R&D facilities.

Several policy evaluations of the voucher scheme have provided insight into how it functions. Interestingly enough, during the pilot schemes, vouchers were granted at random to approximately half of the applications, whereas the other applications received none. This enabled the evaluators to form a very solid data set and control sample to measure the use of this instrument. In particular, by comparing the number of actual studies commissioned by the successful applications with the number of studies commissioned by the unsuccessful ones, the exact additionality[29] could be determined. The results, reported in Cornet et al (2006), are that *'Out of every ten vouchers, eight are used for a project that would not have been assigned without such a voucher, one is used for a project that would have been assigned anyway, and one voucher is not used.'* Thus, there is evidence for a very high

[29] Additionality refers to the increased use *as a result* of this policy measure. In other words, it compares how many firms are now engaged in R&D projects with universities to the number of firms that would have done it anyway (without the voucher scheme).

additionality. It was not possible to apply this methodology during a later evaluation of the regular scheme, as every application was granted a voucher. Via other means, the additionality measured was still very high and robust, though not as high as during the pilots (Bongers et al, 2008). An extensive survey, augmented by qualitative research, showed that the scheme was highly valued by SMEs, who believed that it contributed significantly to their innovativeness. In recent years, various countries have introduced similar schemes. An overview is given in Table 6. Given the relative newness, there are no results of other evaluations yet.

Table 6: Overview of innovation voucher schemes in Europe[30]

COUNTRY/REGION	(Intended) start date	Name of the scheme	Organisation (person involved)
Netherlands	2004	Innovatievoucher	Senternovem; Ministerie Economische Zaken
Ireland	2nd half 2007	Innovation vouchers	Enterprise Ireland
Northern Ireland (UK)	2nd half 2008	Innovation vouchers	Invest Northern Ireland
West Midlands (UK)	2007	Index Voucher System	Aston University
Austria	2nd half 2007	Innovationsscheck	FFG
France (run at regional level)	At least since1995	Prestation Technologique Réseau (PTR)	OSEO et Réseau de développement technologique régional
Denmark	2nd half 2008	Viden-kupon (knowledge vouchers)	The Danish Agency for Science, Technology and Innovation
Baden-Württemberg (DE)	2nd half 2008	Innovationsgutscheine	Wirtschaftministerium B-W
Sachsen Anhalt (DE)	2008	Forschungsscheck	Investionsbank Sachsen Anhalt
Piemonte (IT)	2nd half 2007	Voucher	FINPIEMONTE S.p.A.
N Rein Westfalen (DE)	2nd half 2008	Pilot 'Innovations-gutschein NRW '(textile sector only)	Zitex zukunfstinitiative Textil NRW
Catalunya (ES)	2nd half 2008	Bonos per Innovar	CIDEM
Valencia (ES)		Cheque Innovacion	Impiva
Flemish Region (BE)	2003	Grondig Technolgisch Advies (GTA) 'short technological service projects '	IWT
Walloon Region (BE)	2009	Cheque Innovation	Agence Stimulation Technologie

The conclusion is that voucher schemes are a successful way to promote technology transfer in a particular area, namely SMEs.

9 Revisiting the European Paradox

Fostering the level of industrial innovation involves not only providing support for the 'demand side'[31] (industry), for the 'supply side' (university), and for the process of technology transfer itself, but also nurturing and reinforcing these market interactions. As some early studies advance, the importance of public research organisations to provide specific relevant innovative knowledge to firms depends on the quality and function of the interaction among various market actors in an economy (Bodas Freitas et al., 2008). We will try to discuss the general performance of university-industry interaction.

One of the first issues we wish to address is the capability of firms (demand) to use university knowledge. Companies do not have necessarily have the capacity to assimilate and exploit the knowledge produced by universities or may not be willing to make the required investment in upstream research activities; and they may well fail to actually benefit from this research (Cohen and Levinthal, 1989; Dosi et al., 2006). Instead, policy-makers tend to look at technology transfer mainly as an issue of transferring intellectual property; they assume that once industry is provided with access to new scientific discoveries, it will invest the necessary resources to convert them into commercial technology and have the capabilities to develop an industrial innovation (Lee and Gaertner, 1994). In

[30] Table is based on input from the IWT Workshop in Belgium on 17 June 2008 "Benchmarkoefening van bestaande innovatievoucher- programma's"

[31] We use the terms 'demand side' and 'supply side' to simplify the discussion, but we do recognize that such a linear view fails to acknowledge the more complex, interactive exchange of knowledge between universities and firms.

particular, Dosi et al. (2006) argue that one of the reasons for European lagging behind in innovation relates to the capabilities of the industry (demand). They argue that on average, Europe observes a 'lower presence in sectors based on new technological paradigms (such as ICT and biotechnologies), a lower propensity to innovate, and a relatively weak participation in international oligopolies in many activities" when compared to the USA. Industrial policies and technology development projects are claimed to be able to support the development of national innovative and competitive competences (Sharp, 2000; Dosi et al., 2006).

The second issue affecting the performance of university-industry interaction refers to the quality of European science (the supply). While the apologists of the 'European Paradox', argue that 'EU countries play a leading global role in terms of top-level scientific output, but lag behind in the ability to convert this strength into wealth-generating innovations' (Dosi et al., 2006, p.1450), bibliometric data shows that Europe is lagging behind the US in top-level science, with the exception of a few institutions and disciplines. Moreover, this lag in scientific quality is expected to be accentuated by the current national and European science policies that have been put in place - the reduction in structural funds for public research, the increasing inclusion of industrial applicability in the competitive allocation of research funds, and the pressure on universities and scientists to become entrepreneurial and patent (Sharp, 2000; Dosi et al., 2006; Geuna and Nesta, 2006). Indeed, Lee and Gaertner (1994) show that some experimental cutting-edge technology development projects at universities were successful and on time, because the university could build on its own comparative advantage in strong research.

Excessive pressure for applicability and short-term research affects the time allocation of researchers to teaching and curiosity-driven research (Geuna, 2001; Beath et al., 2003). This has not only short-term implications for the quality of teaching and the maintenance of individual long-term research lines, but more importantly restricts the long-term quality of university output including skilled labour force, basic knowledge developments and skills to manage very ambitious long-term research projects (Sharp, 2000; Geuna and Nesta, 2006). In particular, researchers who had part of their research agendas financed on a long-term basis by one specific industry-related fund, were found to be less able to maintain their high performance (Goldfarb, 2008). In addition, despite enhanced contact with other scientists, collaboration with industry also restricts communication among scientists because of the secrecy rules set by firms, and because of their increased effort to commercialise and patent their research results and patenting (Welsh et al 2008). Competition among researchers, which is based on the ability to choose relevant research purposes, and to determine their research agendas (Ziman, 1987; Dasgupta and David, 1994), is also expected to increase in the context of competitive allocation of public funds for research, and it is likely to lead to poorer communication among scientists. Therefore, several studies and programmes evaluations have stressed that too much industry influence on academic research could undermine future pay-offs from academic research, not only because of its incentives to distract researchers from basic curiosity-driven research but also to invert the values of traditional academic freedom (Berman, 1990, Dosi et al. 2006, Goldfarb, 2008).

Several policies have been suggested to address these points. Desirable European science policies include the distinction between research and graduate teaching universities, from undergraduate and technical colleges, as well as the support for high quality basic science, relying on world-class peer review (Dosi et al., 2006). Moreover, European investment in large-scale, technologically ambitious missions justifiable in terms of their intrinsic social and political value would enable the launch of strong and concentrated incentives for science and technology (Dosi et al., 2006). On the one hand, researchers would have the means and incentives to be involved in challenging basic research. Moreover, researchers are found to be mobilised by incentives to compete in international technology races (Lee and Gaertner, 1994). On the other hand, by mobilizing considerable resources for high quality basic research, several outcomes (mostly unexpected) could be developed and lead to industrial opportunities. Indeed, the European industrial advantages in microelectronics have been associated with the great mission-oriented projects launched by national governments (Sharp, 2000; Dosi et al., 2006).

A third issue related to the performance of university industry interaction refers to the fact that industrial innovation is not only dependent on interactions with the university. The Community Innovation Survey (CIS) shows that fewer than 10% of firms collaborate with universities and public research organisations, while other market actors, in particular customers, suppliers and competitors, are more important for the daily innovative activity of firms (Tether, 2002; Bodas Freitas et al., 2008).

Moreover, analysing in detail firms that collaborate with university, Levi et al (2009) find that only some firms do that on a regular basis. Indeed, Bodas Freitas et al. (2008) show, that even taking industry and country differences into account, novel product innovators as well as firms that innovate in both product and process tend to rely relatively more on customers than on public research organisations.

Additionally, national differences in the use of various channels of knowledge transfer seem to exist and be reliant on the different national incentives and institutions such as academic career design, university financing rules, and science and technology policies (Gittelman; 2006; Bodas Freitas and Verspagen, 2008). However, the channel used to transfer technological knowledge between university and industry do not seem to affect the performance of the transfer (Bozeman, 1994).

Furthermore, the reduction of policy incentives for patenting and commercialisation of university knowledge might be a good strategy for several reasons. Firstly, academics tend to use patents as signalling devices, and consequently, most European universities were found not to benefit from licensing activities (Geuna and Nesta, 2005; Bodas Freitas and Nuvolari, 2008). The immediate consequence is that university is deviating research funds to pay for patenting its research results. Secondly, patents are an instrument to protect and foster innovation. If the patenting knowledge is very basic, it will most likely slow down the development of related knowledge. Moreover, the excessive fragmentation of IPR among too many owners can slow down research activities and product development because all owners can block each other (Heller and Eisenberg, 1998; Dosi et al, 2006). Therefore, national policies encouraging university patenting might be ineffective or detrimental to innovation development, research financing, the accounting balance of universities, and even university-industry collaboration.

In summary, Europeans seem to be constrained by problems affecting both the demand and supply of high-quality public research rather than (only) the transfer process between university and industry, as the apologists of the European Paradox believe (Dosi et al., 2006).

10 Interdependence between knowledge transfer channels

As we have stated in Section 2, interaction between university and industry is done through a wide diversity of channels, which tend to be complementary rather than substituting each other (Bekkers and Bodas Freitas, 2008). For example, the wider the informal contact network or the publication record of a scientist, the more the scientist is likely to engage in collaborative and contract research (D'Este and Patel, 2007). Moreover, the effect of publication productivity on patent productivity is found to be significant and positive (Geuna and Nesta, 2005; Stephan et al., 2007). Again, we stress that evidence suggests the relationship between scientific productivity and interaction with industry depends on both the content and the size (in terms of research funds), and the variety and length of this interaction. In particular, scientific productivity increases from interaction with industry only when this interaction represents less than 15% of the scientist research funds, and it refers to high scientific activities (Manjarrés et al., 2008).

The reason why several channels overlap, relates to the inherent self-reinforcing incentives that underlie the skewed distribution of research resources and productivity (Lotka, 1926; Merton 1968). The more a scientist produces high quality research, the more important it is for him/her to maintain and increase his /her productivity performance, to keep up a wide network of contacts with other researchers, to invest in supervision of bright students, and to participate in challenging collaborative research projects. Moreover, especially in some disciplinary areas, involvement with industry is important in order to access specific production technologies and infrastructures, as well as materials and tests environments.

Thus, policies should see technology transfer not as a one-off, but as a long-term activity in which a great number of scientists develop to proceed with their research agenda (Lam, 2005; Balconi and Laboranti, 2006; D'Este and Patel, 2007). Indeed, the opposite worlds of university and industry no longer exist or even never existed as conceptualised by policy-makers (Lam, 2005). Increasingly, collaborative teams are the mode of organisation in industry, and this relates to issues of complexity and multidisplinarity of used technologies (Wang and von Tunzelmann, 2000). In particular, from the 1990s, firms seem to have been developing flexible organisational structures to facilitate university knowledge development and transfer (Lam, 2005). 'Within the firm, researchers are 'research

gatekeepers' who connect firms' R&D projects to state-of-the art knowledge inputs from the outside research communities. Externally, they protect the firm's proprietary knowledge resources and investment in collaborative projects, while at the same time engaging in open knowledge exchange with their external colleagues in order to explore and identify new scientific advances' (Lam, 2005, p. 264). Hence, industry and university collaboration sets a type of market in which academic researchers and firms bring in their motivations, expectations and resources (Lee, 2000; Lam, 2005; Bodas Freitas and Verspagen, 2008).

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Study 4: A study of the factors which affect knowledge transfer activities between European and non-European partners, focusing on collaboration with partners in "emerging economies"

Environment for Knowledge Transfer (KT) to and From Emerging Markets: The BRIC Economies

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Table of Contents

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Executive Summary

The focus of this paper is on the environment for KT between European research institutions (mainly public research organizations – PRO) and institutions in the four biggest emerging markets outside the EU, the so-called BRIC economies (Brazil, Russia, India and China). The BRIC economies are of special interest for Europe, due to a comparably stable economic growth and the increasing sophistication of national industries: each BRIC economy has a great potential for collaborative R&D and other forms of KT which is not yet fully tapped by European PRO's and other institutions. The study will concentrate on the following three aspects of KT environment:

- Locations for research:
  The first part of the study examines the general environment in each observed economy with special regard to two aspects, namely sources and locations of knowledge (where can potential partners for KT be found?) in each BRIC economy and in which research areas the respective country has its strengths. This part will form the basis for suggestions to European PRO and other institutions regarding adequate partners for KT in each BRIC economy.

- Government policy and practice:
  The second part examines the level of importance attached to technology transfer by the government of each observed country and the general institutional environment which may affect KT in a positive or negative manner. The observations will demonstrate that some BRIC countries have a rather liberal attitude towards KT whereas others control the in- and outflow of technology by a strict technology transfer regime. Two layers will be addressed: the "macro" layer basically consists of laws and rules, e.g. on the ownership in inventions or other intellectual assets which are funded by the state, or on "desired" or "undesired" technologies. The corresponding regulatory framework may, for instance, treat a certain area of technology in a peculiar manner. The "micro" or "operational" layer describes the daily administrative practice, e.g. when it comes to the approval or registration of technology contracts, but also with regard to the general administrative environment. This second layer is especially hard to grasp, as it largely consists of behaviours and attitudes which depend on the general socio-economic situation of a country (e.g. the endowment with administrative resources) or traditional thinking. In sum, the second part will sensitize European PROs and other research institutions for the necessity to consider that institutions in non-European target countries may significantly differ from their institutional environment at home.

- Legal environment
  The third part is dedicated to the legal environment in each BRIC country. The observations are focused at those areas of law which are of immediate importance to a KT project, namely protection of intangible assets by patent law or by know-how provisions and contractual provisions which have to be observed in the course of an agreement on KT. The observations will not stop at explaining the legal rules, but also highlight the peculiarities of legal practice, especially of the enforcement of the laws in each BRIC economy. The aim of this part is to elaborate suggestions, e.g. with regard to strategies that anticipate possible conflicts and help to avoid a court dispute if the law in the respective country is not reliable.

In a final part, the study summarizes suggestions to both the immediate "players", i.e. the PRO or other institutions which consider an engagement in one of the BRIC economies, and to the European Commission with regard to collaboration on government level with the observed countries.
The paper is based on literature from social sciences and law, and on statistics issued by international organizations such as OECD, UNCTAD or national institutions, e.g. national patent offices. One problem encountered in the course of elaborating the study was the lack of quantitative information regarding "soft" issues which play an important role in daily practice, such as behaviour of administrators in the course of issuing an approval, or of judges in the course of a court trial. As will be further outlined, especially in the second part of the study which deals with administrative interference in KT, there is abundant anecdotal evidence which at best demonstrates what *can* happen in the course of an engagement in one of the observed countries, but there is no further evidence whether such behaviour is the rule or rather exceptional. Wherever the present study has to rely on such anecdotal evidence, the possibility that the available information lacks representativeness will be highlighted, and the explanations will be put in relation with other evidence. The aim of this study is not to deter European research institutions from engaging in one of the BRIC economies but to reduce the

abundant and sometimes contradicting information to a realistic picture which does not only highlight the dangers but also chances and possibilities. Another problem that may affect the accuracy of the findings of this study is the lack of most actual statistical data. The BRIC economies have annual growth rates of 5 – 10 percent. Statistics which are two or three years old do not cover, for instance, the maturation of a certain industry which may have become a promising new location for collaborative research in the past two years. Also here, statistical evidence will be put in relation to current information regarding recent developments, and possible deviations will be addressed, so as to provide the reader with information as accurate as possible.

The recommendations of this study can be summarized as follows:

- Regarding the areas of research/potential partners, the European Commission could foster private-public collaboration especially in those economies where the private sector is comparably weak, by launching a dialogue between European enterprises and PROs and research institutions from the observed countries.
- Regarding the institutional environment and the stability of the law, European research institutions should be aware that in some BRIC economies (especially in China and Russia), recent history and cultural peculiarities cast their shadows on daily administrative practice and on the enforcement of legal rules. Therefore, they are well advised to anticipate that in case of an unforeseeable event, they may not easily resort to a public authority which will protect their rights and interests and to take the necessary precautions. The European Commission is, inter alia, advised to rethink its present practice of imposing European IP protection standards on third countries in future Economic Partnership Agreements. Proposals elaborated on grounds of the domestic preconditions and tackling actual institutional and legal shortcomings observed in each BRIC economy would have a better chance to be implemented in practice.

1 The observed BRIC economies

Rapid development, improved education and increased sophistication of domestic industries enhanced the importance of the BRIC countries for Europe, not only as consumer markets or targets for labour intensive investment, but also as locations for scientific cooperation. All four observed countries offer a huge variety of opportunities for KT, not only from Europe to BRIC economies but also in the opposite direction. In an UNCTAD survey of 2004, 70 percent US and European transnational companies had already outsourced R&D to third countries, with China, India and Brazil being among the ten most attractive targets.[32] Moreover, all BRIC countries are endowed with a certain wealth in natural resources, directly exploitable crude resources or biological diversity, which can become subject matter of KT.

In the course of a long colonial history, *Brazil* has adopted Continental European attitudes and values. Many Brazilians have not only adopted Continental European culture but are of European descent. Due to its geographical peculiarities, Brazil has strong potential in "green" technologies, i.e. the life science sector, food, etc. R&D intensity in the private sector is reported to be weak, however. Brazilian enterprises are reported to be reluctant to invest in R&D intensive activities of insecure outcome.

Modern *Russia* does not look back at a colonial history or other forms of foreign control but developed in a largely autonomous manner. The Tsar regime was immediately followed by a no less authoritarian Communist rule. The post-Soviet years have demonstrated how difficult it is to establish a third alternative between authoritarian ruling by a more or less caring government, and extreme social imbalances due to the abuse of economic freedom by a few individuals. Today, government authorities play an important role in any kind of transactions, including KT. Reportedly, unpredictable administrative decision-making and lack of good business conduct throughout the country form huge disincentives to engage in Russia. Reforms are on the way, however, not least due to the increasing exposure of Russian investors to international standards. The recent contract between important EU members and Turkey and other future transit states on a new gas pipeline from the Caspian Sea which aims at circumventing Russian territory will fuel the countries' endeavour to diversify its industrial output. So far, however, R&D remains confined to the public sector. Russia's exports are limited to resources like oil and gas, sophisticated products are manufactured elsewhere.

Indians proudly allude to the fact that their country is the biggest democracy in the world. Indeed, India has inherited democracy and social structures from the UK which ruled the country for two centuries. In spite of occasional outbursts of religious conflicts and extreme income imbalances, the Indians have managed to maintain their identity, the variety of religions, languages and life styles under the umbrella of western-style democracy, including a fairly functioning division of powers. In the area of R&D, India has managed to become a respected world player in key technologies such as IT, software development and increasingly also in the area of life sciences.

China is the BRIC economy which is farthest away from Europe, not necessarily in terms of geographical distance - a flight to South or West Brazil or to Kamchatka may take even longer than a flight to Shanghai - but in terms of history, values and attitudes. China has a largely indigenous history, in spite of its semi-colonization until the outburst of the First World War. Neither the British nor the coalition of European colonial powers (plus Japan) which entered China in the mid of the 19th century could gain foot in the manner the UK, for instance, gained foot in India. After millennia of Imperial Rule and a few decades of political instability, China remained largely isolated under Communist Rule between 1949 until 1978. The reforms after 1978 marked a significant shift towards openness and competition. Chinese engineers impressively demonstrated their capability of absorbing technologies brought to China via foreign direct investment. Such absorption was partly a natural result of serving as a location of manufacturing for export. Exposure to western manufacturing and management styles generated the desired learning effects which enabled Chinese manufacturers to climb up the value chain. On the other hand, massive complaints of US and European industries about rampant IP infringement indicate that a good part of technology absorption was facilitated by an immature legal system which could not catch up with rapid industrialization.

[32] United Nations Conference on Trade and Development: Globalization of R&D and Developing Countries, p.7, at http://www.unctad.org/en/docs/iteiia20056_en.pdf

2 Where is R&D located and who are the players?

2.1 Brazil

2.1.1 R&D landscape

Reportedly, Brazil accounts for 1.5 – 1.9 percent of worldwide scientific publications[33], a respectable percentage for a not yet fully industrialized country which points to a good performance in the public research field. However, scientific productivity is basically confined to universities, public research organizations (PRO) etc, and rarely translated into sophisticated products, processes or services. The patent application and grant numbers speak a clear language – 60 – 70 percent of patents filed with the Brazilian National Institute for Intellectual Property (INPI) go to foreign applicants. With a stable 1 percent of the GDP over the past years, the expenditure on R&D is low but comparable to that of the other BRIC economies[34].
As far as locations for a profitable engagement are concerned, Brazil has a lot to offer in "green" areas of S&T, especially biotechnology. As the world No.1 mega-diverse country, Brazil is home to one fourth of the world's known species.[35] Foreign pharmaceutical companies are aware of Brazil as a profitable location for research on nature-based medicine but the government restricts foreign access to domestic biodiversity. Brazil is leading the coalition of developing countries which insist in an additional obligation in the TRIPS Agreement to indicate the source and origin of genetic material in the patent application documents if the subject matter of the application is related to such material.

2.1.2 The private sector

One reason for the passivity of the enterprise sector may have been the rather uncoordinated inflow of FDI. Foreign investment is growing (equivalent to ca. 23 billion Euros in 2007, as compared to ca. 13 billion Euros in 2006) but it mainly flows in infrastructure oriented services (electricity, construction, etc.) and in manufacturing. FDI in the manufacturing sector is to a certain extent technology intensive (automotive industry, machinery) but predominantly aimed at supplying the Brazilian market[36], not at export to industrialized countries where expectations with regard to sophistication and quality of consumer goods are high. Another reason for the poor R&D performance of the private sector may be that traditions rooting in the ideal of "family ownership" in land, now in enterprises, are still alive. According to a survey, most Brazilian enterprise leaders do not want to introduce modern corporate governance but continue to regard their enterprises as family property, without need for a supervisory board or the like.[37] The risk adversity arising from such traditional thinking may explain the passivity with regard to R&D projects of insecure outcome.
Only a few areas like agriculture are reported to be R&D intensive. In the field of agriculture, Brazil has a comparably mature technological level in terms of quality and high productivity at low prices. Agriculture is also the leading export sector (44 percent of exports in 2005). The high degree of professionalization in this sector has rendered Brazil an attractive target for powerful US and European food industries. In general, however, the level of learning effects generated by familiarizing Brazilian engineers with advanced manufacturing technologies etc. can be assumed to be rather low. Apart from a few enterprises which are innovative enough to stand up to worldwide competition[38],

[33] *Maria Beatriz Amorim Páscoa*, In search of an Innovative Environment – the new Brazilian Innovation Law, available at the WIPO document database, at http://www.wipo.int/sme/en/documents/brazil_innovation.htm, mentions 1.5 percent, *Claudia Ines Chamas*, The Treatment of Know How and other Intangible Assets in International R&D Cooperation: The Brazilian Experience, at http://www.kooperation-international.de/countries/themes/info/detail/data/37697/ , cites 1.9 percent.
[34] Only China's expenditure is higher, namely 1.4 percent of the GDP
[35] *Stefanie Bucher*, The Protection of Genetic Resources and Indigenous Knowledge - Disclosure of Origin on the International and Latin-American Agenda, 39 IIC 35 (2008)
[36] UNCTAD investment policy review Brazil: http://www.unctad.org/en/docs/iteipcmisc20051_en.pdf, 15 et seq. (note: the review has been completed in 2005, and the most actual data mentioned therein are from 2003, so that the review may not accurately represent the latest state of art.)
[37] See *Érica Cristina Rocha Gorga*, Does Culture Matter for Corporate Governance? A Case Study of Brazil, Stanford Law School John M. Olin Program in Law and Economics Working Paper No. 257 (2003), at http://papers.ssrn.com/paper.taf?abstract_id=410701
[38] Reportedly, there are two internationally competitive innovative enterprises. One is EMBRAER (Empresa Brasileira de Aeronáutica), the world's third largest aeronautical enterprise, another one is PETROBRAS, an energy company with high innovative capacity in offshore/deep water oil production. In both companies, the Brazilian state is the majority stockholder and both companies would not have survived without huge public funding.

innovative potential is reported to be largely absent in the private sector, in spite of numerous innovation regulations, plans and programmes launched by various Brazilian government authorities, such as the Ministries for Science and Technology, of Energy, of Education, of Telecommunications, of Planning and of Trade, Economic and Industrial Development.

2.1.3 The public sector and government attempts to enhance private-public collaboration

Government endeavours to enhance private–public R&D cooperation are impressive. The majority of activities is coordinated by the National Council for Scientific and Technological Development[39] (hereinafter "National Council") [40.] In the 1990s, for instance, the government spent much effort on programmes to establish a competitive IT industry, including software and hardware. The Brazilian IT industry, however, could not keep pace with the development of IT in East Asia. In 2004, the government passed a Law on Innovation with the main intention to foster innovation in private enterprises, especially in SME, and to facilitate the diffusion of technological results from PROs into the private sector.[41] The new law provides for a formalized process of bidding for technology licenses from PROs – the idea is that PROs publish a "request for licensees" and accept the most profitable offer. Moreover, in order to foster innovation in the SME sector, the law regulates a formalized mode of allowing underequipped SME to use laboratories of PROs. The law also obliges PROs to establish "Offices of Technological Innovation" with the capability to manage the innovative results of R&D. The legal incentives do not stop at institutional level but also include provisions on the relationship between individual researchers and institutions: for instance, the law formalizes the circumstances under which researchers may take a leave in order to participate in a private-public collaboration and a "special leave" if the respective researcher is involved in a start up project. Moreover, the law generously permits public funding organizations to grant subsidies to promising innovation projects launched by enterprises, provided that the respective enterprise also invests a due amount.

The efforts of the government to increase private-public cooperation also comprise a "Science and Technology Development Plan" launched by the Ministry of Science and Technology for the period between 2007 and 2010 with guidelines aiming at a) improving the R&D performance of the private sector and b) further promoting research in strategic "green" technologies such as biofuels, biotech and environmental technologies, etc.[42] The plan announces a generous budget of roughly 15 billion Euros for increased investment in science and technology. That the plan is not only a non-binding recommendation is evidenced by a number of accompanying decrees which, inter alia, establish a legal basis for the distribution of public funds and regulate which forms of private innovative activity are eligible for tax deduction.

It may still be too early to expect a noticeable change in the Brazilian science and technology landscape. The last measures to increase private-public partnerships were adopted only two years ago. There are signs of initial positive responses from the enterprise sector, however. Reportedly, an increasing number of SME but also PRO with respect to start-up companies resorts to the venture capital at low interest rates which became possible under the mentioned state budget reserved for science and technology. It remains to be seen when the new measures will be accepted on a broader front by both PROs and private enterprises.

In sum, European enterprises or PRO which want to engage in Brazil should be aware that the most rewarding form of R&D cooperation in Brazil is joint research with Brazilian colleagues from PRO or universities but such partners can hardly be expected to serve as intermediaries between the public research sector and the market. It is not yet clear whether the obligation of universities etc. to establish Offices of Technological Innovation under the Innovation Law have borne fruit. Most probably, it is still too early to expect that each university operates an office with sufficient management and negotiation skills to transform research results into marketable products.

2.1.4 Implications for Europe

As far as cooperation with Europe is concerned, Brazil has participated in only 159 projects under 6th Framework Programme for Research and Technological Cooperation (FP6). Expenditures dedicated to European-Brazilian research under FP6 amounted to mere 14 million Euros. Brazil has been the

[39] The CREST Country Report Brazil pepared by *José Luis Briansó Penalva* mentions various overlapping institutions but the National Council would be the central one.
[40]The official acronym is "CNPq"
[41] See outline of the law by *Páscoa*, above note 2
[42] See CREST report on Brazil (above note 8), pp.13 et seq.

third largest recipient among the four observed countries. Only India has benefitted less.[43] More specific information about the content of the projects undertaken under FP6 could not be obtained. Various projects under the 7th Framework Programme (FP7) are under preparation. Moreover, Brazil has a number of bilateral ties with European countries. Many projects implemented at this level, however, have the character of development aid in the R&D sector, as they are primarily focused at issues which are mainly relevant for Brazil as a developing country such as environment, sustainability, etc. The US seem to have opted for a slightly different approach, as US-Brazilian R&D collaboration is mainly aimed at mutual benefit, tackling such issues as renewable fuels, agriculture (an area in which Brazil has its strengths) and biomedicine, including exploitation of genetic resources.[44]

In sum, in spite of many government efforts to enhance the enterprise sector's permeability to technical knowledge, potential partners to knowledge transfer are most likely to be found in the public research sector. Among the potential areas of research, most promising should be "green" areas such as pharmaceuticals, genetic engineering, bio-energy (e.g. sugarcane). Or, translated into the categories established under FP7, collaborative research with Brazil should be best possible under the themes "health", "food, agriculture & fisheries, biotechnology", "energy" and "environment", to a certain extent also under the theme "nanotechnologies, materials, etc." with special focus on "materials". Especially in "green" areas, the public research sector has already accumulated much experience and will presumably accumulate even more, due to generous public spending in such strategic research areas under the mentioned plans and regulations. Due to an already existing R&D basis which is likely to be further strengthened with government assistance, Brazil may even go beyond the role normally attached to a developing country, namely that of a technology importer. That is, in important key technologies, KT between Europe and Brazil can be expected to flow in both directions.

2.2 Russia

2.2.1 R&D landscape

In spite of an entirely different history, the R&D landscape of Russia is quite similar to that of Brazil, in that the public research sector is traditionally strong whereas the enterprise sector lacks innovative power. Russia has a long tradition of basic research in natural sciences but a huge part of research in Soviet times was dedicated to defense and other prestigious areas. Market and civil demand oriented R&D was largely absent. The sudden decrease in public funding of R&D and the collapse of social security after the fall of the Soviet empire effected an emigration wave among Russia's best scientists. During the consolidation phase under President Putin after 1998, the state generated new income, inter alia, by participating in the profitable exploitation of Russia's vast natural resources. Today, in spite of a large R&D sector, Russia's contribution to the worldwide pool of industrially applicable innovations is negligible, with only 0.4 "triadic" patents per million inhabitants.[45]

2.2.2 The private sector

Regarding the enterprise sector, only four Russian enterprises, namely the state controlled giants Gazprom, Lukoil, Severstal and Rusal, account for 65 percent of Russia's outward FDI. Investment largely relies on revenues from the high oil and gas prices of the past years[46] and is focused at collaboration with enterprises in the west or in the Middle East. The majority of Russian enterprises have no ties to partners abroad. Reportedly, only six percent of Russia's enterprises are somehow engaged in R&D, the rest remains passive and supplies the local demand with products which are not competitive on the world market.[47] The Russian government is well aware of the lack of

[43] CREST OMC Working Group: Country Report Russia: An Analysis of EU-Russian Cooperation in S&T, Dec. 2008, p.18
[44] Implied by the CREST country report on Brazil (above note 8), p.35.
[45] OECD Factbook 2009: Economic, Environmental and Social Statistics, excel chart available at Statistical profile of Brazil at http://stats.oecd.org (click on "Country statistical profiles 2009" – "Russia"), click on "i" after "triadic patent families", then on "country comparison chart".
[46] OECD Investment Policy Reviews: Russian Federation – Strengthening the policy framework for investment, p. 16 et seq.
[47] *Alfred Watkins*, From Knowledge to Wealth, Transforming Russian Science and Technology for a Modern Knowledge Economy, World Bank – Europe and Central Asia Region, Private and Financial Sectors Development Unit, Policy Research Working Paper 2974, p.15 (http://www-

innovativeness of its industries, and also of the reasons, namely heavy reliance on natural resources which lulls any ambition to perform well in terms of innovation. According to recent press reports, strengthening Russia's innovative competitiveness is one of the primary concerns of the present President Medvedev.
One important measure which aims at bringing R&D and market together is the establishment of so-called Special Economic Zones (SEZ), i.e. zones in which foreign high-tech enterprises are invited to commence innovative activity under preferential conditions, in order to generate learning effects among Russian employees and partner enterprises. In China, SEZ once formed an efficient instrument to attract foreign investment.[48] In Russia, after a number of rather uncoordinated attempts to establish SEZ in the 1990s, the government enacted a new "Law on Special Economic Zones" on 22 July 2007, with the express intention to increase the level of manufacturing industries, to foster innovative activity and its practical implementation and to commercialize available scientific knowledge.[49] The main purpose of the law is the reduction of the present dependence on the exploitation of natural resources, which is also evidenced by a provision which excludes extraction and processing of raw materials from the activities permitted within the SEZ (Art.4 (5) No.1 and 2). Investors enjoy, inter alia, tax deductions, preferential treatment under an SEZ-specific exemption of imports to the SEZ from customs, and a streamlined "one stop shop" administration. There are no special rules on conflict resolution, however, so that in case of a conflict (e.g. around IP rights) the parties have to resort to the available law enforcement infrastructure which is widely criticized as non-reliable[50]. The government reserved a total budget of 2.27 billion Euros for the establishment of SEZ. Regions which are willing to establish an SEZ have to take part in a tender procedure and outline, inter alia, their specialization and the feasibility of the project. Each SEZ is free to specialize in certain areas of manufacturing or science and technology, and to exclude interested investors which do not fit in that particular specialization pattern. However, the law distinguishes between two types of SEZ, namely "industrial and commercial SEZ" and "scientific and technological" SEZ. Whereas the former can be established at any location in Russia, the latter will be agglomerated around the already existing research centers. The latter should be of special interest for PROs from Europe. However, for being admitted to both types of SEZ, parties which are interested in an engagement have to invest a minimum of 10 million Euros, the first tranche of at least one million Euros payable in the first year. This sum indicates that foreign investment from the enterprise sector is the most desired form of engagement in the SEZ. Possible exemption with regard to the public research sector and possible public-public collaborations within an SEZ could not be found.
It is still too early to forecast whether the recent additional government impetus to SEZ development will be a success. Previous attempts to establish SEZ were disillusioning. Also in future, the main deterrent to foreign investors, namely administrative and legal uncertainty, will not disappear due to the establishment of such zones.

2.2.3 The public sector

Half of Russian R&D is performed by the public sector, above all by the institutes under the famous Russian Academy of Sciences, which was founded in the first half of the 18th century by Tsar Peter the Great. Since the re-emergence of the state as main investor and entrepreneur in Russia under President Putin, the number of research institutes under the Academy grew by 50 percent. Simultaneously, the number of university research units and of enterprise research labs fell by 30 percent.[51] That half of investment in R&D is initiated by the government should not belie of the fact that also government spending has been on the decline for many years. Since the fall of the Soviet Union, Russia suffered from a huge brain drain. Numerous hopelessly underpaid researchers emigrated to find lucrative posts abroad. The situation is reported to have slightly improved, due to a government's decision to substantively increase the salaries of R&D personnel employed by state institutions.
A good part of the government measures to enhance the level and to broaden the areas of R&D in Russia are aimed at Russia's universities which served as mere education facilities so far, whereas R&D was concentrated on the research institutes. In a manner which has some similarities with the German "Excellence University" programme, Russia launched an "Innovative University" programme

wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2003/03/22/000094946_03031111352820/Rendered/PDF/multi0page.pdf)
[48] See II. 4 a) below
[49] A detailed outline of the law and its practical implications is provided by *Klaus Knaul*, Russisches Gesetz über Sonderwirtschaftszonen (Russian Law on Special Economic Zones), WiRO 3/2007, pp. 70 et seq.
[50] See below III.2 and IV. 2.f)
[51] *Watkins*, above note 16, pp. 13 et seq

in the course of which universities are invited to compete for a grant of up to 29 Million Euros per university for the most promising research project. Another programme, the "Federal University" programme, used 390 Million Euros between 2007 and 2009 to establish two university centres in the South and in Siberia but the process is reported to be slow and cumbersome.[52]
A further measure is aimed at enhancing the attractiveness of R&D in Russia, so as to prevent Russian researchers from emigration and to invite already emigrated scientists to return to Russia, mainly by financial incentives. By motivating émigrés to return to Russia, the government hopes to achieve two goals, namely to reverse the brain drain of the past years and to profit from the inflow of advanced technical knowledge acquired by émigrés during their work abroad. Returners from EU member states may serve not only as a route of KT to Russia but, from a European point of view, also as links to Russian research institutions.[53]

2.2.4 Implications for Europe

Russia is reported to be the BRIC country with the closest ties to Europe. In the past, Russia was the biggest non-EU participant in FP6.[54] Further cooperation took place under the International Association for the Promotion of Cooperation of Scientists of the New Independent States of the Former Soviet Union (INTAS) with smaller budgets per research project or the half-political International Science and the Technology Centre (ISTC) an organization co-founded by the USA, Japan, the Russian Federation and the EU with the special aim of transferring R&D capacities from the defense sector to civil areas. Also on a bilateral level, Russia has concluded an impressive number of formal agreements on R&D promotion with EU partners. Presumably due to huge revenues from oil and gas sale, Russian enterprises are increasingly capable of financing joint research projects at equal shares with European partners. As far as the content of joint R&D is concerned, basic research seems to be the dominant form, mostly in the areas of environment, nanotechnologies and information technologies. Special consideration is given to the relatively young area of nanotechnology research.[55]
On the bilateral level, biotechnology is one of the biggest areas of joint R&D. European partners bemoan, however, that true "innovation" in a sense of technical solutions with capability of market diffusion, is still difficult to achieve in cooperation with Russian partners. [56]
Russia is close to Europe, in geographical as well as in cultural respect. There is much room for scientific cooperation especially in the area of basic research. Moreover, recent government attempts to enhance the market diffusion of R&D results are no longer mere declarations of will on paper, but supported by substantial government funding. Such public commitment will hopefully enhance the R&D propensity of Russia's industries in the medium term, even though the danger that a number of initiatives will peter out in uncontrolled bureaucratic channels is high. At present, the most promising areas for collaborative research can be found in the public sector, most notably among the numerous research institutes under the auspices of the Academy of Sciences. It should be noted, however, that as the recent government measures are primarily targeted at establishing new locations for research in the industry and education sector, investment in grading up the traditional R&D sector, e.g. by enhancing the level of internationalization and openness of the available research institutes is low. Therefore, there is a certain danger that, at least in the short and medium term, Russia's traditional PRO which are still the main addressees for joint research may suffer under this shift of government support whereas new locations for research are still under construction.

[52] CREST Country Report Russia (above note 12), p. 11.
[53] Ibid.
[54] Pursuant to the CREST Country Report Russia (above note 12), Russia participated in 470 projects under FP6 with a total value of 50 Million Euros.
[55] ERAWATCH National Profile Russia, at http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&topicID=4&countryCode=RU,p. 49
[56] Pursuant to the CREST Country Report Russia (above note 12, p. 28), only three EU Member States indicated that one instrument of R&D cooperation with Russia would be applied research, and all EU Member States and Associated Countries regard the lack of capability to produce practically applicable research results as one of five "challenges" of cooperating with Russia.

2.3 India

2.3.1 R&D landscape

India is the "poorest" of the four observed economies, with an average per capita GDP of 2753 US$ in 2007.[57] Nevertheless, the country has made great progress since the dawn of the 1990s. Today, software, IT and pharmaceuticals are the most innovative sectors. In the pharmaceutical sector, manufacture of generic versions of pharmaceuticals developed elsewhere is still dominant but the R&D spending of Indian pharmaceutical giants like Ranbaxy or Dr. Reddy is on the rise. The formation of a robust pharmaceutical sector with an increasing capability to innovate became possible, inter alia, due to weak patent protection over the past decades. Only a few years ago, in 2005, India brought its patent regime in compliance with the requirements of the TRIPS Agreement and introduced full product protection for pharmaceuticals. Prior to the amendment, the Indian pharmaceutical industry was free to imitate innovative medicines from abroad, to sell the generic versions a fraction of the price of the original and to develop the industrial basis for further innovative activity in this area.[58]
Industrial and technological development is uneven, however. 60 percent of the population works in the agrarian sector, and the majority is self-employed on the subsistence level. The illiteracy rate is still high for an emerging giant but generous public funding of the past years at least resulted in a primary graduate rate of 94 percent. The quality of primary education is reported to be low[59], which may explain why official statistics still indicate a youth literacy rate of mere 76.4 percent between 1995 and 2005. Only 38 percent of children at secondary age graduate from a secondary education institution, and a rather low 22 percent of university graduates have a degree in science or engineering.[60] There are no clear statistics on the availability of scientists and/or engineers. According to one statistic, India has only 119 researchers per million people, as compared to 344 in Brazil, 709 in China and impressive 3.319 in Russia.[61] The shortage of skilled personnel is aggravated by the fact that skilled English speaking Indian engineers are sought-after worldwide.[62] Many are absorbed by MNC's which are active in India and which profit from much lower salaries for skilled personnel in India than in their respective home countries.

2.3.2 The private sector – various areas for collaborative research

2.3.2.1 "Indigenous" innovation

Innovation can be found in many areas, and, surprisingly, in spite of the fact that public research institutes (and to a very small extent also universities) are reported to account for about two thirds of R&D in the country, the vast majority of visible, spectacular innovation, is carried out in the private sector. Be it new medicines, the famous Dabawalla "lunchbox" logistics which is based on a unique indigenous forms of communication within a rural community, cell phone services and internet information platforms for the rural population, etc., innovation in India seems to be highly demand oriented. "Demand oriented" in India means to a large extent concentration at the supply of a predominantly poor population with reliable products at affordable prices.
Innovation in India has many facets. One is adaptation of pre-existing solutions to domestic needs. Production of generics and their successive improvement in form of so-called incremental innovation is one characteristic feature of India's innovation landscape. Another one is innovation in "young" areas of technology. In the software sector, for instance, India is about to achieve world leadership. Another source of knowledge is "indigenous", i.e. traditional knowledge accumulated over centuries, mostly in the areas of agriculture and traditional medicine. A part of such traditional knowledge can hardly become subject matter of KT, as it is indissolubly tied with specific local conditions. Other forms knowledge accumulated by local communities, however, can be transplanted into other environments.

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[57] OECD statistics, under http://stats.oecd.org/viewhtml.aspx?queryname=18185&querytype=view&lang=en
[58] There still exists some leeway for escaping liability for patent infringement, however, as will be further explained in IV. 3. a)
[59] *Isak Froumin/Shanthi Divakaran/Hong Tan/Yevgeniya Savchenko*, Strengthening Skills and Education for Innovation, in: *Mark A. Dutz* (ed.), Unleashing India's Innovation: Towards Sustainable and Inclusive Growth, World Bank Publications 2007, p. 129 et seq.
[60] See UNDP statistics under http://hdrstats.undp.org/en/countries/data_sheets/cty_ds_IND.html
[61] *Mark A. Dutz/Carl Dahlman*, The Indian Context and Enabling Environment, in *Dutz* (ed.), above note 28, p. 31
[62] *Isak Froumin/Shanthi Divakaran/Hong Tan/Yevgeniya Savchenko*, above note 28

MNCs in the areas of food and pharmaceuticals have recognized the huge innovation potential and want to tap it.
India's government is aware of the chances but also of the dangers inherent in its strong potential of indigenous innovation. The chances consist in generating additional revenue for the poor rural communities, by making their grassroots inventions broadly available. Non-government initiatives such as the Honeybee Network or the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI) assist them by establishing communication networks and by professionalizing the exploitation of traditional agricultural knowledge, which includes securing of intellectual property rights, documentation of grassroots solutions as well as their valuation and further commercialization. The National innovation Foundation (NIF) has created a database which contains ca. 50.000 entries. Involvement of the public R&D sector in this India-specific type of innovation, however, is reported to be poor.[63] The dangers, at least from an Indian point of view, consist in the appropriation of domestic traditional knowledge by foreign firms. On the WTO level, India supports the integration of the protection of local communities against bio-prospecting in the WTO/TRIPS system. The Indian Act on the Protection of Plant Varieties and Farmer's Rights (2001) contains a quite unique farmer's right to „save, use, sow, resow, exchange, share or sell their farm's produce". One of its special features is that it treats the farmer's privilege to exploit the produce of their own land according to the International Convention for the Protection of New Variety of Plants (UPOV) as a positive right.

2.3.2.2 "Modern" forms of R&D

Foreign innovative firms, mostly from the US, perceive India as a favourable location for outsourcing innovative activities, by way of founding wholly owned subsidiaries which employ Indian scientists, or by way of entrusting innovation to Indian enterprises. Scientific investment is growing and mainly of private-private character. Planned investment presently amounts to 4.7 billion US$. Foreign engagement is unevenly distributed, geographically as well as with regard to areas of R&D. More than half of it goes to Bangalore, India's IT and software centre, followed by Delhi and Mumbai. The IT sector is India's biggest absorber of investment, also with regard to services, not least due to the average Indian's good command in English. Some critics bemoan that the Indian software industry would not yet be strong enough to develop independent and comprehensive software solutions. Instead, their capacities would be limited to delivering custom-made partial solutions to comprehensive software products created elsewhere. Collaboration between Indian developers would be rare, because of too much suspicion nourished by fierce competition.[64]

In another R&D intensive area, namely collaborative experimenting with and testing of pharmaceuticals, an increasing number of large foreign pharmaceuticals companies resort to Indian laboratories, where skilled personnel is available at lower salaries.[65] Moreover, in a similar manner as observed in Russia, the Indian government has recognized nanotechnology as a new area in which India has to become a world leader, not least due to a comparably mature industrial basis in the pharmaceutical and textile sectors. The government is reported to support the formation of industries around this young discipline with generous funds.[66]

The comparably huge amount of foreign investment in innovative areas does not only bring about advantages for India, however, as the best heads are absorbed by foreign companies, and the high salaries they are ready to pay further aggravates the shortage of skilled personnel in purely domestic areas of R&D as well as in government agencies. The Indian Patent Office(s), for instance, suffer under a severe shortage of examiners.[67] In order to enhance public-private partnerships mainly between *Indian* enterprises and R&D institutes, the government has launched a number of programmes, also with the objective of a broader diffusion of innovative activity to areas within and outside the IT sector. Reportedly, the most successful one has been the Sponsored Research and

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[63] *Anuja Utz/Carl Dahlman*, Promoting Inclusive Innovation, in: *Dutz* (ed.), above note 28, p.104
[64] *Anthony P. D'Costa*, Exports, University-Industry Linkages, and Innovation Challenges in Bangalore, India, World Bank Policy Research Paper 3887, April 2006, at
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=923232
[65] *Paul Laudicina/Jonathan M. White*, India and China: Asia's FDI Magnets, Far Eastern Economic Review Oct. 2005, p.25
[66] *Nidhi Srivastava/Nupur Chowdhury**, Regulation of Health Related Nano Applications in India: Exploring the Limitations of the Current Regulatory Design***, Notizie di Politeia
Anno XXV - N. 94 - 2009***, p.160 et seq.***
[67] Below IV 3. a) (2)

Development (SPREAD) programme which is said to have entailed a boost in private-public innovation in the biotechnology area.[68]

The Indian government is planning to enact an Innovation Law, in order to better coordinate the scattered R&D landscape which presently performs best where an actual demand exists. Chapter IV of the present draft version obliges the legislature to eliminate obstacles to innovation and R&D, through slimmer administrative procedures, tax holidays and other fiscal incentives. Hereby, special consideration is given to innovation in "low cost technologies for the benefit of the common man", and angel investors. Moreover, the legislature is expected to shape bank regulations in a manner that facilitates cheap loans to innovators. The instructions of the law with regard to deregulation, financial incentives, etc., are held in a rather general language, and it remains to be seen whether they will be understood as guidelines for concrete action or as mere declarations of political will.

2.3.3 The public sector

One problem encountered in the course of promoting private-public partnerships is that a large part of Indian PROs is dedicated to prestigious mission oriented research (nuclear technology, aerospace) with little relation to the actual demand.[69] Among the various central departments in charge of certain areas of research, namely the Department for Science and Technology (DST), which is in charge of formulating general science-related policies, and the Department of Scientific & Industrial Research (DSIR), the Department of Atomic Energy (DAE), the Department of Space (DoS), the Department of Biotechnology (DBT) and the Department of Ocean Development (DOD), the DSIR and the DBT are reported to have closer ties to the industry. In general, however, the bureaucracy which characterized the pre-1990s period is reported to prevail in the public S&T sector.[70] Public R&D as well as education does not seem to be efficiently concentrated on areas in which India's industry has developed strengths and in which special need for more sophisticated, worldwide competitive production exists. In the IT sector, there are only weak links between industry and PROs or universities. Moreover, reportedly, universities would not educate enough software engineers, and the mushrooming private IT training institutes could not replace a thorough academic education.[71]

Pursuant to Art.6 of the mentioned draft Innovation Act, the Ministry of Science and Technology will be in charge of elaborating a National Annual Integrated Science and Technology Plan, to provide a) information of available resources and needs, and b) proposals with regard to a national mechanism regarding basic research, with regard to the enlargement of the scientific manpower and its efficient allocation, and with regard to the identification of mission oriented "national flagship programmes". Moreover, the annual plan should propose mechanisms of public-private collaboration in the S&T area and identify locations for Special Innovation Zones. An annex to the draft Act contains further guidelines regarding direct and indirect tax incentives for enterprises or other organizations which engage in the establishment of Innovation Parks or Special Innovation Zones with privileged treatment in terms of reduced bureaucracy. It remains to be seen in how far such annual plans will be translated into practice, in that they direct a bigger amount of the available R&D capacity into academic level research.

2.3.4 Implications for Europe

In sum, it seems that India is a good location for R&D cooperation in the area of applied innovation. Innovation and capital find easily together. Due to the variety of traditions, religions and attitudes, industrial and technological development does not extend to all parts of the society. On the other hand, not least due to the boost in "green" technologies such as biotechnology, nature-based pharmaceuticals, etc., the preserved traditions themselves become sources of innovation and creativity. The environment for KT between India and Europe varies from area to area. Especially favorable conditions are offered in "new" areas of R&D such as IT and nanotechnology, but also the

[68] *Carl Dahlman/Mark A. Dutz/Vinod K. Goel*, Creating and Commercializing Knowledge, 49 et seq, in: *Dutz (ed.)*, above note 28.
[69] *Götz Müller/Margot Schüller*, Der IKT-Sektor in China und Indien – Marktüberblick und Hintergrundanayse (The information and communication technology sector in China and India – market survey and background analysis), China aktuell, Dec. 2004, 1324 et seq.
[70] Ibid.
[71] *D'Costa*, above note 33

"traditional" pharmaceuticals sector. In all these areas, India has strengths and provides for a fairly developed infrastructure.

2.4 China

2.4.1 R&D landscape

Among the four BRIC economies, China has undergone the most remarkable development in the past three decades. From the dawn of the opening and reform policy in 1978, the most desired form of foreign engagement in China was technology intensive investment. Hereby, China pursued an export oriented investment policy: foreign investment was allowed to settle in Special Economic Zones (SEZ) in coastal zones where they enjoyed certain privileges, such as reduced bureaucracy, tax holidays and reduced ex- and import tariffs. In exchange, the foreign partners were expected to bring in advanced manufacturing technologies. Commodities manufactured within the zones were intended for export and banned from import to mainland China. Until the mid-1990s, China's internal economy was termed a "socialist commodity economy". Such "socialist commodity economy" was characterized by a continuing planned economy and, outside the state plan, an increasing freedom of "manager-entrepreneurs" to dispose of state-owned production capacities and resources in a market adequate manner. At least for a transitional period, however, the inefficient state owned enterprises (SOE) which supplied the Chinese market should be protected against the inflow of competing commodities of higher quality from the SEZ.[72] Later, in the course of China's step-by-step transformation, the "socialist commodity economy" was transformed into the present "socialist market economy" in which the still existing SOE are increasingly exposed to worldwide competition. The government's attempts to improve the situation comprise rules which encourage foreigners to invest in China's SOEs.[73] Another strategy points in the opposite direction, namely endowing state-controlled firms with enough capital to purchase technologically capable but financially depressed European firms. Such attempts to obtain advanced technology by way of purchasing its owners is not welcomed by many European governments, but in the light of China's surprisingly robust economy in spite of the economic crisis, it is likely that such Chinese shopping tours through Europe will continue.

In spite of many setbacks, e.g. uncontrolled inflow of commodities produced in the zones to mainland China, and – from a Chinese point of view – insufficient technology intensity of foreign investment, the SEZ model and the concentration on consumer and export oriented branches in the course of economic development can retrospectively be regarded as a success story. Today, China is the world's largest end producer not only of toys and textiles but also of computer and other technologically advanced hardware. It should be noted, however, that a good part of the impressive value of output in commodities classified as "high tech" ($218.2 billion in 2005)[74] includes rather labour intensive assembly of components to end products.[75] Nevertheless, China has successively climbed up the value chain, from an average value added of mere 10 percent in the mid-1990s to estimated 20 to 25 percent today.[76]

Retrospectively, one may also say that China has made excellent use of its comparative advantage, namely a diligent, fairly skilled and cheap workforce. As the "world's factory", China supplies the world market with adequately priced, competitive goods, and, in the course of direct investment, the Chinese after decades of isolation, familiarized themselves with advanced manufacturing processes in a step-by-step process. Today, as salaries and wages are on the rise, neighbouring countries like Laos, Cambodia or Vietnam become targets for Chinese direct investment in labour intensive sectors.

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[72] More on the SEZ and their impact on China's economic development at *George T. Crane*, The Political economy of China's Special Economic Zones, Sharpe 1990; *Richard Pomfret*, Growth and Transition – why has China's economic development been so different?, 25 J. Comp. Econ. 4222 (1997); *Y.Y. Yueh*, Foreign Investment and Economic Change in China, 131 China Quarterly p.637 et seq. (1992)

[73] See Tentative Provisions on Using Foreign Investment to Reorganize State Owned Enterprises of Nov. 8, 2002, enacted by the State Economy and Trade Commission, the Ministry of Finance, the State Administration for Industry and Trade and the State Administration of Foreign Exchange, in Chinese on http://www.law.com.cn, search item "liyong waizi".

[74] China Statistical Yearbook 2006, Chapter 18-9 (CD ROM version)

[75] Pursuant to the China review of the OECD Innovation Policy Review series (2008), the technology intensity of China's manufacturing sector is rather low – see Synthesis Report of the Review at http://www.oecd.org/dataoecd/54/20/39177453.pdf; (p. 10) - hereinafter "synthesis report".

[76] Statistical Yearbook (above note 43); *Anne Stevenson-Yang/Ken DeWoskin*, China Destroys the IP Paradigm, Far Eastern Econ. Rev. Mar. 2005, p.9

Somewhat in contrast to the top-down manner in which the Chinese government implements S&T policies, it seems that technological progress in China is in fact highly decentralized and oriented at the existence of an actual demand. That is, it developed hand in hand with industrial development, not only, but to a great extent in the enterprise sector. China's strong regionalism, which will be further outline below[77], is characterized by strong ties between local politics, administrations and entrepreneurs who tend to interpret central guidance in their very own way. The foundation for such regionalism was created in the mid-1980s when the government decided that local governments should raise tax incomes within their respective areas of responsibility, which meant a huge incentive to local governments to work closely with the economic players on the spot and to keep them wealthy and healthy (also by protecting them against non-local competitors). Retrospectively, such immediate collaboration between decision makers on the spot had its advantages. Without it, under rigid central guidance and planning which would not have been able to consider local conditions, the available resources may have been allocated in a less efficient manner. Regionalism enabled a clustered development which started in the most promising areas at the southern seaside. These clusters, after a while of successful development, sent out rays to other, not yet developed areas. Today, the two megacities Shanghai and Beijing are dominating China's R&D landscape whereas Guangdong and other comparably wealthy and well-industrialized provinces have reached a technological level that allows applied-science related R&D.[78] On the other hand, a predominant "local" political involvement is not necessarily the best basis to realize long-term scientific projects, especially basic research. Strong dependence on local conditions may put risky R&D ventures with insecure outcome at the mercy of local politicians and in conflict with their rather short-term profit oriented political ambitions.

Finally, China's education sector as a source of capable scientists and engineers should not remain unmentioned. In spite of the countries' huge size and regional inequalities (rich provinces in the South and East, poor provinces in the inland, especially in the far west), China has an excellent education infrastructure. Education in China is not only a matter of public spending, but the entire society holds education in high regard. The later explanations will mention the prevailing Confucian thinking as one factor which negatively affects the performance of the law in China[79] but the education sector shows Confucianism from its best side. Just as in the neighbouring economies Japan, Taiwan and Korea, at latest at primary age, children are faced with fierce competition in entrance exams to access the best next higher school. Parents dedicate a significant part of their household income to the education of their child (not "children", due to the one child policy). Today, the youth illiteracy rate in China is negligible, in spite of a writing system that consists of thousands of characters, and, what is especially important with respect to S&T, the majority of Chinese opt for a higher education in science or engineering. The higher education system actively supports this orientation towards mathematics, physics, etc., for instance by allowing students which are one-sidedly gifted in mathematics to enroll even if the overall entrance exam grades do not suffice, due to weaknesses in other areas.[80] On the other hand, recent studies show that the Chinese education system, in spite of being targeted at educating the scientists and engineers of tomorrow and in spite of having produced a sharp increase in S&T personnel since the 1990s, finds it difficult to allocate its young graduates on the labour market. The best heads are rarely absorbed by China's huge SOE's, i.e., those enterprises which are most desperately in need of a personnel fresh-up continue to lie idle in terms of innovation and management skills. Moreover, many of China's most gifted students, namely those who are sent abroad to obtain a degree in Europe or in the US, decide to stay abroad. Since 2000, the government launched some initiatives to motivate them to return, in a manner which is similar to the mentioned programmes launched in Russia. The initiatives such as preferential tax treatment seem to have borne fruit, as the most recent available figures (from 2004) show a slight increase of returners to China.[81]

2.4.2 The private sector

At a first glance, the R&D structure of China reflects the smooth transformation from a planned to a market economy. Today, more than two third of R&D is carried out by the enterprise sector whereas in the 1980s, research was still a domain of public research institutes. A closer look into the enterprise sector, however, reveals that a good part of such R&D accounts for previous public institutes which

[77] III. 4 and IV IV.4. f)
[78] See ERAWATCH National Profile China, http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&countryCode=CN&topicID=4, p. 20 et seq.
[79] See below IV. 4. f)
[80] See *Peter Ganea/Jin Haijun*, China, in: *Paul Goldstein/Joseph Straus/Peter Ganea/Ashley Isaacson Woolley/Tanuja Garde* (eds.), Intellectual Property in Asia – Law, Economics, History and Politics, Springer Publishing 2009, p.17 (at 45 et seq)
[81] The „synthesis report" expresses doubts whether the recent increase in the number of returners will be durable – p.29

have smoothly transformed into self-responsible private-alike institutions. Some world players such as Lenovo emerged from such former state-run public research organizations.[82]
An increasing part of R&D activity carried out in China - some surveys indicate 25 to 30 percent – is reported to account for foreign enterprises but the available information on a changed foreign perception of China from a good location for labour intensive manufacturing to a profitable place for joint R&D are somehow contradictory. The Chinese statistical yearbook indicates that the majority of FDI goes to Wholly Owned Foreign Enterprises whereas joint R&D cooperation with Chinese is comparably unpopular. Also other material indicates that western, most notably European high tech enterprises are reluctant to entrust their technology to Chinese, mainly due to a high degree of legal uncertainty.[83] Reportedly, the largest part of foreign-induced R&D in China ins carried out in the IT sector. Other industry areas such as machinery and automotive industry are catching up, thereby grading up the manufacturing sector which is traditionally strong in China, from mere assembly to Chinese involvement in R&D. A relatively new area is nanotechnology. Reportedly, also in this area, foreign enterprises have started to conduct research in China.[84] In sum, the best conclusion one can draw from the fragmented information is that foreign R&D activity is on the rise, but that China bears the potential for even more collaborative Sino-foreign R&D.
Purely domestic R&D has not yet reached a level which would reflect the actual innovative potential of China, in the light of a studious population, available public funds for R&D, etc. One problem is China's size and the difficult implementation of national policies and guidelines on the grassroots, due to a relatively high independence of the regions. China's S&T landscape is large and diversified, and its single parts are not yet put together to a clear innovation infrastructure. In certain areas, there is overinvestment in equipment but there are not enough scientists and engineers to use it. On the other hand, China has a high university output of engineers and scientists but not all of them find an adequate position. At present, domestic R&D is largely confined to so-called experimental development, i.e. to comprehending existing technological solutions developed outside China instead of inventing independent and essential "indigenous" solutions.[85]
A continuing problem is the insufficient funding of risky R&D projects with insecure output. About 70 percent of high tech services and production in China is accumulated in the SME sector.[86] Surprisingly, in spite of the fact that China only a few decades ago still adhered to the socialist planned economy and that the state still plays an important role in "top down" administrative guidance, demand-oriented grassroots business seems to be the most dynamic and efficient form of economic activity in China. Chinese show a high propensity towards private entrepreneurship. The first economic reforms after 1978 which allowed peasants to sell a part of their products at the market, entailed a boost in agricultural production and remarkable improvements to food supply. Today, purely domestic private firms – the majority of them being SME – are still small but their number and industrial output is growing even faster than FDI from abroad.[87] Nevertheless, access to assistance from the in other respect omnipresent state or to bank loans is difficult, in spite of the existence of government programmes such as the Technical Innovation Fund for Small and Medium-sized S&T Firms. China's bank sector is reported to be risk averse, and state guidance often directs loans into inefficient and non-innovative SOE. State subsidies are available to the enterprise sector. The mentioned Medium and Long-Term National Plan for S&T Development is accompanied by Implementing Rules which provide that domestic enterprises shall receive substantive state assistance if they decide to purchase technology or R&D-related equipment.[88] In general, however, big enterprises enjoy preferential treatment. About 25 percent of the subsidies under the mentioned Technical Innovation Fund for Small and Medium-sized S&T Firms are granted to huge enterprises, another 43 percent to medium sized enterprises and only one third of the available funds are entrusted to smaller enterprises which, however, account for 83 percent of all enterprises in China.[89] Moreover, regional political leaders often prefer prestigious "visible" construction projects over investment in hardly comprehensible R&D

[82] „Synthesis report", p. 31
[83] In 2005, for instance, the German Asia Pacific Committee, an organization jointly established by the German Federation of Industries, the Association of German Chambers of Industry and Commerce, and other business federations, have published "Guidelines for Entrepreneurs: Technology Transfer to China, which advises German enterprise leaders to be cautious in cooperation with Chinese, to sell them outdated technologies as latest state of the art and to split up manufacturing processes and to entrust single steps to different partners, so as to prevent one Chinese cooperation partner from obtaining all the knowledge which is necessary to copy the product and the process of its production.
[84] „Synthesis report", p. 32
[85] „Synthesis report", p. 23
[86] *Liu Bin*, Woguo zhongxiao qiye zhishi chanquan gongzuo de sikao (Thoughts about IP management in Chinese SME), Zhishi chanquan (Intellectual Property), Jan. 2008, 50 et seq.
[87] OECD Summary of the Economic Survey on China, 2005, at http://www.oecd.org/dataoecd/10/25/35294862.pdf
[88] ERAWATCH National Profile China, above note 47, p.12
[89] *Liu Bin*, above note 55

projects which can only be profitable in the longer term. And, reportedly, innovative private enterprises which have successfully brought new technologies on the market are in danger of wetting the appetite of public authorities. After having neglected such enterprise in the risky initial phase, they now want to take a free ride on its innovative success, e.g. by exerting pressure on it to license its technology to an SOE at unfavourable conditions.[90]

Nevertheless, the statistics of the State Intellectual Property Office (SIPO) indicate that since 2006, the number of grants to domestic applicants has only been slightly below the grants to foreigners and that between January and May 2009, the number of domestic grants for inventions exceeded the number of grants to foreigners by far.[91] Most domestic patents are granted to the enterprise sector. On average, only 20 percent of domestic patents went to public research institutions (including universities) but such data must be relativized in the light of the fact that in especially S&T intensive areas, such as biotechnology, public research institutes and universities prevail over enterprises.[92]

2.4.3 The public sector

China's most reputed public research organization is the famous Chinese Academy of Sciences (CAS), the role of which is quite similar to that of the mentioned Russian Academy of Sciences. After a major overhaul at the dawn of the 2000s which entailed, inter alia, a reduction of research institutes, the CAS seems to perform efficiently and to be capable of conducting basic research on world class level, also in cooperation with foreign institutions such as the German Max Planck Society. Whereas the Academy has been downsized and streamlined, universities are increasingly engaged in R&D, and the government is actively supporting the universities as a second major player in the area of basic research.[93]
China's universities show a strong propensity towards commercializing their research results. Most universities have a "Technology and Science Office" which, inter alia, decides about the further exploitation of research results.[94] A clear pattern of private-public partnership is not yet visible. Licensing to the industry is not the preferred route of commercializing IP. Universities rather tend to establish spin-offs which too often show a poor entrepreneurial performance.[95] However, private-public partnerships with the private partner funding a project carried out by the public partner (mostly a university) are on the rise, and in 25 percent of such collaborations, the private partner is reported to be a foreign enterprise.[96] Precautions should be taken with regard to the possible existence of university in-house regulations on ownership in and exploitation of research results: if such rules exist and are applicable to collaborative results, their application may be excluded by the collaboration contract if they impose unfavourable conditions on the European partner.[97] As far as the content of R&D is concerned, many Chinese universities and research institutes are at the forefront of new technologies, such as nanotechnology and biotechnology. The mentioned statistics with regard to patent applications for genetic inventions, pursuant to which 80 percent of such inventions account for universities, gives rise to the assumption that universities actually fulfill their new function to serve not only as locations for higher education but also as sites for basic research. The number of outward oriented Chinese university researchers with knowledge of foreign languages and of foreign attitudes is on the rise. Many of them maintain networks with colleagues from abroad, which is also demonstrated by an impressive number of joint Sino-foreign publications.[98]
In spite of the huge potential of the public sector, China has difficulties in implementing a country-wide robust innovation policy. The present landscape is a tangled mass of more or less declaratory initiatives under the State Council's (the countries' highest administrative organ which supervises the ministries and central agencies) 15-year National Plan for Short and Long-Term Development of Science and Technology which lasts from 2006 until 2020. Responsible for its draft is the State

[90] *Stevenson-Yang/DeWoskin*, above note 45; more about state intervention at III. 4.
[91] SIPO statistics available under http://www.sipo.gov.cn/sipo_English/statistics/
[92] The SIPO proudly alludes to a rapid increase in domestic patent applications and grants in the area of genetic inventions, and to the fact that in 2008 the number of domestic applications as well as grants exceeded the number of foreign applications and grants by far. Simultaneously, however, the report bemoans that 80 percent of such patents went to universities and the other 20 percent to public research organizations, without any enterprises being involved.
[93] "Synthesis report" p. 35 et seq.
[94] *Rainer Oesch (ed.)/Olli Kolla/Zhang Liguo*: Technology Transfer of Research Results Protected by Intellectual Property. Tekes Review 259/2009, p.24 et seq.
[95] *Stevenson-Yang/DeWoskin*, above note 45.
[96] „Synthesis report", p. 41 et seq.
[97] See *Oesch (ed.)/Kolla/Zhang*, above note 63, p.23
[98] „Synthesis report", p. 39 et seq.

Council's Steering Committee on Science & Technology and Education and the main responsibility for its implementation is with the Ministry of Science and Technology (MOST) but many other ministries and central agencies, such as the Ministry of Commerce (MOFCOM) or the State Intellectual Property Office (SIPO), are also involved. The plan defines a number of mission oriented research areas like aircraft engineering or moon exploration, but also an even higher number of demand-oriented areas, e.g. transgenic plant breeding or drug development. The total expenses for R&D should rise from already impressive 1.4 percent to 2.5 percent in 2020, with a share of 15 percent dedicated to basic research (in 2004: 6 percent).[99] The present "indigenous innovation" campaign is part of this plan; it aims at increasing the domestic ownership in key technologies so as to reduce dependence on foreign technology standards. Indeed, China has a huge market with increasingly wealthy consumers, and therefore good chances to create robust domestic standards which, once successfully established, would become mandatory for foreign enterprises in China and may even be exported to other parts of the world. The majority of the funds under the plan are dedicated to strategic areas defined by the government, with a strong emphasis on basic research and characterized by ambitiousness with respect to China's future role as a world technology leader. To a smaller extent, the plan builds on already existing rather demand oriented programmes which have shown limited success over the past decades, such as the Spark programme launched in 1986 to professionalize the rural sector, and the Torch programme launched in 1988 which at that time already aimed at bringing industry and public research together.[100]

2.4.4 Implications for Europe

China offers a lot of opportunities for cooperative R&D and other forms of KT. In contrast to the situation in other BRIC economies, locations for R&D are not confined to certain technological areas. China provides for a huge and ever-increasing variety of areas in which joint R&D is possible. It seems, however, that most opportunities for research on life sciences and other future oriented high-tech areas can be found in the public sector whereas the enterprise sector has its strengths in traditional manufacturing of hardware. The latter may provide opportunities for applied research, e.g. in form of partnership between a local enterprise and a European PRO. Private-public partnerships are not unfamiliar to Chinese researchers and entrepreneurs. That is, apart from formalized Sino-EU research programmes such as CO-REACH, China also offers opportunities for independent, privately organized research projects.
In geographical respect, two major clusters account for most of the R&D spending of the country, namely Beijing and its renowned universities and PROs and Shanghai with the industrial and entrepreneurial knowledge accumulated over decades of rapid development. Moreover, as mentioned, other, comparably wealthy provinces which are now China's centers of industry and manufacturing (e.g. Guangdong or Zhejiang) are catching up. Here, mainly industry partners may be found, e.g. for applied research related collaboration.

3 Government Policy and Practice

This chapter deals with governmental or administrative involvement in research activities. KT may be affected, for instance, by government control of areas defined as "strategic", or by rules on state ownership in results of publicly funded R&D or obstacles occurring in daily administrative practice. The ownership in intellectual assets and the enforcement of such ownership rights is another important element of the institutional environment but it will be treated in a later chapter on the legal framework.[101] The key questions of this chapter are: what degree of administrative control can a European PRO (or enterprise) expect if it decides to engage in one of the BRIC economies? How reliable are the administrative authorities involved in KT, e.g. those being in charge of official approvals, etc.? Is there a regulatory framework that restricts KT in the one or the other direction?
All four BRIC economies are characterized by relative political and institutional stability but as emerging economies, their respective public sectors are often insufficiently endowed with financial resources. Moreover, their increasing involvement in international trade and the role of some BRIC economies as targets of FDI effects a brain drain from the public sector to much more lucrative jobs in

[99] *Ganea/Jin*, above note 49, p.49
[100] Overview of the insititutions involved, the various programmes and the allocation of funds in „Synthesis report", p.54
[101] Chapter IV

the private sector, especially in foreign firms. Those who remain in the public sector are often not adequately educated to make competent decisions in cases which involve complicated technology or scientific results.
Evaluating the actual efficiency of a country's institutions beneath the superstructure composed of laws and regulations is hardly possible, due to the lack of empirical evidence regarding the performance of such institutions. As mentioned, there is much anecdotal evidence e.g. on inappropriate decisions by administrators but too often there is no further evidence as to whether the observed behaviour is the rule or rather the exception. Very often, alarming reports and statements made by European or American business associations seem to follow the journalist's rule that "only bad news is good news". They present bad experiences made by their members as typical for a country and remain silent on cases in which all players behaved according to the rules. The following observations will also have to rely on such anecdotal evidence, but try to put it in relation with other indicators, so as to obtain a more realistic picture.

3.1 Brazil

Brazil's comparably wealthy areas are located around and between Rio de Janeiro and Sao Paolo which at the same time form Brazil's scientific, economic and administrative centers. It should be relatively easy to find competent contact persons and also partners for joint R&D and other projects which involve KT in these areas. However, as mentioned, Brazil is also a good location for R&D in "green" technologies, due to a rich biodiversity. That is, sometimes the nature of an R&D project necessitates engagement in remote areas with relatively poor administrative endowment.
One problem which Brazil, however, has in common with the other BRIC countries, is the difficulty to secure uniform standards of administrative conduct and professionalism throughout the country. With regard to Brazil, commentators even defined cultural and historical gaps between certain regions, namely regions in which sugar cane was cultivated in colonial times and in which land ownership (recently also industry ownership) is synonymous to political power, and former regions of gold prospecting which are characterized by a relatively huge but ineffective administration, which is described as a remainder of the former Portuguese gold taxation authorities. In both areas, administrative treatment is reported to be unfair, with limited access to legal resources.[102]
Anecdotal evidence highlights what can happen to researchers who fail to comply with Brazilian laws and administrative procedures governing R&D. As mentioned, on the international stage, Brazil is one of those countries which claim respect for the national biological heritage of developing countries and a better protection against bio-prospecting. Therefore, the Brazilian government felt that it had to be among the first to introduce a regulation of access to genetic resources at the national level, not least because some foreign pharmaceutical companies already had started to acquire licenses from Brazilian authorities to conduct research on the countries' biological assets.[103]
The result, Brazil's Provisional Act No. 2186-16 (version of 2008 after numerous amendments, the original enactment dates 23 August 2001), regulates access to genetic resources in a quite complicated manner: for permission to access Brazil's "genetic heritage" for mere scientific purposes, scientists have to seek the prior informed consent of the respective local community or the landlord of the site where the genetic information has been found. If, however, commercial interests are involved (if, for instance, a pharmaceutical company applies for access permission), a Contract for Use of Genetic Heritage and Benefit Share has to be concluded with a number of further institutions, namely the local community or local land owner, the authority in charge of granting access and the official Indian Affairs body if indigenous people are involved. For Brazilian researchers, the competent grant authority is the Genetic Heritage Management Council (CGEN) under the Ministry of Environment. Under the CGEN, another body, the Brazilian Institute of Environment and Renewable Resources (IBAMA) examines access requests. For foreign researchers, the situation is even more complicated, as they have to send their request to another institution under the Ministry for Science and Technology which decides jointly with IBAMA about approval.[104]

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[102] *Joana Naritomi/Rodrigo. R. Soares/Juliano Assunção*, Institutional Development and Colonial Heritage within Brazil, IZA Discussion Paper No. 4276, at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1434610

[103] In 2000, the Swiss pharmaceutical producer Novartis AG concluded a contract with a Brazilian NGO under the auspices of the Ministry of Environment, providing Novartis with far-reaching freedom to exploit Brazil's genetic resources and to patent the research results; due to the alarmed public reaction, the agreement was later on transformed into a Provisional Act – see *Bucher*, above note 4

[104] More details in Bucher, above note 4

The procedures are reported to be extremely lengthy (up to two years) and to be carried out by administrators without particular scientific knowledge.[105] Some researchers are tempted to commence research without waiting for an approval, obviously expecting that nothing will happen and that they may obtain approval afterwards. Such attitude can be dangerous, however. In a spectacular case, a scientist had been sent to jail because his keeping of monkeys from a special region for animal research purposes was suddenly regarded as contravening the genetic heritage regime. And, from statements made by judges and prosecutors involved in this case, it seems that if foreigners are involved, the danger is high that they will receive especially hard treatment so as to serve as deterring example to other non-obedient foreigners.[106] Obviously, the impressive brushwork of regulations and institutions on access does not perform well, due to the lack of competent personnel and authorities. And, at least according to anecdotal reports, the authorities obviously add to the problem, by treating non-compliance with the easily trespassible regime with a nationalistic attitude.

Moreover, the interplay between government institutions which are in charge of different aspects of R&D does not seem to be frictionless. This can again be highlighted by the example of the Brazilian regulation of access to genetic resources. In 2001, it introduced in its Patent Act a requirement that patent applications which rely on genetic resources have to indicate that the respective material has been obtained in a legal manner. Domestic implementation, however, turned out to be more difficult than expected. In spite of Art.31 of the Provisional Act which provides that patents involving genetic information should only be granted upon compliance with the access regime, the National Industrial Property Office (INPI) ignored the provision and continued to grant patents for such inventions without examining whether the applicant has had legal access to the genetic information forming the subject matter of the application. The INPI justified its position with reference to the TRIPS Agreement which would not allow a fourth patenting prerequisite apart from novelty, inventiveness and industrial application. That is, the debate around the integration of access provisions in the patent law continued on the domestic level, in a country which strongly supported such integration on the international stage. The INPI upheld its resistance for more than five years, then it finally gave in. Since January 2007, a resolution issued by INPI requires that all applications (not only applications pertaining to biological subject matter) indicate a) whether they pertain to Brazil's biological heritage and b), if yes, whether the corresponding material was obtained in compliance with the mentioned Provisional Act. Moreover, such obligation retroactively extends to all applications already filed with the INPI since the entry into force of the Provisional Act. That is, the INPI made a complete turnaround and now imposes even harsher conditions on patent applicants than required by the Provisional Act.[107]

Of course, such incidents do not give rise to confidence in Brazil's institutions and the predictability of their acts and policies. European PRO are well advised to observe the environment regarding a certain area of S&T, as to whether there is an established regulatory and institutional regime or whether there is a continuing political debate around only halfway decided matters. However, as indicated above, it would be premature to conclude from anecdotal evidence that *ad hoc* changes in the regulatory framework are typical for Brazil. The same is true with regard to the experiences made by foreign scientists who came at odds with the Brazilian access regime. It has to be considered that biotechnology, due to the fact that Brazil perceives its rich biodiversity as a strategic asset, is a rather exceptional, highly politicized area and therefore a good stage for ambitious officials and judges. Authorities may behave differently if faced with problems in, let's say, rather tranquil areas of KT. Unfortunately, there is hardly any information about the administrative involvement in other areas of S&T or technology transfer in general. It seems, however, that since the enactment of the new Industrial Property Act in 1996, the former strict control of technology transfer agreements under a registration system supervised by INPI has been abolished. The previous regime allowed the INPI to refuse registration if it did not agree to the content of the contract. Now, under Decree No. 51 of 15 May 1997, the INPI limited its competence to examining contracts as to their formal compliance with the law.[108] Nevertheless, it should be kept in mind that international technology transfer contracts are still subject to formal approval and registration. Apparently, however, the Brazilian registration regime does not give much rise to complaint.

In sum, from the explanations above, the following explanations can be extracted:

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[105] See *Bucher*, above note 4

[106] See New York Times article "As Brazil Defends Its Bounty, Rules Ensnare Scientists" as of 28 August 2007, available at http://www.nytimes.com/2007/08/28/science/28biop.html

[107] See *Bucher*, above note 4

[108] *Jose Antonio B.L. Faria Correa*, Chapter 5: Brazil, p.5-1 et seq., in: *Melvin F. Jaeger*, Trade Secrets Throughout the World, Thomson Reuters/West 2008 (looseleaf)

a) On the macro/political level: keep yourself informed about political debates and possible regulatory changes which may affect your area of research and try to shape your engagement in a manner that anticipates such changes;

b) On the operational level: do not expect that the immediate players within Brazil's institutional brushwork accord to well and long established rules. As mentioned above under II 1., especially in the area of S&T, a lot of policies and regulations, including new or shifted competences attributed to existing institutions, may not yet be resourced with experienced and competent personnel.

3.2 Russia

In spite of the declared policy to incite innovative activity with help of foreign investment, the government's approach towards collaborative R&D and other forms of Russian-foreign activities remains xenophobic in a number of aspects.
As outlined above, most R&D in Russia is still carried out by the public sector and, in spite of the described government's attempts to become stronger in civil R&D, the focus of research is still on rather mission-oriented areas which are strongly connected to the public interest. Consequently, government interference in R&D is comparably strong and the Russian state has taken a number of measures to keep the subject matter of and ownership in results of R&D under state control.
The biased approach towards collaboration with foreigners in high-tech areas –declared will to import foreign know-how in order to enhance the competitiveness of its industries on the one hand, heavy control of foreign engagement in a high number of areas determined as "strategic" on the other hand – is highlighted by the new "Act on Procedures of Making Foreign Investment in Business Entities of Strategic Importance to National Defence and Security of the State" of 5 May 2008. It limits foreign control in a number of mainly high tech and R&D intensive areas like aviation, pharmaceuticals, geophysics, weaponry related materials research, etc. In some of these areas, foreign enterprises can hold only 10 percent of the shares of a Russian enterprise, in others up to 50 percent. Investments which exceed one of these limits will be subject to a complicated official examination and approval procedure which can take up to seven months. Foreign investors, on the one hand, appreciate the new law as it replaced the previous practice of unpredictable ad-hoc decisions on the permissibility of foreign investment. On the other hand, they bemoan the broad range of areas defined as "strategic".[109]
The new Act is mainly focused at substantive investment by financially strong foreign companies, and affects European PRO only indirectly. However, Russia has a number of further restrictions which would directly be applicable e.g. to a collaborative research between a European university or research institute and one of Russia's institutes under the Academy of Science. Special concerns are raised by the relatively new regime regarding ownership in research results which are funded by the Russian state.
First of all, Chapter 77 of Part IV of the new Russian Civil Code on "Intellectual Property" contains unique provisions on so-called "unified technology", meaning a set of different intellectual assets, e.g. inventions, computer programs, technological know-how, etc. which in combination form a uniform technological result. Chapter 77 provides that if the creation of such "unified technology" has been funded by the state on federal or regional level, the right to exploit it shall belong to the "organizer" of the creation. The right in each single contribution to the entire set, however, shall belong to its creator in accordance with the other intellectual property right provisions regulated in Part IV of the Civil Code.[110] Most probably, "organizer" means the person or entity which acted under the auspices of the government. Chapter 77 further stipulates that in case of rights pertaining to defense technology, the exploitation shall be carried out by the state and that technologies developed with help of state funding shall preferably be exploited within Russia. Technology export would require the government's permission and registration. Obviously, the aim of Chapter 77 is to ascertain that federally funded research results will be exclusively exploited by state. A non-Russian institution which contributed to a state funded research project may then be banned from exploiting the result in Russia. The provision, however, is hotly debated and it seems that at present, even Russian experts are not entirely clear about the way it will be applied in practice.

[109] OECD Investment Policy Reviews: Russian Federation, above note 15, p.24 et seq.
[110] *Sergey Budylin/Yulia Osipova*, Total Upgrade: Intellectual Property Law Reform in Russia, Columbia Journal of East European Law, Vol. 1 No.1 (2007), p.1, online available at SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1314709

Apart from this new and unique legislation, Russia has another set of provisions on decree level, the Regulations on Allocating and Transferring to Commercial Entities rights in results of Scientific and technical Activities Funded from the Federal Budget enacted by Federal Government decree on 17 November 2005. According to the Regulation, state customers are obliged to ascertain that the government obtains the rights in technical solutions which are not intended for market circulation, intended for restricted circulation only, or the exploitation of which is financed by the state. Moreover, the right in inventions which involve state interests such as defense or health shall be allocated to the Federation, or to the Federation and the contractor (but obviously not to the contractor alone). That is, if a joint R&D project funded by the Russian Federation involves state interests, e.g. a new essential pharmaceutical or maybe even a dual use technology which can be used for civil and for defense purposes, there is certain likelihood that the Federal Government will claim ownership in such invention.[111]

Therefore, if a European PRO participates in a research project which is funded by the Federal Government, the government may claim ownership or at least co-ownership in the result, irrespective of what is stipulated in the contract with the immediate Russian partner. European PROs and enterprises are well advised to anticipate such statutory state ownership. Moreover, the available provisions are obviously limited to state ownership in those cases in which the Russian government funded the entire project. The legal situation with regard to the ownership in research results which are co-funded by a foreign party (i.e. only partly funded by the Russian government) is not clear. Due to the restrictive and sometimes confusing rules, engagement in Russia requires a high degree of alertness. It should be kept in mind that in spite of recent government efforts to enhance the innovativeness of Russian enterprises, Russia's research landscape is mainly composed of institutes under the Academy of Science, which are normally funded by the government. In case of collaborative research, it is very likely that potential partners can only be found among PROs with strong ties to the government. The risk of being deprived of opportunities to market a collaborative research result because the Russian state claims ownership may be minimized by investigating the extent to which the Russian partner's contributions are supported by the government. If there is a certain likelihood that the Russian government may intervene but the European side thinks that an engagement is still desirable (e.g. if there is a prospect of marketing the expected research result outside Russia), the extent to which intellectual assets will be contributed, especially the extent to which secret technologies will be revealed to the partner, should be clarified in advance to any negotiations with the Russian side. The draft of a tenable contract which cannot be overruled by law should be entrusted to an international law firm with experience in Russian law.

Finally, on the operational stage, i.e., in daily administrative practice, the human factor should not be neglected. Already under the previous president Putin, the government has recognized the need for a better investment climate and enacted a number of laws in the area of commerce and trade which set statutory thresholds for fees, deadlines, etc. that can be imposed by administrations in the course of application procedures and the like. Such clear rules enhance legal certainty and reduce the leeway for administrative misconduct.[112] Nevertheless, one should not expect that requesting and obtaining an official approval always proceeds according to rules. The number of forms that have to be filled and approvals that have to be requested, as well as of the different agencies that have to be approached in case of a new project, is impressive.[113] The impenetrable brushwork of administrative requirements forms a fertile ground for arbitrariness and corruption.[114] Administrative obstacles do not necessarily have to be directly related to S&T and knowledge transfer but they can nevertheless affect scientific engagement in Russia. For a PRO or single researchers without noteworthy financial resources, such obstacles may become insurmountable. A short trip to Russia, for instance, may fail because the

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[111] *Ksenia Fedotova/Rainer Wedde*, The Treatment of Know-how in International R&D Cooperations – Russia, under http://www.kooperation-international.de/countries/themes/info/detail/data/37701/

[112] *Bernard S. Black/Anna S. Tarassova*, Institutional Reform in Transition: A Case Study of Russia, The Supreme Court Economic Review, Vol. 10, p.211 et seq., at http://papers.ssrn.com/abstract=311276

[113] *Harry G. Broadman*, Reducing Structural Dominance and Entry Barriers in Russian Industry, World Bank Policy Research Working Papers No. 2330, at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=224261

[114] Many articles are dedicated to this topic – see, *inter alia*, *Laurent Weill*, How Corruption Affects Bank Lending in Russia, Bank of Finland Institute for Economies in Transition (BOFIT) Discussion Paper 18/2008, at http://ssrn.com/abstract=1304592; *Partti Haaparanta/Tuuli Juurikkala*, Bribes and Local Fiscal Autonomy in Russia, BOFIT Discussion Papers 12/2007, at http://ssrn.com/abstract_id=1001424; The Economist as of July 2nd http://www.economist.com/businessfinance/displaystory.cfm?story_id=13962526

online available visa application document is not printed in the required size.[115] Many problems may be eliminated in advance to an engagement, if there would only be a chance to know about their existence. Therefore, prior to any engagement in Russia, it is very advisable to resort to an experienced consultant or law firm with the capability to imagine all possible unpredictabilities, also with regard to such side aspects as settling in Russia, renting space, etc.
In direct interaction with a Russian partner, it is advisable to resort to persons known from previous activities, e.g. a former Russian guest researcher, and not to rely too much on formalized relationships like a contract. Russians themselves interact in a highly informal manner, thereby often reaching out beyond the surficial borderline between "public" and "private". If there is a joint interest, entrepreneurs tend to work hand in hand with administrators and politicians, on a highly personal, unofficial level.[116] Such brushwork of personal relationship, however, is not easily accessible to outsiders. Therefore, resorting to acquaintances as door openers in public-private as well as in public-public cooperation should be considered.

3.3 India

Between 1951 and 1991, the Indian government strictly controlled, inter alia, the establishment of new companies, changes in production, mergers and acquisitions and also direct investment from abroad under the so-called "License Raj" system. The legal basis for the government's interference in economic activity was the Industries Development and Regulation Act of 1951. In 1991, after a first preparatory reform in the mid 1980s, License Raj was finally abolished. In a few areas it lives forth, "for reasons related to security and strategic concerns, social reasons, problems related to safety and overriding environmental issues, manufacture of products of hazardous nature and articles of elitist consumption".[117]

The abolishment of License Raj boosted the foundation of new, robustly growing firms whereas enterprises founded during the License Raj regime still find it difficult to adapt to the changed environment.[118] Especially firms which produce and deal with intangible assets such as innovative solutions and software are not much confronted with remainders of the old regime which was traditionally focused on the output of tangible commodities.[119]

From the fragmented information that could be obtained, it seems that government control of foreign research activity or of KT flows is negligible, obviously due to the poor endowment with administrative resources. On the political level, India's S&T-related ministries rather pursue a policy that aims at facilitating research activities. In 2000, the government has merged various ministries and administrations into a Ministry of Information Technology (MIT) so as to better serve the needs of the fast growing IT and software sectors. Reportedly, the new ministry substantively contributed to the further growth of these sectors, by providing the necessary physical infrastructure (enhanced connectedness throughout the country etc.). The mentioned draft National Innovation Act aims at further reducing bureaucratic obstacles to innovative activity. One area in which administration may become problematic is health and pharmaceuticals but government control of new medicines,

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[115] An EU-Russian visa facilitation agreement in order to improve academic exchange is reported to have remained without effect, see ERAWATCH National Profile Russia, above note 24, 24

[116] Observed by *Valery Yakubovich/Stanislaw Sheksnia*, The Formation of the Russian Cellular Industry: Entrepreneurial Success in a Failing Economy, INSEAD Business School Working Paper May 2007, at http://ssrn.com/abstract=1032169

[117] *Philippe Aghion/Robin Burgess/Stephen Redding/Fabrizio Zilibotti*, The Unequal Effects of Economic Reforms: Evidence from Dismantling the License Raj in India, University of Zurich Institute for Empirical Research in Economics Working Paper No. 345, at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1076162

[118] *Sumit K. Majumdar*, The Hidden Hand and the License Raj: to an evaluation of the relationship between age and the growth of firms in India, Journal of Business Venturing 19 (2004) 107

[119] *Nirvikar Singh*, Some Economic Consequences of India's Institutions of Governance: A Conceptual Framework, UC Santa Cruz Economics Working Paper No. 556; SCCIE Working Paper No. 03-20, at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=508662; *John Armou/Priya Lele*, Law, Finance, and Politics, The Case of India, at http://ssrn.com/abstract=11116608

approval procedures etc. is reported to be lax.[120] As mentioned, especially nanotechnology-related R&D (also health related one) is enthusiastically fostered by the government which has recognized this young discipline as a new area in which India has to become a world leader. Also here, health security concerns do not seem to play a major role.[121]

Also on the operative level, i.e. daily administrative practice, there is little evidence that foreign researchers have to suffer under harsh bureaucracy or administrative arbitrariness. India's administrative elite with significant powers is selected in a rigid nation-wide examination conducted by the Union Public Service Commission (UPSC) which supervises, inter alia, selection, transfer and conduct of administrators. Those few who are found eligible for the highest posts become officers of the Indian Administrative Service (IAS). They are trained and then dispatched to serve on the regional and national level. Only 5600 IAS officers are reported to be in service, and they perform multiple duties. Inter alia, they serve as quasi-judges on the local level, if, for instance, a petitioner has had problems with the police or other administrative authorities. Lower-level administrators can be found on county level but the most powerful are the IAS administrators, each of them being responsible for hundreds of thousands or even millions of Indians. Political interference in the strict examination and selection procedures is not possible. However, local politicians can influence the transfer of IAS officers from one post to the other. Transfers are reported to occur frequently, and transfer to a better position can accelerate an administrator's career. Reportedly, it is a widespread practice that politicians enclose themselves in a group of loyal administrators.[122] Reports about the efficiency of India's officers, especially the IAS, are contradictory. Some hold that the work of India's bureaucrats, especially of the IAS elite, would be comparably fair and transparent.[123] Others emphasize a high degree of inefficiency and even corruption, due to the observed political influence on transfers, partly also due to the extreme work overload and a decreasing academic level of young administrators, as the emerging IT industry would absorb rare talents.[124] Especially on the lowest level of administration outside the IAS, where local state employees with little education and small salaries interact with citizens, corruption is reported to be the rule.[125] It is hard to determine from outside which side is correct. India is a developing country, with a state budget that does not allow high salaries for government officials. The hopelessly undermanned Indian patent office is a good example. Recruits have to pass the lengthy and burdensome UPSC entry competition which is mainly related to general administrative matters, just to suffer afterwards under a huge workload for a very low salary. Such prospects are certainly not attractive for young engineers, physicians or biologists, especially not for the most talented ones who have a realistic chance to be absorbed by foreign company. Nevertheless, western researchers or research organizations are unlikely to get in trouble with administrations on the grassroots level where administrative misconduct is reported to be especially rampant.

In sum, the best conclusion that can be drawn from the available information is that in those areas in which India has R&D capacities, and even in areas which are "strategic" and should therefore still be subject to the License Raj regime, government interference in R&D activity or the in- and outflow of knowledge is the least thing that a European research institute or enterprise has to fear, due to a chronically understaffed and underequipped public sector.

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[120] *Nidhi Srivastava/Nupur Chowdhury*, above note 35, quoting a report of the National Commission on Macroeconomics and Health which bemoaned that the existing regulations on health and pharmaceuticals would not be sufficiently enforced, mainly due to lack of personnel.

[121] *Nidhi Srivastava/Nupur Chowdhury*, above note 35

[122] *Lakshmi Iyer/Anandi Mandi*, Traveling Agents: Political Change and Bureaucratic Turnover in India, Harvard Business School BGIE Unit Working Paper No. 09-006, at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=508662

[123] *Nirvikar Singh*, Holding India Together: The Role of Institutions of Federalism, Munich Personal RePEc Archive, Oct. 2008, at http://mpra.ub.uni-muenchen.de/12432/

[124] "India's Civil Service", The Economist, 6 March 2008 – subscribers can download the article (which, by the way, uses a rather drastic language) at http://www.economist.com/world/asia/displaystory.cfm?story_id=10804248; further anecdotal evidence at *Sandeep Kohli*, "The License Raj is Dead. Long Live the License Raj" Online version of the Wall Street Journal, http://online.wsj.com/article/SB123451653488482115.html, bemoaning, *inter alia*, lengthy procedures for issuing a business license.

[125] *Lant Pritchett*, Is India a Flailing State? Detours on the Four Lane Highway to Modernization, Harvard Kennedy Working Paper 09-013 (2009), at http://ssrn.com/abstract=1404827

3.4 China

Among the observed countries, China seems to have the strongest governmental and administrative involvement in knowledge transfer activities. Since the dawn of the opening and reform policy in the late 1970s, the Chinese government pursued the ambitious goal to catch up with the developed west in technological respect. Therefore, the government's endeavours which were so far limited to keeping pace with developments in the defense sector, whereas the industrial basis could not even supply the domestic population, now aimed at absorbing high tech in all kinds of sectors and branches. Foreign investors from the developed west were sought after to bring China's shallow industry into shape. The leadership also recognized that without an adequate institutional and legal framework, foreigners would hardly entrust their sensitive technologies to Chinese partners.

The first technology transfer rules and procedures implemented in the mid-1980s intended to absorb advanced technologies from abroad at the cheapest possible price. Technology contract clauses which overly restricted the Chinese partner were forbidden. After the termination of the technology contract, at latest after ten years, the recipient was free to use the technology in whatever form. Clauses on post-contractual secrecy obligations were not possible.[126] Therefore, this first legal and administrative framework (then the Ministry of Foreign Trade and Economic Cooperation, now merged into the Ministry of Commerce, MOFCOM) clearly favoured the Chinese partner to a technology import contract. Obviously, however, such favourable treatment should be granted *within* a legal framework.[127] Reports from the mid-1980s reflect that the Chinese government at that time was well aware of the investment disincentives created by legal uncertainty.[128] The first provisions on technology import and export, however, were drafted in a fuzzy manner and left much room for arbitrariness. Many foreign companies which pioneered in China soon complained about unreliable institutions.

In 1999, the new Contract Act and then later on the Technology Import and Export Rules of 2001[129], a new administrative superstructure and a set of accompanying rules abolished a number of flaws of the old framework. The new regulatory framework distinguishes between "free", "restricted" and "prohibited" technologies. Registration of technology contracts is still mandatory, even if their subject matter pertains to "free" technology but the new Provisions on the Registration of Technology Import and Export Contracts which entered into force on 1 February 2009 introduced clear deadlines for such registration.[130] The Regulatory framework is further comprised of the Administration of Technology Import Prohibition and of Technology Import Registration of 1 February 2009[131], the Methods on the Administration of Technology Export Prohibition and Technology Export Restriction of 26 December 2005 (both enacted by MOFCOM)[132] and the lists of restricted and prohibited technologies issued by MOFCOM.[133]

The amended regime on technology transfer still reflects the intention to channel the import of technology in accordance with the needs of China's economy. A number of restrictions were maintained and even though not all kinds of technology import contracts have to be approved, registration of any kind of transfer and licensing contracts, accompanied by evidentiary material, e.g. regarding the status of the parties, the lawfulness of the contract, etc., is still mandatory. Administration and registration of technology import and export contracts is carried out by local administrations unless key technologies are at issue. In the latter case, the central Ministry of Commerce has competence.

Therefore, also under the new regime, the state retains a high degree of control over the technology flow to and from China, inter alia, by prescribing which technologies are desirable and which technologies should be kept out of the country, e.g. technologies which affect China's trade balance or

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[126] *Peter Ganea/Thomas Pattloch*, Intellectual Property Law in China, Kluwer Law International 2005, p.269 et seq.
[127] *Ganea/Jin*, above note 49, p.17 (38 et seq).
[128] *Henry R. Zheng*, The Patent System of the People's Republic of China, University of San Francisco Law Review, Vol.23 No.2/3 1987, p.245 et seq.
[129] Gazette of the State Council 2002 No.2, 17; English translation in China Patents & Trademarks February 2002, p.56.
[130] In Chinese: http://tfs.mofcom.gov.cn/aarticle/zcfb/200902/20090206026831.html; an unofficial English version was found at http://www.fdi.gov.cn/pub/FDI_EN/Laws/law_en_info.jsp?docid=102316
[131] http://www.gov.cn/flfg/2009-02/04/content_1221155.htm
[132] See website of the Ministry of Science and Technology (MOST) http://www.most.gov.cn/bszn/new/xzck/wjxz/200512/t20051226_55328.htm
[133] List of import restrictions/prohibitions at http://www.gov.cn/flfg/2007-11/02/content_793830.htm; list of export restrictions/prohibition at http://202.123.110.3/flfg/2008-09/25/content_1105522.htm

expose domestic producers to foreign standards.[134] The mentioned lists on import and export prohibition and restriction which mention, for instance, a number of concrete technologies in the life science area as restricted, and a number of military or dual use technologies as prohibited either from import or from export - can be amended so as to comply with a changed trade or security situation. It may therefore happen that a technology previously categorized as "free" later changes into restricted technology and vice versa, and there is no further provision (or no such provisions could be found) on how such a change will be retroactively applied to already concluded technology contracts.

Important for KT in the course of direct investment is another set of rules, the State Council's Provisions on Guiding the Direction of Foreign Investment of 11 February 2002. [135] They stipulate four categories of technology related investment, namely prohibited, restricted, free and "promoted" investment. The latter, "promoted" investment means investment which involves advanced technologies, whereas at least according to these provisions, restricted investments may even pertain to investments which involve outdated technologies. "Promoted" investment will be facilitated by tax reductions and other advantageous treatment.

Further important provisions can be found in the Implementing Regulations to the Act on Sino-Foreign Equity Joint-Ventures of 22. July 2001.[136] If capital is brought in in form of a patent or secret technological knowledge, the local Administrations for Industry and Commerce have to be provided with a feasibility study and other technical details for approval (Rule 7).

That is, KT to and from China is accompanied by a whole thicket of regulations which have to be carefully observed. In a similar manner as Russia, but a few years earlier, the Chinese technology transfer regime has reacted to complaints about its unpredictability and lack of reliability. The legislature introduced clearer rules, e.g. deadlines for administrative decisions. However, a foreign PRO or enterprise which concludes a technology contract with a Chinese entity or enterprise has to be aware that in order to comply with the law, technical details and other sensitive data have to be submitted to local authorities, namely the branches of the MOFCOM and/or the AIC, depending on the nature of the KT. In spite of a number of regulations, e.g. Art.23 of the Technology Import and Export Rules, which oblige administrators to maintain confidentiality with regard to such data, there are complaints that in daily practice, secret information submitted to administrations has been divulged to local competitors. Of course, this is also anecdotal evidence, and the number of cases in which administrators behaved according to the rules is not documented. Nevertheless, European secret holders should be aware of a certain susceptibility of administrators to political demands.

Reports also refer to various other forms of more or less informal interference by mostly local administrations to the advantage of domestic competitors. Accordingly, "coerced technology transfer" is carried out, for instance, by local content requirements which provide local suppliers with insights in the technology of the investor's product or process, or by forcing foreigners in a JV with a Chinese partner, thereby enabling the Chinese party to access technological secrets of the foreign party. To a foreign enterprise which has won a public tender, it can happen that it is afterwards forced to enter into a JV with a local enterprise by the local competent authority. After successful termination of the JV, the regional government may organize another tender, but only to let the former Chinese partner with his newly acquired know-how come off as the winner.[137]

From the available evidence it can hardly be concluded that all administrative interference in KT is part of a dark national strategy to appropriate foreign technological knowledge for free. The laws enacted by the National People's Congress and the regulations enacted by the State Council (China's highest administrative authority which supervises the other ministries and central administrations) reflect the nation's interest in KT, predominantly KT in form of technology import, but there is no evidence that administrations are silently encouraged to break the laws, e.g. by non-compliance with the rules which oblige them to keep submitted technical data secret. As mentioned, China is highly regionalized, with strong provinces in which local governments, administrations and entrepreneurs work hand in hand.

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[134] The provisions on technologies that may be put on the list of restricted technologies if the circumstances require so are contained in Art.17 of the old Foreign Trade Law to which Art. 8 of the Technology Export and Import Regulations of 2001 still refer. The new Foreign Trade Law of 6 April 2004 contains parallel provisions on subject matter that can fall under prohibited or restricted technologies.

[135] In Chinese, at http://wzj.saic.gov.cn/pub/ShowContent.asp?CH=ZCFG&ID=36

[136] See website of the local Administation for Industry and Commerce oft he City of Shijiazhuang http://www.sjzmbc.gov.cn/public/show.jsp?id=20040628171162

[137] *Paul Ranjard/Benoit Misonne*, Study 12: Exploring China's IP Environment – Strategies and Policies, Study on the Future Opportunities and Challenges of EU-China Trade and Investment Relations http://trade.ec.europa.eu/doclib/docs/2007/february/tradoc_133314.pdf

Local players sometimes disregard the laws which reflect the interests of the whole country, but not necessarily of their region. It should be noted, however, that China's regionalism does not only affect foreigners but also non-local Chinese. In the 1990s, non-obedience to central guidance went so far that the government had to enact provisions which prohibited inner-Chinese trade barriers aimed at protecting local producers against "imports" from other localities. The relatively new Antimonopoly Act of 30 August 2007 (in force since 1 August 2008) contains a whole chapter V on the "abuse of administrative power". It prohibits, inter alia, the discriminating fixation of minimum prices or determination of technological standards (which products from outside the region do not meet). Such provisions also demonstrate how relevant the problem of localism still is in a purely domestic context.

As even non-local Chinese find it difficult to gain foot in a certain locality with a well-established personal network, it is very important for a European party to be alert and to take precautions in advance to an engagement in China. Inter alia, it should collect information about the parties who may have an interest in a KT-related project. Moreover, if possible, it would be good if the European party could resort to a loyal "door opener", e.g. a former PhD student. In any case, it is advisable to develop a sense for the very informal ways the Chinese interact with each other, and to anticipate possible irregularities that may occur after the commencement of a project. Further steps should include an exact determination of know-how that is necessary to accomplish a planned project and that will sooner or later have to be revealed. One problem regarding negotiations around technology contracts (not necessarily with Chinese) is that revealing secret knowledge cannot be avoided in the course of technology contract negotiations but this topic will be treated under IV.4 in the legal part.

4 Legal framework/protection of intellectual assets

The law of a country and the availability of resources to enforce it is another important factor that should be considered when planning an international project that involves transfer of knowledge. Relevant laws for KT are in the first line the technology related IP laws, such as patent law or plant variety protection, to a lesser extent utility model protection for simple technical solutions, and in certain cases also copyright protection, e.g. for software solutions. Very important in the course of international KT is also the protection of secret know-how. Another important area of law is the regulation of technology contracts. In chapter III above we have already learned about technology contract rules which restrict contractual freedom so as to allow the government and/or administration to control the in- and outflow of technology.

The following explanations with regard to each BRIC will highlight those peculiarities of the national law which may affect a KT project and refrain from lengthy introductions into each BRIC's IP system. At least the three WTO members Brazil, India and China have already brought their IP laws in compliance with the TRIPS Agreement, so that the law on the books should not pose too many surprises to potential European partners. The same is also true with regard to Russia which shaped Part IV to the Civil Code, a whole "IP Act", in anticipation of a coming accession to the WTO. Nevertheless, Russian IP legislation has its peculiarities, which will be further explained below. Also China's recently amended Patent Act deserves special attention.

Moreover, it should be noted that the European Commission, through bilateral Economic Partnership Agreements, presently invites emerging economies, including India, to conclude bilateral Economic Partnership Agreements with the EU. Such Agreements contain chapters on patents, copyright, trade secret protection, enforcement, etc., which are modeled according to the various IP-related European directives, and therefore partly criticized as TRIPS-plus provisions which would limit the freedom of emerging economies to interpret and to implement the TRIPS provisions in their own national interest.

At least as important as the scope of protection under national law, e.g. subject matter exempted from patent protection, is the actual enforcement of the law. The TRIPS Agreement is the first multilateral IP agreement which does not only prescribe minimum standards with regard to content and scope of rights or limitations but also requires a minimum level of actual enforcement. However, the language used in the corresponding Chapter III of the TRIPS Agreement is rather imprecise. It uses widely interpretable expressions like "equitable", "adequate", "not unnecessarily complicated" etc., and above all, Art.41(5) of the Agreement prescribes that no member shall be required to establish an IP regime distinct from law in general or to withdraw resources from law in general just to grant preferential protection to IP. That is, countries with an underdeveloped legal infrastructure still enjoy much freedom to neglect the enforcement of IP laws. In some countries, non-transparent procedures and biased court decisions remain a central problem, in spite of international enforcement obligations. The recent

decision of the WTO panel with regard to the US complaint against inadequate copyright and trademark enforcement in China demonstrated how difficult it is to prove that a WTO member neglects its enforcement obligations under TRIPS. Inter alia, the US failed to provide evidence that China's criminal sanctions against copyright infringers would not form a real deterrent.
Law enforcement in each BRIC economy depends more or less on the stage of the general economic development and on cultural peculiarities. Especially with regard to the legal culture, differences between the four observed countries are huge. For instance, with regard to law and legality as understood in Europe, China lags behind the economically "poorer" economy India which inherited a quite well-developed legal system from its former colonial power UK.

4.1 Brazil

4.1.1 Patents

Since 1996, Brazil has an Industrial Property Law (Law No. 9276)[138] which is largely compliant with the requirements of the TRIPS Agreement. It covers, inter alia, patent and utility model protection, and protection against unfair competition, including unfair competition in form of divulging trade secrets. Regarding the treatment of software *per se*, Brazil follows the European perception that such software works cannot be patent protected, because of their non-technical character. Software protection is separately regulated, in an extra legal provision but nevertheless as copyrighted work, by the Software Law of 1998 (Law No. 9606). Articles 76 et seq. of the Industrial Property Law regulate a quite unique "certificate of addition of invention", i.e. a protection title for an improvement or further development of an already published invention which may even lack inventiveness, provided that it belongs to the same inventive concept.
A number of further laws and decrees regulate restrictions on applicants and patent owners, such as INPI Decree No. 134 of 2006, pursuant to which patent applicants have to declare whether their invention involves biological material which pertains to the national biological heritage and which, as seen above, causes some problems because proof of legal access can be a cumbersome bureaucratic process. It should be noted that the process of examination until the grant of the patent is reported to be lengthy, in spite of a comparably low number of patent applications per year, which could mean that the INPI is in need of more qualified manpower.[139]
Brazil has implemented the Doha Declaration on the TRIPS Agreement and Public Health and the WTO General Council's Decision on paragraph 6 of the Declaration, the outcome of a long dispute between the industrialized world and developing countries, in its laws. Pursuant to the Doha Declaration and the accompanying provisions, patent protection for pharmaceuticals shall not inhibit the access to affordable medicines in poor countries. TRIPS members can issue compulsory licenses without prior negotiations to facilitate access of the poor to medicines if there is a cause of urgency. Hereby, members enjoy much freedom to determine a cause that justifies urgent measures. A cause of urgency may be, for instance, that too many poor citizens of that country cannot afford a patented medicine.[140] If another country, e.g. the one where the producer of the said medicine is located, does not agree with the compulsory license because it has a different notion of "urgency", it has to prove that the situation in that other country is not so urgent. In a much-debated case, the Brazilian government's decision to grant a compulsory license for the HIV pharmaceutical "Efavirenz", the government of Brazil declared the lack of affordable pharmaceuticals in the country as "urgent" enough to meet the requirements of Art.71 of the Industrial Property Acton compulsory licenses for

[138] English version available at the WIPO collection of laws for electronic access http://www.wipo.int/clea/en/text_pdf.jsp?lang=EN&id=515
[139] *Christopher Nußbaum/Peter Ganea/Nina Sophie Klunker/Henning Möller*, Umgang mit Know-how in internationalen FuE-Kooperationen - Ein Leitfaden für Forschungsinstitute und Hochschulen, p.34, at http://www.bmbf.de/pub/know_how_internationale_kooperation.pdf
[140] Sub-paragraph 5 (b) of the Declaration states that members enjoy a great amount of freedom to determine the grounds for issuing a compulsory license for the production of generic medicines. It can be regarded as a very generous interpretation of Art.31 (b) of the TRIPS Agreement according to which in advance to the issuance of a compulsory license, the requesting party must have made the attempt to agree with the patent owner on reasonable licensing conditions, and that only in cases of national emergency or other circumstances of extreme urgency or in cases of public non-commercial use, the compulsory license may be issued without such prior attempt to agree with the right owner.

public purposes[141] and issued two compulsory licenses which, inter alia, allowed Brazil to purchase generic versions of the medicine from India.[142]
It should be noted, however, that the issuance of the compulsory licenses in Brazil were preceded by negotiations between the government and the holder of the "Efavirenz" patent regarding reasonable prices which would have allowed the government to distribute the said pharmaceutical under its national AIDS programme. The licenses were imposed only after the parties failed to reach an agreement. That is, at least at present it seems that the government does not wildly issue compulsory licenses without hearing the patent owner. Nevertheless, a European PRO or firm which owns patent in the pharmaceutical area or other areas in which "urgency" is comparably likely to arise, should be aware that the government has the last word, a danger which, by the way, exists irrespective of whether the respective patent holder cooperates with Brazilian partners or has other KT relationships to the country. Holding a patent in Brazil suffices (otherwise, a compulsory license would not even be necessary). On the other hand, the government's "Efavirenz" decision is internationally lauded as a victory of the developing world over a powerful company. Such international backing may sooner or later lower the scruple to issue compulsory licenses without preceding negotiations.

4.1.2 Software

With regard to software *per se*, the mentioned Software Law states that protection shall accord to the principles established by the Copyright Act of 1998 (Law No. 9610), but not including moral rights protection, thereby putting emphasis on the mainly commercial character of software works. Also the protection term of 50 years is not counted from the death of an individual author/developer but from the date of publication, or creation, if the software has not been published in the meantime.

4.1.3 Plant variety protection

Another important area of IP protection in a country with a huge agricultural sector is the protection of plant varieties. In this area, Brazil, like most other countries, has opted for a *sui generis* protection regime under the Plant Variety Act of 1997 (Law No. 9456). Plant varieties, which are result of non-technical breeding, are explicitly excluded from patent protection. The Plant Variety Act largely adheres to the UPOV convention in the version of 1978 which allows local farmers not only to use their seeds on their own land but also to sell and to exchange their local produce.

4.1.4 Know-how

The protection of technological secrets/know-how is essential in KT activities. In its unfair competition chapter, the Industrial Property Act of 1996 contains provisions on the protection of trade secrets. It regulates, inter alia, that violations of trade secrets can result in criminal liability, i.e. fines and/or and imprisonment for up to one year. Also employees, respectively former employees who reveal trade secrets to competitors or their new employer, can face criminal charges. There is no special regulation on post-employment restrictive covenants, so that it can be assumed that they are freely negotiable between employer and employee. Such covenants would ban the employee not only from revealing a concrete technical secret of his or her former employer but also from bringing in his or her skills and competences adopted during the former employment into a new employment. In case of an engagement in Brazil which involves, e.g. the employment of Brazilian scientists or technicians with access to sensitive knowledge, the inclusion of corresponding clauses in the labour contract should be considered. From the available case law, it seems that such contracts are comparably easy to enforce.[143]

[141] "In cases of national emergency or of public interest, as declared in an act of the Federal Executive Power, and provided the patent holder or his licensee does not fulfill such need, a temporary and non-exclusive compulsory license for exploiting the patent may be granted, *ex officio*, without prejudice to the rights of the relevant titleholder."
[142] The Doha Declaration and accompanying provisions also allow compulsory licenses for the production of medicines in order to supply countries which are not capable to supply themselves.
[143] See *Correa*, above note 77, p.5-7 et seq.

4.1.5 Enforcement

In general, enforcement of IP, including patents, is reported to be fair and, where infringement has been established, mostly in favour of the right owner. Art. 183 of the Industrial Property Code even regulate criminal sanctions against infringing manufacture or sale of patented products, a provision which goes beyond the TRIPS Agreement which does not require members to regulate criminal liability for patent infringement. It should be noted, however, that IP-related litigation is still rare. Court cases are on the rise but reportedly, the number of infringement decisions is still low in the light of the number of patent applications and grants.[144] Brazilian law provides for all necessary instruments and remedies such as provisional measures which are reported to be especially helpful as a measure to stop infringement in advance to litigation which is reported to be lengthy.[145]
Judges and lawyers are reported to undergo a thorough legal education which, however, is sometimes criticized as overly formalized and too much focused at the interpretation of the law on the books, without reference to its practical implications or relatedness to the society.[146] Expertise in IP, especially in technically complicated patent matters is reported to be low and specialized attorneys are rare. In technically complicated cases, Brazilian judges normally rely on expert opinions.[147] Art. 241 of the Industrial Property Act encourages the judiciary to create specialized IP courts. So far, the 35th, 37th, 38th and 39th Federal Court of the State of Rio de Janeiro have been established as specialized courts. Only these courts are allowed to accept complaints against decisions of INPI. Civil infringement cases can be heard where the infringer is domiciled or where the infringement occurred. The corresponding civil procedures rules were not available to this author for further analysis but if the "location where the infringement occurred" can be interpreted as any location where the outcome of the infringement has come to light, and therefore also Rio de Janeiro if infringing products were sold there, the plaintiff may resort to the specialized courts there even if the immediate infringing manufacture, import, etc. has been carried out elsewhere.
Apart from the apparent lack of expertise in patent and technology related litigation throughout the country, enforcement in Brazil does not seem to be especially problematic. Judicial independence seems to be comparably well-established, in spite of reports that Brazilian judges sometimes tend to regard themselves as policy makers. Some judges, for instance, are eager to protect the poor against the powerful, depending on their background. However, it seems that even the few observed biased decisions reflect the judge's personal attitude [148] rather than a general openness of the judiciary to political insinuations. Empirical studies demonstrate that wherever in Brazil access to the judiciary is available (obviously not everywhere), such availability has a mitigating effect on corruption and the executive's misbehavior. The observation implies that the Brazilian division of power does not only exist on the books put is exercised in practice, also against the interest of local officials and political leaders.[149]
In sum, Brazil seems to be a comparably unproblematic emerging market when it comes to legal enforcement of KT-related rights. Reportedly, especially in patent infringement cases, judges tend to take up a strong pro-patent stance if infringement can be established, which somewhat contradicts the countries' skeptical view on IP on the world stage.

4.2 Russia

As mentioned, Russia has only recently enacted a new Part IV to the Civil Code (hereinafter "Part IV") which forms a comprehensive "IP Code", covering general provisions which apply to all kinds of intellectual property, as well as sub-chapters with regard to each kind of IP, including patents, software works, know-how, etc. The old IP laws, including the Patent Act of 1992 were repealed but the greatest part of their provisions were transplanted to Part IV.

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[144] *Joaquim Eugenio Goulart/Ivan Ahlert*, The Enforcement of Patent Rights in Brazil, in *Christopher Heath/Laurence Petit*, Patent Enforcement Worldwide: A Survey of 15 Countries - Writings in Honour of Dieter Stauder, 2nd edition 2005, with all necessary information regarding litigation procedures.
[145] *Joaquim Eugenio Goulart/Ivan Ahlert*, above note 113
[146] *Érica Christina Rocha Gorga*, Does Culture Matter for Corporate Governance? A Case Study of Brazil, John M. Olin Program in Law and Economics Working Paper 257 (May 2003), 72 et seq.
[147] See report on Brazil on the Intellectual Property Owner's website http://www.ipo.org/AM/Template.cfm?Section=Home&Template=/CM/ContentDisplay.cfm&ContentID=22046
[148] *Ivan Ribeiro*, Robin Hood vs. King John Redistribution: How do local judges decide cases in Brazil?, 13 March 2007, at http://ssrn.com/abstract=938174
[149] *Stephan Litschig/Yves Zamboni*, The Short Arm of the Law: judicial institutions and local governance in Brazil, Discussion Paper, 11 May 2008, at http://ssrn.com/abstract=1374857

It should be noted that the enactment of Part IV was accompanied by heavy criticism. The previous laws were characterized as partly flawed but still in basic compliance with the TRIPS Agreement. Part IV, as mentioned, largely incorporates the wording of these previous regulations and added a few more protection titles, such as protection of secret information. The bundling of all kind of intellectual property rights under one law, with common provisions which are applicable to such different subject matter as patents and trademark, however, is quite peculiar and criticized as uncommon and confusing.[150] For instance, Part IV terms all creators of intellectual assets "authors" (not only in the copyright meaning but also including "inventors" of patentable subject matter). The general provisions endow such "authors" with personal rights, e.g. a right to prevent the distortion of the creation, which is normally only granted to authors of copyrighted works, as "moral rights". Consequently, at least according to the legal text, Russian inventors enjoy such personality rights.[151] Therefore, a Russian inventor who made an invention in the course of a cooperative research project (as contractor or employee) may theoretically resort to such personality right to disturb the further development or other exploitation of his or her invention. In sum, it does not augur well that Russian judges, who, as will be further outlined below, are reported to perform badly anyway, in technically complicated cases now have to deal with an unfamiliar and partly confusing law.[152]

4.2.1 Patents

The subchapter of Part IV on patents is only insofar peculiar as it comprises three categories of protected subject matter, namely inventions, utility models and designs, for which "patents" are granted in form of a certificate. As will be further outlined below, Russia shares this peculiarity with China but the Chinese Patent Act itself forms an isolated piece of law, distinct from copyright or trademark law or other areas of IP. Pursuant to the Russian patent provisions, only "inventions" are examined as to substance. Apart from this peculiarity, the patent section does not pose too many surprises from a European point of view. Employee's inventions, for instance, are regulated in a manner which is internationally accepted. Accordingly, the employee is obliged to notify to the employer of an invention made in the course of official duties. The employer may then claim ownership, by filing an application with the Federal Body of Executive Power for Intellectual Property (i.e. the patent office, better known as "ROSPATENT"). If the employer fails to do so, the ownership in the invention and the right to apply for a patent will be assigned to the employee but the employer enjoys a preferential right of use. In order to ascertain that an invention made in the course of employment will actually be treated as a "service invention" according to the law, Russian experts recommend stipulating the prerequisites for a service invention and the employee's remuneration for such invention beyond the normal salary by contract.[153] And, of course, in the course of collaboration with a Russian state entity, it should be anticipated that ownership in inventions created in the course of collaboration may be assigned to the Russian state if state funds were used to enable its creation.
Utility models, i.e. patent-like exclusive rights for tangible technical solutions ("devices") of minor inventiveness, are normally not the result of scientific collaboration but in the Russian context they deserve some attention. Pursuant to Russian law, utility models are not only less inventive but also have to meet a lower "novelty" threshold, in that identical technical solutions used outside Russia do not destroy the novelty of a utility model in the Russian domestic context. Therefore, any party can file a utility model patent application for subject matter in worldwide public use.[154] Especially PRO in the area of mechanical engineering which invented tangible "devices" rather than chemical substances, etc., may be affected by this lower degree of novelty, as they may be faced with their own invention protected as a utility model in Russia, and banned from its exploitation by the party who obtained it in bad faith. It should be noted that bogus applications of slight modifications of technologies invented abroad are quite popular in Russia. In a number of cases, technology exporters had to resort to ROSPATENT to invalidate such modifications, and proof that the patented subject matter is in fact

[150] An overview of the criticism of the past can be found in *Lana Haworth/Philip Haworth*, Codifying Russia's Intellectual Property Law, E.I.P.R (2008), 50 et seq.; Budylin/Osipova, above note 77.
[151] *Adolf Dietz*, Incorporation of Patent Law into Part Four of the Russian Civil Code – A Structural Analysis, in: *Wolrad Prinz zu Waldeck und Pyrmont/Martin J. Adelman/Robert Brauneis/Josef Drexl/Ralph Nack* (eds.), Patents and Technological Progress in a Globalized World, Liber Amicorum Joseph Straus, Springer 2008, 687 (699 et seq.)
[152] *Haworth/Haworth*, above note 119; *Ksenia Fedotova/Rainer Wedde*, The Treatment of Know-how in International R&D Cooperation – Russia, at http://www.kooperation-international.de/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/redaktion/doc/Russia_n_Laenderberichte_Geistiges_Eigentum.pdf&t=1250796396&hash=cc7f430a4debc7332611a7d475f12eb1
[153] *Fedotova/Wedde*, above note 121
[154] *Fedotova/Wedde*, above note 121

equivalent to an existing technical solution is not always easy.[155] Similar problems with bogus applications have recently motivated the Chinese legislature to amend the patent protection prerequisites and to introduce absolute worldwide novelty for invention and utility model patents, including worldwide public use (see below).
Filing a patent application with ROSPATENT is not reported to be especially cumbersome, which may have to do with the relative abundance of technically qualified personnel in Russia. The average duration between application and patent grant (for substantively examined "inventions") is reasonable two years.[156] ROSPATENT is reported to be quite generous with regard to subject matter of questionable inventiveness.[157] It can be assumed that a lot of patents for trivial subject matter have been granted already. Such patents may be used to seek license fees from foreigners who enter the Russian market.
Foreign applicants have to be represented by a Russian patent agency. Russian patent agents do not necessarily have to be scientists or engineers. A legal education suffices. As standards are varying, it seems to be advisable to seek professional advice with respect to capable patent agents.

4.2.2 Software/databases

Just as the patent provisions of the other observed BRIC economies, Russia's patent provisions do not allow the patenting of software. Only copyright protection is available. Moreover, the Russian legislature has introduced a database protection right which is apparently modeled after the European Database Directive of 1996, in that it protects the investment in the creation of a not necessarily creative database against substantial extraction of data and provides for a renewable protection term of databases which are continuously updated. Scientific research is often accompanied by huge compilations of data, but European PRO's doing research in Russia cannot claim the database protection right because Russia is not obliged to grant such right to foreigners under any agreement, and will do so only on grounds of reciprocity. The same is true for the EU. A bilateral Russia-EU agreement on the mutual acknowledgement of the database protection right is not (yet) in sight.

4.2.3 Plant varieties

Another subchapter of Part IV grants "patents" in subject matter termed "breeding achievements", i.e. plant varieties as well as animal breeding results. Applications for such "patents" are not filed with ROSPATENT but with the State Commission of the Russian Federation for Testing and Protection of Breeding Achievements. Insofar, at least with regard to plant breedings, the "patent" in "breeding achievements" is in fact a plant variety protection right and protected under a *sui generis* system outside the patent system. Russia is also member to the 1991 version of UPOV and therefore to the stricter protection regime which allows farmers to exchange variety protected seeds only if the law provides for an explicit farmer's privilege (the old version of 1978 categorically exempted such farmer's use from the scope of rights). No further information could be obtained with regard to the question whether Russia has introduced such a privilege which would ban protection title holders (mostly powerful multinationals) from controlling the exchange of local produce between farmers. However, the antagonism between plant variety right owners and farmers in Russia should not be as fierce as, for instance, in India where an agricultural sector on subsistence level still feeds large parts of the society. It should be noted that the unique Russian breeding right does not only protect plant varieties but obviously also non-biotechnological animal breeding achievements.

4.2.4 Know-how

A first regulation of secret information was contained in the Commercial Secret Law of 2004. Part IV then introduced the term know-how, which, however, extends to a broad variety of secret subject matter, namely not only know-how in the traditional meaning of secret technological information, but also secret information pertaining to business or organizational data. Insofar, it seems that Part IV and the Commercial Secret Law partly overlap. However, they also supplement each other. Whereas Part IV provides that know-how shall only be protected if the right owner has introduced a "commercial secret regime", i.e., taken measures to protect the secret information, the Commercial Secrets Act

[155] See guidelines issued by the law firm Rödl & Partner regarding IP in Russia, http://www.roedl.ru/upload/IP_Leitfaden_01_2009_6655.pdf
[156] *Nußbaum/Ganea/Klunker/Möller*, above note 108, p.34
[157] Guidelines issued by Rödl & Partner, above note 124

clarifies that measures to protect the secret comprise the restriction of access to the secret information, the recording of persons having access to the information, issuing internal rules on secret protection and – in a quite bureaucratic manner - labeling tangible material containing secret information as "secret" and indicating on such material the name and location of the right owner. In spite of their complicatedness, foreign secret holders are strongly recommended to adhere to these requirements and to oblige the Russian partner by contract to do the same, so as to maintain protection of their know-how.[158]

4.2.5 Regulation of licensing and transfer

Part IV also contains some provisions on the transfer of intellectual assets by way of exclusive or non-exclusive licenses and by way of assignment. Important to know is that all technology contracts which involve subject matter for which a protection title is formally granted by ROSPATENT (patents, trademarks, etc.) have to be registered there. Contractual agreements regarding other subject matter which is not formally protected like copyrights or trade secrets do not have to be registered.

4.2.6 Enforcement/legal practice

With regard to international technology transfer, Russia has a bifurcated court system of General Courts and their various instances, and of so-called Arbitrazh Courts. General Courts hear all kinds of cases, including intellectual property rights infringements if individual rights are involved, whereas Arbitrazh Courts are competent to hear cases of commercial character. That is, in most cases, foreign parties to a technology contract will have to resort to a local Arbitrazh Court in case of a dispute.
Law enforcement in Russia is reported to be highly deficient. Many reports refer to corruption in the courtrooms and judges who are subordinate to local political interests, e.g. to protect local parties against claims from outside their jurisdiction. A number of reasons are given for the apparently poor performance of the judiciary, e.g. that Russia had little time to consolidate its infrastructure and to introduce a real division of powers or the huge size of the country which would favor localism. Especially on the lower court hierarchy level, judges are reported to take into account that their decision may be overturned in the following instance (and too many overturned decisions may affect a judge's further career) so that a number of factors which are not necessarily related to the actual case impact on their decisions.[159]
Moreover, especially with regard to complicated cases involving technology transfer, patent or know-how infringements, judges are reported to lack the necessary knowledge and experience. The expectation of an unfair trial deters potential litigants from court litigation and motivates them to seek alternative forms of dispute resolution. All that results in a downward spiral, as the general reluctance to litigate deprives courts of the opportunity to accumulate experience in complicated commercial or technology-related cases. A specialized IP court with the competence to hear patent and other IP cases may have helped to break through this vicious circle but unfortunately, Part IV remained silent on court specialization.
The fact that Part IV of the Civil Code is a relatively new and, as we have seen, in many aspects confusing piece of legislation increases the unpredictability of the law. In a legally and technically complicated dispute, even experts on Russian law will not be able to predict how judges will apply the unfamiliar rules. Therefore, the only advice that can be given to the participants to a KT project is to take precautions and to consider exit scenarios in case that a project does not proceed in the intended manner.

4.3 India

Until the mid-1990s, when India became a member the WTO and had to adhere to the standards of the TRIPS Agreement, the country had little experience with the protection of patents, know-how, etc. In the meantime, IP, especially patents, have become subject matter of a vivid public debate. As mentioned, India is the world's largest producer of cheap generics, with the capability to supply not

[158] *Fedotova/Wedde*, above note 121
[159] General assessment of the deficiencies in Russia's judiciary in: Special Report: Corruption in Russia's Arbitrazh Courts, BNA' s Eastern Europe Reporter, Vol. 14 No. 12; *Jeffrey Kahn*, The Search for the Rule of Law in Russia, 37 Geo J. Int'l. L. 353 (2006*); Bernhard S. Black/Anna S. Tarassova*, above note 81

only the domestic, mostly poor population, but also the markets of even poorer economies without a domestic industrial base for such production. The TRIPS Agreement obliged India to introduce patent protection for pharmaceuticals and to provide foreign innovative producers to proceed against domestic imitators. In 2005, after the expiration of a transitional period for developing countries, India finally had to introduce patent protection for substances. Public resistance against enhanced patent protection was enormous. Shouldering international protection obligations was a bitter pill that had to be swallowed in order to profit from the blessings of free trade. In order to soften the consequences of the accession, a number of mitigating provisions were introduced in the new Patent Act. The compliance of some of them with the TRIPS Agreement is questionable, however.

4.3.1 Patents

4.3.1.1 Unwillingness to protect pharmaceutical patents – consequences for collaborative research

One questionable provision is Art. 3 d) of the Patent Act, pursuant to which medicines derived from a known substance, have to be of "enhanced efficacy" in order to be patentable.[160] The provision is internationally criticized as non-compliant with Art.27 of the TRIPS Agreement which provides that patents shall be granted without discrimination, inter alia, "as to the field of technology". The "enhanced efficacy" requirement would aggravate the application of pharmaceutical patents and therefore discriminate against this special field of technology.[161] Some European commentators point out that a provision like Art.3 d) would also be thinkable in the European context, not in the law, however, but in guidelines for patent examination.[162] In examination practice, the lack of clear standards and rules regarding the required degree of "enhanced efficacy" forms a major problem. A European PRO or other organization engaged in pharmaceutical research may find it difficult to get subject matter patented that is based on already existing solutions.
Art 3 d) is not the only measure to mitigate the effect of international protection obligations. India's Patent regime permits the use of a patented invention for clinical tests prior to the expiration of the patent in order to obtain an official approval timely enough for marketing the generic drug right after such expiration. On the other hand, patent owners do not enjoy test data exclusivity, i.e. the authority in charge of approving new medicines may resort to test data submitted by the patent owner in order to examine whether the patented pharmaceutical and the generic version are bioequivalent. Also here, the compliance of India's patent regime with international rules is under debate. Europe and the US argue that Art.39.3 of the TRIPS Agreement[163] on data protection against "unfair commercial use" would oblige India to respect test data exclusivity. Indian commentators counter that protection against „unfair commercial use" shall not be construed as prohibiting approval authorities from relying on test data submitted to them. For foreign applicants of pharmaceutical patents, the present regime means a factual reduction of the patent protection term. So-called supplementary protection certificates are not available to compensate for lengthy approval procedures. Instead, the present law allows generic producers to commence production and marketing of their generics immediately after the expiration of the patent term. Recently, the European Commission has approached the Indian government with a

[160] "The mere discovery of a new form of a known substance which does not result in the enhancement of the known efficacy of that substance or the mere discovery of any new property or new use for a known substance or the mere use of a known process, machine or apparatus unless such known process results in a new product or employs at least employs one new reactant…
...
Explanation- For the purposes of this clause, salts, esters, ethers, polymorphs, metabolites, pure form, particle size, isomers, mixtures of isomers, complexes, combinations and other derivatives of known substance shall be considered to be the same substance, unless they differ significantly in properties with regard to efficacy"

[161] With reference to this provision, the Indian patent office refused to grant a Swiss pharmaceuticals producer a patent for the cancer medicine *Glivec*. The applicant tried to challenge the provision before court but the Madras High Court finally ruled that the question of compliance of a legal provision with an international agreement like TRIPS would be a matter of a panel hearing at the WTO and outside the jurisdiction of Indian courts. That is, the ball was played to the Swiss government which, however, showed no interest in pursuing the case; more details in *Tanuja V. Garde*, Circumventing the Debate over State Policy and Property rights: Section 3(d) of the Indian Patents Act Law, in: *Prinz zu Waldeck und Pyrmont et al.* (eds.), above note 120, 242 et seq.

[162] See *Heinz Goddar*, Patentability of Pharmaceutical Products in India – the Novartis case, IIC 28 (2009)

[163] "…members, when requiring, as a condition of approving the marketing of pharmaceutical or of agricultural chemical products which utilize new chemical entities, the submission of undisclosed test or other data, the origination of which involves a considerable effort, shall protect such data against unfair commercial use. In addition, Members shall protect such data against disclosure, except where necessary to protect the public, or unless steps are taken to ensure that the data are protected against unfair commercial use."

proposal of an Economic Partnership Agreement (EPA)[164], which contains a chapter with IP clauses, including clauses on the introduction of supplementary protection certificates of five years of extended protection *plus* test data exclusivity. Due to the huge public support that India's generics industry presently enjoys, it is very unlikely that the Indian government will be able to make concessions in this area.
A third measure to protect domestic generics industry producers is India's parallel import regime. Sec. 107 A (b) of India's Patent Act allows the importation of patented product if first circulation abroad is made in compliance with the domestic law. After the 2005 amendment to the Patent Act, the actual consent of patent owner in first circulation is no longer required; it suffices that the circulation in the country of origin is legal according to that countries' law. That is, if the law of the exporting country provides no patent protection, which is the case in those least developed countries which, according to exemption rules of TRIPS, do not have to protect pharmaceuticals until 2016, the first circulation is always compliant according to national law, even if initiated without the consent of the patent owner. The provision aims at encouraging Indian generics producers to transplant their factories to other, less developed economies where patent protection for pharmaceuticals is not available, e.g. neighbouring Bangladesh. The re-import of these generics cannot be banned under Indian law. The compliance of this provision with TRIPS is highly questionable. Many commentators argue that it would violate the import right of TRIPS. Such import right may not be workable against parallel imports from countries where the patented products were put on the market with the consent of the patent owner, but it would be violated in case of imports from countries where a patent could not be obtained. In business practice, however, this provision seems to be of minor relevance, as it does not seem to have effected an exodus of Indian pharmaceutical producers to least developed countries like neighbouring Bangladesh or other South or South East Asian countries.

4.3.1.2 The Patent Office(s)

India's Patent Office is in fact comprised of four Patent Offices in Delhi, Mumbai, Chennai and Kolkata. The offices suffer under a huge annual increase in applications, from 25.000 in 2005 (4.500 grants) to 30.000 between April and August 2007 alone (10.000 grants). Due to the mentioned lack of personnel, examiners are reported to heavily rely on search reports. The workload has been significantly increased in 2005, when the black box/exclusive marketing rights (EMR) system for pharmaceutical patents was abolished in the course of the enactment of the new Patent Act – the opening of the black box revealed 12.000 unprocessed applications.
The workload of the patent administration is likely to further increase, as it became and International Search Authority (ISA) and an International Preliminary Examination Authority (IPEA) under the Patent Cooperation Treaty (PCT) in January 2008. In anticipation of the increased importance of the patent office, the government commissioned a computer firm to digitize ca. 10 Million pages of patent specifications available only in hardware form but the commissioned firm failed to perform its task. A new tender was launched but the whole process of computerizing the patent administrations was substantively delayed.
Apart from that, Indian generics producers and NGO's dedicated to protecting the poor against high "monopoly prices" for medicines add to the workload of the patent offices, by filing oppositions against the grant of pharmaceutical patents (pursuant to India's Patent Act, any party, and not only "interested parties" can file such opposition) in order to delay the patent grant.

4.3.2 Plant varieties

As already mentioned, India provides for a quite unique plant variety protection regime which protects not only commercial breeders but also a positive right of farmers in their produce and its unrestricted use, trade and exchange. Moreover, due to foreign pressure, India has become a member of the UPOV convention. The accession was accompanied by public commotion and even farmer riots on the streets. India only surrendered to the 1978 version of the UPOV, which, as mentioned leaves the rights of local farmers to locally trade and exchange their produce untouched. Due to the political sensitivity of this topic, it will be difficult to motivate India to elevate domestic plant variety protection to the standards of UPOV 1991, as proposed in the mentioned EPA draft.

[164] Text of the proposal under http://bilaterals.org/IMG/pdf/EU-India-Texts_Goods_SPS_IPR_feb2009.pdf (IP chapter starts at p. 35 in the pdf document); critical assessment by *Carlos M. Correa*, Negotiations of a Free Trade Agreement European Union – India: Will India Accept TRIPS Plus Protection?, at: http://www.oxfam.de/download/correa_eu_india_fta.pdf

4.3.3 Software

India's present copyright regime does not give much rise to complaint. Due to a flourishing "Bollywood" entertainment and software industry, copyrights are in the national interest and comparably efficiently enforced. Especially in the software area, right owners are well-organized in the National Association of Software and Service Companies (NASSCOM) which has instituted a number of raids against copyright infringements. In spite of the relatively high importance of copyright for domestic industries, India presently refuses to further enhance its copyright protection from the TRIPS level to the level of the WIPO treaties (World Copyright Treaty; World Performances and Phonogram Treaty) which would oblige India to introduce, inter alia, legal protection against the circumvention of technical measures to protect digital contents. Therefore, also EPA draft proposals to adhere to the higher WIPO standards will probably be ignored by the Indian government.

4.3.4 Know-how

In the best Common law tradition, India does not provide for statutory know-how protection. The situation may change if the mentioned Innovation Law will enter into force in its present form, as it contains a whole chapter on the protection of secret information. At present, however, Indian know-how protection largely relies on precedents from the UK and the principles established there.[165] Insofar, there is a relatively high degree of legal certainty for European right owners, at least when it comes to civil liability for trade secret divulgation. Criminal law does not protect trade secrets against misappropriation but if the secret is embodied in a tangible object, e.g. plans or blueprints, the criminal provisions against theft may be applied.[166] With respect to information stored in digital form, the Information Technology Act contains a provision against unauthorized access to electronic documents which can be fined with up to Rs 10 Million (ca. 143.000.- €).[167] In sum, it seems that in general, foreign parties are properly protected against misappropriation of secret information brought in in an international collaboration.[168]
On the other hand, European PROs and other organizations engaged in collaborative research in India are well advised to take precautions with regard to confidentiality obligations on employees. Art. 27 of the Indian Contract Act of 1872 (amended) stipulates that contractual agreements which restrain a party from lawful profession, trade or business, shall be void, except that such restraint is related to sale of the goodwill of a business. That is, in general, a former employee cannot be prevented from exercising his or her skills and knowledge acquired during employment under a new employer or in the course of his or her own business. Only in a few cases, if, for instance, the employee leaves the employer prior to the expiration of a fixed employment contract, or if the employee appropriates a concrete secret and offers it to the new employer, a violation of trade secret may be established.[169] It remains to be seen whether at least post-employment restrictions against a reasonable compensation for a certain period of time will be regarded as valid under Art.27 of the Contract Act. In any case, a PRO which transfers secret knowledge to India in the course of a cooperation should be aware of the pro-employee attitude adopted by Indian law.

4.3.5 Enforcement

As mentioned, "rule of law" is not an alien concept to Indians, mostly due to the adoption of British legal thinking in the course of colonization. Adherence to written contracts and to abstract legal rules is widely accepted. Other emerging economies, mostly located in East and South East Asia, find it more difficult to familiarize themselves, e.g. with contractual regulation of rights and obligations in the course of a cooperation – such formal agreement, so the traditional understanding in many societies, would in fact form an impolite allegation that the contract partner would otherwise not keep to his promises.

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[165] *Pravin Anand*, Chapter 19: India, in: *Melvin F. Jaeger*, Trade Secrets Throughout the World, above note 77, p.3 et seq.
[166] *Anand*, above note 134, p.9 et seq
[167] *Anand*, above note 134, p.9 et seq; *V.K. Unni*, Treatment of Know-how in International R&D Cooperation: A Case Study of India, at: http://www.kooperation-international.de/countries/themes/info/detail/data/37699/?PHPSESSID=ab5172343927d8129bbe0431d9dc8c92
[168] See Indian case law, summarized by *Anand*, above note 134, p.19
[169] Case law summarized by *Anand*, above note 134, p.11 et seq.; see also *Nußbaum/Ganea/Klunker/Möller*, above note 108, p.37

India is different in this regard. In a survey, multinationals expressly lauded India for "rule of law, transparency, cultural affinity and regulatory environment" as factors which favour investment.[170]
On the other hand, the cultural commonalities which facilitate Indian-European negotiations and, later on, the performance of a contract, should not belie of the great difficulties to get access to the judiciary. India is a developing country, and in spite of a good legal education, public investment in the judicial infrastructure is limited. India's judges and other legal personnel are reported to be overburdened with unresolved cases.[171] Reportedly, a notable self-consciousness of lawyers, prosecutors and judges which results in lengthy pleadings and hundreds of pages of legal reasoning aggravates the problems.[172] On the other hand, there is little complaint about government interference in court cases.[173] Once a court decision is rendered, it is likely to be based on little else but on a thorough interpretation of the law. Nevertheless, mainly because court procedures can be extremely lengthy, European parties to a technology contract are well advised to take measures to avoid a legal dispute, e.g. by including alternative dispute resolution clauses in collaboration or license contracts, and by considering exit scenarios in case that the collaboration does not proceed in the anticipated manner.[174]

4.4 China

China is under worldwide criticism as a safe harbour for intellectual property infringers. During three decades of rapid industrial development, Chinese engineers have developed the capability to copy even the most complicated technologies. Chinese copies of cars, parts, medicines, electronic devices, etc., however, are also notorious for their deficiency in terms of quality, safety and reliability. The reasons are obvious: a copy made on grounds of an illegally appropriated blueprint enables the imitator to build, for instance, a car with all other necessary equipment and a fancy design, but such copy cannot incorporate the experience and the implicit knowledge accumulated by the engineers and technicians who were involved in the production of the original.
After a number of improvements to the law on the books to bring it in compliance with the requirement of international agreements as to substantive protection standards, recent endeavours of the Chinese legislature also target at improving the quality of law enforcement. The public perception is to a great extent focused at intellectual property issues. The average Chinese may have heard more about patents and copyright than the average European. That IP is a matter of public perception, however, does not mean that it is appreciated throughout the country. Especially if foreign interests are involved, rather the opposite is the case, namely that exercise of IP by foreign patent owners, especially by powerful multinationals, is increasingly criticized as "abuse of IP". One hotly debated issue was a patent pool in DVD technology owned by a conglomerate of electronics firms which was publicly criticized as rendering DVD equipment and carriers overly expensive. Under much public sympathy, a group of Chinese law professors from various universities requested SIPO to invalidate one of the essential patents of the pool. Even before the SIPO could decide on the validity, the owner withdrew it in order to avoid further negative publicity.[175] Also the recently decided "OBE v. Kanghua" case in which a German process patent holder accused a Chinese enterprise of infringement[176] was accompanied by a heated public debate on "abuse".
China's National IP Strategy of 2008 reflects this relatively new public sentiment, inter alia, by announcing freedom from foreign technological dominance as one of its major objectives. And, as will be further outlined below, also the recent amendments to the Patent Act reflect this "fortress China" attitude. At a first glance, the result, namely reduced protection in a number of aspects, may not be in the interest of European right owners. In the long term, however, the fact that the Chinese laws are in the process of changing from a mere law on the books to laws which are shaped in the national interest is not necessarily bad news: a law which is shaped in the national interest is likely to be taken

[170] *Paul Laudicina/Jonathan M. White*, India and China: Asia's FDI Magnets, Far Eastern Economic Review, Oct. 2005, p.25 et seq.
[171] *John Armour/Prixa Lele*, Law, Finance, and Politics: The Case of India, at: http://ssrn.com/abstract=1116608
[172] See *Hilary K. Josephs*, Legal Institutions and Their „Proper" Place in Economic Development: India and China Compared (August 1, 2004). Available at: http://ssrn.com/abstract=572165
[173] *Franklin Allen* et al., Financing Firms in India, (April 11, 2009). EFA 2006 Zurich Meetings. Available at SSRN: http://ssrn.com/abstract=898066
[174] See also *Unni*, above note 136
[175] *Zhan Yin/Zhu Xuezhong*, Intellecutal Property Right Abuses in the Patent Licensing of Technology Standards from Developed Countries to Developing Countries: A Study of Some Typical Cases From China, 10 Journal of World Intellectual Property p.187 (2007)
[176] See below, a) (3)

serious by those who have to apply it in the domestic context, which will in turn close or at least narrow the gap between the law and its actual enforcement.

4.4.1 Patents

4.4.1.1 Peculiarities of the recent amendment

In a similar manner as Russia, China understands "patent" as a certificate for different subject matter, namely inventions, utility models and designs – "invention patent" means "patent" in the European sense, for a technical solution on a relatively high level of inventiveness, as compared to utility models. In 2003, the number of domestic applications for invention patents for the first time exceeded the number of applications from abroad, and in the meantime, the number of Chinese applications nearly doubles the number of foreign applications, with ca. 200.000 domestic applications in 2008.[177] Also the number of grants to Chinese applications showed a sharp increase over the past years, but it does not yet reflect the dramatic increase in applications, which gives rise to doubts regarding the quality of Chinese applications. At least, in 2008 the number of grants (ca. 47.000) nearly equaled the number of grants to foreigners.

In 2000, and therefore shortly in advance to the accession to the WTO in November 2001, the Chinese Patent Act was largely brought in compliance with the requirements of the TRIPS Agreement.[178] However, as indicated above, the third revision of 2008 is no longer dedicated to bringing the law in compliance with international requirements but to make it fit the domestic interest.

One new provision which is of immediate relevance for European parties engaged in joint R&D in China is the revised provision in Art.20 of the Patent Act 2008. The previous provision which allowed domestic applicants to apply for a foreign patent for their invention made in China only after filing an application with SIPO was replaced by a mere obligation to submit the invention to SIPO for a confidentiality review before being allowed to apply abroad. This obligation, however, now extends to all inventions completed in China, including those completed by foreigners. Failure to comply with this provision will result in the non-patentability of the said invention. It is still too early to forecast what implications such confidentiality review will have, as the details will be regulated in the not yet amended Implementing Rules to the Patent Act. The intention behind the provision is to keep inventions which are related to China's security or other vital interests within the country. Inter alia, the criteria for keeping an invention confidential and denying the permission to apply abroad are not yet known. However, in the light of the mentioned public IP debate and the mentioned objective to absorb as much technology as possible at the lowest possible price, it may well be that a considerable number of inventions filed with SIPO will henceforth be treated as technology that has to be kept in the country and may not become subject matter of an application abroad. Obviously, in such event, the patentee will be banned from disclosing his invention and it remains to be seen how the drafters of the new Implementing Rules will secure that the inventor is still able to reap a profit from it. Another unanswered question is how non-obedience to the confidentiality obligation by the owner of the technology will be sanctioned.

In sum, a PRO which has made an invention in China will probably have two options: a) to disregard the new confidentiality examination requirement and file an application abroad without informing SIPO. The consequence will be that any opportunity to file a later application in China and to obtain a Chinese patent will be lost, irrespective of whether said technology would have been treated as "confidential"; b) to undergo confidentiality examination, thereby risking that the own invention will be regarded as "confidential", so that the owner of the invention will be banned from patenting abroad and probably strongly restricted in its opportunities to exploit it in China. The risk that an invention may be regarded as "confidential" is hard to assess – such assessment will also depend on the definition of the subject matter that may be regarded as vital to the security and other viral interests of China in the upcoming Implementing Rules. Regarding the additional administrative burden, Chinese officials state that the provision will be applied in a manner similar as 35 US Code 181 et seq., on "secrecy of certain inventions and withholding of patents",[179] and therefore without undue delays.[180] Pursuant to Chinese experts, it is expected that the SIPO will have three months to inform the applicant whether his

[177] Latest SIPO statistics, published by the EPO: http://www.epo.org/patents/patent-information/east-asian/helpdesk/china/facts-figures.html

[178] Details of the second amendment in *Peter Ganea*, Die Neuregelung des chinesischen Patentrechts, GRUR Int. 2002, p.686.

[179] http://www.uspto.gov/web/offices/pac/mpep/documents/appxl_35_U_S_C_181.htm

[180] Third Revision of China's Patent Law, Legal texts and documents on the drafting process 2006 – 2008, edited by EU-China IPR2 programme, at: http://www.ipr2.org/images/eu_patent_law-090805-7-final.pdf, p. 220 et seq.

solution may fall under technologies that have to be kept confidential in the national interest, and another two months until a final decision has to be made.
Moreover, the Patent Act contains a new provision which stipulates that inventions based on illegally obtained biological material shall not be patentable (Art. 5 (2)). In addition, Art. 26 stipulates that applications for inventions made on the basis of such genetic material shall indicate the "direct" and "indirect" source of such genetic material, or, if the indication of the "original" source is impossible, state the reasons why it is impossible. In this context, "direct" obviously means the source from which the material was obtained, whereas "indirect" source should mean the geographical location where the genetic material was found in nature. It is not yet entirely clear which administrations will be competent to control access to biological material, grant certificates of legal access etc. Most probably, it will be three agencies, the Ministry of Health, the Ministry of Agriculture, and the Ministry of Science and Technology.[181] That is, there is certain likelihood that the situation for scientists doing research on China's biodiversity may become as confusing and bureaucratic as in Brazil. The patent-related consequence of illegitimate access will be non-patentability. Other sanctions directed against the illegitimate access *per se* are not yet known.

Just like other important BRIC economies, China has aligned the Patent Act with the mentioned Doha Declaration. Chinese authorities are now allowed to determine the standards for issuing compulsory licenses to react to urgent public health problems, and to produce generics in order to help economies which cannot supply themselves with generic medicines. Moreover, China has introduced a patent exhaustion regime which allows parallel imports to China. Both provisions are not in the interest of European industries. So far, the SIPO has been reluctant to issue compulsory licenses but that may change in the light of the mentioned "abuse" debate. Regarding parallel imports, the effect of the new regime on European patent owners should remain limited, at least until the Chinese have become so wealthy that prices charged in China can be challenged by cheaper prices for products legitimately purchased in "poorer" countries. Moreover, just like India, China now permits testing a patented medicine prior to the expiration of the patent term so as to obtain official approval from the national medical authority right after such expiration. Supplementary protection certificates which would compensate not only for lengthy approval procedures but also for the disadvantages arising from this new exemption are not available to owners of pharmaceutical patents.

It should be noted that in the drafting process, a number of even harsher restrictions especially on the exercise of foreign patents were debated but finally jettisoned. Previous drafts, inter alia, contained a provision which would have allowed an infringer to continue infringing production under a peculiar legal license after the expiration of two years from the date at which the patent owner should have known about the infringement but failed to commence legal action. The provision was intended to prevent patent owners from abusing their patent, by seeing the damage grow over years and then ruining the infringer by claiming compensation for infringements of the past. Obviously, concerns that such a unique provision would have discouraged the parties from settling their dispute in an amicable manner and driven them into early litigation, prevailed.

In some areas, the third amendment even means good news to foreign applicants and right owners. Under the previous provisions, for instance, foreign patent applicants could only resort to certain designated patent agents, so that their choice of suitable patent agencies was quite limited. The amended provisions allow them to resort to all legally established patent agencies in the country. China's patent agents, by the way, do not give much rise to complaint. Candidates for the Patent Agent Qualification Exam are required to have a background in science of technology and at least two years of related working experience. Only about 10 percent of candidates pass the exam.[182]
One of the most important improvements for foreign applicants is the enhancement of the novelty prerequisite to absolute, worldwide novelty. Under the previous provisions which excluded from patentability only such subject matter which was either worldwide published or in domestic public use, it sometimes happened that a foreign applicant was faced with a bogus patent for his own technical solution which was in public use (but not "published") abroad. It remains to be seen how the SIPO, its re-examination board and the courts will deal with bogus applications already filed under the previous regime when it comes to invalidation requests.

4.4.1.2 Inventions made in the course of employment and jointly made inventions

[181] http://www.ipr2.org/images/eu_patent_law-090805-7-final.pdf , p.129 et seq.
[182] *Ganea/Jin*, above note 50, p.17 (21)

Chinese law favours the employer in case of an invention made in the course of employment. Pursuant to Art.6 Patent Act, the employer shall have the right to apply for a patent. There is no stipulation that the employee shall inform the employer about the invention and that the employer has some time to decide whether he wants to apply for a patent or leave it to the employee to do so. However, if the parties have agreed otherwise, such agreement shall prevail. That is, the law puts Sino-foreign joint ventures etc. in a favourable position when it comes to employee's inventions. Nevertheless, it is advisable to adequately remunerate employees for their in-house inventions. Fluctuation among Chinese employees is high, and correspondingly high is the danger that employees keep their inventions with them or carry them to a new employer.
In the course of the third amendment, also the provisions on joint ownership were substantively redrafted. The new rules provide that such relationship should be regulated by contract and that in absence of a contractual clause, each co-owner shall be allowed to grant simple, non-exclusive licenses to third parties, provided that the license fees are distributed among the co-owners. From a European perspective, this regulation is somewhat peculiar, as the legislative pattern here is that the technology may not be licensed without the consent of the other parties but that no party shall deny such licensing without due reason.[183] From a Chinese point of view, the new provision has aligned the Patent Act with the broader technology contract regime.[184]

4.4.1.3 Institutional arrangements and peculiarities of patent litigation

China does not (yet) have an intellectual property or patent court but the law requires that at least complaints against decisions of the SIPO shall be heard by a certain court, the Intermediary People's Court No. 1 of the City of Beijing. The last instance is the Supreme People's Court (SPC) which has already established certain principles, e.g. with regard to the treatment of applications in which the claims are not fully supported by the description.[185] In its recent "OBE v Kanghua" decision of 20 August 2009, the Supreme People's Court denied infringement of the process patent of a German enterprise by a Chinese competitor, by stating that the plaintiff's claim must be read as comprising an additional element (here: a fixed sequence of process steps) which could not be found in the defendant's technical solution. [186] According to some critics, the decision represents a general trend in Chinese case law to narrow the protection scope by arbitrarily adding additional elements to the patent holder's claims.
With respect to patent-related litigation, the Supreme People's Court has issued a number of court interpretations which form binding guidelines for all People's Courts throughout the country on how to interpret the law. Most important are the Several Provisions of the SPC on Issues Relating to the Application of Law to Adjudication of Cases of Patent Issues[187], which clarify a number of questions arising from the rather broadly interpretable Patent Act, e.g. by clarifying that also equivalents fall into the scope of patent protection. The Patent Act is also supplemented by Patent Act Implementation Rules which are important for the SIPO, as they regulate the standards for examination and administrative enforcement by the patent administrations throughout the country. Both the SPC Interpretations of 2001 and the administrative Implementing Rules of 2002 still have to be adapted to the amended Patent Act, which has entered into force on 1 October 2009.
The SIPO is widely regarded as an efficient agency. Just like in India, there is always a danger that competent examiners will be absorbed by the industry but the problems seem to be less severe,

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[183] Third Revision of China's Patent Law, above note 148, p.226 et seq.
[184] Pursuant to Art.341 of the Contract Act, each party to a technology development contract has the right to exploit and to "transfer" the jointly developed (not necessarily patented) technology if there is no otherwise contractual stipulation. Rule 20 of another set of provisions, namely the SPC Provisions Regarding the Application of Law to Disputes around Technology Contracts of 30 November 2004, provides that such "transfer" means permission to use by a simple license of non-exclusive character, but not transfer in the meaning of complete assignment of a right, or exclusive licenses which would exclude others from exploiting the technology. In order to avoid a dispute around this issue, it is advisable to regulate the rights and obligations of the parties with regard to joint exercise of the patent by contract.
[185] The SPC held that as long as the application documents reveal the invention to a skilled artisan in a sufficient manner, there shall be no reason to reject the application, even if it is not perfectly draftedSupreme People's Court "Corrosion Prevention" as of 29 May 2005, translated and commented by *Peter Ganea*, GRUR Int. 2007, p.448; the "Pfizer" decision arrived at a similar conclusion.
[186] Unfortunately, the original text is not online available - a Chinese report can be found on the government site: "Intellectual Property Protection in China, at: http://www.ipr.gov.cn/xwdt/gnxw/qy/549463.shtml
[187] Gazette of the Supreme People's Court 4/2001, p.130

probably due to a much higher number of graduates in the areas of science and engineering. The SIPO has to deal with hundreds of thousands of patent, utility model and design applications per year. In addition to purely domestic patents, it also accepts applications filed under the PCT, as IPEA as well as ISA. It is internationally well-connected and quite a lot of SIPO officials, including the present president, have studied in Europe. The SIPO, however, is not only an examination and grant authority but it participates in patent legislations and enacts administrative provisions related to certain aspects of patent law. Moreover, it supervises the local patent administrations, which, as mentioned, are in the first line patent enforcement agencies. In the patent area, administrative enforcement is not as important as in other areas of IP, such as trademarks or copyright. Most patent infringement cases are treated before court, about 3000 per year, whereas the local agencies hear ca. 1000 cases per year.[188] Nevertheless, in the course of the third amendment, the local patent administrations were endowed with additional competences to impose fines on infringers and to investigate in infringement cases. The amendments can be regarded as a turnaround, as the debates around previous drafts rather tended towards a complete abolishment of administrative enforcement in the patent area.[189] Administrative action is a quick and cheap alternative to lengthy and costly court litigation and advisable if trademark counterfeiting and copyright piracy are at issue. Patent cases are often more complicated, as they involve difficult technologies and are often part of a strategy of threatening competitors of forcing them into negotiations. Therefore, most plaintiffs prefer a civil dispute before a court. In contrast to administrations, courts also have the authority to determine damages.

4.4.2 Software and related subject matter

China protects software by copyright. The Copyright Act refers to a special piece of legislation, the Software Regulations enacted by the State Council. The regulation highlights the character of software as a work category of rather commercial nature, by cutting back the moral rights of software developers as "authors", and by granting preferential treatment to the employer in case of an occupational software work. At least according to the Patent Examination Guidelines, software *per se* is not patentable but it seems that a number of patents were granted in solutions which actually formed software *per se*. Business solutions, as well as not necessarily creative (and therefore not copyright protected) data collections can be protected under the Unfair Competition Act of 1993. Its Art.2 No.1 contains a provision which is understood as a catch-up clause against any kind of unfair commercial conduct by competitors, including unfair acts which are not explicitly stipulated by law.[190]

4.4.3 Plant varieties

China is member to UPOV 1978 and protects plant varieties under special legislation, the Regulations of the People's Republic of China on the Protection of Plant Varieties of 20 March 1997. Just like India, China adheres to the lower standards of the 1978 version.

4.4.4 Know-how/business secrets

China regulates business secrets, including technical know-how, in a number of laws and subsidiary administrative provisions. The central provisions are contained in the Unfair Competition Act of 1993. Comparably late, namely on 30 December 2006, the Unfair Competition Act has been supplemented by Supreme People's Court interpretation, the Provisions on Certain Issues regarding the Application of Law to Civil Proceedings in Unfair Competition Cases. The Contract Act of 1999 contains a chapter on technology contracts with provisions on the treatment of know-how in the course of technology transfer. It is supplemented by another Supreme People's Court interpretation, the already mentioned Provisions Regarding the Application of Law to Disputes around Technology Contracts of 30 November 2004. Further relevant laws are the Criminal Act of 1997 which contains clauses of criminal misappropriation of secret knowledge, the Labour Law of 1994 and the Labour Contract Law of 29 June 2007, which contain, for instance, provisions on post-employment restrictive covenants. Numerous administrative regulations such as the Provisions on the Prohibition of the Infringement of Trade Secrets of 23 November 1995 of the State Administration of Industry and Commerce (SAIC) regulate certain aspects of trade secret and know-how protection. In sum, the brushwork of provisions

[188] See *Peter Ganea*, Can China be Forced to Enforce IP? in: *Prinz zu Waldeck und Pyrmont* et al. (eds.) above note 120, p.379 (387).
[189] Third Revision of China's Patent Law, above note 148, p.6
[190] More details in *Ganea/Pattloch*, above note 95, p.162 et seq

on know-how protection is nearly impenetrable, and the draft of a contract that involves secret know-how or a dispute around infringement requires the assistance of experienced and specialized lawyers.
The definition of trade secrets in the Unfair Competition Law and other legal and administrative rules, pursuant to which protected secret knowledge shall not be commonly known, form a commercial asset, be practically applicable and be subject to concrete measures to keep it secret, is basically compliant with European standards. The above-mentioned rules of the SAIC specify that "not commonly known" means that the secret information cannot be immediately derived from what is publicly known. According to a court decision, also the additional information regarding the concrete application of a patented and therefore published technical solution can form not commonly known information and therefore a protected secret. Only if no noteworthy endeavour is needed for obtaining such information, it can be regarded as commonly known.[191]
Protection under the Unfair Competition Provisions is only available against "business entities", i.e. competitors of the trade secret holder. Trade secret divulgation by employees/former employees cannot be directly prosecuted under the unfair competition rules. The Criminal Act, however, provides protection against trade secret misappropriation by "any party", which also includes employees who, for instance, divulge a secret plans or documents to competitors. Further provisions regarding employment relationships are contained in the Labour Act and the Labour Contract Act. The Labour Act contains a rather general provision which states that the parties to a labour contract can agree on confidentiality clauses. The Labour Contract Act specifies that the contract may stipulate that confidentiality shall be maintained after the employment relationship, but such post-employment confidentiality shall be adequately remunerated and not exceed a duration of two years. The latter provision contradicts another administrative rule, the "Opinion of the State Commission for Science and Technology on Strengthened Administration of Technical Secrets in the Course of the Change of Technical and Scientific Personnel to Another Employer" of 2 June 1997, pursuant to which such technical and scientific personnel can be obliged by contract to keep know-how secret for a duration up to three years after employment. The "Opinion" interprets another law, the Law on Promoting the Implementation of Scientific and Technological Results of 15 May 1996. Also this law contains a provision on post-employment restrictive covenants but it does not specify their duration. As the Labour Contract Act ranks higher in the norm hierarchy than the "Opinion", it must be assumed that since 2007, the shorter duration of two years regulated in the Labour Contract Act prevails.
Chinese law also covers divulgation of trade secrets by enterprise managers who are not "employees" in the strict sense. The Company Act of 27 October 2005 provides that board members and managers are prohibited from divulging trade secrets of their company. In case of a violation of that provision, the relevant provisions of the Contract Act and the Criminal Act should be applicable.
The infringement of trade secrets pursuant to the provisions of the Unfair Competition Act and the Criminal Act comprises, inter alia, appropriation of secret information by illegitimate means such as theft or threat, or allowing other to use the information obtained by unlawful means, or knowingly exploiting secret information which has been obtained by such means. The mentioned SPC interpretations regarding the Unfair Competition Act contain an interesting provision pursuant to which secret information obtained by way of re-engineering a product does not form infringement but that the defendant in such case has to provide evidence that the information was indeed obtained by re-engineering and not by the above-mentioned illegitimate means (even though theoretically, the information could have been obtained by way of re-engineering).
The breach of contractual secrecy clauses will be treated below under e) "Technology contracts".

4.4.5 Technology contracts

4.4.5.1 Statutory obligations of licensor/transferor

As mentioned above under III.4, the legal framework around technology contracts contains a number of provisions which allow government and administrative interference in technology cooperation between a Chinese and a foreign party. But also the provisions which regulate the immediate relationship between the partners are shaped in a manner that restricts contractual freedom, often to the disadvantage to the transferring party (i.e. the foreign party in most Sino-foreign technology agreements). Pursuant to Art.347 of the Contract Act, the transferor has to provide the transferee with documents and technical guidance and guarantee that the transferred technology is applicable and reliable. Burdening transferees with obligations regarding the quality of the transferred subject matter

[191] Higher People's Court of Fujian Province, Gazette oft he Supreme People's Court 1995, p. 28; further details at *Liu Xiaohai*, Rechtsschutz von Unternehmensgeheimnissen: Vergleichende Untersuchung zum Schutzniveau des chinesischen Rechts im Vergleich mit dem deutschen und amerikanischen Recht, Peter Lang Publishing House 1999, p.48.

has a certain tradition in China, also with regard to other IP rights, e.g. with regard to the quality and reliability of the products under a transferred trademark.[192] It remains to be seen whether also in the area of technology contracts, alleged failure to provide the transferee with complete documentation or guidance may result in compensation for losses and damages due to malfunctioning technology.
As mentioned with regard to patents, in case of jointly developed technology under a collaboration contract, also ownership and joint exercise should be regulated in detail by contract, also how to deal with conflicts among joint owners around the grant of a license to third parties.

4.4.5.2 Choice of law

Further restrictions to contractual freedom are contained in the regulatory framework around jurisdiction and choice of law. Pursuant to Art.126 (1) of the Contract Act, the parties to a foreign-related contract are free to choose the law which shall be applied by the Chinese court in case of a dispute. Only if the contract does not contain such clause, the law of the "location with the closest connection to the contract" will be applied. In case of technology transfer to China, the courts tend to regard China as the location with the closest connection, as the performance of the contract by a Chinese licensee or transferee, i.e. transforming a technology into marketable products, marketing such products and bearing other economic risks would be of greater importance than simply granting a license or transferring an invention or secret know-how.[193] It should be noted, however, that the tendency among judges to opt for domestic law wherever possible is not a Chinese peculiarity.
A choice of law is not possible in case of Sino-foreign Equity Joint Venture Enterprise Contracts, Sino-foreign Cooperative Joint Venture Contracts, or Contracts for Sino-foreign Joint Exploration and Development of Natural Resources which are performed in China. Art. 126 (2) Contract Act stipulates that in these cases, Chinese law shall be applicable.
Therefore, in some cases, the application of Chinese law cannot be superseded by a contract clause if the contract is performed in China. But even in cases in which the application of a foreign law is possible, it should be considered that Chinese judges would then have to apply an unfamiliar norm, which may enhance the non-predictability of court decisions, especially if we consider that judicial expertise is unevenly distributed throughout the country (see below).

4.4.5.3 Negotiations preceding the conclusion of a contract

Finally, as indicated under III.4 with respect to administrative interference, negotiations prior to an engagement in China are a very sensitive issue. Technology intensive investment normally elevates the status of a locality, and due to the blurred distinction line between "private" and "public", it is very likely that not only the immediate contract partner but also local representatives, politicians, administrators, etc., have a more or less pronounced interest in such a project, especially if it is industry-related. On the other hand, technology contracts can hardly be concluded without revealing at least a part of their subject matter in the course of preceding negotiations. Art.43 of the Contract Act provides that a party which obtains knowledge about a trade secret (including technological secrets) during the preparation of a technology contract shall neither reveal such secret information nor exploit it in an unfair manner. Due to the problematic enforcement situation especially with regard to non-registered and therefore comparably unstable technological secrets, however, this legal provision forms a rather weak basis for court litigation. One thinkable measure could be the application of a patent for the secret information. Then, within 18 months from the filing date in which SIPO will not publish the application, the European party has time to negotiate and to decide whether to withdraw

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[192] The Trademark Act states that the assignor must oblige the assignee/licensee to maintain quality standards and, in case of a license contract, the licensor of the trademark is even under the legal obligation to regularly inspect whether the licensee maintains the quality of the product. In the past, the Supreme People's Court held the US owner of an automobile trademark liable for an accident caused by a defect axle of a car produced under a trademark license by a another manufacturer located in Brazil, from where the car was then exported to China. To the court, the fact that the accused original manufacturer owned the trademark served as *prima facie* evidence that he, as "producer", should have maintained safety standards – more in *Ganea/Jin*, above note 50, p.17 (26)

[193] *Thomas Pattloch*, Das IPR des Geistigen Eigentums in der VR China, Mohr Siebeck Tübingen 2003, p.158; This court interpretation of Art.126 (1) Contract Act is also backed by a rather old SPC provision, the SPC Interpretation on Certain Questions Regarding the Application of the Foreign Economic Contract Act of 19 October 1985. Pursuant to the SPC interpretation, the law of the country where, *inter alia*, the licensee or the commissioner to a technology contract (i.e. in most cases the Chinese party) is located, will be applied if the contract contains no otherwise stipulation. In the meantime, this Act has been replaced by the Contract Act. However, as the content of Art.126 (1) Contract Act corresponds to an old provision which has been transplanted from the old Foreign Economic Contract Act, it can be assumed that the SPC interpretation which refers to that old provision is still valid.See comment No.16 to Art.126 Contract Act, at http://lehrstuhl.jura.uni-goettingen.de/chinarecht/vertrag.htm (translations and comments made by *Frank Münzel*)

the application because of a promising negotiation process, or whether to maintain the application and to obtain a patent instead. In the latter case, secrecy will be lost but the remaining patent forms a comparably stable right which is better enforceable than a trade secret. In any case, engineers, scientists and other participants in negotiations should be sensitized for the need to regard information as a strategic asset, and instructed to avoid unintentional divulgation of information which is not necessarily related to the subject matter of negotiations.

4.4.6 Enforcement

Enforcement in China is under worldwide criticism. China occupies the biggest part of the annual U.S.T.R's "Priority Watch List" of countries which show non-obedient to demands to protect US IP rights. It seems, however, that much of this criticism is based on press reports or other, rather unfounded evidence. The WTO Panel which had to decide about the mentioned US complaint against insufficient enforcement China expressly criticized that the US provided mere press articles as evidence that China's criminal copyright and trademark protection regime would not be deterrent enough.[194] There is little evidence on the actual "amount" of IP infringement in China, apart from reports from various customs authorities, e.g. that more than half of the amount of infringing products detected at national borders originates from China, or that presumably more than 80 percent of business software sold and used in China is pirated. Huge piracy rates, etc., imply little more than that the situation in China is not perfect. Put in relation with the size of the country, its huge population and the enormous industrial output, however, the question arises whether other, smaller countries do not even have higher "per capita" infringement rates than in China.

Recently, the Supreme People's Court has increased its efforts to harmonize decision making by China's numerous local courts, inter alia, by the issuance of numerous judicial interpretations and by limiting the number of courts with competence to hear certain IP cases to some courts located in the better developed coastal areas of China (so far, only in the area of trademarks).[195] Admittedly, there are also other (mostly unpublished) decisions which raise serious doubts about the qualification of some judges.[196]

Also in socio-economic respect, China has undergone remarkable changes. As highlighted with regard to the Patent Act, there is a new trend to shape the IP laws in the national interest, obviously because a national interest has been identified. The Chinese themselves have started to act within the boundaries of law. Around 80 percent of intellectual property disputes in China are between Chinese parties, without the involvement of foreign interests. Moreover, there are signs that those who regard an existing intellectual property right as an obstacle to their own business, do no longer simply infringe that right but take the legal route, e.g. by attempting to invalidate it.[197]

One major problem of Chinese law enforcement has already been mentioned under III.4, namely the relatively high degree of local autonomy and the dependence of judges on local political instructions. China's judiciary does not form an independent third power. In contrast to imperial "Confucian" times when laws were refuted because they signaled to individuals how far they could go with selfish behaviour[198] and in contrast to the Cultural Revolution which perceived law as an obstacle to permanent class struggle, law and judiciary are today regarded as elements of social stability. However, a real "rule of law" which would regard courts as an independent instance with the competence to control politics is not intended by the present leadership. [199] In the local context, judges are still strongly connected to local decision makers. The local People's Governments, for instance, finance their salaries and other benefits. In case of a dispute between an outsider (not necessarily a foreigner) and a local party, it can happen that local politicians interfere to avert damage from the local party. Also the qualification of judges varies throughout the country. The most competent judges, many of them having spent some time abroad and learned and internalized law and legal thinking from the US and from Europe, can be found in Beijing and Shanghai. In other parts of the country, judges

[194] WTO-Panel, China - Measures Affecting the Protection and Enforcement of Intellectual Property Rights, Report of the Panel, 26.1.2009, WT/DS362/R.
[195] *Tan*, above note 165.
[196] For instance, in one reported decision, a court rejected evidence obtained by test purchases of infringing products because it regarded such test purchases as unfair entrapment; reported by *Li Hua*, Major Problems of IPR Protection in China: A View of Civil Procedure, 8 EIPR 285 (2005).
[197] Observed by *Peter K. Yu,* From Pirates to Partners, (Episode II),: Protecting Intellectual Property in Post-WTO China, 55 Am. U. L. Rev. 901 (2006), also downloadable at: http://ssrn.com/abstract=578585
[198] *William P. Alford*, To Steal a Book is an Elegant Offense: Intellectual Property Law in Chinese Civilization, Stanford University Press 1995, 20.
[199] *Eric W. Orts*, The Rule of Law in China, 34 Vand. J. Transnat'l L. 43, 65 (Jan. 2001); *Stanley Lubman*, Bird in a Cage: Legal Reform in China after Mao, Stanford University Press 1999, p.131

often have little experience with complicated technology related disputes. Many courts have been endowed with specialized IP chambers but the experience accumulated there still varies. Reportedly, judges who are insecure about a case sometimes approach the judges of the next higher court (IP litigation normally starts at the Intermediate People's Court level; next higher instance is the Higher People's Court on province level) in order to ascertain that their decision will not be overthrown in the next instance.[200]

Therefore, if a dispute cannot be avoided, a European party should consider measures to avoid local protectionism and incompetent decision making, e.g. by bringing their case to a court which is either located outside the domicile of the infringer, or which is deemed competent to hear a case which involves complicated cases, e.g. the Intermediate People's Courts in Shanghai or Beijing. The Supreme People's Court Interpretation on Issues Relating to the Application of Law to Adjudication of Cases of Patent Disputes of 19 June 2001, encourages infringed parties to undertake such forum shopping, by stipulating that cases in which not only production but also sale/distribution of infringing products is at issue, the courts at any location where such infringing distribution took place, shall be competent to hear the case.[201]

Certain procedural requirements aggravate judicial enforcement. Pursuant to Art.11 of the Several Provisions on Evidence in Civil Proceedings, another set of interpretations issued by the Supreme People's Court on 6 December 2001[202], foreign litigants have to notarize all evidence obtained abroad and forward the documents to the Chinese embassy in their home country for legalization. Such requirements are widely criticized as protracting cases which involve foreign interests. Nevertheless, there are also developments which give rise to hope. The instrument of pre-litigation measures to preserve evidence and to avert irreparable damage, for instance, introduced in the course of the legislation waves of 2000 and 2001 in anticipation of a soon accession to the WTO, is reported to be well-accepted and also well-applied by the courts.

Next, it has been mentioned that China has a "dual" enforcement system which is comprised of court and administrative enforcement. Specialized administrations such as the mentioned local patent administrations or the local Administrations of Industry and Commerce (AIC; the local branches of the mentioned SAIC) which are, inter alia, competent to treat trade secret infringement, enjoy quasi-judicial competence to investigate, to stop infringement and to take further administrative action such as withdrawing business licenses or imposing administrative fines. The role of the administrations, however, is basically restricted to restoring the market order which has been distorted by an infringing act. They are not competent to decide in questions pertaining to the civil relationship between the disputing parties, e.g. in the damage question. However, they may mediate in the damage questions if both parties request them to do so. If the mediation result is not accepted by a party, it may still institute court proceedings. That is, infringed parties which are interested in quick cessation from infringement are well advised to resort to specialized administrations. If they are also interested in damages, court proceedings may be the better alternative, especially in patent infringement cases. The situation of the local patent administrations has been explained above, in context with patent law. At present, their importance is not too high. The local AIC which are in charge of offences against the unfair competition rules (including the provisions on know-how protection) treat more cases per year but the number of administratively decided know-how disputes remains unknown.[203]

Administrative enforcement also suffers under the mentioned local protectionism. Formally, the local administrations are subordinate to the guidance of their central authority, which is the SAIC in case of unfair competition or the SIPO in case of patents. However, they are financed by the local governments and therefore also prone to insinuations from local leaders. Moreover, reportedly, once a complainant has provided a local administration with all necessary information and evidence to take action, it is normally excluded from further participation in the proceedings. From then on, the administrations regard all further proceedings as official action, and further private interference by an interested party is not desired.[204] Therefore, if an infringed party opts for administrative enforcement, it should be prepared that it will most likely lose any possibility to control the further proceedings. Another problem is that local administrations are reluctant to transfer cases which, according to the law, are of criminal character, to the Public Security Bureau or the Public Prosecutor for further criminal proceedings. One reported reason for such reluctance is their eagerness to close the case by

[200] *Ganea/Pattloch*, above note 95, p.294 et seq.
[201] Gazette of the Supreme People's Court 2001 No.4, p.130
[202] Gazette of the Supreme People's Court 2002, p.26
[203] The English SIPO homepage contains annual reports and white books with helpful statistics and figures, inter alia on enforcement of IP in general - http://www.sipo.gov.cn/sipo_English/laws/
[204] *Ranjard/Misonne*, above note 106

themselves and to earn the administrative fine which could not be raised if the case was transferred to the criminal authorities.[205]
In sum, the Chinese enforcement system is far from being perfect but the often-heard allegation that it is "virtually impossible" to enforce IP in China can hardly be upheld. In spite of the fact that China has brought its substantive law in compliance with the TRIPS Agreement, a number of flaws continue to exist on the procedural level, in that, for instance, foreigners are burdened with special requirements, or that there is no clear regulation on the transfer of criminal cases from specialized IP authorities to the authorities in charge of criminal enforcement. Nevertheless, the obstacles are not always insurmountable. The pitfalls can be partly circumvented by forum shopping and by scooping out all possibilities to resort to an authority which is a) competent and b) not under suspicion to surrender to local political pressure. Nevertheless, also with regard to China, the best strategy is to avoid legal disputes, not only by arbitration clauses in a contract (in the end, also adherence to such clauses has to be enforced) but by measures which take into account the moves and the behaviour of the contract partner.

5 Summary/recommendations to European PRO and to the Commission

5.1 Recommendations to PRO

From the explanations above we have learned that each BRIC economy is unique with regard to the availability of R&D opportunities and KT channels, the endowment with institutions which either favour or inhibit knowledge transfer and the legal framework and its enforcement. Nevertheless, with regard to certain aspects of KT, such as law and institutions, or locations for R&D, certain BRIC economies share a number of similarities.

5.1.1 Where can potential partners be found?

5.1.1.1 Russia and Brazil – dominance of the public sector

With regard to the question where R&D is located, we find that both Russia and Brazil have an R&D landscape in common which is characterized by government guidance, mission oriented R&D and unsuccessful attempts of the past to establish links between public R&D and the industry. Recently, both countries have fueled their endeavours to put R&D results on the market, and such endeavours are not limited to mere declarations of intent or regulations on the books, but involve remarkable state funding. As these more substantial measures to bring public R&D and industry together were launched only recently, they have not yet entailed well-established patterns of private-public cooperation. It would therefore be premature to suggest that European PROs should look for potential partners for R&D in the private sectors of each country. The dominant sector for international KT in these countries is still the public sector.
Regarding potential areas of research, Brazil has strengths in "green" areas such as biotechnology or renewable primary products. Both areas can generate marketable results. It should be noted, however, that the latter, namely renewable primary products, is increasingly criticized as aggravating the world food shortage. Russia's R&D is primarily dedicated to mission oriented, purely "scientific" basic research. Not much of this research potential can be linked to industry or generate marketable products. Even in those areas in which Russia's industry has its strengths, basically in the energy and natural resources sector, R&D input is reported to be low. Extraction of resources, refinement, etc., is often carried out with help of outdated equipment.

5.1.1.2 India and China – opportunities for private-public partnerships

The R&D landscapes of China and India are rather market and demand oriented. Both countries offer opportunities for private-public and public-public engagement but especially in India, it seems that the majority of partners for collaborative research and other activities which involve KT can be found in the private sector, including firms in the areas of biotechnology and pharmaceuticals. In spite of the fact that both countries have very different political systems, the starting points for the emergence of high-

[205] *Ganea/Pattloch*, above note 95, 332

tech induced industries in both India and China was the abolishment of an industrial policy that was oriented at import substitution and autarky. In China, the opening and reform policy started in 1978, after the termination of the last aftermaths of the Cultural Revolution. India needed a bit longer, until 1991, when it abolished its "License Raj" industry control system and gave way to an economic boost which effected the emergence of new industries and investment from abroad.
In both countries, however, industrial development proceeded in different directions: in China, the emphasis was on manufacturing tangible commodities. In the course of industrial development, rather simple and labour intensive manufacturing was replaced by sophisticated production of electronic consumer products, spare parts and other devices or cars today. Technology import, predominantly through FDI, still plays an important role. Recent industrial policy, however, aim at fostering "indigenous innovation" so as to get rid of foreign technological supremacy. India instead, maybe due to the historical incident that it freed itself of political guidance shortly before the emergence of the New Economy, concentrated on "soft" knowledge intensive products like software and business solutions. In these areas, new innovative firms developed which, however, served as suppliers of new applications to fundamental software and business solutions developed elsewhere, predominantly in the US. Nevertheless, in these new areas, the informational edge of the developed economies was less dramatic than in other areas, so that India could catch up in terms of sophistication and innovativeness.
A good part of knowledge-intensive activity in India is dedicated to the domestic market, which consists of hundreds of millions of poor consumers. Therefore, much activity aims at providing the rural poor with cheap access to medicines and information. Recently, also the poor rural communities have become sources of innovation. India increasingly perceives its cultural heritage, which, due to thousands years of rural civilization, is strongly connected to the biological diversity of the country, as an important asset. A framework for the proprietization of the countries' biological-agricultural heritage and for a fair benefit sharing in case that knowledge preserved and developed over centuries becomes subject to industrial exploitation is under construction.
In sum, *India* presently provides for many R&D opportunities, in the mentioned software sector (including IT), in the area of pharmaceuticals and biotechnology where, after nearly two decades of imitative activity, investment in independent R&D increases, and also in rather unique areas in which rural traditions and biological diversity come together. The latter is profitable for pharmaceutical and biotechnological research, also in a manner that (traditional) knowledge is transferred to Europe but it should also be kept in mind that India is one of the emerging markets which claim respect for their biological wealth and for the historical achievements of their indigenous populations in the area of traditional knowledge. Therefore, any approach to do research in this area should be accompanied by signals that benefits arising from examining and researching, e.g. the medical effect of a certain plant, will be shared with the local community which has detected and preserved such traditional knowledge.
China's knowledge-intensive industries are less concentrated on domestic demand and more oriented at supplying the world markets with tangible products. Due to the learning effects generated from the high number of direct investment in the manufacturing sector, Chinese engineers have accumulated technological knowledge in a variety of areas. Domestic as well as international private-public R&D is on the rise. In most cases of Sino-foreign private-public partnerships, the "public" partner is a Chinese university. China's universities show a high propensity towards marketing their R&D results. It should be noted, however, that a clear pattern of private-public partnership has not yet developed. Many universities try to market their research results by creating spin-offs. Very often, however, such spin-offs do not accumulate enough experience and entrepreneurial expertise to bring a project to market success. Therefore, the various options of generating a profit from joint research should be addressed in the technology contract. Moreover, the European side could also actively participate in the search for a suitable private partner.

5.1.2 Institutional and legal level – what has to be observed?

In the area of institutions and law, we find similarities between China and Russia on the one hand, and India and Brazil on the other.
In China and Russia, both countries with a socialist past, a certain state control of R&D, be it in form of steering the inflow of "desired" technologies or be it in form of preventing certain technologies from being divulged in the course of R&D collaboration or any other KT activity, is still perceivable. Moreover, in both countries, state institutions are reported to be defective in a manner that sometimes, administrative practice does not comply with national law but is carried out in a highly informal manner and according to peculiar patterns of behaviour which require a "common spirit" among the involved players (local administration, industry, politics).

The low reliability of laws and institutions does not mean that a profitable engagement in the observed countries is not possible. However, a PRO that engages in Russia or China should be aware that it has to interact on a rather informal level with its partners. Therefore, it is necessary to investigate the environment of a potential future R&D partnership. Are there any other interested parties, apart from the immediate contract partner? What are their actual interests? As the European PRO cannot completely rely on the law, and that misbehaviour in the course of performing a contract (or infringements by third parties) will be sanctioned, it has to proceed in a manner which leaves options for future action. That is, unpredictable events have to be anticipated and, in order to be able to react if irregularities occur, it is important to reserve some leeway for later negotiations. Depending on the subject matter of a technology contract, a thinkable strategy may be to split up a joint KT cooperation into certain steps and to withhold certain information until a partial result could be achieved. Moreover, for all valuable secret information that may be revealed in the course of negotiations, the file of patents should be considered, so as to reduce the danger that the intellectual asset will be lost if an unfaithful contract partner divulges it to competitors. Of course, such strategies are difficult, sometimes costly, and everything would proceed easier if one could simply rely on the law in case of irregularities.

In Brazil and India, the institutional environment and the law, in particular the legal mentality, do not give much rise to concern. As mentioned, multinationals expressly lauded the legal mentality that prevails in India. Of course, India consists of a variety of populations, religions and attitudes but in the area of R&D the likelihood that a European investor or researcher will be faced with completely unfamiliar attitudes is not high. The Indian counterpart has normally undergone university education, probably spent a year or longer abroad, is proficient in English and, when it comes to business transactions on white collar level, adopted western attitudes which facilitate negotiations and a smooth performance of the contract. Indian bureaucracy is sometimes lauded, sometimes heavily criticized, but a European research institute will probably not have many opportunities to get in touch with the public service on grassroots level which is reported to be most deficient. In case of a dispute, however, a European party will soon be reminded of the fact that India is a developing country which cannot invest much in public institutions. Court cases are reported to be extremely lengthy. Apart from the advice given above, namely to reserve leeway for later negotiations, also the contractual regulation of alternative forms of dispute resolution should be considered. As mentioned, most problematic in India is not an anti-legal thinking or aversion to formal regulation of relationships by contract, but rather the lack of a physical infrastructure and manpower.

Also in Brazil, institutions, legal mentality and court enforcement do not give much rise to complaint. A problem in Brazil, especially with regard to R&D is that related laws, regulations, but also institutions were created only recently, and that obviously, the new superstructure is obviously not yet filled with enough competent personnel. In general, however, state interference in Brazil is much less problematic than e.g. in Russia or China. Moreover, Brazil has an independent judiciary. The few patent and technology related decisions rendered so far are reported to be fair. It should be noted, however, that as the number of court dispute in this area rises, more problems may be brought to light, e.g. that apart from four specialized courts in Rio de Janeiro, Brazilian courts throughout the country have not yet accumulated much experience in technology related litigation.

5.2 Recommendations to the Commission

As seen, Brazil and Russia find it especially difficult to transform research results into industrially applicable solutions. In order to foster private-public collaboration, the Commission could launch an industry–PRO dialogue between European industries and PROs from the BRIC economies, most notably from Brazil and Russia. In the course of such dialogue, it would be a good idea to draw on experiences already made by European enterprises, e.g. in China, where such private-public partnerships seem to be quite popular. A possible result from such dialogue could be inputs with regard to feasible patterns of private-public engagement, as well as the formation of real partnerships for later private-public cooperation.

A due reaction to the remaining deficiencies in the institutional sector is difficult, as those institutional peculiarities which affect KT are deeply rooted in the overall institutional framework. In India, the BRIC with the lowest per capita GDP, European investment in the poor physical infrastructure would certainly be welcomed. One target of substantial assistance could be the overburdened and understaffed Patent Office.

In the area of law and legal thinking, Europe has already launched a number of initiatives, e.g. the IPR2 programme (which is implemented by the EPO), to cooperate with China especially in the area of law enforcement. The success of such programmes, e.g. whether the enforcement situation in a target

country has improved because of it, or whether an activity under the programme had influenced a new piece of legislation, is hard to assess. Nevertheless, programmes which are based on the idea of cooperation are a more promising approach than exerting unilateral pressure.

IP also plays a role in various Economic Partnership Agreements (EPA) proposed by the EU to various developing countries. Among the BRIC economies, only India is presently faced with a EU proposal to conclude an EPA. The IP clauses in such EPA drafts normally go beyond the TRIPS standards, mostly in that they prescribe that a rather openly worded TRIPS requirement shall be implemented by the respective developing country in a certain manner, mostly in a manner which corresponds to one of the various EU directives on certain aspects of IP. In many developing countries, however, text transplanted from European directives into national law is likely to remain mere law on the books without any practical effect, as such legal transplants too often do not comply with the general legal infrastructure of the country. European enforcement standards, for instance, do not consider that in some countries, enforcement is carried out by specialized administrations rather than by courts. Moreover, in Brazil, India and to a certain extent also in China, IP has become a highly politicized issues. Their governments could hardly justify why they should adopt “TRIPS Plus” standards as result of a bilateral agreement whereas they continue to criticize such standards on the international stage. Therefore, it is advisable to rethink the present practice of imposing the text of European IP directives on countries which are quite different from Europe in cultural and/or socio-economic respect. The “TRIPS Plus” perception of IP clauses which narrow the leeway for interpreting the Agreement could be mitigated if, for instance, such clauses would focus at the reality in the respective country, e.g. at the improvement of peculiar rules and behaviours which have proven to be detrimental to enforcement, rather than at alignment with unfamiliar European standards.

Study 5: An Analysis of the Effects of European and National Guidelines on the Implementation of New Knowledge Transfer Policies at Institutional and Member State Level; Knowledge Transfer Policy at the Universities and Other Public Research Institutions.

Gert Vilhelm Balling

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Management Summary

This study presents a survey on the extent to which universities and other Public Research Organisations in the Member States have implemented new knowledge transfer policies.
Based on 10 primary EU and national guidelines/ code of practice and other knowledge transfer documents, a survey questionnaire has been developed.
Primary umbrella organisations of universities and other Public Research Organisations in the Member States as well as national Knowledge Transfer Networks have been approached and asked to provide input on behalf of their member institutions.
Respondents are distributed across 16 umbrella organisations and eight universities and other Public Research Organisations.[206] The respondents cover 537 universities and other Public Research Organisations, located in the following 16 Member States: Austria, Denmark, the Czech Republic, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, the Netherlands, Slovenia, Spain, Sweden and the United Kingdom.[207]
The study presents trends and an overall estimation of the actual implementation of new knowledge transfer policy in the Member States, but is not comprehensive enough to map the implementation in detail. The analysis will therefore focus on the degree to which a certain percentage of Member States have implemented certain policies, and encompass examples on best practice. Main findings will be presented differentiated into five categories: Internal Policy, External Policy, Staff and Network, Collaborative and Contract Research, Development and Publication of Policies and Procedures.[208]

Internal Policy for Management of Own Intellectual Property

Of Member States present in the survey, based on respondents covering universities and other Public Research Organisations:
– 63 % rate policy to be highly in line with their institutions' overall mission and strategy.
– 50 % have implemented long-term knowledge transfer & Intellectual Property management strategy to a high degree.
– 88 % have general rules concerning disclosure and ownership of new ideas of commercial interest, whilst around 70 % have general rules on publication and dissemination policies as well as on policies on incentives for commercialising Intellectual Property.
– 31 % have implemented a knowledge transfer policy regarding conflict of interest to a high degree.

As regards internal policy, the main findings show a relative difference in the percentage of implementation of general policies and actual policies.
Only in slightly more than half of the present Member States universities and other Public Research Organisations have implemented a policy in line with their overall mission and strategy and a long-term knowledge transfer and Intellectual Property management strategy and mission to a high degree. Although more than two thirds rate the implementation as medium to high degree, the institutional management framework and long-term strategy is a necessity for the development of a knowledge transfer dimension as imbedded in the institutional policies and general development plans.
However, general rules on specified knowledge transfer and Intellectual Property management activities seem to be implemented to a high degree. In 88 % of the present Member States universities and other Public Research Organisations seem to have general rules on disclosure procedures and management of ownership, while around 70 % have general rules on publication and dissemination policy as well as on policy on incentives for commercialising Intellectual Property.
Whereas the routines concerning core activities of knowledge transfer have a high implementation rate, the focus on Conflict of Interest is far less. An explanation could be that Conflict of Interest does not directly influence the daily work in the same way as disclosure procedures and ownership matters, or that it is a moral issue and can be ad hoc administrated at department level, and therefore not prioritised in the written policy.

External Policy for Management of Own Intellectual Property

Of Member States present in the survey, based on respondents covering universities and other Public Research Organisations:
– 69 % have general rules concerning engagement with third parties.
– 6 % rate the implementation of Intellectual Property Pools as high.

[206] Large Public Research Organisations count as one Public Research Organisation, even though their organisation and structure is that of an umbrella organisation.
[207] Respondents from more Member States have announced that they will join the survey, but were not able to supply the data in due time for the report. The background material for this report will be updated as data is received.
[208] Findings are calculated as a percentage of Member States present in the survey, based on respondents covering universities and other Public Research Organisations. See 1.3.1.

– 94 % have a policy on the creation of spin-offs.
– 81 % monitor Intellectual Property protection and knowledge transfer activities and promote them and 44 % have to a high degree implemented the internet as a way to present information on Intellectual Property.

As regards external policy, the main findings show a considerable difference in the percentage of implementation of relational policies and the internet as concerted outreach.
Spin-offs have the highest rate of implemented policies in the survey with 94 % of the present Member States, even though the policies vary in explicitness. Staff can engage themselves, but have to choose whether they want to work for the spin-off or for the institution. Regarding engagement with third parties it is desirable and somewhat expected that researchers engage themselves. In 70 % of the present Member States policies on engagement with third parties in relation to financing and ownership have been implemented, and respondents exemplify relational issues through references to codes of conduct ranging from general Customer Relation Management considerations to Model Agreement templates.
In 81 % of the present Member States respondents monitor Intellectual Property protection, knowledge transfer activities and the promotion of them. Since most of the institutions seem to have local portals presenting Intellectual Property in relation to their institution website, and only in 44 % of the present Member States respondents rate the implementation of such activities as high, one would expect a relatively low output regarding access to national Intellectual property Portals. But apparently, there seems to be ambitious national portals presenting information on university and other Public Research Organisation Intellectual Property in a number of Member States as well as broader setups developed by several national Patent and Trademark Offices. An explanation of the relatively low rating on internet activities could be that the universities and other Public Research Organisations, even though they have the possibility, do not prioritise being present at national or other platforms than the one offered by their own institution.
The tendency is that more Knowledge Transfer Offices report data to national and European surveys. This trend is supported along two different strings. On the one hand, more Member States are beginning to attach funding requirements to survey participation, so in the future, universities and other Public Research Organisations will be obliged to a higher degree than now to report performance data to national or international knowledge transfer surveys. On the other hand, the Commission Expert Group on KT Metrics (EU 2009b) recommended a European survey model to harmonise European surveys to improve the possibility for individual universities and other Public Research Organisations and Member States to monitor and compare knowledge transfer achievements against themselves and each other on a shared set of indicators, in order to identify trends and to support work on improvements if needed.
While all other issues in this part had the interest of most of the involved universities and other Public Research Organisations, there is a clear indication that respondents do not value Intellectual Property Pools as a useful tool for making an innovative idea to be attractive to the private sector in the sense that various universities and other Public Research Organisations cross-license their intellectual assets or otherwise throw the results of collaborative research in a joint pool. In almost half of the present Member States respondents rate the implementation of Intellectual Property Pools lowest possible, and only in 6 % of the present Member States a score higher than medium is given. Although the interest in the field is low and success stories are rather hard to find, the networking opportunity and obtaining of critical mass is fully in line with the potential of the Intellectual Property Pools and supports the idea of joining efforts where research institutions do not have the scope and volume of exploitable research results to justify the establishment of a Knowledge Transfer Office.

Staff and Network

Of Member States present in the survey, based on respondents covering universities and other Public Research Organisations:
– 70 % feel that training on awareness and basic skills to a high degree has been integrated into the knowledge transfer practice.
– 93 % have access to knowledge transfer services to fulfil their legal obligations.
– 80 % have Knowledge Transfer Networks for practitioners.

Training of Knowledge Transfer Managers and researchers is considered important, and in almost 70 % of the present Member States respondents feel that training on awareness and basic skills to a high degree has been integrated into the knowledge transfer daily practice. Looking at the supply of knowledge transfer training, it is clear that courses and other training activities mainly are focussed on Knowledge Transfer Managers.
In at least 93 % of the present Member States it seems to that universities and other Public Research Organisations have access to a minimum service to fulfil their legal obligations. This service is performed through in-house facilities in the form of Technology Transfer Offices or Knowledge Transfer Offices offering comprehensive services. It is though striking that in 38 % of the present Member States the respondents

declare that their Knowledge Transfer Offices are not reviewed and in 46 % that they are. The survey reveals three levels of review; metrics, external and internal quality control. Surveys seem to be the primary means of monitorisation of efficiency and effectiveness of the Knowledge Transfer Office, although focus tends to be more on measurable output than on processes and procedures.
In 81 % of the present Member States universities and other Public Research Organisations do have Knowledge Transfer Networks for practitioners. This survey has focussed on national practitioners' Knowledge Transfer Networks and not European or other international Knowledge Transfer Networks. With this delimitation in mind, the number is impressive, even if Knowledge Transfer Networks are defined broadly by the respondents covering smaller, larger as well as more specialised Knowledge Transfer Networks.

Collaborative and Contract Research

Of Member States present in the survey, based on respondents covering universities and other Public Research Organisations:
– More than 75 % consider not only their own interests and objectives, but also those of potential partners from the private sector.
– 63 % declare that clarification and negotiation is in the hands of the Knowledge Transfer Office.
– Only 6 % do rarely clarify access rights to Intellectual Property at an early stage in the projects.
– 46 % use model agreements.

In a substantial percentage of the present Member States respondents express that they not only consider their own interests and objectives, but also those of potential partners from the private sector. There is general consensus concerning 'fair rules', which are also embedded in both national Model Agreements and national codes of practice. The general attitude is that the fairness principles are based on the Public Research Organisation's public and social mission.

The same rate of implementation goes for clarification of access rights to Intellectual Property, where consensus is that clarification is enforced at an early stage in the projects and at least before signature. In 46 % of the present Member States either local or national Model Agreements are used. The national Model Agreements are either (more or less) agreed upon by different stakeholders or elaborated on the basis of experience collected from the universities and other Public Research Organisations.[209]

A surprising result is that in only 63 % of the present Member States respondents declare that clarification and negotiation is in the hands of a Knowledge Transfer Office. As regards respondents where both Knowledge Transfer Offices and researchers are involved in the clarification and negotiation process, there seems to be two different scenarios: The first scenario is universities and other Public Research Organisations where there are no rules on this matter and where Knowledge Transfer Managers, researchers or other personnel can take the lead in a clarification and negotiation process. The second scenario is where researchers seem to be the natural choice, but they can contact Knowledge Transfer Managers if they need help. Member States with 'professor's privilege' belong to this category.

Development and Publication of Policies and Procedures

Of Member States present in the survey, based on respondents covering universities and other Public Research Organisations:
– 63 % declare that their government has adopted policies in order to make universities and other Public Research Organisations develop and publicise policies and procedures for the management of Intellectual Property.
– 75 % of the organisations have taken certain initiatives in order to make universities and other Public Research Organisations develop and publicise policies and procedures for the management of Intellectual Property.
– 37 % are highly aware of the recommendation (EU 2008b).
– 17 % of the governments have promoted the recommendation's code of practice (EU 2008b).

Both governments and organisations seem to be acknowledged by the respondents for taking initiatives to make universities and other Public Research Organisations develop and publicise policies and procedures for the management of Intellectual Property.

On the one hand a rich variety of policies and initiatives are mentioned: The implementation of Bayh-Dole inspired legislation, the steering mechanisms between government agencies and the universities, national funding schemes for the development of professional Knowledge Transfer Offices, funding of Proof of Concept programmes, national guidelines and codes of practice, codes of conduct for collaboration with

[209] See Annex B Model Agreements.

industry, model contract tool kits, public grants addressed to universities and other Public Research Organisations for developing knowledge transfer infrastructure and promoting activities at local level etc.

The umbrella organisations and national Knowledge Transfer Networks seem to have added value at three levels. The Spanish Knowledge Transfer Network, RedOTRI, has produced a technical dossier about collaborative R&D and best practices for Intellectual Property Rights management; the Finish Knowledge Transfer Network, Research and Innovation Services, produces policy documents for the network members and carries out several benchmarking exercises involving all member institutions, and the Irish University Association contributed to the discussions around the code of practice.

DG Research has produced the *Commission Recommendation on the Management of Intellectual Property in Knowledge Transfer Activities and Code of Practice for Universities and other Public Research Organisations* (EU 2008b) with key recommendations to Member States for establishing or adapting Intellectual Property / knowledge transfer policies, and a code of practice for universities and other Public Research Organisations with operational principles for setting up institutional policies and knowledge transfer systems.

In 38 % of the present Member States respondents rate the awareness of the recommendation as high, which on the one hand must be considered a medium rating. However, if interpreted in the perspective of that only 17 % of the Member State governments seem to have promoted the code of practice yet, the awareness rate can be interpreted as relatively high.

Recommendations

This section provides recommendations for the EU Commission in relation to the findings of this study.

1. The present survey presents trends and an overall estimation of the actual implementation of a new knowledge transfer policy in the Member States and is not comprehensive enough to map the implementation in detail.
- It is recommended to carry through a more comprehensive study on the implementation of operational principles for setting up institutional policies and knowledge transfer systems at universities and other Public Research Organisations to confirm or disconfirm the findings and trends of the present survey.

2. Except for Conflict of Interest policies, general rules on core activities of knowledge transfer at the universities and Public Research Organisations have a high implementation rate, even though the institutional management framework and long-term strategy does not seem to be imbedded at the same level.
- It is recommended that the Commission encourage further implementation on operational principles for setting up institutional policies and knowledge transfer systems, particularly regarding institutional management framework and long-term strategies as well as Conflict of Interest policies.

3. Information on Intellectual Property is often presented on the local institution websites. However, cross national Intellectual Property Portals and in particular Intellectual Property Pools do not seem to be prioritized by the universities and other Public Research Organisations according to their potential.
- It is recommended that the Commission support a study on existing national Intellectual Property Portals and Intellectual Property Pools for universities and other Public Research Organisations in order to develop best practice, and to encourage Member States to support the implementation of such Intellectual Property Portals. Member States should also be encouraged to support Intellectual Property Pools where research institutions do not have the scope and volume of exploitable research results to justify the establishment of a Knowledge Transfer Office.

4. Most universities and other Public Research Organisations have access to a minimum service to fulfil their legal obligations through Knowledge Transfer Offices at the institution, even though Intellectual Property-related issues in collaborative and contract research not to a sufficient degree are clarified and negotiated by the Knowledge Transfer Managers. Given the importance of the Knowledge Transfer Office, it is remarkable that only a third of the offices are reviewed.
- It is recommended that the Commission encourage universities and other Public Research Organisations to use Knowledge Transfer Managers to secure contractual responsibilities for the institution towards third parties. Universities and other Public Research Organisations should also be encouraged to review Knowledge Transfer Office processes and procedures on a regular basis to secure optimal professionalism.

1 Introduction and Methodology

Protection and exploitation of Intellectual Property at universities and other Public Research Organisations is a relatively young field of activity in most of the EU Member States.
The exploitation of research is critical to economic growth. Knowledge transfer from the research sector to the commercial sector is essential to allow society to benefit from the results of research and extract value from research.

The European Commission Knowledge Transfer Forum Expert Group is a follow-up on the CREST IP Expert groups 2004 and 2006, the *Responsible Partnering Handbook* (EU 2005a), the *Commission Communication on Knowledge Transfer Improving KT Between Research Institutions and Industry in Europe + Voluntary Guidelines* (EU 2007a), the Initiative for a Charter for the Management of Intellectual Property from Public Research Institutions and Universities [*IP Charter]* (EU 2007c), the knowledge sharing axis of *European Research Area Green Paper* (EU 2007b) and the adoption of the *Commission Recommendation on the Management of Intellectual Property in Knowledge Transfer Activities and Code of Practice for Universities and other Public Research Organisations* (EU 2008b). This recommendation / code of practice promotes the development of Intellectual Property management policies at a Member State level and principles/practices for their management by Public Research Organisations.

This report focus on universities and other Public Research Organisations in the Member States. The study is based on a survey building on primary EU and national guidelines, codes of practice and other primary knowledge transfer documents. The study will present the extent to which universities and other Public Research Organisations in the Member States have implemented new knowledge transfer policies.

The report consists of three main sections:
1) Introduction and methodology
2) Presentation of results and analysis, part 1-5
3) Annexes
   - A) Commented EU and national based documents on guidelines and code of practice,
   - B) Model Agreements
   - C) Questionnaire
   - D) Links from primary publications
   - E) Links to Member State policy documents
   - F) References

1.1 Primary Publications

In order to compile an overview of the national and European initiatives regarding guidelines and code of practice related to new knowledge transfer policies for universities and other Public Research Organisations, relevant publications on a European and a national level were collected, studied and used as a source to form a questionnaire.

10 primary publications have been selected through searches at the European Community Research and Development Information Service (CORDIS) using knowledge transfer keywords, through references in publications and in accordance with advice from the Knowledge Transfer Forum Expert Group and DG Research. Further documents have been implemented during the survey, where respondents have been requested to add links to policy documents, guidelines and/or codes of practice that have influenced their own implementation of new knowledge transfer policies.

The 10 primary publications are categorised according to whether the publications are produced in an EU or a national context and according to chronology. All listed publications are described in more detail in Annex A and are linked to full versions:

1. European Commission, Expert Group on the Management of IPR (EU 2004a), *Management of Intellectual Property in Publicly-Funded Research Organisations: Towards European Guidelines*
2. European Commission (EU 2007b), *European Research Area Green Paper*
3. European Commission (EU 2007a), *Commission Communication on Knowledge Transfer Improving KT between Research Institutions and Industry in Europe + Voluntary Guidelines*
4. European Commission (EU 2007c), *Initiative for a Charter for the Management of Intellectual Property from Public Research Institutions and Universities* [*IP Charter]*

5. European Commission, DG Research (EU 2008b), *Commission Recommendation on the Management of Intellectual Property in Knowledge Transfer Activities and Code of Practice for Universities and other Public Research Organisations*
6. AURIL (AURIL 2001), *Partnerships for Research and Innovation between Industry and Universities*
7. Auril/UUK/Patent Office (AURIL 2002b), *Managing Intellectual Property – A Guide to Strategic Decision-Making in Universities*
8a. AURIL (AURIL 2002a), *Handbook of Intellectual Property Management*
8b. *Murgitroyd & Company* (M&C 2002)*, THEROS Intellectual Property Guidelines*
9. Irish Council for Science (ICS 2004), *National Code of Practice for Managing Intellectual Property from Publicly Funded Research*
10. Irish Council for Science (ICS 2005), *Code of Practice for Managing Intellectual Property from Collaborative Research, Technology and Innovation*

1.2 Survey

1.2.1 Structure and Content of Questionnaire

The questions in the questionnaire are formulated over the guidelines and codes of practice extracted from the above listed primary publications to gather information on how and to what extent universities and other Public Research Organisations in the Member States have implemented new knowledge transfer policies.

The questionnaire has been discussed internally in the European Commission by the Knowledge Transfer Forum Expert Group as well as DG Research. Both have contributed with useful input to the design and content of the questionnaire, and the number of questions has been reduced, 1) in order to focus on questions one would expect the respondents to be able to answer, and 2) with due respect for the fact that too long questionnaires have a tendency to not be completed.

The questionnaire consists of 26 questions and 36 sub questions and covers the following five thematic areas:

1. Internal Policy for Management of Own Intellectual Property
2. External Policy for Management of Own Intellectual Property
3. Staff and Network
4. Collaborative and Contract Research
5. Development and Publication of Policies and Procedures

The design of the questionnaire is a mixture of a quantitative and a qualitative approach:

The qualitative element is important in order to be able to collect the unprompted opinions with no predetermined set of responses, where the participants are free to answer whichever way they choose. An obvious advantage is that the variety of responses is wider and more truly reflects the opinions of the respondents. This increases the likelihood of receiving unexpected and insightful suggestions, since it is impossible to predict the full range of opinions.

Quantitative questions take the form of multiple-choice questions in this survey. Obviously, there needs to be sufficient choices to cover the range of answers fully, but not so many that the distinction between them becomes blurred. With quantitative questions, it is easy to calculate percentages and to filter out useless or extreme answers that might occur in the qualitative format.

This survey includes quantitative questions that make it possible to map the implementation of new knowledge transfer policy in diagrams. Additionally, qualitative questions have been included to make room for greater freedom of expression. There is relatively little bias due to the open-ended format and the opportunity to qualify and clarify answers.
Report data was collected during the first half of 2009. Questionnaires were sent out July/August 2009 and data collected in August and September this year.

1.2.2 Respondents and Representivity

Primary umbrella organisations of universities and other Public Research Organisations in the Member States as well as potential national Knowledge Transfer Networks have been approached. Some of the umbrella organisations have answered the questionnaire on behalf of their members, while others have either collected information from the members or distributed the questionnaire to their members and asked the institutions to complete it themselves.
Umbrella organisations have been identified through European knowledge transfer-organisations, members of the Knowledge Transfer Forum Expert Group and DG Research. The questionnaire was sent out electronically by email directly to the contact persons or organisations.
The questionnaire has been sent out to 80-100 organisations and through knowledge transfer capacities in the individual Member States. Respondents are distributed across 16 umbrella organisations and eight universities and other Public Research Organisations and located in the following 16 Member States: Austria, Denmark, the Czech Republic, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, the Netherlands, Slovenia, Spain, Sweden and the United Kingdom. 16 out of 27 Member States correspond to a representation of 59 %.[210]
According to research by *ERAWATCH* (EU 2008c), the 27 Member States have an estimated 864 public universities and 1,850 other tertiary education institutions such as technical colleges. Research activities are concentrated in less than 500 of these institutes, most of which are public universities. The 2006 Proton Europe's annual survey on knowledge transfer activities included 325 institutions in four countries and ASTP's included 140 institutions in 22 countries. The present survey is based on input from respondents that cover 537 universities and other Public Research Organisations[211] distributed across 16 Member States.
To obtain validity, the number of covered universities and other Public Research Organisations is important, but even more important for the analysis is the fact that the Member States present not only represent the elite, but also broadly cover a sampling group of the EU27. The group of Member States represented through the respondents to this survey has been compared to three different recent segmentations according to 1) knowledge transfer metrics, 2) number of researchers and 3) innovation performance. The result is that the present survey is based on a sampling group that to a relatively high degree represents the diversity of EU27:
1) In the expert report *Metrics for Knowledge Transfer from Public Research Organisations in Europe* (EU 2009b), table 6.1 presents the number of Member States where knowledge transfer data were available for the fiscal year 2006: Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Latvia, the Netherlands, Portugal, Slovenia, Spain, Sweden and the United Kingdom.
The present survey includes more than 75 % of all Member States where knowledge transfer data were available in 2006. Furthermore, it includes three of the remaining Member States, where knowledge transfer data were not available in 2006.
In the Metrics report, table A4.1 on 'Universities – raw country level results, 2006' (EU 2009b) presents data from the following Member States: Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
If the results are categorised as: 'high performance', 'medium performance' and 'low performance', according to licences executed and to licence income earned, the present survey has several Member States represented in each of the three categories.
2) In the report *A more research-intensive and integrated European Research Area* (EU 2008a), table I.2.1 presents the total number of researchers (FTE) per thousand people in the labour force, 2000 – 2006 in all 27 Member States.
If the results from 2006 are categorised as 'high percentage', 'medium percentage' and 'low percentage', this survey matches more than 75 % of the Member States in the two first categories, and more than 10 % in the last.
3) In the *European Innovation Scoreboard 2008* (EU 2009c), 'Figure 2, a summary innovation index' lists Member States according to the following categories: 'Innovation leaders', 'Innovation followers', 'moderate innovators' and 'catching up countries'. Furthermore, 'Table 2, Innovation Growth Leaders' lists Member States according to the following categories: 'growth leaders', 'moderate growers' and 'slow growers'.
The present survey covers several Member States in each category of both figure 2 and table 2.

[210] Respondents from more Member States have announced that they will join the survey, but were not able to supply the data in due time for the report. The background material for this report will be updated as data is received. One respondent have only responded to very few questions. The questions not answered are categorised under the category "No answer".
[211] Large Public Research Organisations, regardless of their number of research institutes, count as one Public Research Organisation.

1.3 Analysis

1.3.1 The Relation between Respondents and Member States

The distribution of universities and other Public Research Organisations per Member State is relatively wide covering from less than 10 to more than 100. Since knowledge transfer policies develop in collaboration between Member State level and institutional level, they are assumed to be relatively homogeneous within the individual Member States. Percentages presented in the survey analysis are therefore calculated on the basis of Member States, where respondents have completed the questionnaire (16 = 100 %). No differentiation has been made between the amount of covered organisations/institutions, unless there has been a significant difference between answers from other Public Research Organisations than universities.

1.3.2 Source of Errors

A few umbrella organisations that did not have information at hand on members' knowledge transfer policy distributed the questionnaire and asked institutions to send in material on their own. It was not anticipated and it produced a potential source of error, since the questionnaires were directed at umbrella organisations and not individual universities and other Public Research Institutions. As a result, responses from individual units have been carefully examined to avoid possible misunderstandings of the questions.
A non-response analysis can help to reveal if there is a certain pattern in the group of respondents that did not answer the questionnaire. This survey though, does not encompass a non-response analysis because the known reasons for not participating are manifold: The organisation
a) did not receive the questionnaire because umbrella organisations could not be identified.
b) did not answer the questionnaire because the needed background knowledge was not at hand at the organisation and there was not enough time to collect information from member institutions.
c) did answer the questionnaire, but did not manage to do it in time.
d) did not respond to the invitation to take part in the survey.
No umbrella organisations for universities and other Public Research Organisations that cover knowledge transfer have refused to participate in the survey, but in several Member States, it has not been possible to identify umbrella organisations for universities and other Public Research Organisations covering knowledge transfer. The limitation therefore seems to lie in the survey model. When approaching umbrella organisations, it is possible to obtain a high volume of covered universities and other Public Research Organisations from Member States where umbrella organisations with a knowledge transfer focus exist. But, since some Member States do not have umbrella organisations for universities and other Public Research Organisations or do not have umbrella organisations for universities and other Public Research Organisations with insight into knowledge transfer policy at institutional level or the resources to collect the information, it is difficult to obtain a full or even distribution of covered universities and other Public Research Organisations; some data may also have relative validity.
Umbrella organisations have done their very best to support this survey. They have done it on a voluntary basis, at relatively short notice and on behalf of a vast amount of universities and other Public Research Organisations. For these reasons, it would not be feasible to demand that these organisations should produce documentation for compiled answers. To secure the highest possible validity, questions posed and multiple choice answer categories have been selected to appear as simple, clear, unambiguous and non-leading as possible. However, in a few instances, due to misunderstandings, extreme or misleading answers have been erased.

1.3.3 Level of Analysis

Based on the representation of Member States, the number of covered universities and other Public Research Organisations as well as the coverage of different segmentations, the present survey will be able to present trends and an overall estimation of the actual implementation of new knowledge transfer policy in the Member States. Due to the uncertainty related to the number of present Member States, the number of respondents and the validity of the aggregated answers, this survey is though not comprehensive enough to map the implementation in detail.
The analysis will therefore focus on the degree to which a certain percentage of Member States has implemented certain policies. Specific Member States will in general only be mentioned in relation to certain best practices that can be highlighted for inspirational purposes.

2 Analysis

2.1 Analysis Part 1, Internal Policy for Management of Own Intellectual Property

The first part focuses on Intellectual Property management and knowledge transfer policy within the institution.

2.1.1 Strategy and Mission

Public Research Organisations' mission statements focus not only on teaching and research, but also on components that strengthen knowledge transfer for the benefit of society. The Knowledge Transfer Office is often the focus point for this, facilitating the transfer of publicly funded discoveries into new products and services for public use and benefit.
One of the general pieces of advice in guidelines and codes of practice is that an Intellectual Property management strategy for universities and other Public Research Organisations should have a written policy on knowledge transfer and commercialisation of research that relates to and supports the overall mission of the institution. Such an approach could support a long-term strategy as well as include details on the actual implementation in the form of activities.
One of the first EU based texts on the matter, *Management of Intellectual Property in Publicly-Funded Research Organisations: Towards European Guidelines* (EU 2004a) states that "the corresponding policy should be to protect inventions and diligently develop inventions only when this would not be expected to occur by simply putting the results in the public domain. If we define innovation as the process that converts discoveries from research into the development of new products, the mission of the Knowledge Transfer Offices is to help Public Research Organisations to take a pro-active role in the innovation process."

Q: To what degree do universities and other Public Research Organisations that are part of your organisation have a long-term knowledge transfer and Intellectual Property management strategy and mission? **(Figure A)**
– Where was it debated?
– Which organisations or people contributed to developing it?
– What examples/models are used from which Member State?

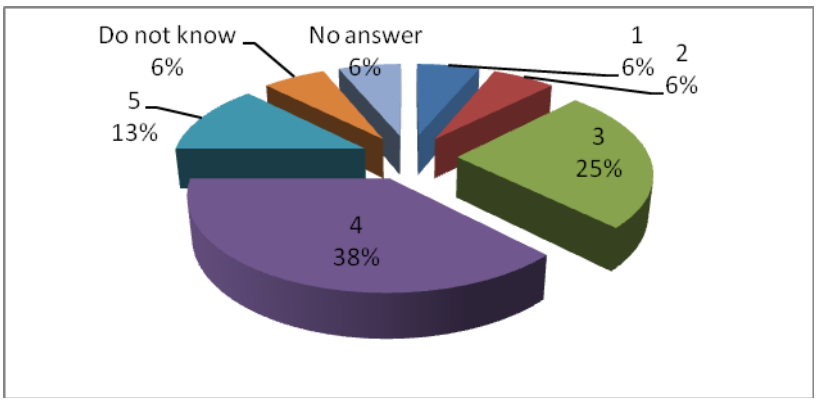


Figure A (1 is the lowest and 5 is the highest degree)

In around 50 % of the present Member States respondents gave explicit high scores, and 76 % rated the degree as medium to high, meaning that universities and other Public Research Organisations to a relatively substantial degree have implemented a long-term knowledge transfer and Intellectual Property management strategy and mission.
Some of the Member States with a longer knowledge transfer experience have a set of national codes of practice, backed up by knowledge transfer strategies at each institution, while others in the voice of a respondent: "organise yearly events where researchers and managers [Knowledge Transfer Managers] can meet and as a result develop mechanisms at national and institutional levels".
The debate on long-term knowledge transfer and Intellectual Property management strategy and mission seems to have been involving a long range of knowledge transfer players. Naturally, universities and other Public Research Organisations are mentioned in most of the responses, since they decide on overall institutional strategy processes (board members, senior staff etc.). Besides that, the debate involves knowledge transfer players such as national Knowledge Transfer Networks, relevant ministries, regional

authorities, local business development organisations, patent offices etc. National expert groups functioning as influential professional government advisory groups were also mentioned as contributors to the debate.

Q: To what degree have the universities and other Public Research Organisations that are part of your organisation developed a policy in line with their overall mission and strategy regarding identification, possible exploitation and protection of Intellectual Property? **(Figure B)**

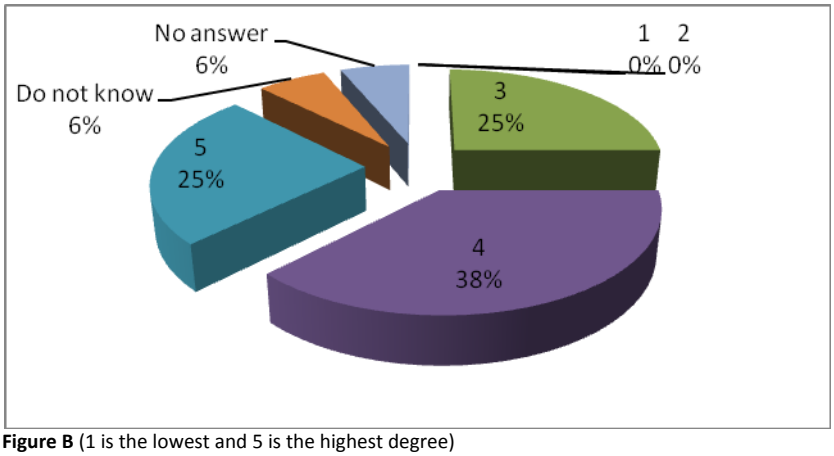


Figure B (1 is the lowest and 5 is the highest degree)

Where the long-term knowledge transfer and Intellectual Property management strategy and mission in general scored high, it was to be expected that the question on the degree to which the policy was in line with their overall mission and strategy regarding identification, possible exploitation and protection of Intellectual Property would follow the same pattern.
In 63 % of the present Member States respondents give the universities and other Public Research Organisations a high rating on policy implementation (regarding identification, possible exploitation and protection of Intellectual Property) in line with their overall mission and strategy, and more than 88 % rate it as medium and higher, it is clear that the great majority of the institutions in general seems to have their overall knowledge transfer policy in place, related to institution mission and strategy.
For Member States such as Germany, Italy and Sweden it should be noted that the knowledge transfer landscape differs from that of the other Member States: Germany differs because each of the 'länder' has a Ministry of Research & Education and therefore the Member State has more heterogenic conditions nationwise, while Italy and Sweden still have 'professor's privilege' (as opposed to institutional ownership) and researchers therefore do not have to disclose their findings to local Knowledge Transfer Offices, but act in more heterogeneous and more complex landscapes of knowledge transfer players.
Denmark, France, Germany, Sweden, Switzerland and the United States are mentioned as being inspirational models on general knowledge transfer policy.

2.1.2 Disclosure

A policy on disclosure of new ideas with commercial interest should provide clear rules for researchers and students.
Many universities and other Public Research Organisations have a formal procedure for the disclosure of new ideas/discoveries with commercial potential by researchers to the Knowledge Transfer Offices. In most Member States, it is mandatory for the researchers at universities and other Public Research Organisations to disclose patentable inventions to their university.
To facilitate this activity, there are easily accessible standard invention disclosure forms. These forms are available through several of the listed guidelines / codes of practice, e.g. *Auril Handbook of Intellectual Property Management* (AURIL 2000a). To make this process work as swiftly as possible, the *Commission Communication on Knowledge Transfer Improving Knowledge Transfer between Research Institutions and Industry in Europe* (EU 2007a) suggests that a clear system of information exchange be used to prevent unnecessary disturbance of the research activity.

Q: Are there general rules at the universities and other Public Research Organisations that are part of your organisation concerning disclosure of new ideas of commercial interest? **(Figure C)**
– What are the general rules?

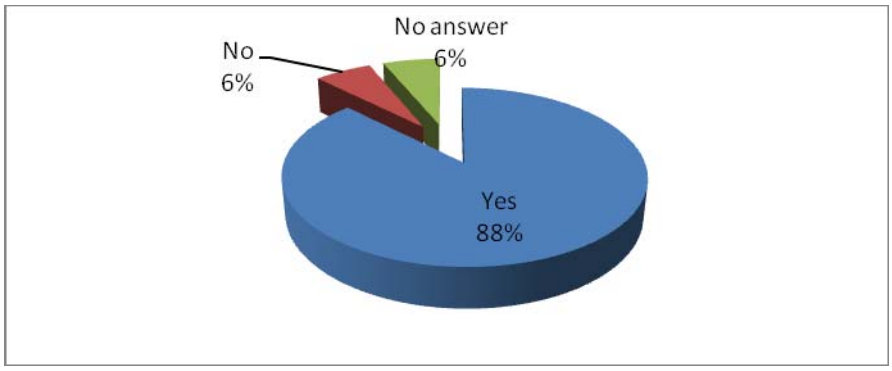


Figure C

In 88 % of the present Member States universities and other Public Research Organisations seem to have general rules concerning disclosure of new ideas of commercial interest.
Rules are set out in national codes of practice, Higher Education Acts as well as statutes of universities and other Public Research Organisations or the like. In some Member States, national rules are optional and the individual institutional development plan contains the specific rules concerning disclosure.
The general rule seems to be that researchers are obliged to disclose inventions with commercial potential to the Knowledge Transfer Office prior to publication. The Knowledge Transfer Office then has to decide whether they want to pursue the idea or not. Some name it a GO or NO GO policy, and others call it an INVEST or DIVEST policy. The general rule seems to be that if the university or other public research organisation decides for DIVEST/NO GO, then the initiative is given back to the inventor for him or herself to decide whether they want to exploit the idea independently of the institution.

Q: Are the general rules on disclosure of new ideas of commercial interest [Figure C] mandatory or optional to follow? **(Figure D)**

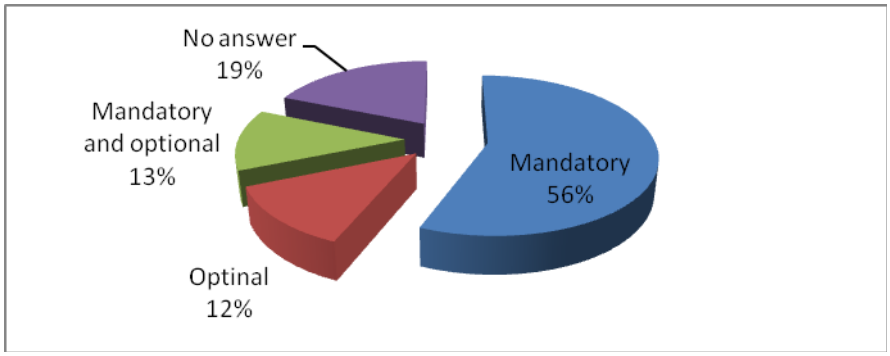


Figure D

In at least 56 % of the present Member States respondents (i.e. 69 % of the 81 % of the present Member States where respondents answer that they do have general rules) state that it is more or less mandatory to follow these rules and in some cases, funding agencies have made them binding obligations in the grant terms and conditions.
The respondents' description of the general rules can be categorised as these topics: 1) agreements, 2) contracts, 3) patents and 4) software. Member States with 'professor's privilege' influence the relation between 'mandatory' and 'optional', since the inventor does not have to disclose findings to a Knowledge Transfer Office at the university and other Public Research Organisations.

2.1.3 Ownership of Research Results

Q: Are there general rules at the universities and other Public Research Organisations that are part of your organisation concerning ownership of research results? **(Figure E)**
– What are the general rules?
– Are these generally similar or do individual organisations differ markedly in their policies?

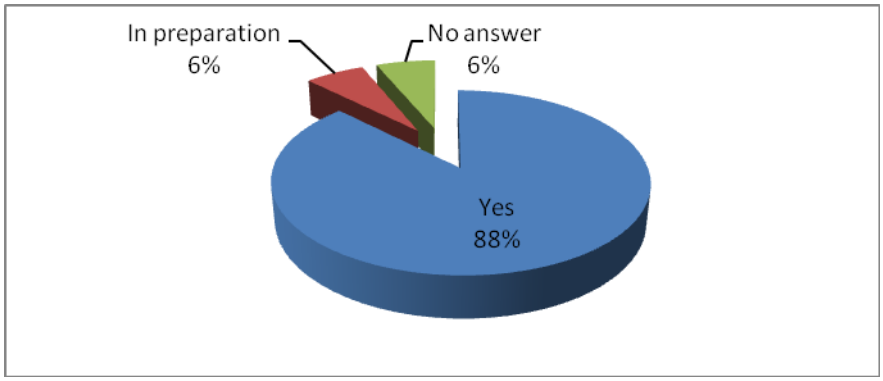


Figure E

A policy on the ownership of research results should provide clear rules for staff and students. The great majority of the Member States have general rules stating that ownership belongs to the university and other Public Research Organisations, here in the words of a respondent: “Intellectual Property arising from publicly funded research shall be owned by the Public Research Organisation.”
Even if the invention is owned by the university or other public research institution, several respondents point to the fact that the researchers have a right to appear as inventors. In one case, the university and other Public Research Organisations and the researchers even share the ownership of the research results.
The institutions waive their rights if they do not see a commercial potential in the inventor's idea. In Denmark, the Knowledge Transfer Office has two months to find out whether the institution wants to invest in the invention or waive the right and give it back to the inventor. A respondent formulated it this way: “Results of publicly founded research belong to the institution unless the institution waives its [right].”
Ownership is influenced by ‘professor’s privilege’, but in one of the two Member States where this is relevant, it is stressed that even if national law is applied, most university researchers give ownership to universities.
All but one of the present Member States seem to have general rules on ownership, while one is in the process of implementing this. Ownership of research results therefore seems to be dealt with in more or less the same way across most of the present Member States.

2.1.4 Publication and Dissemination

Universities and other Public Research Organisations could benefit from reserving the right to publish, because they are expected and often obliged to publish the results of research projects.

Q: Are there general rules at the universities and other Public Research Organisations that are part of your organisation concerning publication and dissemination policy? **(Figure F)**
– What are the general rules?
– How many have ‘Open access’ policies in place?
– At what level is it decided which publications are to be put into the public arena?

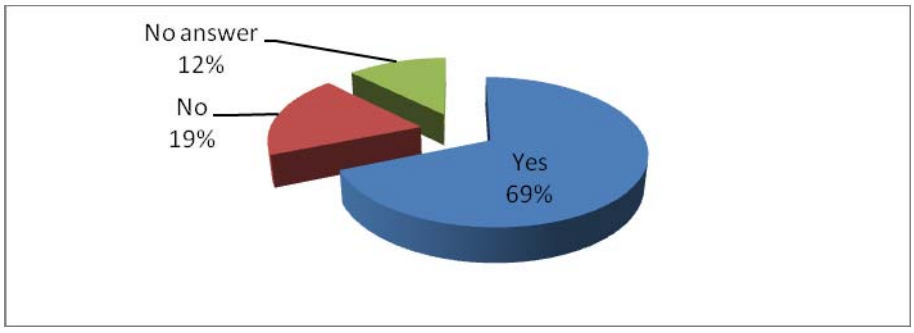


Figure F

In 69 % of the present Member States there seems to be general rules at universities and other Public Research Organisations on publication and dissemination policy. Among the respondents, there is a clear commitment towards the publication of new ideas and scientific findings, “Dissemination of knowledge is the highest priority for us,” as one respondent formulates it. Several respondents, however, emphasise that results must be protected before publication and that publication can be postponed in case of sensible Intellectual Property Rights. This can be quite extensive, for as one respondent exemplifies: “When there is a legitimate interest of the particular student or researcher (this could also be an economic interest) the

application of the theses can be suspended for no longer than five years "

In the survey material, two differences appear as regards publication and dissemination policy: One point made by one of the Public Research Organisations other than university is that neither contract reports nor technical reports are disseminated to the public at large, only technical publications, indicating that this category is not as common as it is for universities. Another point is that although there seems to be consensus regarding the formulation of general rules, it is not the same as to say that these rules decide how the game is to be played. A respondent states that it is becoming increasingly difficult to make the researchers hold back the publications until the protection is secured, and adds: "Now it is publish or perish."

Open access is not only a global trend in the world outside the universities and other Public Research Organisations, but seems to be turning ever more popular inside institutions working for open access to research data and publications. This is to ensure both that researchers can exchange information freely and that citizens have easy access to knowledge produced at universities and other Public Research Organisations. Open access extends the need for necessary policies and efficient mechanisms to identify inventions with commercial potential, so that inventors can publish immediately or protect their work before publication.

For some respondents, the open access discussions have just begun, while others are in the process of implementing open access policies and yet others experience open access as a requirement for certain funding programmes. Nevertheless, even if open access is appreciated generally, it is emphasised that "academic journals are considered very important because that's how the academic community works."

One of the questions asked was who decides whether publications are to be put into the public arena. For some respondents there does not seem to be any restrictions in this respect, and several respondents name individual researchers as the authority who should decide. Others mention that people at stakeholder and institutional level have to be consulted, which is natural as soon as a third party is involved. At the other end of the scale, we find Public Research Organisations other than universities where each publication is reviewed by management (advised by referees) to determine whether it contributes to the institution's mission and goals and the interests of the sector.

2.1.5 Conflict of Interest

The Commission Communication on Knowledge Transfer Improving KT between Research Institutions and Industry in Europe (EU 2007a) states that "research institutions should publish a clear conflict of interest policy for staff engaged in situations that could lead to their obligations to the research institution being influenced, in order to ensure that the research institution's scientific objectiveness and academic independence are not affected, and that the research institution does not engage in activities which conflict with its basic missions and values."
Two main points are made: On the one hand, it should be mandatory for the researchers to notify their Head of Department as well as the Knowledge Transfer Office when they are going to be engaged in projects or activities that could lead to a conflict of interest in the dilemma between their considerations of personal gain and their obligations to the research institution. On the other hand, it would be appropriate if the department/institution helped the researchers to be able to recognise a conflict of interest. In that way, conflicts of interests can be avoided or at least managed and resolved where they occur and hopefully at an early stage (EU 2007a).

Q: To what degree have the universities and other Public Research Organisations that are part of your organisation developed a policy on how to manage conflicts of interest between university/public research organisation, department and inventors/research staff? **(Figure G)**

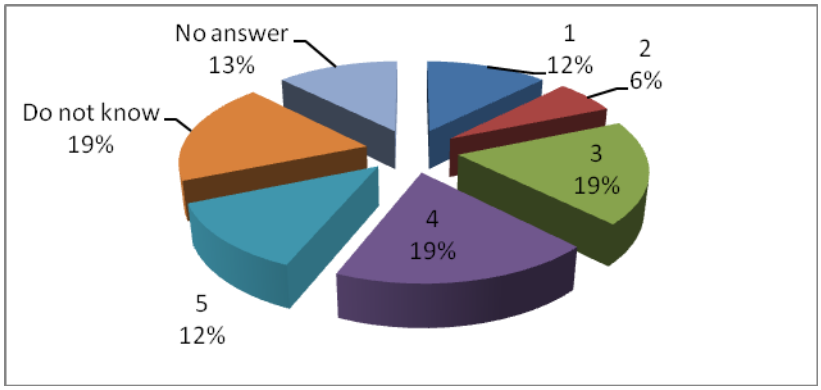


Figure G (1 is the lowest and 5 is the highest degree).

In only 31 % of the present Member States respondents feel that universities and other Public Research Organisations to a high degree have implemented a knowledge transfer policy regarding Conflict of Interest, while in 18 % of the present Member States the respondents feel that universities and other Public Research Organisations to a low degree have implemented a knowledge transfer policy regarding Conflict of Interest.
The result is rather striking since the research institutions' scientific objectiveness and academic independence are at stake, as well as the general reputation of the institutions.
In Denmark, some universities and other Public Research Organisations have a written policy of Conflict of Interest. In an attempt to inspire those that do not have, examples on Conflict of Interest policies from international and national universities and other Public Research Organisations, are displayed at the homepage of the national technology transfer network for inspiration.

2.1.6 Incentives and Split of Returns

Management of Intellectual Property in Publicly-Funded Research Organisations: Towards European Guidelines (EU 2004a) as well as the *Commission Communication on Knowledge Transfer Improving Knowledge Transfer between Research Institutions and Industry in Europe* (EU 2007a) state that it is important that appropriate incentives are put into place for the scientists to reward the additional effort they may be required to make in addition to their teaching and research duties. It is also vital that their academic reputations are enhanced by traditional publishing activities.

Q: Are there incentives at the universities and other Public Research Organisations that are part of your organisation for commercialising Intellectual Property? **(Figure H)**
– What are the incentives?
– For institutions/institutes/inventors?
– Are they fairly similar or are there differences across different types of universities or different regions?

Q: How were a) the licensing policies, b) the split of returns from knowledge transfer revenues between institution, department and inventor developed by universities and other Public Research Organisations that are part of your organisation?

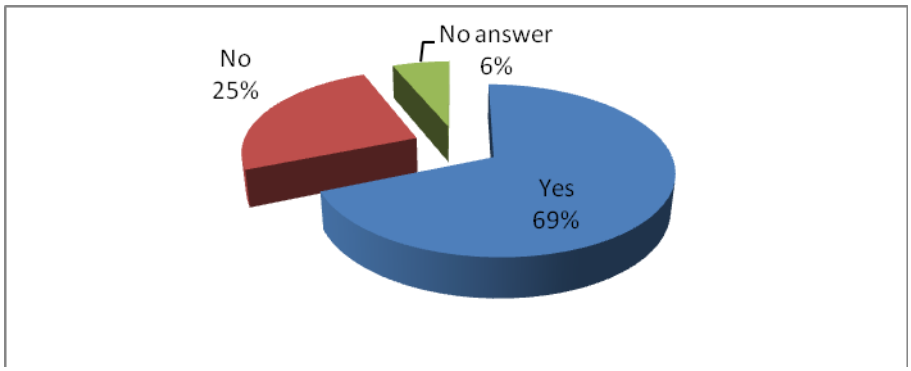


Figure H

In almost 70 % of the present Member States there seems to be incentives at the universities and other Public Research Organisations for commercialising Intellectual Property.

On the one hand, universities and other Public Research Organisations receive funding through funding schemes for development and operation of knowledge transfer by refund of university patenting costs, public grants for invention disclosures or for collaboration projects. This funding is explicitly knowledge transfer related and used in the commercialisation process. On the other hand, both departments and institutions often receive a part of the revenue. The reason for this is to be found in universities as complex and richly faceted units. Since only some areas at an institute/department at a university and other Public Research Organisations are successful in exploiting Intellectual Property, the *Managing Intellectual Property – A Guide to Strategic Decision Making in Universities* (AURIL 2002b) states the importance of distributing income within the institution to avoid fragmentation.

Many universities and other Public Research Organisations have adopted a formula-based approach to the allocation of financial returns from licensing revenues, e.g. 50-25-25 or 33-33-33 for the inventor, department and institution, respectively – or a guaranty of a minimum of the net income ranging from 20 to 23 %.[212] In more than 60 % of the present Member States respondents mention revenue sharing in one way or another, but with a variation in benefit sharing schemes.

For inventors in Finland, patents etc. may be taken into account when salary levels are determined, and in Slovenia, there is even a small reimbursement at invention disclosure as well as additional valuation points at the academic habilitation process.

The Knowledge Transfer Offices are not mentioned when it comes to economic incentives, neither as a department nor concerning individual Knowledge Transfer Managers, but as one of the respondents comments, the Knowledge Transfer Offices have "moral incentives"…

When asked if the development of split returns on knowledge transfer revenues was debated at the level of organisation, practitioner or government, there was an overwhelming unity in the perception that the organisations were the main drivers.[213] In only 12 % of the present Member States respondents mentioned practitioners as taking part in the debate, and in only 19 % government participation is mentioned.

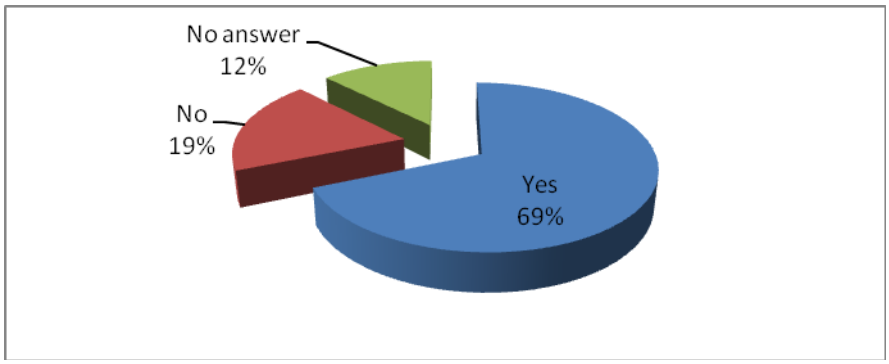
2.2 Analysis Part 2, External Policy for Management of Own Intellectual Property

This part focuses on knowledge transfer policy and Intellectual Property management by focusing more specifically on the active transfer and exploitation.

2.2.1 Engagement with Third Parties

While universities and other Public Research Organisations are obliged to protect and to exploit their own Intellectual Property, it can be helpful to face that third party also have a legitimate interest in Intellectual Property Rights and expedient to find a proper balance. This course of action seems to be pursued by the majority of the respondents.

Q: Are there general rules at the universities and other Public Research Organisations that are part of your organisation concerning engagement with third parties? **(Figure I)**
– What are the general rules?
– Is national guidance in place?
– Is engagement an expectation of academic staff?



[212] Concerning spin offs, the researchers involved often receive a share of the equity. First of all to acknowledge that they have to spend a considerable amount of time on the spin off in the start up phase, and second to ensure that the researchers keep a continuing interest in supporting the development of the spin off.

[213] Although the question is relatively clear, there may be respondents marking 'organisations' while meaning individual institutions. There has, however, only been one clear example of this misunderstanding.

Figure I

Respondents from 69 % of the present Member States claimed that there are general rules concerning engagement with third parties.[214]
The general rules are described in relation to laws and regulations concerning the position of the university or other Public Research Organisations as publicly funded institutions, which is why state aid rules are rated high. However, Non-Disclosure Agreements and national Model Agreements are also mentioned.
Several of the respondents regard general rules in the perspective of the relationship between financing and ownership of Intellectual Property. The standard comment here is that researchers' results belong to third parties when they cover the whole cost of the project, if not, ownership is shared.
When respondents comment on code of conduct, they refer to three different levels of guidelines: The most general is Customer Relation Management the more specific on a general level is the code of conduct agreements, e.g. *Contacts, Contracts and Codices* (DI 2004) in Denmark, a code of conduct agreed upon by the Danish Rector's Conference and the industry organisation DI. Finally, the national Model Agreements such as the Lambert Agreements are very specific.
In around 50 % of the present Member States respondents think that national guidance is in place, but Germany, for instance, has numerous regulations at 'länder' level even though national 'Musterverinbarungen' are in place, which makes national guidance difficult.[215]
Regarding the engagement of the academic staff, several respondents hold that researchers are urged to support engagements with third parties, but that it is not explicitly a part of the employment terms and conditions. One respondent states that it is "desirable, but not an expectation […] but can be alluded to in the promotion policies of the individual public research organisation."

2.2.2 Intellectual Property Portals

For Intellectual Property to be accessible, it needs to be attainable. Internet portals seem to provide a new and easy accessible platform for presenting information on local or national Intellectual Property portfolios to potential licensees and buyers.

Q: To what degree have universities and other Public Research Organisations that are part of your organisation made Intellectual Property easily accessible, for example on the internet? **(Figure J)**
– Are there local portals (at the institutions), regional portals or a central portal for all the universities?
– Do universities and other Public Research Organisations that are part of your organisation use cross-national non-profit portals?
– Do universities and other Public Research Organisations that are part of your organisation use cross-national commercial portals?

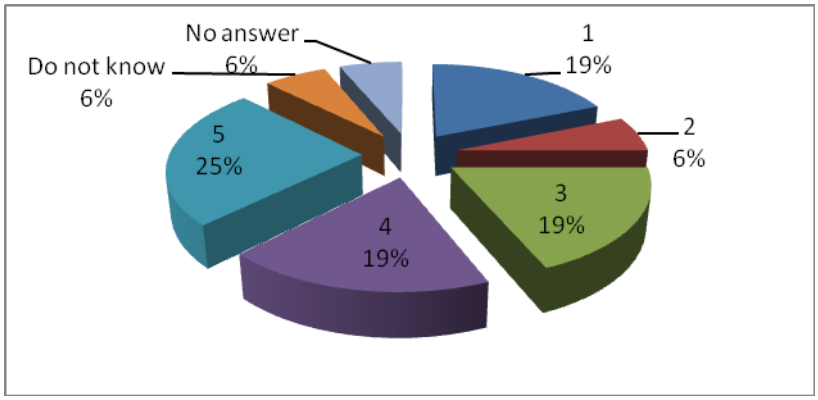


Figure J (1 is the lowest and 5 is the highest degree)

There is no tendency in the responses that indicates that the use of the internet, as a way to present information on Intellectual Property, is only applied at a moderate level.
Most of the institutions seem to have local portals in relation to their university webpage. In only 44 % of the present Member States respondents rate the implementation of such activities high. One should therefore expect a relatively low output regarding access to national portals. However, apparently there are national portals in a number of Member States: In Germany, Technologie Allianz www.technologieallianz.de facilitates database access to Intellectual Property generated at universities and other Public Research

[214] One respondent answers that there were general rules, but that they are not codified. This answer was interpreted as a "yes".
[215] See Annex E.

Organisations in Germany. The Irish Expertise Ireland www.expertiseireland.com links to experts, funding sources and Intellectual Property from universities and other Public Research Organisations in Ireland. The French France Transfert Technologies www.f2t.fr gives access to Intellectual Property from universities and other Public Research Organisations in France. In Denmark, the Danish patent exchange www.patentexchange.dk presents the national Intellectual Property portfolio from the universities and other Public Research Organisations.
Broader setups beyond universities and other Public Research Organisations are developed by the national Patent and Trademark Offices, e.g. in Slovenia, Spain and Denmark. EU initiatives such as the Enterprise Europe Network, previously known as Innovation Relay Centres are also mentioned.[216]
One interpretation of the rather moderate rating could be that it is due to the fact that the universities and other Public Research Organisations do not prioritise being present at national or other platforms than the one offered by their own institution, even though they have the possibility of doing so.

2.2.3 Intellectual Property Pools

Small and medium sized universities and Public Research Organisations often have a limited Intellectual Property portfolio. Some of them collaborate on setting up so-called Intellectual Property Pools including Intellectual Property from more than one research organisation.
An Intellectual Property Pool can help create a critical mass of Intellectual Property, which is necessary for an innovative idea to become attractive to the private sector. It is a way to attract attention to the universities and other Public Research Organisations involved.
Creating an Intellectual Property Pool around an innovative idea or a technological area can, on the one hand, offer the research party an advantage in the negotiation phase and, on the other hand, offer the interested party a better overview.
Besides creating better links between industry and universities and other Public Research Organisations involved, it can also lead to the creation of stronger relationships between Knowledge Transfer Offices and provide a basis for further inter-institutional collaboration.

Q: To what degree have the universities and other Public Research Organisations that are part of your organisation set up Intellectual Property Pools in the sense that various universities under the umbrella organisation cross-license their intellectual assets or otherwise throw the results of collaborative research in a joint pool? **(Figure K)**
– For what purpose have these pools been established?
1) For profit oriented purposes?
2) To enable access by creating a strong patent portfolio with the purpose of granting non-exclusive licenses?
3) Other considerations?

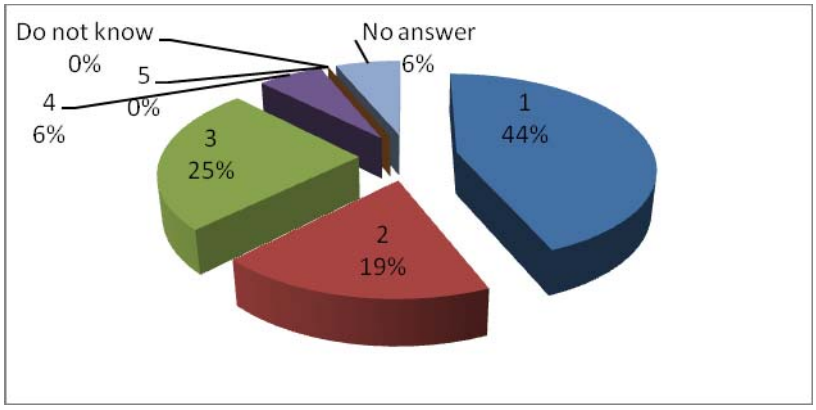


Figure K (1 is the lowest and 5 is the highest degree).

There is a clear indication that respondents do not value Intellectual Property Pools as a useful tool for making an innovative idea attractive to the private sector. Almost in half of the present Member States respondents rate the implementation of the Intellectual Property Pools as low as possible, and only in 6 % of the present Member States respondents give a score higher than medium. Looking at the reasons for not having established Intellectual Property Pools, most respondents point out that they have not (yet) established any Intellectual Property Pools, some would rather work on a case to case basis in collaborative research agreements and finally some set up national Intellectual Property Portals instead.

[216] The answer is broader than the question asked, because it includes international initiatives. The answer is, however, relevant although it is impossible to say to what degree the other respondents are aware of and use platforms like the one mentioned.

Only a few respondents comment on experience with the use of Intellectual Property Pools, mainly leaving the impression of the lack of success in doing so. When asked to point out the purpose of establishing pools, profit is the main motive in 26 % of the presented Member States followed by “the wish to strengthen the Intellectual Property portfolio with the purpose of granting non-exclusive license” with 12 %. When respondents point out a motivation factor on their own, they mention network creation and the wish to obtain critical mass.
Even though the interest in the field is rather low and success stories are rather hard to find, the networking opportunity and the obtaining of critical mass are fully in line with the potential of the Intellectual Property Pools, and support the idea of joining efforts where universities and other Public Research Organisations do not have the scope and volume of exploitable research results to justify the establishment of a Knowledge Transfer Office. These research institutions will probably not get the same attention joining an Intellectual Property Portal.

2.2.4 Spin-Offs

Universities and other Public Research Organisations may benefit from a policy for the creation of spin-offs, allowing and encouraging the public research organisation's staff to engage in the creation of spin-offs where appropriate, and clarifying long-term relations between spin-offs and the public research organisation.

Q: Do the universities and other Public Research Organisations that are part of your organisation have a policy for the creation of spin-offs? **(Figure L)**
– If yes, does it allow the staff to engage in the creation of spin-offs?
– If yes, does it clarify long-term relations between spin-offs and the institution?

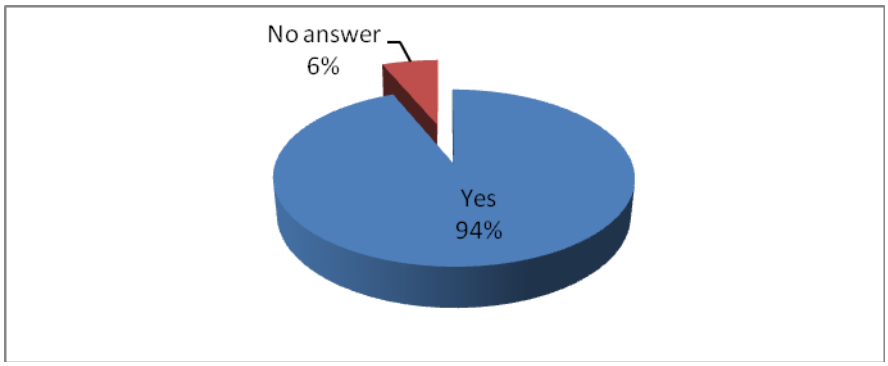


Figure L

In at least 94 % of the present Member States respondents have a policy on the creation of spin-offs, although some respondents reply that the policy may vary in explicitness. A classic setup corresponding to more respondents is that the spin-off policy is a part of the Intellectual Property policy. A spin-off is created and a researcher move over from the university and other Public Research Organisations. The spin-off is formed around the commercialisation of the Intellectual Property. Typically, the institution only takes a relatively small percentage of the equity and is therefore ‘diluted’ fairly early in the spin-off’s development phase. The universities and other Public Research Organisations normally do not intend to run the spin-off, but rather to provide a framework in which they can develop.
Different actions are taken to promote the foundation of spin-offs. Austria's Universities of Applied Sciences are involved in so-called A+B start-up centres (e.g. tech2B in Upper Austria) developed by the Austrian Research Promotion Agency (FFG). In Denmark, universities have been allowed to organise technology transfer activities in the form of subsidiary companies since 2005. One of those is Science Ventures Denmark, established by the University of Southern Denmark. As the first commercial company founded by a Danish university, it invests in young companies with the aim of helping inventions from universities and other Public Research Organisations mature to a level where they can either be sold to established industries, or form the basis for companies' own business areas.
In Lithuania, some universities have science parks and business incubators, but in 2009, the universities and other Public Research Organisations have initiated an impressive project in creating five science valleys.
On the question regarding whether staff is allowed to engage in the creation of spin-offs, the respondents seem to agree that researchers can engage themselves in the creation of the spin-off. However, several respondents point out that because of conflicts of interest, researchers and professors will have to resign or go on leave while working for the spin-off. Even so, that does not necessarily end the conflict of interest, because an institution appointed director and former professor would be in a dilemma between the interests of the shareholders and the university.

As regards long-term relations between spin-offs and the institution, the formal rules seem to define the relations, but the sale of shares etc. is often up to the universities and other Public Research Organisations. A Public Research Organisation other than university presents an example of such an individual exit strategy, where spin-offs, based on what is considered non core technologies to the research institution, have to be diverted within five years.

2.2.5 To Promote and to Monitor

Q: Do universities and other Public Research Organisations that are part of your organisation monitor Intellectual Property protection and knowledge transfer activities and promote them? **(Figure M)**
– If yes, how do they promote them?
– Has there been any national level evaluation?
– Are there any national level marketing and promotion tools?

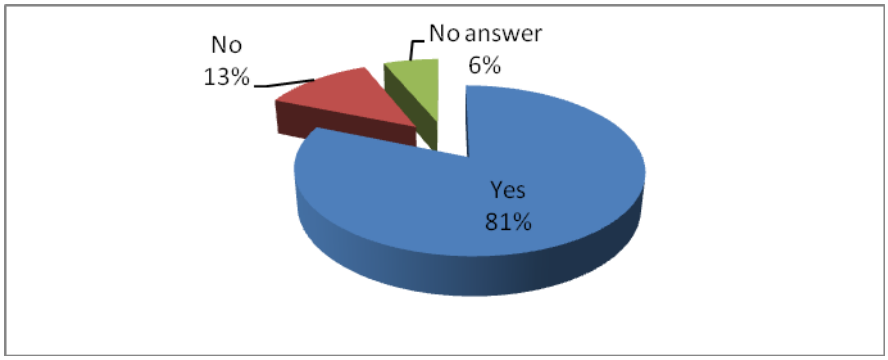


Figure M

In 81 % of the present Member States respondents monitor Intellectual Property protection and knowledge transfer activities and promote them.
The respondents describe three levels of promotional efforts:
1) The first level is internal campaigns at the university and other Public Research Organisations, formulated with the target of encouraging researchers to get involved in knowledge transfer. Respondents not only refer to poster campaigns, but also add training programmes and career progression as parts of the campaign. And just as career progression is now becoming an argument for making the individual researcher engage in knowledge transfer, commercialisation events seem to become more visible and broadly accepted at the individual institutions. One respondent emphasises that companies are now invited to awareness events at the research institution.
2) The second level is external campaigns and outreach: a) Events for social interaction cover conferences, conventions, marketplaces etc. where people meet face to face; b) distribution of PR material for knowledge transfer in the form of books, 'portfolio wrap-ups', calendars etc. and c) a virtual package related to the internet, covering direct mail campaigns, technology offers at institution websites, national websites or national virtual patent exchanges etc.[217]
3) The third level is quite different. Universities and other Public Research Organisations produce data for either governmental evaluation programmes or national/international surveys in order to benchmark themselves. The surveys are run by government agencies, national Knowledge Transfer Networks or international Knowledge Transfer Organisations.

Monitoring, evaluating and promoting the activities can strengthen the effectiveness of the management of knowledge transfer activities in order to promote their exploitation. Performance indicators can be a convincing argument because they document that universities and other Public Research Organisations are able to manage Intellectual Property effectively. If not, the indicators can also be helpful in identifying problems as well as opportunities not taken. Finally, the indicators can be a way to rethink budgets as well as strategies and measure whether the actual activities seem to be in line with more general policies.
More Member States are joining national and European surveys. Data on knowledge transfer is available for 13 individual Member States[218], and Proton Europe and ASTP, the two large European Knowledge Transfer Organisations, collect data from more than 20 Member States. Although umbrella organisations to a large degree do not know what surveys their member institutions join, cf. question 14, the tendency is that more

[217] Examples on national Intellectual Property portals in 2.2.2.
[218] Expert Group on KT Metrics (2009b): *Metrics for Knowledge Transfer from Public Research Organisations in Europe*, table A4.1 on 'Universities – raw country level results, 2009'.

Knowledge Transfer Offices report data to national and European surveys. This trend is supported along two different strings. On the one hand, several Member States are beginning to attach funding requirements to survey participation, so that in the future, universities and other Public Research Organisations to a higher degree than now will be obliged to report performance data to national or international knowledge transfer surveys. On the other hand, the Commission Expert Group on KT Metrics has recommended a European survey model to harmonise European surveys.

The strategy of the Expert Group on KT Metrics was to identify some core indicators, and agree on a harmonised set of definitions and formulated questions. The purpose was to improve the possibility for individual universities and other Public Research Organisations and Member States to monitor and compare their achievements in this field against themselves and each other on a shared basis, in order to identify trends and to support work on improvements if needed. The Expert Group on KT Metrics has come up with seven core performance indicators and six supplementary indicators:[219]

Performance indicators:

- Research agreements
- Invention disclosures
- Patent applications
- Patent grants
- Licences executed
- License income earned
- Spin-offs established

Supplementary indicators:

- Knowledge transfer involving SMEs
- Knowledge transfer involving domestic firms
- Knowledge transfer involving the research organisation's own region
- Exclusive licenses
- Share of valid patent portfolio that has ever been licensed
- Patent share of license income
- Technology areas for patenting

2.3 Analysis Part 3, Staff and Network

This part will focus on principles for a knowledge transfer policy and Intellectual Property management by focusing more specifically on staff and network.

2.3.1 Training Staff and Researchers

Training in basic skills regarding Intellectual Property and knowledge transfer helps to raise awareness for research staff as well as researchers on doing the business properly.
Basic topics could include the process of identifying and protecting Intellectual Property, understanding patentability and the patenting process etc.
Training may be provided by professional international providers like Proton Europe, ASTP, LES etc., but can also be organised based on collaboration with local knowledge transfer environments.
On a European level the CERT-TTT-M initiative aim to create a pan European knowledge transfer program on certifying Knowledge Transfer Managers.[220]

Q: To what degree do the universities and other Public Research Organisations that are part of your organisation train staff and researchers on Intellectual Property awareness and basic skills in Intellectual Property and knowledge transfer? **(Figure N)**
– Who initiates the training?
– Who finances the training?

[219] Definitions and formulated questions can be found in the report Expert Group on KT Metrics (2009b): *Metrics for Knowledge Transfer from Public Research Organisations in Europe*.
[220] www.ttt-manager.eu

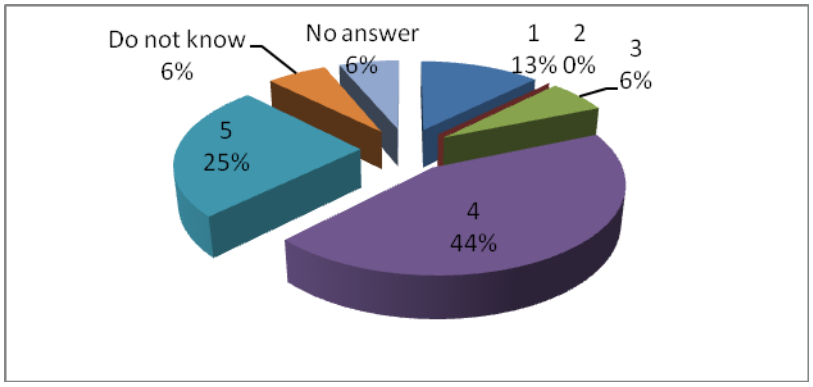


Figure N (1 is the lowest and 5 is the highest degree).

Training of Knowledge Transfer Managers and researchers is considered important, and in almost 70 % of the present Member States respondents feel that training in awareness and basic skills to a high degree has been integrated into the knowledge transfer daily practice. The question has a built-in ambivalence, since it addresses both research staff and researchers. There is no knowledge of Member States that train researchers but not research staff in Intellectual Property and knowledge transfer. So, the 70 % definitely relate to the Knowledge Transfer Managers.
More Member States and international organisations like Proton Europe and ASTP do, however, also train researchers in Intellectual Property awareness and basic skills in Intellectual Property and knowledge transfer. Some Member States have specific researcher orientated activities, e.g. introduction courses on Intellectual Property and commercialisation, PhD courses on commercialisation taught by the national Patent and Trademark Offices as well as entrepreneurship training programmes.
When asked who initiates the training, the universities and other Public Research Organisations seem to be the absolute main drivers. In the Member States where the institutions do not initiate training alone, it is mainly organisations that assist. Here, it is presumed that these organisations are typically national Knowledge Transfer Networks, umbrella organisations etc.
When it comes to financing, the universities and other Public Research Organisations also seem to be the main drivers, but with a range of contributors. Both organisations and national authorities are mentioned as important contributors, and in some Member States, the national authorities support training activities through funding of national Knowledge Transfer Network activities.

2.3.2 Knowledge Transfer Competences

In order to perform knowledge transfer, universities and other Public Research Organisations have to have access to professional resources. The most typical setup is in the form of Technology Transfer Offices / Knowledge Transfer Offices, for either individual institutions or clusters thereof.
The Irish *National Code of Practice for Managing Intellectual Property from Publicly Funded Research* (ICS 2004) identifies two types of Knowledge Transfer Offices, where the first functions as a service organisation, and the second also acts as a strategic exploitation office authorised to generate, protect and enforce Intellectual Property Rights.
Most guidelines and codes of practice offer lists of specific responsibilities and priorities for Knowledge Transfer Offices. In the *Commission Communication on Knowledge Transfer Improving KT between Research Institutions and Industry in Europe* (EU 2007a) there is a standard set of characteristics for a Knowledge Transfer Office:

> "Is staffed by professional knowledge transfer experts, including – or with access to – legal, financial and Intellectual Property 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 Intellectual Property 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."

Q: Do the universities and other Public Research Organisations that are part of your organisation have their own knowledge transfer unit or do they have access to a professional knowledge transfer service to advice on legal, financial and commercial perspectives on knowledge transfer? **(Figure O)**

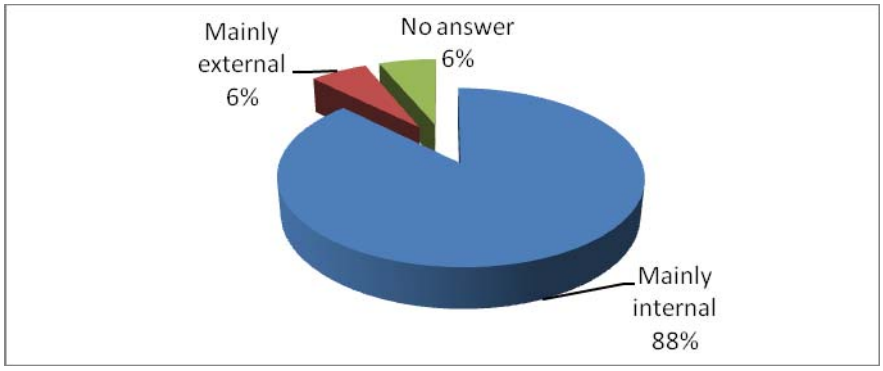


Figure O

In at least 93 % of the present Member States universities and other Public Research Organisations seem to have access to a minimum service to fulfil its legal obligations. This service is performed through in-house facilities in the form of Technology Transfer Offices or Knowledge Transfer Offices offering comprehensive services. The offices are normally located at the individual institution, but some have regional offices and national associations as well to assist in offering services in this regard. When it comes to Member States with 'professor's privilege', the field of knowledge transfer services is more complex regarding both numbers of players and interrelations. Nevertheless, in addition, all offices, also the comprehensive ones, rely on a wide network of their own partners for business development, licensing etc.
Since the in-house facility is so common it is, however, striking to see that the level of evaluation is relatively low.
The most common way of monitoring a Knowledge Transfer Office is to measure its output. This is done by the national knowledge transfer surveys in e.g. Denmark, Italy, Spain and the United Kingdom, and the international knowledge transfer surveys conducted by Proton Europe and ASTP. One might argue that these surveys do not include quality control and evaluation, but focus on measurable quantitative outputs instead of processes and procedures.

– Have these arrangements been reviewed to see which is most successful? If so, which organisation initiated the review? **(Figure P)**

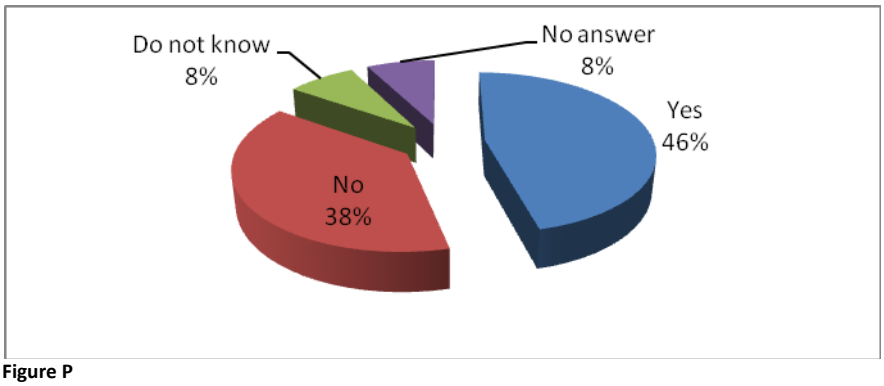


Figure P

In 38 % of the present Member States respondents declare that there is no review of their Knowledge Transfer Office and in 46 % the respondents declare that they have reviews.
The reviews described by the respondents are conducted at three different levels:
1) Metrics: International and national metrics as a benchmark tool
2) External quality control: Review with the external quality assurance organisation
3) Internal quality control: Internal monitoring of efficiency and effectiveness

There seems to be a wide range of initiatives at international, national, regional and internal levels with the aim of clarifying the efficiency of knowledge transfer. However, four factors make it difficult to aim at a recommendable type that fits all. First of all, the field is relatively young and experts still need to experiment with different structures and models, secondly, the knowledge transfer communities in the Member States vary quite substantially in length of experience, amount of funding etc. Thirdly, the universities and other Public Research Organisations in Europe are very diverse, also in size, so that it is unlikely that one particular type of arrangement can be recommended for them all. Finally, one can add the span between the Knowledge Transfer Office as service organisation and strategic exploitation office mentioned in the beginning of this chapter.
As an example of structural changes, France is now introducing 14 regional structures with emerging regional organisations.

2.3.3 Practitioner's Knowledge Transfer Network

In some Member States, there are practitioners' Knowledge Transfer Networks. They typically offer training to develop knowledge transfer competences among administrative staff and facilitate knowledge exchange, present news and events on the global knowledge transfer stage as well as disseminate relevant information from national agencies, the EU Commission etc.
Individual Knowledge Transfer Offices can become members of Knowledge Transfer Networks in their respective countries, but many Knowledge Transfer Offices also participate, as members or non members, in activities facilitated by international Knowledge Transfer Organisations like Proton Europe, ASTP, AUTM, LES etc., and thereby become members of the international knowledge transfer community. Some are individual members, some are institutional members and others are members of national Knowledge Transfer Networks with a seat on the board of an international Knowledge Transfer Organisation, e.g. Proton Europe. The number of memberships of the international organisations is considerable, and alone Proton Europe's memberships include 220 Knowledge Transfer Offices and a network of 10 national partner associations comprising over 500 Knowledge Transfer Offices.

Q: Is there a knowledge transfer practitioners' network in your country with which you work on matters of policy and process? **(Figure Q)**

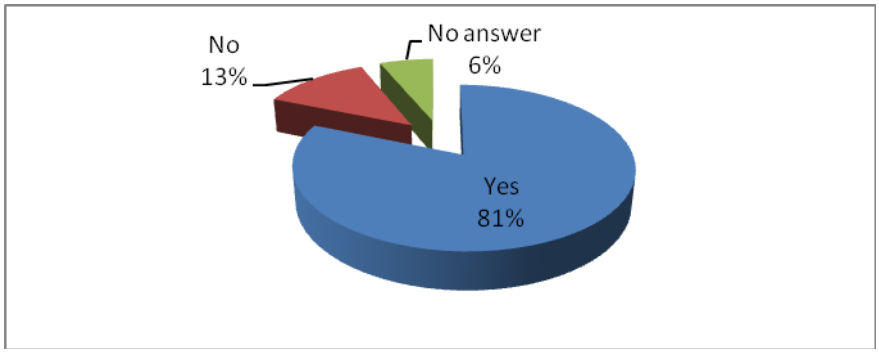


Figure Q

This survey has only asked about national practitioners' Knowledge Transfer Network and not European or other international Knowledge Transfer Networks. With this restraint in mind, it is impressive that there seem to be Knowledge Transfer Networks for practitioners in 81 % of the present Member States. An explanation for the relatively high coverage could be that networks are defined broadly covering small, large as well as more specialised networks.
Some of the minor networks are described as either informal[221] or at the level of an Research & Development committee within the organisation. This group, however, only accounts for around 6 of the 81 % related to a Knowledge Transfer Network.
Some national Knowledge Transfer Networks are also major players in the global knowledge transfer community. AURIL in the United Kingdom, Réseau C.U.R.I.E. in France and RedOTRI in Spain not only act within their own borders as networks and influential interest groups, but also play an important role in relation to the international Knowledge Transfer Organisations, interest groups and the EU Commission.
Some Knowledge Transfer Networks enter into partnerships for the benefit of their members. Technologie Allianz in Germany have partnerships with BDI e.V. (Federation of German Industries), DQS GmbH (German company for certification of management systems) and SIGNO (government funding scheme for universities,

[221] Did not count as a Knowledge Transfer Network in the survey.

businesses and private inventors), besides partnerships with the two Knowledge Transfer Networks Réseau C.U.R.I.E. and Proton Europe.
The Knowledge Transfer Networks also differ in terms of funding. Some have substantial subsidies from regional or national authorities, while others have to base their level of activity on member fees. Therefore, there is a wide span in number and the art of activities and projects they facilitate or produce. The most active national Knowledge Transfer Networks set up several courses, conferences, experience groups, workshops etc. every month.
Some of the more advanced national Knowledge Transfer Networks have an elaborate strategic political profile as well as an internet profile for outreach purposes. On the level of policymaking, they collaborate with the central administration in form of government agencies and other social and economic bodies to strengthen the relations between universities and companies. As regards outreach, some networks run extensive bilingual websites. The Danish Knowledge Transfer Network's website includes a news portal with daily updates, newsletter service, knowledge transfer event calendar, list of Knowledge Transfer Offices, personal profiles of knowledge transfer personnel, access to guidelines, Acts, legal documents, Model Agreements and a national virtual patent exchange. In line with AUTM's better world project, new success stories are disseminated in a popular format once a month at the website.

2.4 Analysis Part 4, Collaborative and Contract Research

This section covers research activities conducted or funded jointly by a university and other Public Research Organisations and the private sector in the form of collaborative research (where all parties carry out Research & Development tasks) and contract research (where Research & Development is contracted out to a public research organisation by a private company).

2.4.1 Interests and Objectives

In the *Commission Recommendation on the Management of Intellectual Property in Knowledge Transfer Activities and Code of Practice for Universities and other Public Research Organisations* (EU 2008b), it is stated that "the rules governing collaborative and contract research activities should be compatible with the mission of each party. They should take into account the level of private funding and be in accordance with the objectives of the research activities, in particular to maximise the commercial and socio-economic impact of the research, to support the public research organisation's objective to attract private research funding, to maintain an Intellectual Property position that allows further academic and collaborative research, and avoid impeding the dissemination of the R&D results".
Definitions of contract research and collaborative research are manifold, which is why the definitions displayed in the *Recommendation* (EU 2008b) will be displayed here:

"'Contract research" (cf. § 3.2.1 of the Framework on State Aid18) means research contracted out to a public research organisation ("agent") by a private-sector entity ("principal"), and whose costs are fully paid by the latter and where the principal carries the risk of failure. In this case the terms and conditions are usually specified by the principal.[222]

"Collaborative research" (cf. § 3.2.2 of the Framework) is when at least two partners participate in the design of the project, contribute to its implementation, and share the risk and the output of the project. In particular, should there be any financial contribution from the public research organisation, this would be considered as a collaborative research situation and not as "contract research" in the context of the Code of Practice." (EU 2008b)

In the *Initiative for a Charter for the Management of Intellectual Property from Public Research Institutions and Universities* (EU 2007c), six good pieces of advice are presented concerning the split between responsibilities and roles in relation to contract research and collaborative research:

Contract research:
"• The partners will reach a written agreement about the status of the owner, about publication and about the rights of use of the research results.

[222] The *Recommendation* (EU 2008b) also state that parties are free to "negotiate different agreements, concerning ownership of (and/or possibly user rights to) the Foreground", e.g. the Recommendation use an example from contract research, "where some of the Foreground can be kept by the university and other public research organisation, if agreed and negotiated so with the private sector party." Agreements are subject to compliance with any relevant legislation, such as the Community Framework for State Aid for Research and Development and Innovation.

• Provisions governing the use of the available know-how will be agreed in writing.

• Contractual arrangements will be made regarding the remuneration of researchers for their work and inventions."

Collaborative research:
"• The party generating the research results will be the owner of such results or have the right to use them pursuant to the applicable law.

• All partners should benefit from favourable conditions for the transfer of rights of use and for mutual claims. The cooperation partners will, for example, agree on whether or not to file a patent for an invention.

• Public fund providers should remain neutral with regard to the exploitation of Intellectual Property but should at the same time ensure that equal consideration is given to the interests of all cooperation partners."

Q: Do the rules at the universities and other Public Research Organisations that are part of your organisation consider not only their own interests and objectives but also those of potential partners from the private sector? **(Figure R)**

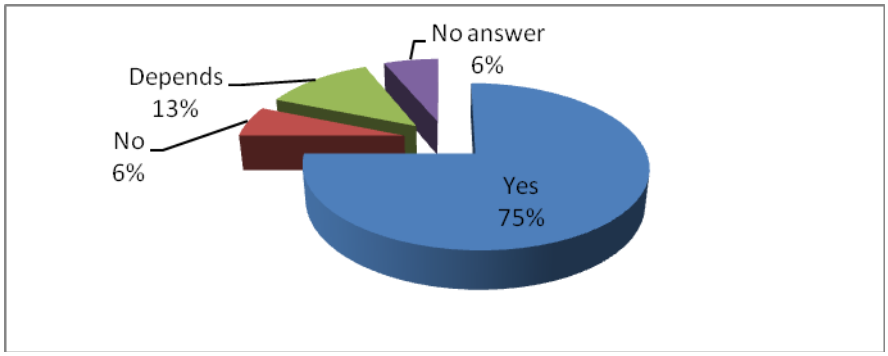


Figure R

In nearly all present Member States respondents express that they not only consider their own interests and objectives, but also those of potential partners from the private sector.
The respondents from the present Member States that have national Model Agreements or national codes of practice refer to the principle that 'fair rules' should take account of the interests of all parties and that Intellectual Property should be owned by the partner that invented it, be it the research institution, a company or a joint venture. The general attitude is that the fairness principle is based on the university and other Public Research Organisations' public and social mission. A respondent describes it as a win-win situation, also considering the interests of the university and other Public Research Organisations, researchers and those of society in general. Another respondent sharpens the private sector focus by stating that Intellectual Property first has to serve the economy, but has to be balanced against state aid rules to ensure optimal use of Intellectual Property.
However, a third respondent emphasises that national legislation about Intellectual Property management at universities on the one hand was designed to contribute to technology transfer as such, but on the other hand, also was designed to "protect Public Research Organisations' Intellectual Property from being illicitly transferred to corporate entities." Today this relationship is by some respondents still considered one between unequal partners: "The private sector usually enforces its own contractual research terms."

2.4.2 Clarification and Negotiation

Who actually negotiates the conditions related to collaborative and contract research – is it the Knowledge Transfer Office or is it individual researchers or other persons or organisations?

Q: Are the Intellectual Property-related issues at universities and other Public Research Organisations that are part of your organisation in collaborative and contract research clarified and negotiated by the Knowledge Transfer Office or by individual academics or by another person or organisation? **(Figure S)**

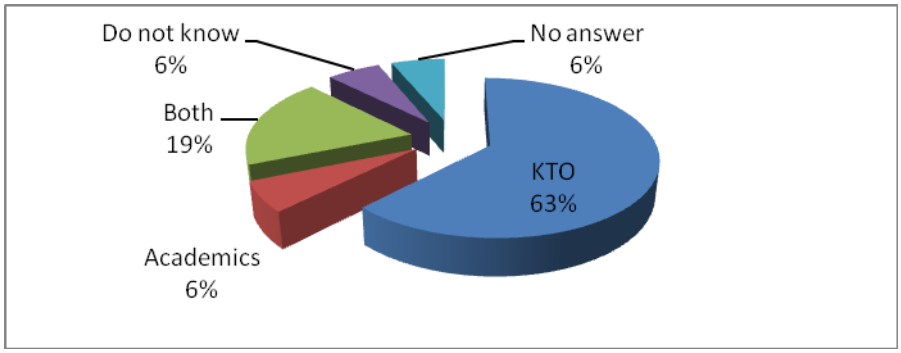


Figure S

In 63 % of the present Member States respondents declare that clarification and negotiation is in the hands of the Knowledge Transfer Office.[223]
As regards respondents where both Knowledge Transfer Offices and researchers are involved in the clarification and negotiation process, there seems to be two different scenarios. The first scenario is universities and other Public Research Organisations where there are no rules and where Knowledge Transfer Managers, researchers or other personnel can take the initiative in a clarification and negotiation process. The second scenario is where researchers seem to be the natural choice, but they can contact Knowledge Transfer Managers if they need help. Member states with 'professor's privilege' belong to the categories where researchers or both Knowledge Transfer Offices and researchers are involved.
However, although there are rules as to who is responsible for these matters, a respondent describes a situation that may be familiar to other Knowledge Transfer Managers: "In principle a knowledge transfer officer should carry out all negotiations. In practice, however, this may not always be the case". In cases like these it is a relief that agreements normally have to be signed by representatives of the central administration or Knowledge Transfer Office, before it is binding on both parties.

2.4.3 Access Rights to Intellectual Property

The *Commission Communication on Knowledge Transfer Improving Knowledge Transfer between Research Institutions and Industry in Europe* (EU 2007a) states that "agreements should clearly delineate the distribution of rights between the parties, including ownership of the background knowledge brought to the project, and ownership and access rights in relation to inventions, results and know-how arising from the partnership (and any associated Intellectual Property Rights)."

Q: How and when would access rights to Intellectual Property at universities and other Public Research Organisations that are part of your organisation be clarified in a project?

Nearly all respondents clarify access rights to Intellectual Property at the very early stage in the projects and at least before signature, but concerning the second half of the question relating to procedures, the answers can be categorized into three levels, where the first is based on simple statements describing what they do, the second relates procedures to national Acts and finally the third, where universities and other Public Research Organisations base their policies and procedures on an actual strategy.
In the first category respondents describes that in "collaborative research an Intellectual Property agreement is put in place" or that "contract research can be described in two steps: 1) general framework negotiated in a context of research collaboration, and 2) if research outputs are convincing, there will be a elaboration and negotiation of a licensing agreement."
In the second category respondents describe how universities and other Public Research Organisations are required to establish adequate procedures for the management of Intellectual Property in relation to contract research and collaborative research. And even if detailed policies and procedures for management of Intellectual Property may vary from institution to institution, several respondents refer to procedure obligations in relation to National Acts, e.g.: "Preferentially, all background that is either included or excluded should be listed in the agreement before the project. During the project particular attention is paid to identify the projects that any invention disclosure may be related to; this is also an obligation coming from the Act on the Rights in Inventions made a Higher Education Institutions."

[223] One respondent refer to the "general manager of the university of applied sciences in co-operation with a research coordination office." This answer in interpreted in favour of the Knowledge Transfer Office category, because the difference is marked towards researchers.

The third category belongs to the universities and other Public Research Organisations of a size and research capacity where Intellectual Property strategies are formulated in more detail. One example is the Fraunhofer Society, a German research organization with 59 institutes spread throughout Germany, each focusing on different fields of applied science. In their intellectual strategy *Competitive – Today and Tomorrow; Intellectual Property Strategy for Contract Research* the section on *Intellectual Property Strategy* is formulated like this: "Ownership of the products, prototypes or other material objects developed on behalf of a client is transferred to that client. Moreover, the client is granted rights to Fraunhofer IP that permit utilization of the development. Such rights usually consist of application-based, non-exclusive or exclusive rights to use foreground IP and, if applicable, rights to use background IP. In exceptional cases, the client is granted outright ownership of unrestricted exclusive rights to foreground IP of the Fraunhofer-Gesellschaft. The key criterion in this case is the assessed potential value within the patent and technology portfolio of the institutes.

This strategy
- increases Fraunhofer's innovative potential
- permits wide range application of Fraunhofer IP,
- protects the client – through the possibility to secure exclusive rights,
- improves the competitive position of the Fraunhofer-Gesellschaft and its clients – both today and in the future."

Model agreements have been drawn up to assist universities and other Public Research Organisations, industry and in particular small and medium enterprises, to collaborate more effectively. In 46 % of the present Member States universities and other Public Research Organisations use Model Agreements. Some use national Model Agreements, e.g. Denmark, Germany, Spain and the United Kingdom. Some of these are agreed upon by different stakeholders, while others are elaborated based on experience collected from the universities and other Public Research Organisations.[224]
Respondents that have a more sceptical approach to the Model Agreements have either tried the more authorised Model Agreements, but generally think the agreements have to be negotiated on a project to project basis with certain provisions being common across agreements, or they seem to use locally developed Model Agreements as a starting template.
All three perspectives do, however, get inspiration, either from Model Agreements from organisations within their own Member State or from Lambert Agreements and toolbox and "US TTO".

2.5 Analysis Part 5, Development and Publication of Policies and Procedures

This part will focus on knowledge transfer policy and Intellectual Property management by focusing more specifically on policies and initiatives to develop and publicise policies and procedures.

2.5.1 Government Policies and Organisation Initiatives

Q: Has your government adopted policies in order to make universities and other Public Research Organisations develop and publicise policies and procedures for management of Intellectual Property? **(Figure T)**
– Has it been debated?
– Did many have such policies and processes in place or not?
– Were incentives offered – e.g. funding for knowledge transfer?

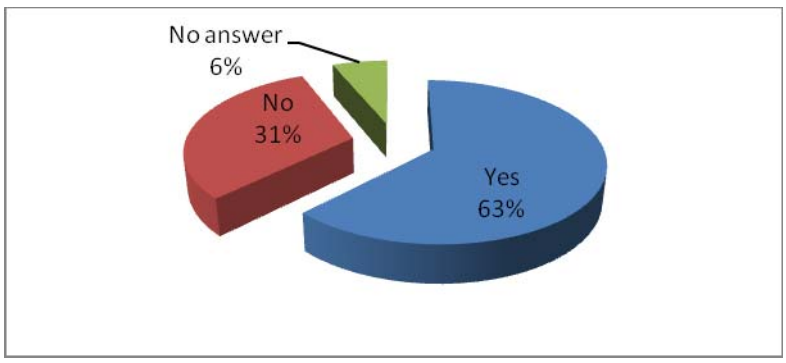


Figure T

[224] Model Agreements from Denmark, United Kingdom and Germany are presented in Annex B.

In 63 % of the present Member States respondents declare that their government has adopted policies in order to make universities and other Public Research Organisations develop and publicise policies and procedures for management of Intellectual Property.
A rich variety of policies and initiatives are mentioned: The implementation of Bayh-Dole inspired legislation including institutional Intellectual Property ownership, the steering mechanisms between government agencies and the universities, national funding schemes for the development of professional Knowledge Transfer Offices, funding of Proof of Concept programmes, European and national guidelines and codes of practice, codes of conduct for collaboration with industry, model contract tool kits, public grants addressed to universities and other Public Research Organisations for developing knowledge transfer infrastructure and promoting activities at local level etc.

Two inspirational initiatives from 2004 will be mentioned:

1) The Irish code of practice (ICS 2004) is a very clear practical guide that is widely acknowledged. The code addresses each aspect of the management and transfer of research and development results from universities, institutes of technology and other Public Research Organisations to the commercial marketplace. In particular, it stresses the need for a real commitment from universities and other Public Research Organisations and funders to the timely exploitation of research and to ensuring that the necessary resources and expertise are provided for commercialisation.

2) The government of the Netherlands stimulated the implementation of 'Knowledge Valorisation' at universities by several grant schemes. Knowledge Valorisation can be translated into the art of converting scientific knowledge into economic and/or social value. Since 2004, it has been a formal core activity of universities, alongside education and research. Knowledge Valorisation in form of policy statements can be found on the homepage of several universities from the Netherlands.
In around 50 % of the present Member States respondents state that there has been a debate on the implementation of policies. The debates have included parliament, institutions and other stakeholders. However, even though a majority of stakeholders take part in the debate and maybe even contribute to the development of policy, this does not necessarily lead to the implementation of the very same policy: Where some major universities and other Public Research Organisations had institutional policies in place at a rather early stage, a respondent points out that it is actually still a challenge for small universities. Beside government focus and grants, size and nature of the research at the institution matters and small universities do not necessarily have neither the commercial research capacity nor the resources to sustain a Knowledge Transfer Office.

Q: Has your organisation taken certain initiatives in order to make universities and other Public Research Organisations that are part of your organisation develop and publicise policies and procedures for management of Intellectual Property? **(Figure U)**
– Has it been debated?
– Have the initiatives taken been influenced by European and/or other countries' policies?

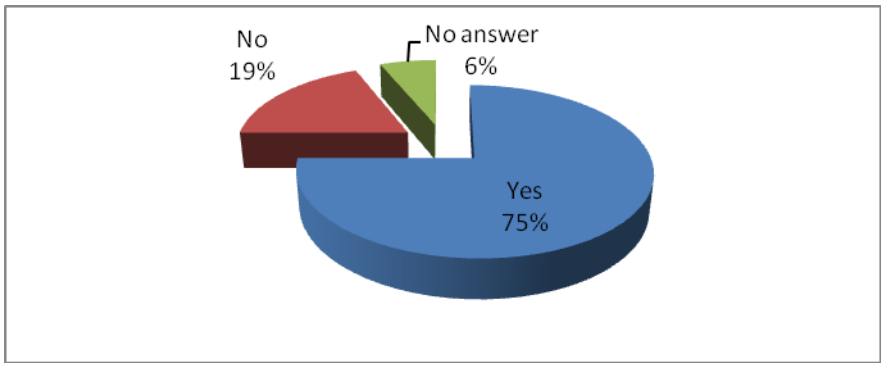


Figure U

In 75 % of the present Member States organisations have taken certain initiatives in order to make universities and other Public Research Organisations that are part of their organisation develop and publicise policies and procedures for management of Intellectual Property.

The umbrella organisations and national Knowledge Transfer Networks seem to have added value on three levels. The Spanish network, RedOTRI, has produced a technical dossier about collaborative R&D and best practices for Intellectual Property Rights management. The Finish network, Research and Innovation Services, produces policy documents for the network members and carry out several benchmarking exercises involving all member institutions, and the Irish University Association contributed to the discussions around the code of practice.

In more than 60 % of the present Member States respondents indicate that organisations like their own have contributed to the debate. The debate has taken place at different levels in the organisations, with sessions of the plenary board as well as broader workshops or working groups. As inspirational initiatives, the respondents mention EU publications such as 'Responsible Partnering' (EU 2005a), Commission Communications (EU 2007a), but national networks AURIL, AUTM and Réseau C.U.R.I.E. are also mentioned.

2.5.2 2008 Commission Recommendation and Code of Practice

The 2008 *Recommendation on the Management of Intellectual Property in Knowledge Transfer Activities and Code of Practice for Universities and other Public Research Organisations* (EU 2008b) promotes the development of Intellectual Property management policies at a Member State level and principles/practices for their management by universities and other Public Research Organisations.

Q: To what degree are the universities and other Public Research Organisations that are part of your organisation aware of the 2008 Commission Recommendation on the management of Intellectual Property in knowledge transfer activities and Code of Practice for universities and other Public Research Organisations? **(Figure V)**
Has your government taken initiatives to promote the Code of Practice or other methods for improving knowledge transfer to universities and other Public Research Organisations that are part of your organisation?

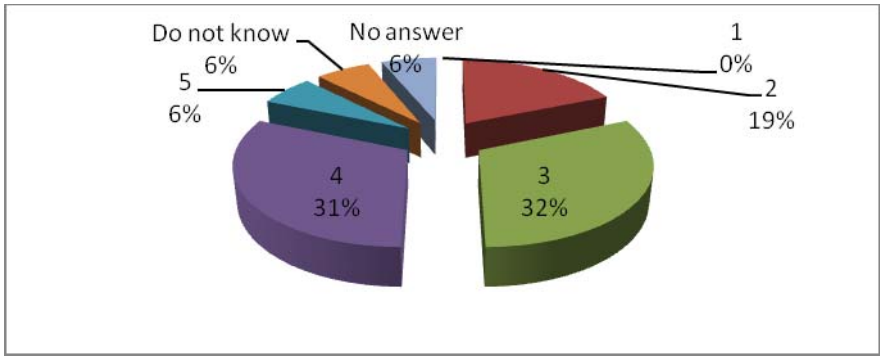


Figure V(1 is the lowest and 5 is the highest).

The respondents state that the university and other Public Research Organisations awareness on the recommendation is medium, with an average score of 3.5. However, if seen in the light of that only 17 % of the present Member States governments seemingly have promoted the code of practice, the awareness rate can be interpreted as relatively high. It would therefore be interesting to know how many of the umbrella organisations, national Knowledge Transfer Networks and international Knowledge Transfer Organisations have distributed information on the Recommendation and code of practice on their own initiative.

3 Annexes

Annex A Commented list of and links to available reports
Annex B Model Agreements
Annex C Questionnaire
Annex D Links from Primary Publications
Annex E Links to Member State Policy Documents
Annex E References

3.1 Annex A. Commented List of and Links to Available Reports

3.1.1 European Commission, Expert Group on the Management of IPR (2004): Management of Intellectual Property in Publicly-Funded Research Organisations: Towards European Guidelines.

http://www.protoneurope.org/news/news_archive/files/iprrep
The report reviews the knowledge transfer processes and its development over the last 30 years.
The traditional Licensing Model is here supplemented by a more active policy of collaborative research with industry, and by a pro-active involvement in the creation of spinout companies.
The report reviews the practical issues in defining the objectives, the missions, the functions, the funding and the resources and makes recommendations on how they can be resolved.
The report includes a list of guidelines for collaboration between industry and public research organizations in Europe.

3.1.2 European Commission, European Research Area Green Paper (2007)

http://ec.europa.eu/research/era/consultation-era_en.html
European Research Area is to play a still more important role in the development of the European knowledge society. The requirements are that research, education, training and innovation are going to be exercised at a very high level to be able to succeed in overcoming the economic, social and environmental challenges that lies ahead.

The ERA concept combines:

a) European "internal market" for research, where researchers, technology and knowledge freely circulate.
b) Effective European-level coordination of national and regional research activities, programmes and policies
c) Initiatives implemented and funded at European level.

3.1.3 European Commission, Commission Communication on knowledge transfer improving KT between research institutions and industry in Europe + voluntary Guidelines (2007).

http://www.euractiv.com/en/science/eu-pushes-better-knowledge-transfer/article-171564
A number of policy orientations are presented as a basis for common EU knowledge transfer framework. Member States and stakeholders will be encouraged to implement them on a voluntary basis, taking into account national situations. The goal is to harmonize the knowledge transfer activities in order to make the commercialisation of research results more effective.

The voluntary guidelines give advices to good practice for universities and other Public Research Organisations in the commercialization process. For most institutions that refers to their technology transfer activities in the realm of Intellectual Property Rights and collaborative research.

The reports are written by DG Research with recommendations made by Proton Europe.

Guidelines issue policies relating to Intellectual Property Rights, incentives, and Conflict of Interest as well as good practice relating to contractual arrangements.

3.1.4 European Commission, Initiative for a Charter for the Management of Intellectual Property from Public Research Institutions and Universities [IP Charter] (2007).

http://www.euractiv.com/en/science/ip-charter-manage-public-private-research-operation/article-163441
Universities and other Public Research Organisations need to professionalize their management of Intellectual Property. The German Presidency has taken the up the challenge, which has lead to the proposal of an Intellectual Property Charter for this purpose.
The strategy is that awareness of the importance of professional knowledge transfer management will make the universities and other Public Research Organisations more focussed in trying to achieve the standards proposed by the charter.

The Intellectual Property Charter includes the following basic principles and guidelines, on which the cooperation partners could voluntarily base their research cooperation:

- Careful and responsible management of research results and inventions
- Promotion of long-term and sustainable research cooperation
- Mutual respect, understanding and transparency in research cooperation
- Creation of organizational structures and mechanisms for professional Intellectual Property management
- Further training for researchers to raise awareness of Intellectual Property issues in research cooperation and to prevent an uncontrolled know-how drain
- Promotion of the commercialization and public exploitation of protected inventions to increase competitiveness and economic success
- Promotion of the exploitation of research results through start-ups and spin-offs.

The implementation of the basic principles are positioned partly through “international research cooperation”, because the management of Intellectual Property has to meet special requirements in the context of globalisation and international research cooperation. Partly through a framework of code of conduct, because the Intellectual Property charter should stipulate minimum requirements for the management of Intellectual Property as means of voluntary self regulation and because it provides the basis for good, professional and efficient cooperation between participants.

3.1.5 European Commission, DG Research (2008): Commission Recommendation on the Management of Intellectual Property in Knowledge Transfer Activities and Code of Practice for Universities and other Public Research Organisations.

http://ec.europa.eu/invest-in-research/pdf/ip_recommendation_en.pdf
Key recommendations to Member states for establishing or adapting Intellectual Property/ knowledge transfer policies:

a) Ensure that Public Research Organisations define knowledge transfer as strategic priority and develop and publicise respective policies and procedures.
b) Support the development of knowledge transfer capacities and skills, also among students.
c) Promote broad dissemination of research results while enabling protection of Intellectual Property.
d) Cooperate and take steps to ensure coherence of ownership regimes and to facilitate cross-border collaborations and knowledge transfer.
e) Ensure equitable and fair treatment of all participants in international research & development collaborations (ownership and access rights to Intellectual Property).

Code of practice for universities and other Public Research Organisations with operational principles for setting up institutional policies and knowledge transfer systems (Annex I):

a) Principles for an internal Intellectual Property policy for effective management of their own Intellectual Property (policy, rules, procedures, incentives, awareness, training, ...).
b) Principles for a knowledge transfer policy focussing on active transfer and exploitation of Intellectual Property (exploitation strategies and policies, including for licensing and spin-offs; access to professional knowledge transfer services; sharing of financial returns; monitoring of knowledge transfer activities.
c) Principles regarding collaborative and contract research (basic principles for Intellectual Property ownership and access rights.

List of best practice examples for Member States to support implementation of the recommendations (Annex II).

3.1.6 European Commission, (2008): Council Resolution on the management of Management in Knowledge Transfer Activities and on a Code of Practice for Universities and other Public Research Organisations.

http://www.era.gv.at/space/11442/directory/11784/doc/11787.html
a) Member States are invited to actively support the recommendation, and to promote the effective take-up of the code of practice by universities and other Public Research Organisations, while fully respecting their autonomy in dealing with Intellectual Property Rights;

b) All universities and Public Research Organisations are called upon to pay due regard to the content of the Commission's code of practice and to implement it according to their specific circumstances, including appropriate flexibility for contract research.

c) Member states are invited to establish, in partnership, light and effective governance arrangements, including the monitoring and evaluation of the take up and impact of the recommendation and code of practice, on the basis of indicators, the exchange of best practices with active involvement of stakeholders, which could lead to the definition of further guidelines on specific issues of common interest where justified.

3.1.7 Irish Council for Science (2004): National Code of Practice for Managing Intellectual Property from Publicly Funded Research.

http://www.forfas.ie/publication/search.jsp?ft=/publications/2004/Title,827,en.php
The Code addresses each aspect of the management and transfer of research and development results from universities, institutes of technology and Public Research Organisations to the commercial market place. In particular, it stresses the need for a real commitment from universities and other Public Research Organisations and funders to the timely exploitation of research and to ensuring that the necessary resources and expertise are provided for commercialisation.
Specifically the code provides guidance on the following areas:

- Intellectual Property management strategy (Demand for written policies)
- Technology Transfer Offices (as integral part of the research institutions)
- Identification and Disclosure of Intellectual Property (development of formal and informal procedures)
- Protection and Ownership of Intellectual Property (ownership is not an end in itself)
- Commercialization (partnerships)
- Sharing of benefits (incentives policy)

3.1.8 Irish Council for Science (2005): Code of Practice for Managing Intellectual Property from Collaborative Research, Technology and Innovation.

http://www.forfas.ie/publications/2005/title,785,en.php
The key objectives of the code of practice are to foster collaborative research between enterprise and academia in Ireland and the commercialisation of research output.
The code of practice provides guidelines for the management and commercialisation of Intellectual Property from collaborative research between industrial and academic partners. It provides a set of principles and a consistent starting point for negotiation that the partners should adopt in establishing collaborative research agreements, including a flexible approach to the issues of ownership and rights of exploitation of research outcomes.

For industry, this code aims to:

- Facilitate access to institutes, faculty and students that are aware of industrial needs and the processes through which knowledge acquires value
- Provide an approach to obtaining access to Intellectual Property that supports strategic business investment and the inclusion of Intellectual Property in product development
- Provide a starting point and clear principles and guidelines to manage the Intellectual Property aspects of collaborative research agreements
- help to ensure speed, simplicity and consistency in negotiating collaborative research agreements with Public Research Organisations

For the research community, this code offers:

- Endorsement of the need to grow and sustain research and teaching capabilities that are not internationally competitive
- Greater recognition of the strengths and results provided by the community
- A starting point and clear principles and guidelines to manage the Intellectual Property aspects of collaborative research agreements
- Speed, simplicity and consistency in negotiating collaborative research agreements with industrial partners
- An approach to securing the access to research results necessary for teaching, research, publication and building and sustaining research capabilities
- The opportunity to optimise benefits from commercial exploitation of research results and to attract further support from industry

3.1.9 AURIL, Partnerships for Research and Innovation between industry and universities; AURIL (2001)

http://www.auril.org.uk/pages/publications.php
Partnerships for Research and innovation is intended to look for mechanisms behind these partnerships, providing a guide to the process and best practice tips to improve the chances of success.
Entails chapters on why one should form partnerships, what types of partnerships there are, how to set up and managing a sound partnership and finally how to draft the agreement.

3.1.10 Auril/ UUK/Patent Office (2002): Managing Intellectual Property - A guide to strategic decision-making in universities.

http://www.auril.org.uk/pages/publications.php
This guide highlights key themes and good practices to be found in the broadly successful record of UK universities in managing Intellectual Property. The Guide identifies key issues that senior managers need to address in developing their strategies and illustrates a number of ways in which commonly encountered challenges can successfully be met.

Main chapters:

1. Why is Intellectual Property important? (benefits, need for strategic management and a strategic checklist)

2. Financial expectations and budget management (Risk and returns, handling uncertainty, realistic expectations and budgets)

3. Ownership of Intellectual Property and negotiations with sponsors

4. Incentives (To whom, how and relationship to other university policies)

5. Intellectual Property management functions (Responsibility and structure of the Knowledge Transfer Office, relationship with other university entities, on notification of inventions and other complexities in Intellectual Property management)

6. Implementation: working with others (Collaboration with universities and external organisations)

7. Monitoring and evaluation (Indicators, measures and ratios)

3.1.11 AURIL, Handbook of Intellectual Property Management; AURIL (2002).

http://www.auril.org.uk/pages/publications.php
The main goal is to raise awareness of Intellectual Property amongst staff for early identification of key innovations and to reduce the possibilities of accidental non-confidential disclosures that could prejudice successful Patent applications.
It entails chapters on:

- Intellectual Property Policy and Role og commercialisation Departments (includes key elements of Intellectual Property policy, role of Knowledge Transfer Office and sample procedure)
- Establishing Awareness of Intellectual Property (includes introduction to THEROS, Intelectual Property presentation slides, key information on patents, trademarks, design, copyright & confidential information))
- Identification and Tracking of Intellectual Property (includes Recordkeeping procedures, guidelines for the use of laboratory notebooks, sample technical disclosure form)
- Evaluation of Intellectual Property (includes sample evaluation form)
- Protection of Intellectual Property (includes detailed information on patents, designs and trade marks)
- Marketing of Intellectual Property (includes use of patent information)
- Commercial Arrangements & Disputes (includes purchase, sale & review checklist)
- Sample Agreements (includes licensing agreement checklist)
- Spin Out Companies (includes contact details for UNICO)
- Intellectual Property Management and Review (includes sample management information schedule, patent summary questionnaire, sample internal report format)
- Ownership of Intellectual Property Rights (includes copyright and contracts of employment)
- Universities and the Internet (includes internet policy)
- Theros (includes sample copy)

3.1.12 Murgitroyd & Company: THEROS Intellectual Property Guidelines (2002).

http://www.murgitroyd.com/theros.html
The Theros Intellectual Property Guidelines are intended to assist in the effective management of such assets, whether the assets are developed by the universities and other Public Research Organisations alone or in association with other research groups or with funding authorities or with commercial companies. It provides guidelines for the identification of Intellectual Property Rights and is intended to indicate situations in which professional advice in the management of Intellectual Property Rights may be required.
Aim:

- Clear up some common misunderstandings about Intellectual Property Rights
- Draw attention to the importance and relevance of Intellectual Property Rights in academic and research work; and
- Indicate the areas where professional advice is required

3.2 Annex B. Model Agreements

3.2.1 Collaborative Business and University Research - Lambert Agreements (UK)

http://www.innovation.gov.uk/lambertagreements/
As a result of the Lambert Working Group a homepage was established 2005 to provide a toolkit for universities and companies wishing to undertake collaborative research projects.
The Model Agreements are the primary content. There are five model research collaboration agreements.
Guidance Notes help understanding the terms of the Model Agreements and some of the legal issues. Other tools are the Outline and Decision Guide. The Outline is designed to help identifying main issues to be discussed with collaborators, to ensure similar expectations for the proposed project.

3.2.2 Collaborative Business and University Research – Schlüter Agreements (DK)

http://en.fi.dk/innovation/model-agreements
The Johan Schlüter Committee Model Agreements provide a practical tool for private for enterprises and Public Research Organisations entering into research collaboration.
Inspired by the Lambert Agreements the Danish Agency for Science, Technology and Innovation initiated The Johan Schlüter Committee. This expert Intellectual Property committee was established to facilitate the negotiation of R&D-contracts between academia and industry by providing a practical toolbox of Model Agreements and accompanying manuals.
The Model Agreements offer practical guidance in respect to issues such as the management of Intellectual Property Rights, publication of research results and confidentiality on business secrets in joint research projects.

This internet toolbox was launched in 2008 and followed by an English translation of the basic Model Agreements in early 2009.

3.2.3 Germany[225]

The Berlin Contract

http://www.ipal.de/en/downloads_information/downloads/
Consists of two agreements, a contract research and a collaborative research model.
The Berliner Model Contract is based on the interests of the industrial sector. According to Schöpke the model does not offer much flexibility, as the agreements on the one hand do not provide options and on the other hand offer very specific provisions for the calculation of licence fees. The model is not supported by academia and most universities and Public Research Organisations and is applied in only a few projects.

The Hamburg Contract

Model agreement for cooperations between universities and industry. According to Schöpke there is up front transfer and assignment of the ownership of all results and Intellectual Property Rights, when signing the agreement. At the same time the university and other Public Research Organisations may have to waive the right to any inventions arising from the research project. Like the Berlin contract the Hamburg contract is hard to accept for the universities and other Public Research Organisations due to the bias mentioned before.

Council for Innovation (BMWI), sample agreements for R&D cooperation

http://www.bmwi.de/BMWi/Navigation/Service/publikationen,did=217918.html
Four Model Agreements: 1 research cooperation agreement, 2 for contract research and 1 model for a service contract.
Contrary to the other Model Agreements, these sample agreements introduce a license model as well as a model for calculation of remuneration of licence fees. According to Schöpke universities and other Public Research Organisations appreciate the introduction of the licence model and, like the Danish and English agreements, they are based on the interests of the industry as well as the universities and other Public Research Organisations. The sample agreements are little known and not widely accepted.

[225] The part on German Model Agreements is based on Tanja Schöpke's contribution to this expert group: *Options for a European-wide model agreement for contract research / collaborative research.* The comments here will therefore be very brief.

3.3 Annex C. Questionnaire

Questionnaire on KT for umbrella organisations for universities and other Public Research Organisations as well as national networks of KT Please answer according to the 'average' institution in your organisation/ network, when possible. When answers refer to programmes/ reports/ policy papers, please set up a link or mail the PDF files (English is preferred).	
QUESTIONS	**ANSWERS**
Which organisation/ network do you represent?	
Which country do you come from?	
How many and what kind of institutions are member of your organisation/network?	
Part I	**- concerning principles for the internal policy for effective management of own Intellectual Property (policy, rules, procedures, incentives).**
1. A) To what degree do universities and other Public Research Organisations (PROs) that are part of your organisation have a long-term Knowledge transfer (KT) & Intellectual Property (Intellectual Property) management strategy and mission? A1) Where was it debated? A2) Which organisations or people contributed to developing it? A3) What examples/models are used from what Member State?	A) Please rate on a scale of 1-5 the degree to which you feel your member institutions have this, where 1 is the lowest and 5 is the highest. 1□ 2□ 3□ 4□ 5□ 6□ Don't know Please comment: A1) A2) A3)
2. A) Has universities and other Public Research Organisations that are part of your organisation made Intellectual Property easy accessible, for example at the internet? A1) Are there local portals (at the institutions), regional portals or a central "portal" for all the universities?	A) Please rate on a scale of 1-5 the degree to which you feel your member institutions have done this, where 1 is the lowest and 5 is the highest. 1□ 2□ 3□ 4□ 5□ 6□ Don't know Please comment: A1) A2)

A2) Do universities and other Public Research Organisations that are part of your organisation use cross national non-profit portals? A3) Do universities and other Public Research Organisations that are part of your organisation use cross national commercial portals?	A3)
3.1 A) Are there general rules at the universities and other Public Research Organisations that are part of your organisation concerning disclosure of new ideas of commercial interest? A1) What are the general rules? A2) If there are general rules, is it then mandatory or optional to follow these rules?	Please comment: A) A1) A2)
3.2 A) Are there general rules at the universities and other Public Research Organisations that are part of your organisation concerning ownership of research results? A1) What are the general rules? A2) Are these generally similar or do individual organisations differ markedly in their policies?	Please comment: A) A1) A2)
3.3 A) Are there general rules at the universities and other Public Research Organisations that are part of your organisation concerning engagement with third parties? A1) What are the general rules? A2) Is national guidance in place? A3) Is engagement an expectation of academic staff?	Please comment: A) A1) A2) A3)
3.4 A) Are there general rules at the universities and other Public Research Organisations that are part of your organisation concerning publication and dissemination policy? A1) What are the general rules? A2) How many have “Open access” policies in place? A3) At what level is it decided which publications are to be put into the public arena?	Please comment: A) A1) A2) A3)
4. - Have the universities and other Public Research Organisations that are part of your organisation developed a policy in line with their overall mission and strategy regarding identification, possible exploitation, protection of Intellectual Property?	Please rate on a scale of 1-5 the degree to which you feel your member institutions have done this, where 1 is the lowest and 5 is the highest. 1□ 2□

	3□ 4□ 5□ 6□ Don't know
5. A) Have the universities and other Public Research Organisations that are part of your organisation set up Intellectual Property Pools in the sense that various universities under the umbrella organization cross-license their intellectual assets or otherwise throw the results of collaborative research in a joint pool? B) For what purpose has these pools being established? B1) For profit oriented purposes? B2) To enable access by creating a strong patent portfolio with the purpose of granting non-exclusive licenses? B3) Other considerations	A) Please rate on a scale of 1-5 the degree to which you feel your member institutions have done this, where 1 is the lowest and 5 is the highest. 1□ 2□ 3□ 4□ 5□ 6□ Don't know Please comment: B) B1) B2) B3)
6. - Have the universities and other Public Research Organisations that are part of your organisation developed a policy on how to manage conflict of interest between university/Public Research Organisation, department and inventors/research staff?	Please rate on a scale of 1-5 the degree to which you feel your member institutions have done this, where 1 is the lowest and 5 is the highest. 1□ 2□ 3□ 4□ 5□ 6□ Don't know
7. A) Do the universities and other Public Research Organisations that are part of your organisation train staff and researchers on Intellectual Property awareness and basic skills in Intellectual Property and Knowledge Transfer? A1) Who initiates the training? A2) Who finances the training?	A) Please rate on a scale of 1-5 the degree to which you feel your member institutions have done this, where 1 is the lowest and 5 is the highest. 1□ 2□ 3□ 4□ 5□ 6□ Don't know A1) Please mark the box next to the statement you find most true with an X: □ institutions □ organisations □ regional authorities □ national authorities A2) Please mark the box next to the statement you find most true with an X: □ institutions

	□ organisations □ regional authorities □ national authorities
8. A) Are there incentives at the universities and other Public Research Organisations that are part of your organisation for commercialising Intellectual Property? A1) What are the incentives? A2) For institutions/ institutes/ inventors? A3) Are they fairly similar or are the differences across different types of universities or different regions?	Please comment: A) A1) A2) A3)
Part II	**- concerning principles for a KT policy (exploitation strategies, policy)**
9. A) Do the universities and other Public Research Organisations that are part of your organisation have a policy for the creation of spin-offs? A1) If yes, does it allow the staff to engage in the creation of spinoffs? A2) If yes, does it clarify long-term relations between spin-offs and the institution?	Please comment: A) A1) A2)
10. A) Do the universities and other Public Research Organisations that are part of your organisation have their own knowledge transfer unit or do they have access to a professional knowledge transfer service to advice on legal, financial, commercial perspectives on knowledge transfer? B) Have these arrangements been reviewed to see which is most successful? If so, which organisation initiated the review?	A) Please mark the box next to the statement you find most true with an X: □ Mainly in-house □ Mainly external Please comment: B)
11. - How were a) the licensing policies, b) the split of returns from KT revenues between institution, department and inventor developed by universities and other Public Research Organisations that are part of your organisation?	Please mark the box next to the statement you find most true with an X: □ By debate at the level of your organisation □ By debate among KT practitioners □ By government initiatives
12. - Is there a KT practitioners network in your country with which you work on matters of policy and process?	Please comment:
13. A) Do universities and other Public Research Organisations that are part of your organisation monitor Intellectual Property protection and KT activities and promote them? A1) If yes, how do they promote them?	Please comment: A) A1) A2)

A2) Has there been any national level evaluation? A3) Are there any national level marketing and promotion tools?	A3)
14. - Do universities and other Public Research Organisations that are part of your organisation monitor Intellectual Property protection and KT activities and join the annual Proton Europe or the ASTP surveys?	Please rate on a scale of 1-5 the degree to which you feel your member institutions have done this, where 1 is the lowest and 5 is the highest. 1□ 2□ 3□ 4□ 5□ 6□ Don't know
15. A) Have your government adopted policies in order to make universities and other Public Research Organisations develop and publicise policies and procedures for management of Intellectual Property? A1) Has it been debated? A2) Did many have such policies and processes in place or not? A3) Were incentives offered – eg funding for KT?	Please comment: A) A1) A2) A3)
16. A) Have your organisation taken certain initiatives in order to make universities and other Public Research Organisations that are part of your organisation develop and publicise policies and procedures for management of Intellectual Property? A1) Has it been debated? A2) Have the initiatives taken been influenced by European and/or other countries policies?	Please comment: A) A1) A2)
17. A) Are the universities and other Public Research Organisations that are part of your organisation aware of the 2008 Commission Recommendation on the management of Intellectual Property in knowledge transfer activities and Code of Practice for universities and other Public Research Organisations? B) Have your government taken initiatives to promote the Code of Practice, or other methods for improving knowledge transfer to universities and other Public Research Organisations that are part of your organisation?	A) Please rate on a scale of 1-5 the degree to which you feel your member institutions are aware of this, where 1 is the lowest and 5 is the highest. 1□ 2□ 3□ 4□ 5□ 6□ Don't know B)
Part III	**- concerning principles regarding collaborative and contract research (basic principles for Intellectual Property ownership and access rights)**

18. - Do the rules at the universities and other Public Research Organisations that are part of your organisation consider not only their own interests and objectives but also those of potential partners from the private sector?	Please comment:
19. - Are the Intellectual Property-related issues at universities and other Public Research Organisations that are part of your organisation in collaborative and contract research clarified and negotiated by the KT office or by individual academics or by another person or organisation?	Please comment:
20. - How and when would access rights to Intellectual Property Rights universities and other Public Research Organisations that are part of your organisation be clarified in a project?	Please comment:
21. A) Do the universities and other Public Research Organisations that are part of your organisation use model agreements for collaborative research? A1) If yes, have your model agreements been inspirited by model agreements from other Member States.	Please comment: A) A1)

3.4 Annex D. Links from Primary Publications

European Commission, Expert Group on the Management of IPR (EU 2004a), *Management of Intellectual Property in Publicly-Funded Research Organisations: Towards European Guidelines*
OECD Report "*Turning Science Into Business: Patenting and Licensing at Public Research Organisations*" April 2003 – http://oecdpublications.gfi-nb.com/cgi-bin/OECDBookShop.storefront/EN/product/922003021P1
Key figures 2002, *Towards a European Research Area*, ISBN 92-894-4205-0 – ftp://ftp.cordis.lu/pub/indicators/docs/ind_kf2002.pdf

Commission of the European Communities *Investing in Research: An Action Plan For Europe* COM(2003)226 – http://europa.eu.int/eur-lex/en/com/cnc/2003/com2003_0226en02.pdf

European Commission DG Research Third European Report on Science & Technology Indicators, 2003, ISBN 92-894-1795-1 – http://www.cordis.lu/indicators/third_report.htm

AUTM: *Licensing Survey: FY 2001* published 2003 – http://www.autm.net/surveys/01/01summarypublicversion.pdf

Nottingham University Business School *Annual UNICO-NUBS Survey on University Commercialisation Activities - Financial Year 2001*, 2002 – http://www.nottingham.ac.uk/business/research/TechTransfer

Presentation by Y. Tsukamoto at the TIP workshop on the Management of Intellectual Property Rights from Public Research on December 11, 2000 – http://www.oecd.org/dataoecd/13/39/1903874.pdf

The Bayh-Dole Act. A Guide to the Law and Implementing Regulations" http://www.ucop.edu/ott/bayh.html
Leydesdorff, Dr Loet and Cooke, Philip and Olarazan, Mikel (2002) Technology Transfer in European Regions: Introduction to the Theme Issues. Journal of Technology Transfer 27(1):5-13 – http://dlist.sir.arizona.edu/archive/00000105/01/index.htm

The October 2002 special edition of Innovation & Technology Transfer includes a very useful glossary of terms; www.cordis.lu/itt/itt-en/02-spec01/glossary.htm

Historical overview made by Howard W. Bremer: *University Technology Transfer: Evolution and Revolution*. – 1998, Council On Governmental Relations – http://www.cogr.edu/docs/Anniversary.pdf (p. 13)

OECD *Patents and Innovation in the International Context* OCDE/GD (97) 210, 1997 – http://www.oecd.org/dataoecd/35/13/2101372.pdf

EC Expert Group Report on *Role and Strategic Use of IPR in International Research Collaborations* EUR 20230, 2002 – http://europa.eu.int/comm/research/era/pdf/ipr-eur-20230_en.pdf

"Lambert Review of business-university collaboration" – http://www.hmtreasury.gov.uk/media//06729/lambertemergingissues_173.pdf

Benchmarking Industry-Science Relations - The Role of the Framework Conditions - June 2001, http://www.benchmarking-in-europe.com/eu_initiatives/enterprise_dg/framework_conditions/isr.htm

This is one of the conclusions of the European Research Advisory Board document on "Improving innovation" published under the reference EURAB 02.053 final – http://europa.eu.int/comm/research/eurab/pdf/recommendations2.pdf
Business-Higher Education Forum: *Working Together, Creating Knowledge: The University-Industry Research Collaboration Initiative,* http://www.acenet.edu/bookstore/pdf/working-together.pdf
WIPO: http://www.wipo.org
There are different definitions of Spinout companies. For a typology and examples of different forms, see for example Clarysse et al *Spinning off new Ventures – typology of strategies in Europe,* 2002, available from http://www.iwt.be/obs/obsdef.htm

Good Practice in the Transfer of University Technology to Industry:
http://www.cordis.lu/eims/src/eimsr26.Htm

The Management of Intellectual Property in Higher Education – Production of a Good Practice Guide. A Project for UUK and AURIL with support from the DTI and the Patent Office –
http://www.sqw.co.uk/data/IP.html

Centre for Economic Policy Research, *Incentives and Invention in PROs*, 2003,
http://www.cepr.org/pubs/new-dps/dplist.asp?dpno=3916
Everett M. Rogers, Jing Yin and Joern Hoffmann : *Assessing the Effectiveness of Technology Transfer Offices at US Research PROs.* Journal of the Association of University Technology Managers, Vol. XII (2000) 47-80 –
http://www.autm.net/pubs/journal/00/assessing.html
Public Investments in University Research: Reaping the Benefits. Report of the Expert Panel on the Commercialisation of University Research, May 4, 1999, http://acst-ccst.gc.ca/comm/home_e.html

Presentation of James W. Murray at the OECD Workshop on Management of Intellectual Property Generated from Public Funded Research, December 11, 2000 –
http://www.oecd.org/dataoecd/13/41/1903892.pdf
A detailed analysis of skills and training needs can be found in the Oakland Innovation and Information Services report produced for the Department of Trade and Industry *Business Interface Training Provision (BITS) Review,* March 2002, info@oakland.co.uk

AURIL *Handbook of Intellectual Property Management,*
http://www.patent.gov.uk/about/notices/ipguide.pdf

AURIL/UUK/Patent Office: *Managing Intellectual Property – A guide to strategic decision-making in Universities*, September 26, 2002, http://www.patent.gov.uk/about/notices/manip/index.htm

AUTM: *Technology Transfer Practice Manual*, revised 2003 edition, available from
http://www.autm.net/index_ie.html

BBSRC: *Bioscience Exploitation Guide*. http://www.bbsrc.ac.uk/biobusiness_guide

IPR HelpDesk: http://www.ipr-helpdesk.org

European Commission (EU 2007b), *European Research Area Green Paper*
Eurobarometer: Europeans, Science and Technology, June 2005, http://ec.europa.eu/public_opinion

2006 EU Industrial R&D Investment Scoreboard, http://iri.jrc.es/research

2005 EU Survey on R&D Investment Business Trends, http://iri.jrc.es/research

Building in particular on the European Statistical System, which will be addressed in a forthcoming Commission Communication on Statistics on Science, Technology and Innovation, as well as on the ERAWATCH information system on national research policies (http://cordis.europa.eu/erawatch) and on the EU Industrial Research Investment Monitoring (http://iri.jrc.es).

Commission Communication on knowledge transfer improving KT between research institutions and industry in Europe + voluntary Guidelines
Europe currently has the highest per-capita numbers of science and engineering graduates and academic papers (Key Figures – http://ec.europa.eu/invest-in-research/monitoring/statistical01_en.htm)

AUTM survey – http://www.autm.net/events/File/FY04%20Licensing%20Survey/04AUTM-USLicSrvy-public.pdf

ProTon survey –
http://www.protoneurope.org/news/2006/art2006/artjanmar06/2asfy2004/attachment_download/file

ASTP survey 2006 – http://www.merit.unu.edu/publications/docs/200605_ASTP.pdf

Moreover, efficient knowledge transfer in European research institutions is hindered by a range of factors, including: cultural differences between the business and science communities; lack of incentives; legal barriers; and fragmented markets for knowledge and technology: http://ec.europa.eu/invest-in-research/pdf/download_en/consult_report.pdf

ProTon Europe: http://www.protoneurope.org

See Irish report on technology transfer – http://www.universitiesireland.ie/news/techtransfer.php

Pooling resources. Belgian *VIB*: www.vib.be

Pooling can address a single industry sector (for example th *White Rose Consortium:* www.whiterose.ac.uk

Innovation Relay Centres (IRCs) network: http://irc.cordis.lu

Crest decision tree – http://ec.europa.eu/invest-in-research/policy/crest_cross_en.htm

Lambert agreements – http://www.innovation.gov.uk/lambertagreements

Danish code of conduct between industry and university: Contacts, contracts and codices – http://billed.di.dk/wimpfiles/lores/image.asp?objno=/686201.pdf

Responsible partnering: http://www.responsible-partnering.org

Various "creative commons"24 approaches (open access, open publications, open software, …) are increasingly endorsed by many universities: http://creativecommons.org

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: IP4Inno – http://www.proinno-europe.eu/ip4inno.html

It is therefore important that the appraisal criteria also take into account other activities such as patenting, licensing, mobility and collaboration with industry. EUA Vienna conference conclusions – http://www.eua.be/fileadmin/user_upload/files/EUA1_documents/report_web%20221006.1161606166446.pdf

Report of the CREST Expert Group "*Promote the reform of public research centres and universities in particular to promote transfer of knowledge to society and industry*" – http://ec.europa.eu/invest-in-research/pdf/download_en/final_crest_report_march2006.pdf

ITTE report on "Improving institutions for the transfer of technology from science to enterprises" – http://ec.europa.eu/enterprise/enterprise_policy/competitiveness/doc/itte_expertgroupreport.pdf

To fund novel ways to facilitate knowledge sharing between research institutions and companies, in particular for SMEs: www.europe-innova.org

There is a growing tendency towards open access to research data and publications: See http://europa.eu.int/comm/research/press/2004/pr1506en.cfm and http://www.oecd.org/document/15/0,2340,en_21571361_21590465_25998799_1_1_1_1,00.html

It is recommended that both parties consider the questions raised in the CREST decision guide (see Section 3.5 of the CREST report: 7 http://ec.europa.eu/invest-in-research/pdf/report_final_june28.pdf

EU and other international sources:
The *Responsible Partnering* initiative: http://www.responsible-partnering.org

Results of the first and second OMC cycles (EU): http://ec.europa.eu/invest-in-research/coordination/coordination01_en.htm

Management of Intellectual Property in publicly-funded research organisations: Towards European Guidelines (EU): http://ec.europa.eu/research/era/pdf/iprmanagementguidelines-report.pdf

Turning science into business (OECD): www.oecd.org

National sources:
Guidelines for Teaching Hospitals entering into Research Agreements (DK):
www.forskningskontrakter.techtrans.dk/HS/viewPage.action?site=eng_HS&page=Manual%20in%20pdf

Contracts, Contacts and Codices – Research Cooperation Between Universities and Companies (DK):
www.rektorkollegiet.dk/fileadmin/user_upload/downloads/Contacts__contrats_and_cod.pdf

Recommandations pour l'adoption d'une Charte de la propriété intellectuelle par les établissements publics d'enseignement supérieur et de recherche (FR) : ftp://trf.education.gouv.fr/pub/rechtec/technologie/charte.rtf

National Code of Practice for Managing Intellectual Property from Publicly Funded Research (IE):
www.forfas.ie/icsti/statements/icsti040407/index.html

National Code of Practice for Managing Intellectual Property from Public-Private Collaborative Research (IE):
www.sciencecouncil.ie/reports/#ipcode04

Partnerships for Research and Innovation (UK) : www.auril.org.uk/publications/pfrai

A Guide to Managing Intellectual Property: Strategic Decision-Making in Universities (UK):
www.patent.gov.uk/about/notices/2002/manip/index.htm

Lambert Agreements – A toolkit for universities and companies wishing to undertake collaborative research projects (UK): www.innovation.gov.uk/lambertagreements

Existing assistance services:
Additional information and assistance with respect to IPR-related issues and support to innovation may be obtained from different sources, including:

The Innovation Relay Centres (http://www.innovationrelay.net), a network of more than 70 centres involving more than 240 organisations in 33 countries which provide assistance on marketing innovation, help venture capitalists find new technologies to exploit, and help companies source innovative solutions to satisfy a technological need.

The Cordis Marketplace service (http://www.cordis.europa.eu/marketplace), an online service where you can find RTD results and search for innovative business opportunities on emerging technologies.

Gate2Growth (http://www.gate2growth.com), which offers in particular a database of experts and service providers - ranging from incubators to patent lawyers, to accountants and training providers in every European country.

The ProTon network (http://www.protoneurope.org), a European association of technology transfer professionals.

The IPR Helpdesk (http://www.ipr-helpdesk.org), which assists potential and current participant in the EC research Framework Programmes on Intellectual Property Rights issues arising in this context ; they also publish a number of general-purpose papers on specific IPR issues.

The European Patent Office (http://www.european-patent-office.org), which grants European patents and offers additional services, e.g. training seminars and patent information products (CD-ROMs, on-line Espacenet database, etc.).

The World Intellectual Property Organisation (WIPO – http://www.wipo.int), whose website also contains specific information for SMEs ; it should also be noted that WIPO runs a mediation and arbitration facility (http://arbiter.wipo.int)

National Patent Offices (http://www.european-patent-office.org/onlinelinks/a/aa), which grant national patents and often provide additional services to local users.

The OECD – see in particular their Guidelines for the licensing of genetic inventions. (http://www.oecd.org/sti/biotechnology/licensing)

European Commission (EU 2007c), *Initiative for a Charter for the Management of Intellectual Property from Public Research Institutions and Universities* [*IP Charter]*
Management of Intellectual Property in publicly-funded research organisations: Towards European Guidelines (EU), http://ec.europa.eu/research/era/pdf/iprmanagementguidelines-report.pdf
Responsible partnering: http://www.responsible-partnering.org
CREST Report, Cross-border collaboration between publicly funded research organisations and industry and technology transfer training, http://www.patent.gov.uk/crestreport.pdf

Lambert Agreements – A toolkit for universities and companies wishing to undertake collaborative research projects (UK), http://www.innovation.gov.uk/lambertagreements/

Irish Council for Science (ICS 2004), *National Code of Practice for Managing Intellectual Property from Publicly Funded Research*
AUTM (US TT org.): http://www.autm.net

AURIL (UK TT org.): http://www.auril.org.uk

Theros Intellectual Property Guidelines: www.theros.co.uk

ProTon Europe (Public Research Organisations Technology Offices Network-Europe): www.gate2growth.com/ProTon.asp

EARMA (European Association of Research Managers and Administrators): www.earma.org

ASTP (Association of European Science and Technology Transfer Professionals): www.astp.net

LES (Licensing Executives Society-Europe including LES- Britain & Ireland): www.les-europe.org

AURIL Handbook of IP Management: http://www.auril.org.uk

Irish Council for Science (ICS 2005), *Code of Practice for Managing Intellectual Property from Collaborative Research, Technology and Innovation*
For more information on record keeping, please see or www.sciencecouncil.ie
For sample confirmatory assignment form, please see www.sciencecouncil.ie
For sample invention disclosure form, please see www.sciencecouncil.ie

3.5 Annex E. Links to Member State Policy Documents[226]

Austria
National Action Plan Innovation / Nationaler Aktionsplan Innovation - Beitrag zum nationalen Reformprogramm 2005 bis 2008
tp://www.bmwa.gv.at/NR/rdonlyres/B69A17DB-CB05-40AF-BAC9-B575D64CF047/19891/NAPInnovationEndbericht20051004.pdf

[226] Incomplete list based on CORDIS and feedback from respondents.

Research, Technology Development and Innovation in the Structure Funds Programmes 2007-2013 / Forschung, Technologieentwicklung und Innovation (FTI) in den Strukturfondsprogrammen 2007 bis 2013
http://www.rat-fte.at/view.mc?docid=91

Strategy 2010 - Perspectives for Research, Technology and Innovation in Austria / Strategie 2010 - Perpektiven für Forschung, Technologie und Innovation in Österreich - Weiterentwicklung des Nationalen Forschungs- und Innovationsplans
http://www.rat-fte.at/

The National Research und Innovation Plan / Nationaler Forschungs- und Innovationsplan
http://www.rat-fte.at/view.mc?docid=98
http://www.rat-fte.at/view.mc?docid=90

Belgium
Flanders: Innovation Pact for Flanders / Innovatiepact voor Vlaanderen
http://ewi-vlaanderen.be/documenten/Beleid_innovatiepact.pdf

Flanders: Policy letter 2008: Science & Innovation / Beleidsbrief 2008: Wetenschap & Innovatie
http://ewi-vlaanderen.be/documenten/VR%202007%202610%20MED%2012-34Bis%20BB%20Economie%20Ondernemen%20Wetenschap%20Innovatie%20en%20Buitenlandse%20Handel

Memorandum: Science and Technological innovation 2004-2010 / Memorandum: Science and Technological innovation 2004-2010
http://www.vrwb.be/MFiles/Memorandum.pdf

Memorandum: Science and Technological innovation 2004-2010 / Memorandum: Wetenschap en Technologische Innovatie 2004-2010
http://www.vrwb.be/MFiles/Memorandum.pdf

Research, Technology and Innovation in Belgium: the Missing Links / Research, Technology and Innovation in Belgium: the Missing Links
http://www.belspo.be/belspo/h ome/publ/p ub_ostc/ind/ind07_en.pdf

Bulgaria
National Innovation Strategy / Национална иновационна стратегия
http://www.mi.government.bg/ind/inov/docs.html?id=97265

Operational Programme "Development of the Competitiveness of the Bulgarian Economy 2007- 2013" / Оперативна програма “Развитие на конкурентоспособността на българската икономика 2007 – 2013”
http://www.iaphare.org/en/content/index.php?id=763 http://www.iaphare.org/bg/content/index.php?id=181

Strategy for Encouraging Investment in Bulgaria 2005-2010 / Стратегия за насърчаване на инвестициите в Р България 2005-2010 г.
http://www.mee.government.bg/ind/doc_invest/Investment-strategy-JUNE-2005.pdf

Cyprus
NATIONAL STRATEGIC DEVELOPMENT PLAN 2007 – 2013 / ΣΤΡΑΤΗΓΙΚΟ ΣΧΕΔΙΟ ΑΝΑΠΤΥΞΗΣ 2007 – 2013 / NATIONAL STRATEGIC DEVELOPMENT PLAN 2007 – 2013 / ΣΤΡΑΤΗΓΙΚΟ ΣΧΕΔΙΟ ΑΝΑΠΤΥΞΗΣ 2007 - 2013

Denmark
Progress, Innovation and Cohesion - Strategy for Denmark in the Global Economy / Fremgang, fornyelse og tryghed - Strategi for Danmark i den globale økonomi
http://www.globalisering.dk/multimedia/Pixi_UK_web_endelig1.pdf
http://www.globalisering.dk/

Progress, Innovation and Cohesion - Strategy for Denmark in the Global Economy / Fremgang, fornyelse og tryghed - Strategi for Danmark i den globale økonomi
http://www.globalisering.dk/multimedia/Pixi_UK_web_endelig1.pdf

http://www.globalisering.dk/

Estonia
Action Plan for Growth and Jobs 2005-2007. For implementation of the Lisbon Strategy / Eesti majanduskasvu ja tööhõive tegevuskava 2005-2007. Lissaboni strateegia rakendamiseks
http://www.riigikantselei.ee/failid/1.October_2005_Estonian_Action_Plan_for_Growth_and_Jobs.pdf
http://www.riigikantselei.ee/failid/2005_10_13_MTTK_L_pp.pdf

Estonian Action Plan for Growth and Jobs 2008-2011 For implementation of the Lisbon Strategy / Eesti majanduskasvu ja tööhõive tegevuskava 2008-2011 Lissaboni strateegia rakendamiseks
http://www.riigikantselei.ee/majanduskasv
http://www.riigikantselei.ee/majanduskasv

Knowledge-Based Estonia. Estonian Research and Development and Innovation Strategy 2007-2013 / Teadmistepõhine Eesti. Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia 2007-2013
http://www.hm.ee/index.php?0&popup=download&id=5961

National Strategic Reference Framework 2007-2013 and Operational Programmes / Riiklik struktuurivahendite kasutamise strateegia 2007-2013 ja valdkondlikud rakenduskavad
http://www.struktuurifondid.ee/index.php?id=12034
http://www.struktuurifondid.ee/index.php?id=6473

Progress Report on the Action Plan for Growth and Jobs 2005-2007. For implementation of the Lisbon Strategy
http://www.riigikantselei.ee/majanduskasv
http://www.riigikantselei.ee/failid/EE_PROGRESS_REPORT_2006.pdf

Estonian Copyright Act
http://www.legaltext.ee/en/andmebaas/ava.asp?m=022

Finland
Government statement on Innovation Policy / Valtioneuvoston innovaatiopoliittinen selonteko eduskunnalle
http://www.innovaatiostrategia.fi/en/overview / http://www.tem.fi/files/20298/INNOPOL_SELONTEKO.pdf

Knowledge, innovation and internationalisation / Osaaminen, innovaatiot ja kansainvälistyminen
http://www.minedu.fi/OPM/Tiede/tiede-_ja_teknologianeuvosto/julkaisut/linjaus_2003.html?lang=en
http: //www.minedu.fi/OPM/Tiede/tiede-_ja_teknologianeuvosto/julkaisut/linjaus_2003.html

Review2008 / Linjaus 2008
http://www.minedu.fi/export/sites/default/OPM/Tiede/tiede-_ja_teknologianeuvosto/tiedotteet/STPC_press_2008.12.09_Linjaus2008.pdf
http://www.minedu.fi/export/sites/default/OPM/Tiede/tiede-_ja_teknologianeuvosto/julkaisut/liitteet/Linjaus2008_09.12.2008.pdf

Science, Technology, Innovation
http://www.minedu.fi/export/sites/default/OPM/Tiede/tiede-_ja_teknologianeuvosto/julkaisut/liitteet/Review_2006.pdf?lang=en
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Study 6: Options for a European-wide model agreement for contract research / collaborative research

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Table of Contents

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Executive Summary

This paper addresses the use and content of model agreements for research collaborations between the private and the public sector by analysing underlying scenarios of collaborations, the potential impact of different national legal systems and different industry sectors as well as critical and controversial issues involved in contract negotiations to examine the feasibility and options for European-wide model agreements for contract and collaborative research. Public research organisations (PROs) and industry must collaborate more regularly and more effectively than in the past in order to meet the objectives of the Lisbon Agenda. The goal of European-wide model agreements for contract and collaborative research is ultimately to strengthen collaborative research and knowledge transfer and to improve its effectiveness in line with the "Commission Recommendation on the management of intellectual property in knowledge transfer activities and Code of Practice for universities and other public research organisations" ("IP-Recommendations" and/or "Code of Practice") (European Commission, DG Research, 2008).

An appropriate management of intellectual property issues is an important requirement for successful and durable cooperative research activities. The management of intellectual property rights (IPR) must be based on shared principles and practices ensuring reciprocity, equal treatment and balanced benefits, which promotes trust on both sides. The ambition is to build trust and to establish mutually beneficial relations, while respecting each other's core interests (EARTO et al. 2005). Adopting standard practices encourages the development of effective frameworks for long-term collaboration. Model agreements for pan-European application would contribute to standard practices and might be a very helping tool.

One can argue whether model agreements are a blessing or a curse, but most stakeholders involved in research collaborations agree that model agreements serve at least as helpful guideline and reference provided they reflect and balance the different interests of the stakeholders. Stakeholders are therefore in principle in favour of developing a European-wide model agreement for contract and collaborative research. They argue that model agreements would be appropriate and feasible for at least 80% of contract provisions, meaning for 80% of contract provisions model clauses or modules could be drafted without difficulty or lengthy discussions between the public and private sector. The generation of decision tree diagrams would also be of great help according to them.

However, stakeholders also regard model agreements more critically in proportion to the number of clauses that can be negotiated in an agreement, in contrast to non-negotiable clauses, because of the need to apply rules and regulations of i.e. funding organisations which must be respected in the agreement and are not negotiable. Therefore they stress that a precondition to enjoy the benefits of model agreements is the possibility to agree on a professional standard. This could only be accomplished if its provisions achieve to balance the divergent and conflicting interests of the different players. In any case, all stakeholders agree that model contracts cannot be more than a compromise. They are made on a general level, and therefore specific and detailed interests cannot be addressed. This circumstance appears to be one of the reasons why often good models are not achieved.
One major advantage of model agreements stated by stakeholders is the possible reduction of time needed for contract negotiations, if models are used properly. This way more time is available for discussion of the technical and other issues that are most relevant in respective collaborations. However, models do not always have this effect. In fact the use of “bad”/ill-suited models may lead to the opposite effect according to one stakeholder.

Effective collaborative research and management of intellectual property throughout Europe also require that all stakeholders have access to similar resources of professional staff. Stakeholders argue that many organisations of the public and private sector, especially small organisations, may not have access to sufficient professional staff with the required expertise in contract negotiations. Model agreements may help avoiding legal uncertainties of researchers or other non-legal personnel and could thus be beneficial in this matter. Model contracts also appear to be specifically important to small and medium enterprises (SMEs) whose capacity for dealing with the legalities is often less than those of universities. However, model agreements must in any case be adapted to the particular project by qualified staff so that the benefit for researchers and non-legal staff would still be limited.

A number of critical issues frequently arise when negotiating and applying collaborative research agreements. The pivotal challenge of model agreements is to find a balanced solution for diverging interests. If a model agreement does not mutually balance the diverging interests of the partners, it

does more harm to the stakeholders than any good. In this way, it inhibits fair negotiations by fostering positions. Model agreements can create rigid positions and can thereby support the bargaining power of project partners. Hence, existing model agreements are viewed critically and even generally rejected by many stakeholders. As a rule, negotiations must be based on interests, not on positions. Therefore, it is not possible to propose one single solution for diverging interests. To the contrary, model agreements must provide proposed solutions for different scenarios of research collaboration. This might be accomplished by providing a set of model agreements for different scenarios, as done by the Lambert group, or by proposing optional clauses for critical provisions, as in the DESCA model consortium agreement. Where scenarios and optional clauses cannot be agreed upon due to opposing interests of stakeholders, guidelines could be provided instead. The Lambert tool kit and the DESCA model consortium agreement provide useful examples for options for pan-European model agreements. German model agreements for research collaborations on the contrary serve rather as examples for more or less unbalanced agreements as they tend to favour the private sector. They are therefore criticised and not supported by many German universities and German research organisations.

Regarding the feasibility of European-wide model agreements, reflecting diverging interests mutually seems to be the greatest challenge. In comparison, the impact of different and complex legal systems of the member states and different industry sectors do not seem to present a major hurdle. Even though provisions of applicable legal systems have to be taken into account, the compatibility with national and EU law is not seen as an overall critical issue by stakeholders as specific national or EU provisions apply to all contracts directly. Stakeholder from different countries confirmed that standard provisions in research contracts work under different national legal systems. However, it is of great importance to be aware of and to know the national legal framework which implies and its impact on the research project and the agreement. Guidelines and standard clauses seem to be sufficient in most cases to address relevant specifications of national legal systems appropriately. Specific consideration must be given to national provisions regarding intellectual property (IP), in particular to questions of IP ownership as well as state aid law.

Regarding the applicability of different industry sectors the provision of optional industry-specific standard clauses, where appropriate, seems to be equally doable and sufficient. Stakeholders report that different industry sectors generally do not have an impact on research agreements. However, in some sectors, in particular the pharmaceutical and biotech as well as the telecommunication sector, additional sector-specific standard provisions would be required. Even though it would not be possible to cover all legal aspects of every possible industry sector, industry-specific aspects could be included as options or modules, in guidelines or in elucidations.

It is neither appropriate nor possible in this paper to propose specific wording for European-wide model agreements that claims to solve all critical issues. Instead, it is emphasised that in research projects the underlying concerns require consideration and negotiation in the light of the specific objectives that the partners seek to achieve. Nonetheless, the development of standard approaches, arrangements and conditions regarding model agreements, if feasible, is encouraged by stakeholders. Based on the discussions with stakeholders and the analysis in this paper it is therefore recommended to the European Commission to initiate and support a stakeholder-driven process to discuss the feasibility of European-wide model agreements in the Member States, even though some stakeholders query how often model contracts would actually be used in practice. Most stakeholders find such a project useful and exciting, as it would also foster the necessary discussions between the public and the private sector referred to in the "Responsible Partnering Initiative" (EARTO et al. 2005). An equal number of representatives of different Member States of the public and private sector, as well as of different industry sectors should be represented in the stakeholder group. It is recommended to identify different standard scenarios of collaboration and to discuss options for contract and collaborative research in the light of the identified scenarios. One option would be the development of a model agreement for each identified scenario. In addition, optional clauses for critical issues as well as specific legal provisions in identified Member States and industry sectors could be provided, where appropriate.

If the assigned stakeholder group, however, is not be able to agree upon standard scenarios of collaboration and/or optional provisions to balance critical diverging interests, the development of European-wide model agreements for contract and collaborative research may not further be pursued by the Commission, as otherwise it seems likely that unbalanced model agreements would result. The damage created by the use of unbalanced model agreements would be much higher than the actual benefit. In such a case, a set of guidelines including model clauses, links, tools and the like could

instead be developed in the light of the IP-Recommendations, the Code of Practice and the principles of Responsible Partnering for the support of the European research community.

Pan-European model agreements would contribute to share and to exploit knowledge in European/international cooperative research activities. There is also a need for a pan-European model agreement regarding the development of free circulation of knowledge as the "fifth freedom" that will increase trust in European/international cooperative research activities worldwide.

For the future, more consideration could also be given to protection and litigation costs as well as patent-pooling issues, as these issues are not reflected in this paper.

Last but not least, a critical opinion on model agreements by one stakeholder is shared:

"In my opinion, at the present state of affairs, committing substantial resources from stakeholders into the development of a European-wide model agreement for contract research most likely would be a dead end. The reasons behind this (perhaps sad) conclusion are that contract research in today's Europe is typically:

- based on agreements reached between parties belonging to the same jurisdiction (no trans-national element)
- related to the Principal's core business, which varies greatly both between sectors (both private and public) and between organisations
- relies heavily on the Principal's background IP and other proprietary and/or confidential information
- agreed on the basis of different industry models made to serve the industrial stakeholders' individual needs for directed/controlled, short-term, limited scope projects (sub-contracts) (no European-wide model has so far, as far as I know, been provided and put to the test, contrary to the situation in the collaborative research field - see inter alia DESCA)
- an activity that will be subject to national legislation concerning value-added tax ("sale of a research service")

In the area of collaborative research, however, there have been substantial achievements over the last decade in converging rules & models towards European-wide models. As you understand from the above, I would prefer that resources where concentrated on bringing this positive development even further. Having such a model in place, the basis for moving on into the contract research field would presumable be more solid, inter alia due to the efforts done by stakeholders in aligning different interests on a general level (higher success rate)."

"This job is of great importance to all stakeholders".

1 Introduction, objective and methodology

The aim of this paper is firstly to answer the question of whether European-wide model agreements would be of added value to cross border collaboration between the public and the private sector by analysing the current situation of contract negotiations in research collaborations, the use and benefit of existing model agreements and the evaluation of pros and cons of model agreements in general. Secondly, this paper aims to answer the questions if and how a European-wide model agreement could be developed addressing controversial and legal issues, structure, content, basic principles and the procedure of its creation.

To achieve these objectives, this paper analyses specific model agreements and addresses a number of critical legal and industry-specific issues in research-related topics to examine the feasibility of European-wide model agreements for contract and collaborative research. A brief analysis of relevant legal issues of systems of Member States and the European Union and its impact on pan-European model agreements is provided. Therefore, existing model agreements and collaboration agreements used by European organisations as well as relevant literature, guidelines and reports were reviewed. Stakeholders from the public and private sector were involved in the discussion through a questionnaire,[228] interviews, discussion meetings and presentations at stakeholder forums (such as DESCA group meetings, University Business KT-forum, IGLO (Informal Group of Liaison Officers), EARTO working group at Annual Conference, IP management conference, etc.). A two-day workshop was conducted in Brussels with 20 legal counsels and technology transfer staff from public and private organisations to thoroughly discuss the main findings and possible content of this paper.[229] In addition, written feedback was received on draft versions by various stakeholders. Even though the questionnaire was widely distributed (through NCP's, IGLO, KOWI, EARTO, DESCA, etc.) the number received was very low; only 10 questionnaires were received in total.[230] As the discussions with the stakeholders in the workshop and the DESCA group as well as at other occasions were very valuable, the low number of questionnaires received is however not critical for the content of this report.

Firstly, an overview on contract negotiation in research collaborations is given, including typical scenarios, typical content and controversial issues (Chapter 2). Chapter 3 analyses existing model agreements while Chapter 4 focuses on pros and cons of model agreements in general. A key question of this paper is the feasibility of pan-European model contracts, on one hand due to different legal systems in the Member States and industry sectors, on the other hand due to complex and controversial issues (Chapter 5). The discussion leads to proposed options for the content and development of model agreements for contract and collaborative research applicable in the European Union and Associated States (Chapter 6). The paper concludes with recommendations.

[228] The questionnaire is attached as Appendix A.
[229] Participants of the workshop were from the followings organisations and associations: Yellow Research, Alcatel-Lucent, EARMA, Uni Helsinki, KU Leuven, Uni Oxford, Armines, Airbus, NCP Netherlands, IFP, Inserm Transfert, CEA, EARTO, Helmholtz, ANRT, Unite, VTT, WUR, KOWI and Fraunhofer
[230] The questionnaire was received from the following organisations and associations: NCP Netherlands, University of Strathclyde, EARMA, Uni Helsinki, VTT, Uni Oxford, KOWI, Ruhr Uni Bochum, WUR and EICTA (Digital Europe Legal Working Group)

2 Contract negotiations in cooperative research activities

In this section, an overview of the typical scope and content of different types of research agreements, the interests involved as well as controversial issues in contract negotiation are described to elaborate which parts of research contracts are already standardised and therefore could be addressed without difficulty in model agreements and which issues would require special attention or may even impede balanced model agreements.

2.1 General observations on research contract negotiations

General observations reported by stakeholders on the negotiation of research contracts include that sometimes legal experts negotiate contracts according to their internal policies and strategies and not according to the technical and commercial specifications of the project. Often negotiations are blocked by tactics and IP-issues which in fact might not be relevant in every project. Lawyers have to prevent (or minimise) risks for the benefit of their organisation, thus they have to prevent any damage that could stem out of any project. Legal expertise is without question needed in contract negotiation but it is essential that the specifications and objectives of the project are discussed with the researchers involved in the project. Questions like “What does the project intend to achieve?”, “What user rights are particularly needed during the project and for further exploitation of the results?” and the like need to be answered. Otherwise, contracts might be filled with provisions that cover only hypothetical situations like the discussion of user rights, where no commercial application can be achieved in the project. In discussions and negotiations between technical and legal people, it should be possible to find a mutual solution for this dilemma.

Another issue which can be observed, especially in cross-border collaboration is that people use different definitions and language. There is no common legal and technical language. Misunderstandings occur due to different national legal or technical background. English has become the language mainly applicable in cross-border collaboration, but the level of English of involved staff from different European countries differs greatly and often causes problems and misunderstanding when negotiating agreements. Added to this is the fact that the import and use of Anglo-American contractual terms in European contracts may sometime produce unforeseen and sometimes negative effects, as these terms and their use are closely tied to a different contractual culture. To use an example, the use of the term “warranties” may have this effect. Another example is the inclusion of the “entire contract” principle.

Furthermore, contract negotiations should focus on shared objectives (win-win situations) than on opposing interests or positions.

Collaborative research is not only about the transfer of technology. More and more, the paradigm has been shifted from technology transfer to knowledge transfer, which has an impact on the role and modalities of collaborative research. One important aspect of knowledge transfer is learning from partners. But learning processes consume time and resources. Each collaborative project may be part of a more global picture, and it is only the global picture which matters. A global picture means that most often, several different streams of projects will be needed before one is able to combine the results into successful innovation. Finally, a well-balanced situation is not only sharing efforts, costs and returns; it must also include risk sharing, although risk sharing is typically viewed differently according to this status here. Contrary to what many people believe, private parties are generally far more risk aversive than PROs.

2.2 Scenarios of cooperative research activities

Before we can analyse the typical content of contracts in cooperative research activities we need to distinguish between the basic scenarios of cooperative research activities that may be undertaken between PROs and industry partners.

There are three main scenarios of cooperative research activities:

- Research and development ("R&D") service undertaken by a PRO for an industry partner, also referred to as " R&D contract" or "contract research",
- Collaborative research between two or more partners without external public funding, and

- Collaborative research between two or more partners (partly) financed by public funding

The main difference between contract and collaborative research, in fact of a legal nature, is that in contract research there is an "exchange" of a R&D service for a specific fee between the PRO and the industry. The PRO conducts a R&D service for the industry partner and receives in return a fee from the industry partner, which is typically equal 100% of full economic costs of the R&D service plus reasonable margin to comply with the Community Framework on State Aid for Research and Development and Innovation ("State Aid law"). Full economic costs comprise direct, indirect and total overhead including an adequate investment in the organisations' infrastructure.

In collaborative research on the other hand there is no such "exchange" of a R&D service conducted for the other partner, or any other partner in case of a multiparty collaboration, for a fee; in fact each partner carries out the project according to the work assigned to him in the project plan and typically bears the costs for his work on his own (Koch, 2009).

The Code of Practice and the State Aid law also distinguish between contract and collaborative research and define it as follows:

"Contract research means research contracted out to a PRO ("agent") by a private sector entity ("principal"), and whose costs are fully paid by the latter and where the principal carries the risk of failure.[231] In this case the terms and conditions are usually specified by the principal."

However, contract research can mean as well that research is contracted out to a PRO by a public sector entity.

"Collaborative research is when at least two partners participate in the design of the project, contribute to its implementation, and share the risk and the output of the project. In particular, should there be any financial or other contribution form the PRO, this would be considered as a collaborative research situation and not as "contract research".

2.2.1 Contract Research

In this section the characteristics and typical interests and objectives of the public and private sector in contract research are further discussed.

As stated above, the PRO is paid 100% of full economic costs plus a reasonable margin to apply existing knowledge and expertise to a particular technical problem of the industry partner. The PRO acts as a service provider for the industry partner with specialist expertise and/or specialist equipment. However, in many cases non-profit PROs often provide research and development to industry on a full-cost basis without adding any calculated margin. PROs often have high overhead costs and could otherwise not compete in the market. To comply with State Aid rules, this must also be reflected in the IPR section, i.e ownership of results might be kept by the PRO and not transferred to the industry partner. Furthermore, non-profit PROs are not allowed to accumulate profit due to their status.
One important question is how 100% is defined. For example, how is needed background IP of the PRO taken into account, or are rights to inventions which might possibly be developed during the project already included in the price? These issues have to be taken into account in contract negotiations. One can argue that inventions made during the project cannot be anticipated, planned or claimed, and therefore its price cannot be calculated and thus cannot be included in the fee of the research service. And user rights of needed background IP have generally to be negotiated and paid for separately, as they are not part of the research service either. If not 100% of all economic costs of the contribution by the PRO are paid by the industry partner, it may not be contract research, but collaborative research, as it would include a financial or other contribution of the PRO. In contract research the industry partner typically sets the technical specifications, defines the work plan and bears the financial and technical risks at least for the most part. Typical interests of project partners can differ, however, and depend on the circumstances of the project. The frontiers between PROs and industry partners may vary depending on the history of the research in question. Questions like "Where do we come from?", "What is the level of the background of the PRO?", "Where do we want to go?" or "What is the strategy and who are the actors in the research field?" need to be answered.

[231] Stakeholders reported, however, that in R&D contracts the risks are typically not born by the industrial partner only.

Regarding ownership of results, typically the industry partner requires transfer of ownership of results, including all intellectual property rights (IPR) deriving from the research service. In general, one principle should be that if a private entity financially contributes, the status of the ownership of the results should also take into account the level of contribution. PROs, however, often request to keep ownership of the IPR for further research (including third-party research) and offer to grant to the industry partner a user right (non-exclusive or exclusive) in the desired field of application. Though, if the project comprises a pure service for the industry partner where the PRO has no interest whatsoever in the results of the research undertaken, including all IPR, like a study comprising a collection of specific data which the PRO does not need for further research, ownership of all results would likely be transferred to the industry partner. However, this constellation is rather the exception because PROs generally have an interest in the outcome of the research. Due to their public mission to ensure the widest possible dissemination and use of the research results they (co-) produce, they must serve the public and can therefore not be regarded as a pure service provider like a consultancy company, for example. Stakeholders from industry argue however that only if the PRO itself has contributed for more than 50% of the costs would it be acceptable for the PRO to have ownership rights, and licenses to be granted to the private entity. Ownership provisions should be based on shared objectives and interests and not only on financial provisions. Furthermore, background history and strategies of the partners have to be taken into account to avoid any detrimental effect.

In contract research it is therefore important to differentiate between different scenarios of contract research. Special attention must also be made to the definition of results. A distinction must be made between the results of the research and the IPR included in the results. If the content of the research is for example the development of a product, for example a machine, there is no doubt that the industry partner will fully own the machine developed, but it is a matter of negotiation whether the industry partner will in addition fully own all IPR included in the machine.

The Code of Practice unfortunately does not distinguish under the principles regarding collaborative and contract research between different scenarios of contract research. In particular, it defines (p.12):

> *"In the case of contract research the foreground generated by the public research organisation is owned by the private sector party."*

As discussed above, this principle should only apply to scenarios of contract research where the content of the research is a pure service of which the results are of no further interest for the PRO. In addition, the principle does not distinguish between the results and the IPR included in the results because the definition of "foreground" refers to results and to intellectual property rights (IPR) included in the results.[232] Therefore, the rule that foreground generated by the PRO is owned by the private sector party is only appropriate in particular circumstances. As a general principle it appears to be one-sided.

The principle should therefore be understood as a scenario of pure research service for which the private sector entity carries the whole risk of failure, and which is fully paid by the private sector entity, and of which the results are of no further interest for the PRO. In this case the results, including the IPR, would be typically owned by the private sector party.

In the guidance for the implementation of the Code of Practice, it is rightly confirmed that (p. 18)

> *"the parties are free to negotiate different agreements concerning ownership of and user rights to foreground, as the principles in the Code of Practice only provide a starting point for negotiations. For instance, regarding contract research, some of the foreground can be kept by the PRO, if agreed and negotiated so with the private sector party, while respecting the relevant legislation (such as State Aid law)".*

A common procedure in contract research is the application of a "license model" as pointed out above. In this case ownership of the results (products, prototypes or other material objects) developed on

[232] "Foreground" is defined by the Commission e.g. in the FP7 Grant Agreement, Annex II for collaborative projects: "*foreground*" means the results, including information, whether or not they can be protected, which are generated under the *project*. Such results include rights related to copyright; design rights; patent rights; plant variety rights; or similar forms of protection".

It is assumed that the Commission applies the same definition for foreground in the IP Recommendation.

behalf of the private sector entity is transferred to the private sector entity. Any IPR in connection with the results (foreground IPR) is retained by the PRO. The private sector entity is granted a license to that foreground IPR on a non-exclusive or exclusive basis in the desired fields of application to permit utilisation of the development. In this way the competitive strength and advantage of the private sector entity is protected through the possibility to secure exclusive rights. At the same time the competitive position of the PRO which is dependent on a broad knowledge base is improved. In such a concept, confidentiality provisions of the industry partner may be taken into account by the PRO.

Generally, the principle in contract research typically negotiated is that the products generated by the PRO are fully owned by the private sector party. The question of who owns the foreground IP included in the products depends on the project partner's interests in this foreground IP. For the avoidance of doubt, since the industry partner pays 100% of full economic costs of the research service plus a reasonable margin, as the case may be, the PRO granted him all rights necessary to realise a competitive advantage. But this need not necessarily in all cases mean that foreground has to be completely transferred to the industry partner.

2.2.2 Collaborative research outside a public funding scheme

In this section the characteristics and typical interests and objectives of the public and private sector in collaborative research outside a specific public funding scheme are described.

If the research to be undertaken is of scientific interest to one or more PROs and is relevant to the interests, but not for immediate commercial use, of one or more industry partners, then the relationship between PRO and industry partner is usually a joint or shared one. In compliance with the definition of collaborative research in the Code of Practice collaborative research is best defined as research where all parties provide financial or other resources, such as materials or equipment, for the project and all parties have an interest in its outcome for further use and exploitation. Where no external funding is available, all partners bear the costs of their research work themselves. The financial and technical risks involved in the research are shared, and liabilities towards each other are limited or excluded as far as legally possible. Ownership of foreground belongs to the partner who generated the work leading to that foreground. In addition, the partners have to agree on provisions of user rights to foreground IP and background IP. For further exploitation of foreground user rights to background IP is generally provided on a royalty-bearing condition while user rights to foreground IP might be royalty-bearing or royalty-free.[233] The partners also have to agree on joint ownership provisions in case of jointly owned foreground. The main questions in this regard are whether the joint owners have to notify each other or pay any financial compensation when using the joint foreground or licensing it.
A core interest of universities includes publishing research results, while industry partners regard research results as confidential in order to allow protection and further exploitation enabling them to realise a competitive advantage.

Furthermore, the leveraging effect of collaborative research should be mentioned. A basic idea is that each partner only has to pay 50% of his own costs for example, but gets access to the results of the entire project in theory. Obviously, the usefulness of the knowledge of other partners depends on the project. But it is important not to see it narrowly in terms of 50% of the partner's own share.

2.2.3 Collaborative research financed by an external public funding scheme

Finally, the characteristics and typical interests and objectives of the public and private sector in collaborative research (partly) financed by an external public funding scheme are described.[234]

As in collaborative research without explicit external public funding, all partners provide financial or other resources such as materials or equipment for the project, and all partners have an interest in its outcome. The difference is that the specific **legal framework of the public funding scheme** applies to the collaboration and has to be referred to in the collaboration agreement. The conditions of the funding scheme can have a great impact on the collaboration agreement and may limit the flexibility and autonomy of the partners to negotiate the provisions of their choice. Therefore general model agreements for collaborative research would only have a limited use in these types of collaborative projects. Rather a model agreement would need to be developed under each specific funding scheme

[233] see for ex.: IPR provisions of Annex II of the Grant Agreement for collaborative projects funded under FP7.
[234] As many PROs are directly publicly funded, only additional explicit external public funding is meant here.

as for example already developed for the Framework Programmes of the European Commission (FP), currently FP7, through the model consortium agreements DESCA, EICTA IPCA, EUCAR or IMG4. (see section 3 below). **Therefore collaborative research (partly) financed by an explicit external public funding scheme is only partially further considered in this paper.**

2.3 Typical scope and content of R&D contracts

In order to be able to discuss options for European-wide model agreements it is important to identify the typical scope and content of research contracts. This is done for contract and collaborative research contracts separately. As mentioned above only collaborative research agreements that do not have to take into account the specific legal framework of a public funding scheme are addressed.

2.3.1 Contract Research

Typical sections of contract research agreements include the following provisions, although the list included her does not claim to be exhaustive:

- **Definitions**

This section defines the terms used throughout the contract.

- **Subject**

The content of the service, also defined as the description of work, is defined in this section, mostly attached in an annex to the contract.

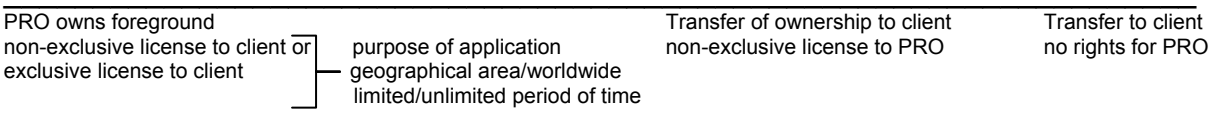
- **Financial provisions**

In contract research the costs of the research activity are generally paid 100% (full economic costs plus a reasonable margin as the case may be) by the industry partner. VAT is added to the fee according to the applicable law of the contract. Provisions on adjustments of the fee may be added for the case that the research and development service cannot be undertaken at the agreed fee. A payment schedule determines the due date of instalments.

- **Research and development result; Rights of Use**

In this section ownership of the research and development results and user rights are defined. Despite the principle of contract research in the Code of Practice, the spectrum of IPR provisions can range from the PRO owning all foreground while granting a non-exclusive license to the industry partner (and to its affiliates, as the case may be) (client) for the purpose of application on which the contract is based and/or in a specific geographical area or worldwide and for a limited or unlimited period of time, to granting an exclusive license to use foreground to the industry partner. Further, it can also include the industry partner owning all foreground and granting a non-exclusive user right to the PRO to complete transfer of ownership of foreground from the PRO to the industry partner without any remaining user right for the PRO at the other end of the line (see graph below for better visualisation). In between many different scenarios of IPR provisions can be identified.

Spectrum of IPR-provisions in contract research:



If during the performance of the contract already existing industrial property rights or copyrights of the PRO ("background IP") are used which are required for the client's commercialisation of the research result, then the client is typically granted a non-exclusive right of use under a separate agreement unless other obligations entered into by the PRO preclude this. As discussed above, the granting of user rights to needed background IP is typically under royalty-bearing conditions and not included in the research service fee.

- **Third-party property rights**

In R&D projects where a lot of IP is used, it is important to agree upon how the serious risk of financial damages due to infringements of third-party property rights is born by the parties.

- **Liability**

In this section liabilities and their limitation are dealt with. Liability of the PRO in the case of violation of obligations (except of essential obligations) and tort may be limited to intent and gross negligence. Liability of the partners is typically limited to the foreseeable, contractually typical damages and is excluded for any indirect or consequential loss or similar damage such as, but not limited to, loss of profit, loss of revenue or loss of contracts. However, limitations of liability generally do not apply to damages from injury to life, body or health subject to national legislation.

- **Statutes of limitation**

To avoid legal uncertainties, many agreements include a time limit for claims of the client for breach of duty and tort, for example to 12 or 24 months. In such case it is usually stated in the contract that negotiations between the contracting parties over claims or over circumstances giving rise to claims suspend the statutes of limitation.

- **Retention of title**

Many contracts include a clause that the client shall only be granted ownership to the result of the research and development and/or the right of use according to the specific IPR provisions in the agreement after full payment of the agreed fee.

- **Confidentiality**

Confidentiality clauses are quite standard in research agreements. An important aspect of the clause is the inclusion of a time limit until when confidential information has to be kept confidential. A time limit of five years is typical. In some provisions all information which is exchanged in the project has to be kept confidential by the party receiving the information from the other party. Standard rule however is the provision that all information which is declared or clearly marked as confidential shall be kept confidential by the receiving party. It is always added that the confidentiality provisions do not apply to information known or generally accessible to the other contracting party or to the public, or information which becomes known or generally accessible to the public after disclosure without any involvement or fault on the part of the other contracting party, or to information disclosed or made accessible to the other contracting party by an entitled third party, or information independently developed by an employee of the other contracting party not in possession of the information disclosed.

- **Publication, Advertising**

If the PRO retains ownership of the results, the client may only be entitled to publish the result of the research and development including identification of the author, after prior consultation with the PRO. For purposes of advertising, the client may only mention the name of the PRO with express consent.
If the client has been granted exclusive user rights or if ownership of the foreground is transferred to the client, the PRO may not be entitled to publish the results of the project. The client, however, needs to negotiate with the PRO how dissertations, applications, and/or registrations of intellectual property rights are dealt with, as supervising dissertations etc. are part of the PRO's public mission, especially if it is a university.

- **Termination of contract**

In this section the possibility to terminate the contract is dealt with. Each contracting party may be entitled to terminate the contract with prior written notice of a certain time limit, e.g. one month minimum. Reason could for instance be that no essential progress in work has been achieved within a significant period of performance. However, since high costs are usually involved in research and development projects termination may be excluded after a certain period of time since the beginning of the contract, e.g. 6 months, and the right of termination is generally limited to exceptional cases only after that time. Each contracting party is usually entitled to terminate the contract with immediate effect for good cause. A provision is added, whether and how the PRO is compensated for the results achieved (which have to be submitted to the client) until termination in case of earlier termination.

- **Miscellaneous / General Issues**

Under the miscellaneous section general issues like applicable law, jurisdiction, or severability are dealt with. These are all standard clauses found in numerous model contracts. A clause is usually added that all ancillary agreements, amendments, additions to the agreement have to be made in writing. A further clause is often added that the United Nations Convention on the International Sale of Goods (CISG) does not apply, as it may conflict with national law. Often, arbitration and mediation

(e.g. International Chamber of Commerce (ICC) or World Intellectual Property Organisation (WIPO)) are agreed upon.

2.3.2 Collaborative Research

In this section, the typical content of collaboration agreements is described. The typical sections of all types of cooperation agreements, two-party and multi-party, include the following provisions, although this list does not claim to be exhaustive:

- **Subject / Purpose**

As in contract research agreements the subject of the joint project is defined in this section, often in a work plan which is attached as an annex to the agreement. The tasks of the partners are typically organised in work packages.

- **Duration**

Often, start and end dates are given. In projects with external public funding, the duration of the grant agreement usually applies to the collaboration agreement. In such cases the collaboration agreement continues in full force and effect until complete fulfilment of all obligations undertaken by the parties under the respective grant agreement and does not provide a specific end date.

- **Rights and Obligations of the Parties / User Rights**

In line with the interests of the parties discussed above under section 2.2.1 and 2.2.2 obligations in this section may include: obligation to exchange all relevant information; for the duration and implementation of the project obligation to grant royalty-free, non-exclusive user rights to needed background (provided that the granting partner is legally free to do so) and/or foreground and in some cases may also include access to side ground (IPR created in parallel to the project). Furthermore, it may include the obligation to grant non-exclusive user rights to foreground for further use and exploitation on royalty-bearing or royalty-free conditions, as well as provisions on joint ownership.

Foreground usually belongs to the partner who has generated the work leading to the foreground. If inventions are jointly achieved by the collaborating parties during the performance of the project (i.e. inventions which include the work of several partners whose intellectual contributions to the idea of the invention cannot be registered separately by each partner as industrial property rights, known as "joint inventions" or "joint ownership"), they may be used and licensed by each contracting party either with or without notification and with or without financial compensation subject to a separate joint ownership agreement. However, framework conditions for joint ownership, including bearing of costs for registration, maintenance and defence of IPR, are usually already included in the collaboration agreement.

- **Governance**

In cooperation agreements with many partners, it is advised to have a management structure in the work plan which is reflected in the cooperation agreement in the governance section. Provisions include the tasks of management bodies, voting rules, frequency of meetings, etc. The DESCA model consortium agreement provides good examples for the governance section.

- **Financial Provisions**

In projects with no explicit external public funding, the partners usually bear the costs of the research work themselves. In case of joint ownership, costs of intellectual property protection might be shared between the parties. Partners may pay royalties to other parties for user rights to background and foreground. In projects with external public funding the specific financial provisions of the grant agreement apply. They are reflected in the collaboration agreement. The budget is usually attached as an annex to the collaboration agreement or applies as part of the workplan.

- **Confidentiality**

Clauses on confidentiality are also standard in collaboration agreements. Generally, no differences apply between collaboration and contract research agreements (see above, under section 2.2.1).

- **Liability**

In collaboration agreements, the partners usually limit or even exclude any liability, except in cases of gross negligence and intent or just in cases of intent.

- **Termination**

Each partner may terminate his participation in the project subject to prior written notice, i.e. three months, for good cause only. A good cause is usually given if further co-operation has become unacceptable, e.g. in case of external public funding, if funding has been reduced significantly. Provisions are added how rights and obligations further apply to the withdrawing partner:

Standard provisions are:

- o User rights to foreground and background granted to the withdrawing partner generally terminate
- o The licenses or user rights granted to the other partners by the withdrawing partner are generally not affected and stay in force
- o The obligations according to confidentiality usually remain unaffected until the time limit agreed in the respective confidentiality clause

If the continuation of the joint project is reasonable, the tasks of the withdrawing partner which have not yet been carried out may be taken on by a new partner after mutual written agreement of the remaining partners. The obligations of the remaining partners to the withdrawing partner stay in force only for research results that were attained prior to the receipt of notice of withdrawal. The rights and obligations of the withdrawing partner usually continue to apply to all research results and industrial property rights that are granted to him on the basis of activities which were assumed and/or started in connection with the project. In the event that the partners mutually agree that the development goal of the project cannot be attained and that thus the basis for the cooperation agreement ceases to exist the partners agree on further proceedings, including any rights to already attained research results, and may conclude a separate agreement, if necessary.

- **Miscellaneous**

Under the miscellaneous section general issues like applicable law, jurisdiction, or severability are dealt with. As in contract research agreements, these are all standard clauses. Concluding provisions may also include a clause that all ancillary agreements, amendments, additions to the agreement have to be made in writing. A section on subcontractors might be added. If a partner assigns some of his tasks to a subcontractor, this generally does not affect its own obligations resulting from the agreement. The respective partner must secure that the subcontractor will comply with all obligations – especially with regard to confidentiality – resulting from the agreement and that the results attained by the subcontractor will be made available to the other partners according to the agreement.

2.4 Typical controversial issues

This section describes issues which are typically controversial in the negotiation of research contracts and might therefore be critical and sensitive in the development of options for model agreements. The pivotal challenge of model agreements is to find a balanced solution for diverging interests. If a model agreement does not mutually balance the diverging interests of all partners, it does more harm to the stakeholders than good.

- **Subject / Financial Provisions**

In contract research the greatest difficulty, obviously, is to agree on the content of work and the fee for the research performed by the PRO. Regarding the fee, the determination of acceptable overheads is often a critical issue. In collaborative research the calculation of financial contributions and determination of payment terms or price revisions might be critical. The calculation of the fee or the financial contribution should include a reasonable contribution to supervisory and infrastructure costs of facilities made available to the project by the PRO (EARTO et al. 2005). In general, the calculation of the fee or the financial contribution will depend on the nature of the collaboration, the use that the partners expect to make of the results, and the rights and benefits that each partner retains.

- **Intellectual Property Rights**

Once the project plan and financial provisions are basically in place, typical controversial issues arise first of all around the provisions of intellectual property rights, meaning questions of ownership, scope and conditions for user rights to background and foreground, publication rights, etc. Partners have difficulty in defining their interests and objectives relating to IPR issues in the project, and in finding the balance between their interests, especially if they do not have access to professional advice and legal

service in order to find an agreement of mutual benefit. In contract research, industry partners usually expect the transfer of ownership for the reason that 100% of the full economic costs of the research work are born by the industry partners, while PROs generally prefer the license model. Industry partners sometimes argue that their request is fair as PROs, unlike industry partners, are already funded by public money, i.e. tax money. Another critical issue in that regard is whether spontaneous inventions made by the PRO during the research work are already included and paid by the fee. Industry partners support this view. PROs argue on the other hand that inventions cannot be claimed, as they cannot be defined in the project plan and are thus not part of the research service fee. This would mean that inventions belong to the PRO and rights thereto have to be paid for additionally.

- **Joint Ownership**

Conditions for joint ownership are often disputed as well. PROs who can only exploit research results by licensing out usually request financial compensation or consent to licensing the jointly owned research results. Industry partners on the contrary generally request free exploitation of the joint ownership without consent and the obligation to financially compensate the PRO.

It is advised to avoid joint ownership where possible. Joint ownership agreements are complex and require a great effort to manage, as it might be difficult to assess the portions of jointly owned IPRs that each partner is entitled to (especially regarding costs for filing, maintenance, defence of such IPR) and it also might limit significantly the efficient exploitation of the IPR.

- **Liability**

A further critical issue is liability and the limitations of liability usually requested by non-profit PROs. Non-profit PROs generally are not able to accumulate financial reserves for financial indemnification or penalties due to their non-profit status. Therefore it is problematic for those PROs to assume high risks which cannot be calculated and for which damages cannot be foreseen. Especially the liability for infringement of third-party intellectual property rights is a very critical issue for PROs. In contract research, PROs are often asked by the industry partner to warrant that the results are free of any third party intellectual property rights. This means in many cases a high risk for the PRO, as the situation of intellectual property rights cannot be overlooked around the world without making a thorough patent search in every country. A world-wide patent search would take up too many financial and other resources and, besides that, reliability is not guaranteed. That is why it is principally impossible for any project partner to provide a world-wide warranty that the results are free of third-party intellectual property rights. Solutions for sharing the risk of IP infringements in a fair way must be found. It should also be reflected appropriately in the liability provisions that it is immanent to research that no party can anticipate the results of the research.

- **Publication**

Publication provisions are also critical in contract negotiations, in particular if the PRO is a university the interests of the industry partner and the university oppose each other. Generally, the university has to publish the results (sometimes even required by law) (“publish or perish” Schöck, 2009) while the industry partner regards the results as trade secret and therefore confidential. This is especially critical where dissertations undertaken at the university are involved.

2.4.1 Conclusion: 80/20 rule

Despite of the numerous controversial issues listed in this section, according to the contributions of many experienced stakeholders, about 80% of contract provisions are not controversial in contract negotiations while only (or still) a maximum of up to 20% of contract provisions might be controversially discussed. This phenomenon is called the "80/20 rule" in this paper. It is therefore argued that model agreements are appropriate and feasible for at least 80% of contract provisions, meaning for 80% of contract provisions model clauses or "boilerplates" (*boilerplates* are defined as text modules or standard text) could be drafted without difficulty or lengthy discussion between stakeholders from the public and private sector.

One stakeholder however commented: "*The „80/20“-rule is easier sold than bought! In the practical world, at least from my experience it is the 20% part that consumes 80% of negotiation time incl. legal work!*"

3 Existing Model Agreements

A number of model agreements for public / private research and development collaboration already exist. In the following a brief overview of selected model agreements is provided to assess whether these model agreements could serve as reference or good example for options of European-wide model agreements.

3.1 Lambert Tool Kit for Collaborative Research ("Lambert Agreements")

Probably the best-known model agreements in Europe are the Lambert Agreements from the UK.[235] The Lambert Agreements provide an innovative Tool Kit with model agreements to facilitate collaboration between publicly-funded research organisations, with a focus on universities and industry.

The Lambert Agreements were developed by the Lambert Working Group of Intellectual Property ("Lambert IP Group") following a recommendation in the Lambert Review on Business-University Collaborations in December 2003.[236] The fact is that the development of model contracts or rather the problem of forming contracts was one of the main barriers to cooperation especially between SMEs and universities identified in Richard Lambert's review. This is why the initiative to develop the Lambert Agreements was taken.The Lambert IP Group was set up in May 2004, chaired by Richard Lambert.
Members of the working group include key stakeholders from UK associations, UK universities, UK companies and government departments.
The group is facilitated by the UK Intellectual Property Office (UKIPO), a unit of the Department of Business Innovation and Science (BIS). The tool kit was among others written by Christine Reid, Member of the Lambert Inner Working Group (Reid, 2007).

"The aim of the Lambert agreements is to encourage university and industry collaboration and the sharing of knowledge. They do not represent an ideal position for any party, but represent a workable and reasonable compromise for both or all parties."[237] (Lambert Tool Kit)

3.1.1 Features

Key features of the Lambert Tool Kit are:

Lambert Model Research Collaboration Agreements 1-5: (one to one)
Five model bilateral agreements which cover different scenarios of collaboration between one academic and one industrial party.

Lambert Model Consortium Agreements A-D: (multi-party)
Four model consortium agreements which cover different mechanisms for IP ownership and exploitation in research collaborations involving several parties.

The Tool Kit also provides:

- a "Decision Tree" to help users selecting one of the Research Collaboration Agreements 1-5. There is no decision guide for the five model Consortium Agreements.
- "Guidance Notes": clear explanation for each part of the agreement, with hypertext links from the model agreements
- "Outline": a summary to identify the major issues in a collaborative research project.

Table 1 outlines the IP terms for Lambert model Research Collaboration Agreements 1 to 5.

[235] see: http://www.innovation.gov.uk/lambertagreements/
[236] http://www.hm-treasury.gov.uk/d/lambert_review_final_450.pdf: the development of model agreements were recommended under Recommendation 3.5.
[237] http://www.innovation.gov.uk/lambertagreements/

Lambert Research Collaboration Agreement	Terms	IPR
Agreement 1	Sponsor has non-exclusive rights to use in specified field/territory; no sub-licences	University
Agreement 2	Sponsor may negotiate further licence to some or all University IP	University
Agreement 3	Sponsor may negotiate for an assignment of some University IP	University
Agreement 4	University has right to use for non-commercial purposes	Sponsor
Agreement 5	Contract research: no publication by University without Sponsor's permission	Sponsor

Table 1: IP terms for Lambert model Research Collaboration Agreements 1 to 5.[238]

Table 2 outlines the IP terms for Lambert model Consortium Agreements 1 to 4.

Lambert Model Consortium Agreement	Terms
Agreement A	Each member of the Consortium owns the IP in the Results that it creates and grants each of the other parties a non-exclusive licence to use those Results for the purposes of the Project and for any other purpose.
Agreement B	The other parties assign their IP in the Results to the lead Exploitation Party who undertakes to exploit the Results. (Alternatively the Lead Exploitation Party is granted an exclusive licence).
Agreement C	Each party takes an assignment of IP in the Results that are germane to its core business and undertakes to exploit those Results.
Agreement D	Each member of the Consortium owns the IP in the Results that it creates and grants each of the other parties a non-exclusive licence to use those Results for the purposes of the Project only. If any member of the Consortium wishes to negotiate a licence to allow it to exploit the IP of another member or to take an assignment of that IP, the owner of that IP undertakes to negotiate a licence or assignment.

Table 2: IP terms for Lambert model Consortium Agreements 1 to 4[239]

The Consortium Agreements do not cover all the circumstances that might arise when a group of universities and industrial partners get together to carry out research, but they illustrate terms that might apply in four possible scenarios.

3.1.2 Assessment

The scenario based approach, decision tree, guidance notes and outline are of great benefit especially to inexperienced researchers and other non legal staff. This could serve as a very useful basis and reference for the development of a European-wide model agreement. A UK stakeholder said that one of the best things to come out of the model contracts discussions have been the generation of the decision tree diagrams which help with the consideration of all the relevant points in a piece of work.

[238] source: http://www.innovation.gov.uk/lambertagreements/index.asp?lvl1=2&lvl2=0&lvl3=0&lvl4=0
[239] source: http://www.innovation.gov.uk/lambertagreements/index.asp?lvl1=3&lvl2=0&lvl3=0&lvl4=0

Representatives from the Lambert Group reported that the high use of the Lambert Agreements was proven in different surveys even though other stakeholders from the UK also reported, that the Lambert Agreements are not directly used in practice. However, they are used as reference in critical negotiations. A further UK stakeholder reported that the Lambert Agreements have not been used that often. However, the main benefits of the Lambert Agreements have been that they identify principles within each that are common to both parties and set out positions for the parties. This means that in a negotiation whilst you might not use the Lambert Agreement you might agree, for example, that the provisions of Lambert 3 are applicable in this case.
According to surveys conducted by the Lambert Group Lambert is globally used, as far as Mexico. It was also reported that the Lambert Agreements receive excellent feedback (McCaul, 2009). According to the feedback of various other European stakeholders it seems as if the Lambert Agreements are not widely used in Europe. In any case, it must be taken into account that the Lambert Agreements are used solely within the Anglo-American contract area / tradition.

In the discussion of this expert paper, some stakeholders from countries outside of England reported that they find it difficult to use the Lambert Agreements, as the terms and language were difficult to understand for somebody not familiar with the legal system of the UK.

Some PROs perceive the Lambert Agreements as being industry-friendly. As the starting point is that the university owns the IP with the option of the industry partner to acquire more rights, this view is not shared by many others.

One major point of discussion is that the Research Collaboration Agreements only provide one model for contract research (No. 5), with only one scenario:

> *"No publication by University without Sponsor's permission, IPR belongs to sponsor."*[240]

Thus, the different scenarios of contract research as described under 2.2. are not addressed.

3.2 FP7 Model Consortium Agreements

3.2.1 DESCA

DESCA (**DE**velopment of a **S**implified **C**onsortium **A**greement for FP7), launched in May 2007, is a comprehensive, modular consortium agreement for collaborative projects funded under FP7. Initiated by key FP7 stakeholder groups from the public and private sector, and co-developed with the FP community, it offers a reliable frame of reference which seeks to balance the interests of all of the main participant categories in FP research projects: large and small companies, universities and other PROs.

In FP6, many different groups produced their own model consortium agreement to fit the particular circumstances of the particular group. Some users then compiled what looked like the “best bits” from different models and sometimes drafted internally inconsistent documents as a result. The DESCA project has tried to bring together all of the key groups involved in producing FP6 model consortium agreements, with the aim of producing one consistent modular agreement for FP7 in the spirit of the “Responsible Partnering” initiative.

DESCA's structure can be described by the following features: (DESCA, 2007)

• Single: One balanced core text where possible
• Modular: DESCA provides options where necessary:
– alternative modules for large projects and small projects
– an optional module for projects with a strong software focus
– optional clauses in the IPR section

[240] This option is not available to Norwegian universities as of 2009 01 01 , due to the codification of the individual academic freedom.

• Didactic: Guidance notes to illustrate and explain clauses and options, examples for different project types to help research managers without legal training as well as first-time FP participants to recognise key issues and to make informed choices to protect their interests.

The DESCA model enjoys broad acceptance in the research community and is widely used in FP7 projects all around Europe, in particular by research organisations and universities, but also by private companies. Stakeholders report that time for negotiations of consortium agreements, even in big consortia with more than 10 partners, has been tremendously reduced in FP7 compared with FP6. About 80% of the DESCA provisions are usually uncritical. However, one stakeholder reported that one of the reasons that a model agreement such as DESCA can be so successful is because of the non-negotiable nature of FP grant agreements. Basically, the parameters within which all the participants operate are well set out in the Grant Agreement and, whilst there are obviously opportunities to negotiate around various issues, the fundamental points of the Grant Agreement must be respected.

One major point of discussion is that even though some representatives from private companies were part of the DESCA group and provided useful input and feedback that was taken into account, at the end the group could not fully agree with the industrial partners on issues like IPR and liability despite the offer to provide options. Industrial partners therefore do not support DESCA. Instead own model consortium agreements were drafted for different industry sectors. However, stakeholders do not report any major difficulties with private companies when negotiating consortium agreements based on DESCA.

3.2.2 EICTA IPCA

EICTA IPCA[241] is the **I**ntegrated **P**roject **C**onsortium **A**greement (IPCA) template of EICTA, the industry body representing the European digital technology industry.

In FP6 EICTA had already developed a model consortium agreement which became the major model consortium agreement not only for the European digital technology industry, but also for all kind of industrial companies. Members of EICTA, namely Alcatel-Lucent and Motorola were also part of the DESCA group, so there was a fruitful discussion between DESCA and EICTA IPCA supporters.

The EICTA IPCA template is composed of two parts. IPCA Part I contains the information specific to the project, and IPCA Part II regroups the legal conditions.
A lot of options are provided for many different aspects.

The main differences to DESCA can be found in the IPR, liability and software section. Access rights (user rights) to foreground are much broader and more favourable in EICTA IPCA than in DESCA. Access rights to side ground are granted in EICTA IPCA, even though access rights to side ground are no longer granted in the FP7 Model Grant Agreement like in previous FPs.

Next to DESCA, EICTA IPCA appears to be the main model consortium agreement used in FP7 collaborative projects. It is used by consortia with strong participation of industrial companies. However, usage appears to be relatively low compared with DESCA. The reason for this could be the lower participation of industry in FP7 in general, and the rather uncommon case that industry partners coordinate a project. Major point of discussion is that EICTA IPCA was developed by one interest grouping without participation of other R&D stakeholders and is therefore generally not supported by PROs. Even though it provides very well-thought through clauses it favours mainly the interests of the industrial sector and is thus not of general use by all FP stakeholders.

3.2.3 EUCAR Model Consortium Agreement FP7

EUCAR, the European Council for Automotive R&D, is the European body for collaborative automotive and road transport R&D. Also EUCAR has already provided a model consortium agreement in FP6 which was used in a significant number of projects with a strong automotive focus, but also by industrial companies in general. The EUCAR Model Consortium Agreement FP7 was launched in April, 2007.

[241] see: http://www.eicta.org/index.php?id=242&id_article=163

The provisions of the model serve the interests of the industrial sector in general and the automotive sector in particular, with a strong focus on exploitation and dissemination of project results. IPR provisions are therefore more favourable to project participants than in the FP7 Model Grant Agreement.

The EUCAR Model Consortium Agreement FP7 is mainly used by participants of the automotive industry. Participants of other industrial sectors seem to prefer EICTA IPCA. However, reliable data on the frequency of usage of FP7 model consortium agreements are not available. Major point of discussion is that EUCAR was developed, as EICTA IPCA, by only one interest grouping without participation of other R&D stakeholders and is therefore not supported by PROs.

One member of EUCAR, namely Daimler, participated also in the DESCA group so that there was not only fruitful discussion between DESCA and EICTA IPCA but also with EUCAR supporters.

3.2.4 IMG^4 FP7 Model Consortium Agreement

The IMG^4 FP7 Model Consortium Agreement242, launched on Oct. 25th, 2007 is provided by ASD-IMG4. ASD is the AeroSpace and Defence Industries Association of Europe. IMG is the Industrial Management Group which represents the larger aerospace companies in Europe. The IMG4-Model is based on DESCA (same headings and clause numbers) and has the same drafting style (AEROSME, 2007). Changes to DESCA can be found in the IPR, liability and governance sections to better serve the objectives of the industrial community in general and the aeronautic sector in particular. Different options like in DESCA are not provided. A model for small ("level 1") and large ("level 2") projects is provided as well as a "Model Agreement for the loan of material or equipment" (Attachment 6 of the model).

3.3 German Model Agreements for Contract and Collaborative Research

In Germany several model agreements for contract and collaborative research have been developed by different stakeholders since 2002, mainly due to the abolition of the "professor's privilege" in Germany (§42 ArbEG (Employee Invention Act)). These are among others namely:

- Berlin contract modules -"Berlin Contract" (Berliner Vertragsbausteine-"Berliner Vertrag")
- "BMWI" (Bundesministerium für Wirtschaft und Technologie): Model R & D Cooperative Agreements)
- Düsseldorfer Guidelines for R&D Contracts between University and Industry ("Düsseldorfer Verträge")
- "Hamburg Contract" ("Der Hamburger Vertrag")

As these models are developed for research cooperations taking place in Germany and are often only available in the German language, only a brief overview is provided in the following:

3.3.1 “Berliner Vertrag”

The Berlin Contract Building Blocks are a collection of template modules for contract and collaborative research. Participants of the working group were from German universities and German industry partners, although industry was significantly more represented than universities.
The model provides two agreements, one for contract research and one for collaborative research.
The IPR provisions provide in contract research the transfer of ownership of the results and IPR to the industrial partner, while in cooperative research the industrial partner is granted an option for a world-wide exclusive license to use the results owned by the university if the university's part in the invention is 50% or above. If the part of the invention attributable to the industry partner is 50% or above, all results and IPR are owned by the industrial partner. In all cases, the university is granted the right to use the results in teaching and further research. Key provisions concern protection costs and financial compensation for inventions. For contract research the concept of a fixed rate is adopted. The model also proposes a respective example of calculation of licence fees.

The Berliner Model Contract serves the interests of the industrial sector. As no options are provided and very specific provisions for the calculation of licence fees are offered, the model does not offer

[242] http://www.aerosme.com/news/article.asp?article=250

much flexibility. The model is not supported by academia and most PROs and is applied in only a few number of projects (Schöck, 2009).

3.3.2 Hamburger Vertrag

Like the Berliner Vertrag the “Hamburger Vertrag” is a model agreement for cooperations between universities and industry. The model is another example of an industry-friendly model. Ownership of all results and IPR are transferred up front and assigned to the industry partner upon signing the agreement. The university waives the right to claim any inventions arising from the research project. Due to the imbalance of interests addressed, the “Hamburger Vertrag” is nearly unanimously rejected in Germany by PROs and in general practice (Schöck, 2009).

3.3.3 Düsseldorfer Vertragswerkstatt-“Düsseldorfer Verträge”

The "Düsseldorfer Vertragswerkstatt" ("Düsseldorf Contract Factory"), launched in January 2004, is a cooperation between Heinrich-Heine-University Düsseldorf and the Center for Intellectual Property, Düsseldorf (CIP). The motive for the cooperation was the development of template modules for a research cooperation agreement between universities and industrial companies (no model for contract research proposed). The contract modules were presented in 2006. The aim of the modules is to strengthen the position of universities in negotiation with industry and to find a balanced solution. Options for payment and patent exploitation clauses are proposed. It is not reported whether the Düsseldorf contract modules are in practical use.

3.3.4 BMWI (Counsel for Innovation): Sample agreements for R&D cooperation

The Sample agreements for R&D cooperation were requested by the "Council for Innovation and Growth" housed within the Federal Chancellery and were launched in 2007. The committee of experts was comprised of representatives from German industry and German universities/research organisations. The package consists out of four model agreements: one model contract for a research cooperation agreement, two varieties for contract research (one with assignment of IPR to industry, one with license to use IPR for industry) and one model for a service contract. The licence model (assignment of rights to the industrial partner instead of transfer of ownership) is not applied in any other prominent German model contract. Furthermore, a model for calculation of remuneration of licence fees is proposed. The sample agreements are currently being reviewed because of upcoming changes in the German Patent Law and Employees Inventors Act. PROs appreciate the introduction of the licence model in principle, but less in its specific embodiment. Overall, the sample agreements are a further attempt to reach a compromise between the respective interests of PROs and industry, though is not yet widely accepted by all stakeholders (Goddar, H. et al., 2009). Also, the BMWI-model is still not well known in practice and therefore hardly applied yet in research projects (Schöck, 2009).

3.3.5 Conclusion German Model Agreements

There are no reliable data as to how often the four German model agreements are used, so that their benefits and added value are difficult to assess. The Berlin Contract is probably the best known and the most widely used. German stakeholders reported that they do not use any of these model agreements and that they hardly come across them in projects so that it can be assumed that the model agreements are rather seldom directly applied in Germany (Schöck, 2009). Reasons for this are probably that all major organisations have their own internal model agreements. However, university representatives reported that industry partners make reference to the Berlin Contract in negotiations, which makes negotiations challenging. It is therefore assumed that the model agreements still serve as guideline, reference and as source of *boilerplates*. The German model agreements are however not supported by most PROs in Germany due to their focus on industrial interests.

As the models specifically refer to specifications of German law (in particular German Employees Inventors Act) and in most cases are only available in German language they are of very limited use in other Member States or Associated Countries.

In comparison with the Lambert Agreements Germany grants more decisive power to the industry, while the UK grants more power to the universities (Werner, 2009).

3.4 Final Remarks on existing Model Agreements

All model agreements have a rationale on which they are based or which applies as a higher concept. One could say that some model agreements are more "project oriented", while others are rather "market oriented". They may intend to serve a bigger picture. As an example, one could argue that DESCA and Lambert could be regarded as "project oriented" as they focus very much on the successful implementation of the specific project and that IPCA EICTA, EUCAR or the German model agreements are "market-oriented", as they put strong emphasis on the unpredictability of the most favourable conditions for world-wide dissemination of projects results. Consistently, IPCA EICTA, EUCAR or the German agreements go beyond project needs to cover exploitation needs of private companies which intend to commercially exploit research results. This seems logical; however, this rationale is not clearly stated in these model agreements.

The rationale of model agreements should always be clear and fully explained. This would mean for the development of European-wide model agreements that at the beginning of the project the rationale that is to apply to these agreements must be discussed and agreed upon before continuing the project.

4 Advantages and Risks of Model Agreements

In this section advantages and risks of model agreements are analysed as well as lessons learned form the experiences with existing model agreements.

4.1 Advantages of Model Agreements

A key benefit of model agreements is that they simplify and facilitate the negotiation process. However, this is only true if the model is well adapted to the specific scope or type of cooperation project (the need for a critical mass of equal cases/projects). This way valuable time and costs are saved which can then be used for other important key issues of the project. This way, model agreements increase the efficiency of negotiation. Model agreements also demonstrate best practices or guidelines and serve as frame of reference when critical issues arise. Model agreements can be used as a check-list and help users who are inexperienced in contract negotiations. Organisations use model agreements as a source for legal provisions or *boilerplates* when drafting own internal model agreements. Good models facilitate the negotiation process and thereby foster the relationship between the project partners. They clarify differences and similarities of different types of research agreements (i.e. contract research agreement, collaborative research agreement, consortium agreement or service contract) and their particular provisions. Good models increase the quality of contracts, as they are typically drafted by a number of experts experienced in contract negotiation. Therefore, they contribute to legal certainty.

In conclusion, if used and applied successfully model agreements facilitate cooperation between public and private organisations. This includes the mutual acceptance of differentiated interests of different industry sectors as well as the differences in the strategic focus of universities. They provide a base for a common discourse and create a common ground. Situations in negotiations of significant imbalance of power of project partners can be prevented (Schöck, 2009). Model agreements may even improve the public relations of the organisations which drafted the model agreement. They foster understanding between researchers and legal experts and thus support interest based agreements if well explained and comprehensive (didactic, scenario approach, decision tree). They contribute to that contracts may be better prepared, negotiated, concluded and implemented. This way, model agreements may initiate a value shift from positional negotiations to mutual understanding of interests (Schöck, 2009).

However, the precondition to enjoy all of these benefits is the possibility to agree on a professional standard. This can only be accomplished if the provisions of the model agreement balance the divergent and conflicting interests of the different stakeholders. First of all, a common language (definitions) is needed before balance can be discussed. Balance starts with understanding of the interests of the other partner. And understanding starts by using the same language.

4.2 Risks

A major risk of the use of model agreements is that users may not adjust the model to the specifications of the project or do not know how to accomplish this. Even though a model intends to support users who are not experienced with contract negotiations, it can however only serve as guideline. Drafting successful contracts can only be achieved by persons who understand the applicable legal framework, the interests and positions of the different parties as well as the specifications of the project in question. This means that both technical and legal experts are indispensable in contract negotiation. Qualified staff can therefore not be replaced by model agreements. Users may thus be lulled in a false sense of security.

Model agreements should also not have the character of “General Terms and Conditions” (Schöck, 2009), which are not flexible and cannot be adjusted. The diversity of cases and specifications of projects are perhaps obscured by standard provisions. If model agreements serve as source for *boilerplates,* there is a danger that the context of clauses gets lost. This happened specifically in FP6 projects, where agreements were drafted from different model consortium agreements with the result that the clauses were not consistent with each other. Maybe even the whole “spirit” of the agreement

gets lost, e.g. a balanced agreement may become unbalanced. This happens if a kind of “cherry-picking” (picking only the favourable clauses from an agreement) is applied.

4.3 Conclusion / Lessons learned

This section is concluded by a summary of lessons learned from existing model-agreements regarding procedure as well as structure and content.

Procedure:

The procedure for the development of model agreements should be a stakeholder process. Stakeholders should evenly be represented by the public and private sector; universities, research organisations and small, medium and global private companies from different sectors and industries. Only in this way can the development of model agreements which adequately reflect the interests of all stakeholders be ensured. Only then is there a chance that model agreements will be accepted and of benefit for all stakeholders. The DESCA model consortium agreement is a good example of such a stakeholder-driven process that included all major stakeholders. Model agreements must also regularly be reviewed based on stakeholder and user feedback and new legal developments. DESCA for example provides for a feedback page on its website where every stakeholder or user can submit feedback to the DESCA coordinators. The DESCA group meets once to twice a year to discuss feedback or further additions or modifications to be made to the agreement. The Lambert Tool Kit also provides a good example of balanced model agreements, as different models are provided for different scenarios.

However, all stakeholders should also understand that model contracts cannot be more than a compromise, so if stakeholders are gathered to be heard they should participate in this process with the understanding that models are made on a general level and that all their specific and detailed interests cannot be included in them. These circumstances appear to be some of the reasons why often good models are not achieved; not all stakeholders are sufficiently heard and too many specific interests are pursued.

Structure and Content:

The preferable structure is a scenario approach as presented by the Lambert Tool Kit. Each scenario provides for a different agreement. Within each scenario, however, it should be decided whether different options should be proposed, as in the DESCA model consortium agreement. As research projects and the interests of partners in those projects are complex, as many different scenarios and options as feasible should be envisaged in the model agreements to reflect this complexity but also to ensure a workable agreement.

A decision tree as presented in the Lambert Tool Kit or presented by the CREST group provides very helpful guidance in the decision of which scenario or option should be used.
Elucidations or guidance notes as provided directly with every clause and every option as presented in DESCA or in the Lambert Agreements are very useful for people with limited or no experience in contract negotiation.

5 Feasibility

Notwithstanding the assumed usefulness of European-wide model agreements for the European research community, this section analyses whether the development of the model agreements is feasible. Feasibility must specifically be analysed regarding the balance of diverging interests, the compatibility of applicable different national laws and jurisdictions, and the impact of different industry sectors.

Calame et al. state:

> *"The challenge of scientific research in general, and of joint research projects in particular, is the thrilling uncertainty about the future potential of the scientific and commercial results to which the research project could lead" (Calame et al. in: Klawitter, 2009).*

Klawitter claims that

> *"this scientific uncertainty should however not pervade into the legal area, in which certainty and clarity are essential."*

The challenge is thus to formulate balanced model research contracts which reflect the scientific uncertainty and the interests of all parties appropriately.

Effective partnerships for collaborative research should lead to sustainable "win-win" situations. This means that model agreements have to reflect the different interests of the parties involved to allow mutual discussions. Interests of partners interact and may vary from project to project. The challenges of realising the benefits of model agreements are to align all interests of the contracting parties and to achieve equitable outcomes without causing complexity.

5.1 Scenario Approach

To address all interests of the contracting parties, a scenario approach with additional options in each scenario appears to be the best option to ensure wide acceptability of European-wide model agreements and its respective provisions.

The benefit of a scenario-based look is that scenarios in combination with a decision tree and guidance notes help partners to better understand what their interests in the collaboration are and what they would like to accomplish in the project. This way scenarios help partners to identify key questions to be answered, so that they are already able from the very beginning of the project to structure and plan the research project and exploitation of research results.

The scenario-based look lays the groundwork for good negotiations in which all key issues are identified and addressed according to the specific needs of each project partner. It is the basis for the creation of tailor-made, interests-based agreements.

Options and scenarios for model agreements can be determined by sufficient investigation of answers to right questions.

In cooperative research activities, the criteria of definition concern the following three basic dimensions:

1. Who is performing the work?
2. Who is providing the financial resources?
3. What are the results and who gets rights thereto?

The following sub-dimensions apply in addition:
Who is defining the work to be performed?
Who shares the risks?
Who needs the results? How and for what are the results needed? To what do the results contribute? (eg. to increased knowledge base, to a prototype, etc.?)

To assess the interests of the contracting parties, first these basic questions without the claim to be exhaustive should be investigated. Furthermore, additional investigation is needed.

If for example the industry partner bears 100% of the costs of research, it has to be clarified what 100% means, i.e. how are licences for needed background IP of the PRO or inventions taken into account?

Before the question of who gets rights to the results can be answered, the following questions must be fully explored:

- What are the results (definition and nature of the results)?
- What is the purpose of the collaboration? Is i.e. creating maximum economic value the overarching goal or maximum beneficial use of knowledge?
- Who needs the results (what kind of use is intended)?
- Are only the results (the product) or in addition also the IPR comprised in the product needed?
- What are the intentions for using the results?

Regarding risks, different types must be distinguished, e.g.:

- Technical risks,
- Commercial risks,
- Foreseeable risks,
- Unforeseeable risks

In answering these and other questions, the interests of the contracting parties can be revealed.

The CREST group (2006) has provided a decision guide with very useful questions for investigating the interests of contracting partners. According to their recommendation questions need to be answered regarding:
-Ownership of IPR?
-Influence of confidentiality & publication?
-Importance of the results for future activity?
-Exploitation of the results?

According to the Code of Practice (p.18), the following IP-related issues should be clarified:
-Ownership of foreground
-Identification of background
-Access rights to foreground and background, and possibly to side ground
-Protection of foreground

Only when all interests have been revealed and investigated can a balanced solution be worked out because balance starts with understanding the interests of the other party/ies.

By analysing different answers to the questions presented above, the following scenarios and options can be elaborated without claiming to be exhaustive:

"Principal and Agent", also known as "Contract Research" or "Research Services Agreement": In this scenario the PRO is performing a research service for the industry partner that the industry partner funds at 100% of full economic costs including a reasonable margin, as the case may be. The industry partner generally sets the specifications of the research work to be performed. Risks may be born by the industry partner or shared by both parties depending on the content of research and interests of the partners in the results. Regarding ownership of the results, if the PRO provides a pure service for the industry partner and has no further interest in the result ownership of IPR is typically transferred to the industry partner. In all other cases the results are owned by the PRO to contribute to the knowledge base, and exclusive or non-exclusive licenses in the field of application are granted to the industry partner. In this way, the possibility of economic exploitation by the industry partner is assured by realising a competitive advantage. Licenses may be granted worldwide or limited to a territory.

Cooperative Research: Joint Exploitation

Where joint exploitation is envisaged in cooperative research, all partners, PRO(s) and industry partner(s), are performing work jointly. All partners set the specifications of the research work to be undertaken jointly. Risks and costs are shared by all contracting partners or alternatively by the partners who intent to exploit the results. Liability is limited or excluded as far as possible under applicable national law. Results are owned by the partners who have developed the results. Other arrangements may be made depending on interests regarding exploitation of the results. User rights to research results are granted to the other partners on fair and reasonable conditions which include royalty-free conditions. Licenses may be granted worldwide or limited to a territory.

Cooperative Research: Public Exploitation
Typical for the scenario of public exploitation is the development of open-source knowledge accessible by the public (public domain strategies). All partners, PRO(s) and industry partner(s), are performing work jointly. All partners set the specifications jointly. Risks and costs are shared by all contracting partners. Liability is limited or excluded as far as possible under applicable national law. The results are likely to be protected by copyright law and may be published and used by all partners on a royalty free basis. User rights may also be granted to third parties.

Many options can be identified within these three basic scenarios. Pan-European model agreements should therefore provide options for all interests of the collaborating partners to ensure acceptability of the model agreement by all stakeholders, as proposed under Section 6.1 below.

5.2 Compatibility with different national laws

One key question regarding the feasibility of European-wide model agreements concerns the possibility of addressing all specific national and European law provisions which need to be reflected. The question is whether it is possible to make sure that all provisions of the model agreements would be in line with the law of all European countries and EU law.

The CREST group (2006) argued in its report on cross-border collaboration[243] that European-wide model agreements are not feasible due to the differences in the legal systems of the Member States.

They state: (p.34):

> *"The IP Group determined that model contracts capable of pan-European application would be overly complicated to be of practical use. The group believes that model agreements that exist at national level are likely to provide a better base."*

The CREST report provides in fact an excellent overview of legal IP provisions in 20 European countries. However, it simply referrs to those complex legal systems without analysing whether these complex legal systems actually are and have to be reflected in contracts. The CREST report also concludes by stating that different national law systems do not seem to hinder cross-border collaboration to a great extent.

DLA Piper and Mason Hayes+Curran provide an online "Country Compare Tool"[244] financed by the European Commission which allows the comparison of the legislation of multiple countries at once.

In practice, however, research agreements under different national laws show that many national provisions do not have to be specifically mentioned in contracts. As a general rule, partners are free to conclude any contracts as long as they do not breach national or EU law. Also, in every contract a so called "severability clause" can be found which states that, if one or more provisions of the agreement are or become fully or partially void, then the validity of the remaining provisions shall remain unaffected. The void provision would then be replaced by a valid one insofar as possible. As specific national or EU provisions apply to all contracts directly, the compatibility with national and EU law is not seen as an overall critical issue by stakeholders. Stakeholder from different countries confirmed that standard provisions in research contracts work under different national legal systems. However, it is of great importance to be aware of and to know the national legal framework which implies and its impact on the research project and the agreement. The fact sheets in the CREST report (2006) are a good basis for information in this regard.

[243] see http://ec.europa.eu/invest-in-research/coordination/coordination01_en.htm
[244] http://www.eutechnologytransfer.eu/compare.php

Another phenomenon in contract negotiations is that the applicable law is often decided at the very end of the negotiation. This requires that the same contract could be used under different legal systems without changing the content of the agreement which is usually the case.

It is therefore argued that, contrary to the findings in the CREST report, model contracts capable of pan-European application could be developed and would be of practical use all around Europe despite the different legal systems which apply. However, when it comes to contract research, stakeholders are more likely to agree with the findings of the CREST group than in case of collaborative research.

There are however a few specific legal national and EU provisions which need particular consideration in model agreements, more so for contract research than for collaborative research. A good example of this are model sub-contractor agreements made by big American companies, according to one stakeholder. These specific issues may be addressed in the guidance notes or included as *boilerplates* in model agreements.

In the European landscape, these issues concern in particular:

IP ownership:
The situation of IP-ownership must be clear for the project; different regimes within Europe mean that the original owner of IP resulting from collaborative research can be the institution, individual researchers, students, the industry partner or a combination of these. This may involve a formal transfer of ownership or the granting of access rights. Italy and Sweden has the "professor's privilege" system assigning inventions to university professors or researchers. Unlike Italy, Sweden's "professor's privilege" system extends only to universities and not to Swedish PROs (Sweden and Italy are currently reviewing the law and considering amendments.) In Sweden and Italy however, contracts are generally reached between industry and researcher before the research activity starts to ensure that ownership of potential results belong to the PRO or university.

IP provisions:
Rules may differ as regards patentable inventions and other types of IP such as copyright law (for example computer programmes, printed or audiovisual training material or reference notes) (CREST, 2006). Different provisions also apply to joint ownership and may also apply regarding prior user rights.

Again, the CREST report is an excellent source for information regarding different national IP provisions. Specific national IP provisions are therefore not further addressed in detail in this paper, mainly because these provisions generally do not have to be reflected in the research agreement itself. But they have to be known to be able to interpret the provisions of the agreement according to national law.

EU law: State Aid law
Regarding EU law, State Aid law must be taken into account. In service research contracts PROs cannot be in business to compete with contract research organisations and may not use public money to do so. This provision concerns the price of the research service the industry partner has to pay to the PRO. Industry partner must cover full economic costs of the research plus a reasonable margin as the case may be.

The State Aid provisions for contract and collaborative research differ.

Regarding contract research, there will normally be no State Aid passed to the industry partner through the PRO if one of the following conditions is fulfilled[245]:

(1) The PRO provides its service at market rate; or
(2) If there is no market price, the PRO provides its service at a price which reflects its full costs plus a reasonable margin.[246]

[245] see: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2006:323:0001:0026:EN:PDF
[246] margin may depend on IPR provisions in the contract, see section 2.2.1

Regarding collaborative research the Commission considers that no indirect State Aid is granted to the industrial partner through the PRO due to the favourable conditions of the collaboration if one of the following conditions is fulfilled:

(1) The partners bear the full cost of the project.
(2) Results which do not give rise to IPR may be widely disseminated and any IPR to the results which results from the PROs work are fully allocated to the PRO.
(3) The PRO receives from the industrial partner compensation equivalent to the market price for IPR which results from the PROs work carried out in the project and which are transferred to the industrial partner.

If none of the previous conditions are fulfilled and the individual assessment of the collaboration project does not lead to the conclusion that there is no State Aid, the Commission will consider the full value of the contribution of the PRO to the project as aid to undertakings.

The basic scenarios described above under Section 5.1 reflect the State Aid provisions appropriately.

5.3 Compatibility with different industry sectors

Another question to be answered is the compatibility of European-wide model agreements with all industry sectors.

Stakeholders report that different industry sector generally do not have an impact on research agreements. However, in some sectors, in particular the pharmaceutical and biotech as well as the telecommunication sector, additional sector-specific standard provisions (sector-specific provisions which apply typically to every project of that sector) are required. Where for example clinical trials are involved, provisions on data, data bases or ethical issues might be necessary. In the telecommunication sector, provisions on software or copyright are necessary.
Even though it would not be possible to cover all legal aspects of every possible industry sector, industry-specific aspects could be included as options or modules, in guidelines or in elucidations. DESCA for example provides a module with software provisions for projects with a specific software focus.

A useful standard clause which could be included in model agreements to ensure compatibility with legal provisions of the biotech or pharmaceutical sector is:

"Each Party shall ensure that its work on the Project complies fully with all applicable local, government and international laws, regulations and guidelines which are effective during the period of this agreement, including those governing health and safety, data protection, and where relevant, the use of human or animal subjects and good clinical practice. In this regard, each Party shall maintain the confidentiality, in accordance with this agreement, of all samples and data relating to the use of human subjects, which is created or used in the course of the Project."

6 Options for the creation of European-wide model agreements / Recommendations

Finally, in this section, tangible options for the creation of European-wide model agreements are recommended regarding content, basic principles, procedure of development and critical success factors.

6.1 Content and basic principles

The basic principle as pointed out above is to develop balanced agreements. If the model favours one side only, it will not be accepted and used by all stakeholders and may even be used to the detriment of the sector which is not favoured in the agreement.

A model agreement would be needed for each of the three basic scenarios under section 5.1:

“Principal and Agent” ("Contract Research")

“Cooperative Research: Joint Exploitation

Cooperative Research: Public Exploitation (Public Domain Strategies)

For the content of model agreements, the typical content of contract research and collaborative research agreements as described under Section 2.2. above is referred to here.

Based on the questions to be answered for the determination of the interests under Section 5.1, different options would be needed under each scenario. Where options are not sufficient, different model agreements under each scenario (more than just one) should be discussed. Without claiming to be exhaustive, the following options should be considered in European-wide model agreements:

Under the scenario “Principal and Agent” at least the following options should be addressed:

Three options and one sub-option in the IPR section:
(1) one option for transfer of ownership of IPR to principal,
(2) one option for granting of an exclusive licence to use IP to principal, and
(3) one option for a non-exclusive license to use IP to principal.

The following sub options should to be considered for option (2) and (3):
(2.1; 3.1) worldwide license or
(2.2; 3.2) limited to territory
(2.3; 3.3) limited in scope (field of application)
(2.4; 3.4) unlimited in scope (all applications)
(2.5; 3.5) license unlimited in time
(2.6; 3.6) license limited in time
(2.7; 3.7) license royalty-free
(2.8; 3.8) license royalty-bearing

Furthermore, costs for registration, maintenance and defence of IPR as well as inventor's fee might also be addressed as options subject to applicable national law.

Two options have to be addressed under liability:
(1): Liability born 100% by principal
(2): Alternative liability provisions (limited or shared liability)

Under the scenario "Cooperative Research: Joint Exploitation" and "Cooperative Research: Public Exploitation" different model agreements would be needed for one-to-one and multi-party research. Options for IP provisions, exploitation of research results and liability should be considered. Modules for software provisions and governance structures (for multi-party agreements) should be added. DESCA and Lambert Tool Kit are useful references in this regard.

Boilerplates regarding different industry sectors should be added as options otherwise explanations in footnotes or guidance notes should be envisaged.

Explanations regarding provisions of different national legal systems, e.g. on IP ownership, copyright or joint ownership provisions should be added in guidance notes.

6.2 Procedure of their development / Critical success factors

To ensure success of the project, e.g. a balanced outcome all stakeholders need to be involved in the process of the development of the model agreements, so stakeholders from universities, PROs, small, medium, and large, national and international companies. As in DESCA, a core and consultation group could be formed. Discussions take place in the consultation group, while the core group would be included in the discussion group. The core group analyses the discussions in the consultation group and writes the templates, guidelines, decision guide, elucidations, etc. according to the outcome of the discussions. As a rule, intermediate drafts will only be discussed in the consultation group. They may be made available to further stakeholders not belonging to the group for feedback if the group so decides.

Once a European-wide model agreement would be available, constant reviews, adjustments and necessary additions have to be made.

If in the consultation group the stakeholders are however not be able to agree firstly on the underlying rationale for European-wide model agreements as pointed out under Section 3.4 above, and secondly on the specific provisions which balance the diverging interests of the partners to the mutual benefit of all stakeholders involved, the development of European-wide model agreements for contract and collaborative research should not be further pursued by the Commission to avoid possible damages which could be caused. In such a case, a set of guidelines including model clauses, links, tools and the like could be developed instead in the light of the principles of the Code of Practice and the Responsible Partnering initiative for support of the European community.

Based on the analysis and recommendations in this paper, and assuming that the demand for European-wide model agreements exists in the Member States, it is recommended to the European Commission to initiate and support a stakeholder-driven process with the aim of developing European-wide model agreements for contract and collaborative research as outlined.

Appendix A Questionnaire

Expert Group on Knowledge Transfer	
Study No.6	**"Expert Paper on options for European-wide model agreements for contract research / collaborative research"**
Expert	Tanja Schöpke (DESCA)

Questionnaire
for stakeholders (e.g. IGLO, ERATO, NCP's, DESCA consultation group)

Short Introduction to the objective of the expert paper:

The expert paper aims at proposing options for European-wide model agreements on main scenarios of collaborative research taking into consideration the expertise, experience and legitimate interests of all stakeholders involved. This is the foundation for interest based, well balanced solutions and therefore for the wide acceptance and use of model agreements.

Question 1 Do you agree with the description of the scenarios in the outline? Are the scenarios appropriately described? Do you agree with the three main dimensions describing the different scenarios and the sub-dimensions with the different scenarios? Do the descriptions reflect your experiences? Can you give practical examples of research collaborations for the different scenarios and sub-dimensions?

Answer:

Question 2 Can you describe your interests in research collaborations with reference to the described scenarios? e.g. one interest of an undertaking might be that the results of the research cooperation shall not be able to be accessed by competitors

Answer:

Question 3 Can you name model contracts that would in your opinion fit the described scenarios? (Selection of model agreements for each scenario) Are different model agreements/options for different scenarios of collaboration available at your institution or do you mainly use one and the same model as a basis for every negotiation?

Answer:

Question 4 Can you describe typical critical or controversial issues in the negotiation of research contracts, possibly within the different scenarios? Why are these issues critical?

Answer:

Question 5 What are your general experiences with model agreements? Which model agreements are often used? How do you evaluate these model agreements (pros/cons)? What are in your opinion critical success factors and added value of these model agreements?

Answer:

Question 6 Can you name specific legal provisions of the Member State where your institution is located which have an impact in research collaboration and therefore have to be taken into account in model contracts, e.g. professor's privilege in Italy and Sweden?

Answer:

Question 7 Can you name/describe particularities of different industry sectors which have an impact in research collaborations and therefore have to be taken into account in model contracts, e.g. particularities of the software industry and their impact on intellectual property rights?

Answer:

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