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NoGAP

Knowledge Transfer Community bridging the gap between research, innovation and business creation

Deliverable 1.4.

Best Practices Methodology, to bridge the gap between research, innovation and business

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4.	Republican Centre for Technology Transfer Minsk	RCTT	Belarus
5.	ICARTI - Tibilisi	ICARTI	Georgia
6.	The Centre for Scientific & Technical Information & Innovation Promotion of Ukrainie	NIP Ukraine	Ukraine

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CO	Confidential, only for members of the consortium (including the Commission Services)	

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1. Introduction

1.1. Considerations

Europe seems to be better at producing high-level knowledge than at converting it into socio-economic benefits.
In addition to the classical ways of transfer and dissemination of knowledge, such as research publications and exchanges of researchers, Public Research Organisations and Universities performing research need to “retrieve” the results on the market, to contribute to the growth of the competitiveness trough research results, to more actively engage in the exploitation of publicly-funded research results, for instance through academia-economy/industry collaborations, licensing and spin-offs.
On the other hand if the economy/industry will increase the trust into research as one driver of the market, they will invest more in the research area through partnership.
R&D is a vitally important input for innovation in both the business and public sectors, while innovation in turn is essential for improving productivity and the quality of life. In most developed countries, the business sector accounts for the majority of investments in R&D, but the public sector also accounts for a significant share of all R&D investments.
In 2012 in the EU-27 countries, the public sector accounted for 37.6% of total R&D expenditures while the business sector accounted for 61.3%.
The remaining 1.1% was due to the private non-profit sector.
Almost all R&D in the public sector is conducted either by government research institutes or by Universities. Together, these are defined as public research institutes, or Research Organisations.
Although a significant share of the R&D performed by Research Organisations is either basic research or humanities research with few short-term commercial applications, a substantial (although unknown) share of public research has immediate or potential commercial value.
This includes research of value to a wide range of commercial applications.
Correlating knowledge transfer policy activity with selected national characteristics, high knowledge transfer policy intensity was found to tend to go together with high national innovativeness, as measured by the European Innovation Scoreboard and competitiveness, as measured by the Global Competitive Index.

1.2. Definition

A **best practice** is a method or technique that has consistently shown results superior to those achieved by other means, and that is used as a benchmark. In addition, a "best" practice can evolve to become better as improvements are discovered.
Best practice is considered by some as a business buzzword, used to describe the process of developing and following a standard way of doing things that multiple organizations can use.
Best practices are used to maintain quality as an alternative to mandatory legislated standards and can be based on self-assessment or benchmarking.
A **best practice** can be an innovative process or working method that has proved successful for its user, in terms of meeting customer needs or optimising operational performance.
The added value comes when organisations can share best practices to improve the way they work, transfer knowledge or do business based on knowledge, across-the-board.
Success can be measured in both quantitative and qualitative terms.

1.3. Motivation

Knowledge transfer between public research and industry in Eastern countries is very non-systematic and is not based on models, strategies or methodology but on ad-hoc solutions, non-generalized, not-coherent with international methodologies and not intended to be able to be adapted to other purposes. Often, the result of research is not used because it is not known by the ones they are intended for.
This Deliverable aims develop a Best Practices Methodology for the knowledge transfer between public research and industry in the societal challenge ‘Secure, clean and efficient energy’, to bridge the gap between research, innovation and business, based on EU experience and on a survey conducted among the stakeholders.

1.4. Scope

NoGAP's mission is to bridge the gap between research and innovation, focusing on improving competences and cooperation between producers and users of knowledge to tackle societal challenges of common interest.

The overall efforts of the project partners have been focused on the main objective, that of reinforcement of cooperation with the Eastern Partnership countries in order to develop a 'Common Knowledge and Innovation Space' on the societal challenge 'Secure, clean and efficient energy'.

Within the NoGAP project we want to:

- identify the main drivers and obstacles of closer links between academia and the market in the field of secure, clean and efficient energy in the Eastern Partnership Region
- develop a best practice methodology to enhance successful commercialisation of research results and to improve the management of these results
- develop innovation support services to foster existing and establish new strategic partnerships
- assess the opportunities for the establishment of sustainable Technology Transfer Centres (TTC) in the participating partner countries on the basis of existing structures and good practice
- improve the competencies of researchers, entrepreneurs and multiplicators by organising trainings
- develop a list of pilot activities to foster mutually beneficial public-private-partnerships between EU and Eastern Partnership countries in the energy sector
- create and organise twinnings between the regions
- promote networking between EU and Eastern Partnership countries.

To implement this objectives, to bridge the gap between research, innovation and business, we need to identify a Best Practice Methodology.

The "*Best Practices Methodology",* will help stakeholders (research organizations of companies involved in the energy sector) in planning future activities. It will be the guideline for the other activities in this Project.

The best practices identified are assessed by a series of criteria, like:

- Innovation
- Technological results
- Financial implications
- Applicability
- Impact
- Social inclusion

The identified solutions are going to be gathered from all significant EU regions and activity domains.

2. Best practices methodology, to bridge the gap between research, innovation and business

This document looks at the relevance gap in the management of the knowledge transfer to the market. Its focus is the nature of the knowledge created by research at the interface between business and academia in the context of major changes likely to affect the nature of demand for such knowledge. Management research has been accused of a lack of relevance to managerial practice and of too narrow a discipline base.
The document reviews the conditions giving rise to this criticism, in the UK and elsewhere, and identifies an important strategic need to increase the stakeholding of users in various aspects of the research and knowledge creation and dissemination process.
The document concludes with recommendations concerning new forms of research partnership and research training that will address the relevance gap. However, bridging this gap does not only require changes in the academic mind-set. Managers and companies too need to re-think their involvement in the research process.
The much lamented 'relevance gap' is as much a product of practitioners wedded to gurus and fads as it is of academics wedded to abstractions and fundamentals. The gap persists because practitioners forget that the 'real world' is actually 'a world' that is idiosyncratic, egocentric and unique to each person complaining about relevance.
Greater attention to the conceptual underpinnings of fads and egocentric perception suggest the existence of more fundamental barriers to effectiveness such as ceilings on improvement, weak situations, ambiguous signals, non-obvious adaptive forms and preoccupation with vision.
Joint practitioner-academic effort dedicated to questions of how events come to be seen as 'real' could re-bridge a gap the nature of which has been misidentified.

A **best practice** is a method or technique that has consistently shown results superior to those achieved by other means, and that is used as a benchmark. In addition, a "best" practice can evolve to become better as improvements are discovered.
Best practice is considered by some as a business buzzword, used to describe the process of developing and following a standard way of doing things that multiple organizations can use.

A **buzzword** is a word or phrase used to impress, or is fashionable.
Best practices are used to maintain quality as an alternative to mandatory legislated standards and can be based on self-assessment or benchmarking. Best practice is a feature of accredited management standards such as ISO 9000 and ISO 14001.
Some consulting companies specialize in the area of Best Practice and offer pre-made 'templates' to standardize business process documentation. Sometimes a "best practice" is not applicable or is inappropriate for a particular organization's needs. A key strategic talent required when applying best practice to organizations is the ability to balance the unique qualities of an organization with the practices that it has in common with others.
Good operating practice is a strategic management term. More specific usages of the term include good agricultural practices, good manufacturing practice, good laboratory practice, good clinical practice and good distribution practice.
Best Practice is a form of program evaluation in public policy. It is the process of reviewing policy alternatives that have been effective in addressing similar issues in the past and could be applied to a current problem.
Determining "Best" or "Smart" Practices to address a particular policy problem is a commonly used but little understood tool of analysis because the concept is vague and should therefore be examined with caution.

2.1. Develop Realistic Expectations

We advise the policy analyst that it is important to maintain realistic expectations when seeking a "best practice" in public policy analysis because the practice may not be solving the problem at all and it may instead produce unfavorable results.

Because a practice seems to be tailored to a specific policy problem and also based on solid research, it does not necessarily mean it is creating good results. However the research can produce thought-provoking concepts on what can and can not work when put into practice.

2.2. Analyze Smart Practices

In policy analysis a "best" or "smart" practice is a clear and concrete behavior that solves a problem or achieves a goal. Smart practices take “advantage” of an idle opportunity at a low cost and little risk. We can refer to this as the finding the free lunches.
These are opportunities for creative policy improvements such as "cost-based pricing" or "input substitution" that have the possibility to generate public value at a very low cost.
Breaking loose from conventions and challenging assumptions can also be way to take advantage of an idle opportunity.
An example of this is the highly controversial practice of the government contracting out a community good or service to nonprofits or the private sector.
This challenges the assumption that a community good or service must be financed through taxation and delivered by government employees.

2.3. Observe the Practice

The primary mechanism in a "smart" practice is the ability or the means of achieving a goal in a cost-effective manner. The secondary mechanisms include implementing features, supportive features and optional features. It can be very complicated to separate between the functions in getting the mechanism to work and the features that support those functions.
Bardach recommends when adapting smart practices for another source, it is important to identify the core essence of the practice while allowing flexibility for how it is implemented so it remains sensitive to local conditions.
Robust smart practices are adaptable to various conditions, have many operational features, and can employ similar but diverse ways to achieve their goals.

2.4. Describe Generic Vulnerabilities

In addition to the reasons why a smart practice might succeed, an analyst should describe potential vulnerabilities that could lead a smart practice to fail - these weaknesses are "generic vulnerabilities”.
Two types of vulnerabilities are worth particular attention:
1) poor general management capacity, which makes it more difficult to effectively implement a smart practice, and
2) weaknesses inherent to the practice itself. Policymakers must develop safeguards in order to minimize the risk of generic vulnerabilities.

2.5. But Will It Work Here?

The final step in identifying an appropriate "best practice" for a policy problem is to ensure that the context from which the practice is derived is comparable to the context in which it will be applied. Risks to implementing the selected "best practice" in the applied context as well as what support structures can be put in place need to be anticipated in order to maximize the likelihood of success. If utilizing a "best practice" pilot or demonstration program, the success of that practice needs to be discounted in order to account for the better than average favorable conditions pilot and demonstration programs usually operate under.
These conditions include increased enthusiasm, advantageous political and economic conditions, and less bureaucratic resistance due to the lack of permanency in pilot programs.
Finally, when considering implementing a "best practice" on a wide scale one must be aware of the 'weakest link' sites with minimal to no resources and how those sites will be supported in order to create the desired policy outcomes.

2.6. Examples of "Best/Smart" Practice Evaluation in Public Policy

The U.S Environmental Protection Agency - EPA produces a document called The Clean Energy-Environment Guide to Action. It is designed to share successful state "best practices" to determine what is most suitable for them to use in generating clean energy policies and programs.

The guide includes 16 clean energy policies and programs that offer opportunities for states to save energy, improve air quality, lower greenhouse gas emission and increase economic development.

An example of a successful "best practice" from the guide is "Building Codes for Energy Efficiency". This practice is to use building energy codes to set requirements that establish a minimum level of energy efficiency standards for residential and commercial buildings.

California Energy Code Title 24 is one "best practice" that is highlighted in this guide. The following points for energy code implementation are to educate and train key audiences, supply the right resources, and to provide budget and staff for the program.

Eugene Bardach has a list of "smart" practice candidates in his book A Practical Guide for Policy Analysis, Eightfold Path (policy analysis). One example is the tutoring program for children in grades 1-3 called Reading One-to-One. The program from Texas includes one on one tutoring with supervision and simple structured instruction in phonemic awareness.

Phonemic awareness is one highly regarded predictor of how well a child will learn to read in the first two years of school.

The program takes advantage of the fact that many children, especially English as a Second Language -ESL students, fail in reading because it is very hard for second language students to understand and pronounce sounds in English.

The program is easily duplicated at a relatively low cost because of the straight forward teaching materials, systematic methods and administrative oversight.

Excessive optimism about the expected impact of untested smart practices is a common critique. If a current practice is known to be ineffective, implementing a promising alternative after weighing the alternatives may be worth the risk.

The nonprofit/voluntary sector is generally lacking tools for sharing and accessing best practices. Steps are being taken in some parts of the world, for example in the European Union, where the Europe 2020 Strategy has as a top priority the exchange of good practices and networking (including the nonprofit sector).

An initiative of sharing good practices in terms of human resources (HR) and leadership among European nonprofit organizations was financed by the EU and launched in 2013, called Asociatia Young.

The platform allows the public to search for good practices and its members the possibility to share their practices, engage in discussions in the forum section and enroll their organization. Membership is free. The project is currently limited to an European audience.

Best practices are used in nearly every industry and professional discipline. High profile areas include information technology development, such as new software, but also in construction, transportation, business management, sustainable development and various aspects of project management.

Best practices are also used in healthcare to deliver high-quality care that promotes best outcomes.

Best practices are used within business areas including sales, manufacturing, teaching, best coding practices|computer programming, road construction, health care, insurance and public policy.

There are some criticisms of the term "best practice."

The work necessary to review and practice the "best" is rarely done.

Most of the time, one will find "good" practices or "smart" practices that offer insight into solutions that may or may not work for a given situation.

Scott Ambler challenges the assumptions that there can be a recommended practice that is best in all cases. Instead, he offers an alternative view, "contextual practice" in which the notion of what is "best" will vary with the context. In essence, such critiques are consistent with the contingency theory, which was developed during the 1950s and 1960s.

3. Drivers and barriers to cooperation and methods to improve cooperation

3.1. Barriers to cooperation between research sector and business environment:

Competence: The main incentive for business enterprises to work with Universities and other partners is their contribution to solving problems which cannot (or not as fast or good) be resolved internally or with other partners and to the understanding of fundamental business-related issues.
Technical: An uncounted number of studies have looked at the role of technologies and other research results in knowledge transfer.
The properties of a technology such as the innovativeness, degree of codification, development stage, complexity or cost determine whether business enterprises are interested in a transfer and whether the transfer is sticky, i.e. needs to overcome many barriers to be successful.
Informational: Informational barriers were found influential above all for SMEs. They refer to companies' abilities to scout for relevant technologies, monitor their technological and scientific environment and maintain an overview of potential funding sources for supporting their R&D activities.
Informational incentives are for instance discussed in the context of signalling technological capacities to clients and partners.
In Belarus there are no contact points of the Enterprise Europe Network (EEN). It creates problems in the promotion of Belarusian technologies to the European market, and access of Belarusian SMEs and R&D organizations to European technology.
Financial: In addition to the direct costs of a technology and transfer discussed, the indirect costs of doing less basic research and more applied research, services and consultancy have been in the focus of academic research.
In Belarus there are no tools of venture financing.
Organizational: Interactions between PROs and companies are governed by different types of coordination mechanisms: hierarchical mechanisms (e.g. governmental laws and regulations, university by-laws), market mechanisms (e.g. contracts stipulating quantities and prices of the transfer), or mechanisms of networks (e.g. trust). Organizational drivers and barriers to Knowledge and Technology Transfer are related to the costs and risks of a transaction and technology access.
Legal: Previous studies have pointed to the importance of IP regulations; university regulations on a wide set of issues such as incentives for invention disclosures; the resources, skills and missions of university administrators and technology transfer intermediaries (facilitators).
In particular the recent reforms in many European countries of the ownership of Intelectual Property - IP resulting from publicly funded academic research, have been discussed critically in regard to their consequences for commercialization.
The main problem of Belarus is that, in Belarus IP created with government funding belongs to the government.
Socio cultural: The partners in university-industry are from different subsystems of society and follow different logics: Ziman (1994, pp. 177-178) has called it the CUDOS (communality, universalism, disinterestedness, originality and scepticism) system of science – based on the Mertonian norms – versus the PLACE (proprietary, local, authoritarian, commissioned, expert) system of technology. Dasgupta& David (1994) contrast Polanyi's (1962) term "Republic of Science" with a "Realm of Technology" which is different mainly because of its differing reward systems and practices of disclosing results.
Also at the individual level differences of personality traits, goals, values and beliefs between scientists and engineers were found. These cultural differences between universities and companies can create barriers to collaboration and limit knowledge transfer success.
Spatial: The empirical evidence that Knowledge and Technology Transfer happens more often at local and regional than at wider spatial levels is substantial (Jaffe, 1989; Jaffe, et al.,1993; Acs, Audretsch, & Feldman, 1991). In particular informal forms of knowledge and technology transfer benefit from spatial proximity, whereas it is less important for formal types.
Educational: In Belarus there are not enough specialists in the field of knowledge and technology transfer and innovation. In the Belarusian's universities, the course "Technology Transfer" is not mandatory for all students. Most graduates of Belarusian universities have no understanding about the process and tools of knowledge and technology transfer.

3.2. Methods to improve the cooperation between research, innovation and business

Facilitators (technology brokers): the person that “translates” from the business language into the research language, that identifies the opportunities and the solutions, offers and requests, that puts together researchers, innovation and business environment.
Technology brokers have discovered how to bridge the disparate worlds they move among outside their boundaries, and how to build new ventures from the technologies and people they come across. In the process, they have developed four intertwined work practices that help them do this: capturing good ideas, keeping ideas alive, imagining new uses for old ideas, and putting promising concepts to the test. Although the markets and settings of different brokers are diverse, their approaches are not. Indeed, the four intertwined processes are remarkably alike across companies and industries.
The necessaries steps of work practices:

- **To bring in promising ideas.** Because technology brokers span multiple markets, industries, and geographic locations, they keep seeing proven technologies, products, business practices, and business models. Brokers recognize that these old ideas are their main source of raw material for new ideas, even when they are not sure how an old idea might help in the future. When brokers come across a promising idea, they don't just file it away. They play with it in their minds—and when possible with their hands—to figure out how and why it works, to learn what is good and bad about it, and to start spinning fantasies about new ways to use it.

- **Keeping ideas alive - ideas can't be used if they are forgotten.** Ideas can't be used if they are forgotten. Cognitive psychologists have shown that the biggest hurdle to solving problems often isn't ignorance, it's that people can't put their fingers on the necessary information at the right time even if they've already learned it. Organizational memories are even tougher to maintain. Companies lose what they learn when people leave. Geographic distance, political squabbles, internal competition, and bad incentive systems may hinder the spread of ideas.

  The product design were particularly good at keeping ideas alive, in part because much of each company's stockpile of ideas is embedded in objects that designers can look at, touch, and play with (it's easier to search through an actual junk pile than a virtual one).

- **Imagining new uses for old ideas**. This step occurs when people recognize new uses for the ideas they've captured and kept alive. Often those applications are blindingly simple.

  An effective technology broker develops creative answers to hard problems because people within the organization talk a lot about their work and about who might help them do it better. Company-wide gatherings, formal brainstorming sessions, and informal hallway conversations are just some of the venues where people share their problems and solutions.

  We can recognize the power of bringing people together face to face: you pick two people, with different experiences and maybe even different training, and put them together and you've got that kind of a synergy, an exchange of ideas. Because whatever this person says will provoke a hundred different ideas in this other one and a hundred different memories.

- **Putting promising concepts to the test.** A good idea for a new product or business practice isn't worth much by itself. It needs to be turned into something that can be tested and, if successful, integrated into the rest of what a company does, makes, or sells. Quickly turning an imaginative idea into a real service, product, process, or business model is the final step in the brokering cycle. *Real* means concrete enough to be tested; *quickly* means early enough in the process that mistakes can be caught and improvements made.

  Technology brokers are not the only businesses that use prototypes, experiments, simulations, models, and pilot programs to test and refine ideas. The difference is that collecting and generating ideas, and testing them quickly, are more than just some of the things brokers do: They are the main things brokers do.

  Brokers must be good at testing ideas, at judging them on merit without letting politics or precedent get in the way. A broker's attitude toward ideas is usually "Easy come, easy go." Brokers treat ideas as inexpensive and easily replaceable playthings that they are supposed to enjoy, understand, push to the limit, break, and change in ways the ideas' inventors never imagined. If an idea seems to solve a current problem, they build on it. If an idea doesn't work

out, they look for another. Brokers rarely keep trying to make something work in the face of evidence that it won't. They focus on finding the best ideas for solving problems, not on solutions for which they can claim glory. We could call it the *nothing-is-invented-here attitude*. It means they reach out-early and often-to anyone who might help them solve problems and test ideas. Brokers view the more familiar "not invented here" syndrome-in which people, believing they know more than others in their field, reject all new ideas that are "not invented here"-as inefficient, arrogant, and ultimately fatal to innovation.

Indicators to measure the innovation - Indicator of Innovation Output: aiming to analyse the impact of the innovation and knowledge transfer on the market, a clear methodology and indicators are mandatory. The indicator will support policy-makers (at local – Business and Technology Transfer Centres, Incubators, Technology Parks, Clusters and regional level) in establishing new or reinforced actions to remove bottlenecks that prevent innovators from translating ideas into products and services that can be successful on the market. Improved performance will contribute to smart growth, in line with Europe 2020 Strategy and its Innovation Union flagship initiative.
The set of indicators will complement the Innovation Union Scoreboard (IUS), and its Summary Innovation Index (SII), which assess how the various strengths and weaknesses of Member States and the EU determine their overall performance, against a broad set of innovation indicators, including inputs, throughputs and outputs.
The “Indicator of Innovation Output" measures the extent to which ideas from innovative sectors are able to reach the market, providing better jobs and making the regions more competitive.
Innovation output is wide-ranging and differs from sector to sector. The set of proposed indicators are based on four components chosen for their policy relevance.

- Knowledge innovation as measured by patents.
- Employment in knowledge-intensive activities as a percentage of total employment.
- Competitiveness of knowledge-intensive goods and services. This is based on both the contribution of the trade balance of high-tech and medium-tech products to the total trade balance, and knowledge-intensive services as a share of the total services exports.
- Employment in fast-growing firms of innovative sectors based on intensive knowledge.

The set of indicators, common for the regions, will assure a common methodology aimed at analysing the impact of the innovation policies and support tools.

The type of research (collaborative or contract and the funding arrangements that come with either one) **and the type of IP** (foreground or background) influence the negotiation of ownership and access rights in the conclusion of research contracts. The common practice is to define this before a project starts, though expressly the sharing of revenues might be agreed upon later in the project or when it becomes clear that such revenues might accrue.

Innovation Vouchers Scheme: aimed at helping micro-enterprises and SMEs to use new technologies and knowledge to increase their competitiveness and enhance their growth prospects. SMEs can exchange these vouchers for services from private companies, universities, research centres and other accredited knowledge/service providers.

The vouchers will give the companies easy access to specialist services such as help in creating a business model and website and using it profitably, a patent, a branding, learning to use e-commerce tools to buy or sell, or adopting more sophisticated tools for internal processes, such as better resource planning, supply chain management, customer relations management.

The bridge between work practice and technology design
The study of work practices is a method of research that reveals opportunities for innovation - innovation that can be easily adopted by real end users. Beyond user-centred innovation, where design is based on user observation and requirements, there are situations where researchers need to link technologies to users. This is particularly true with disruptive technologies that can result in new work patterns. Industrial design can help create these links.
The challenge is not about making proposals to users, but about imagining new functions or ways they can do their work.
This is the sweet spot where industrial design can provide extraordinary insight into the benefits of a disruptive technology, helping users project themselves into a new working environment.
The studies provide:

- Details about how work is organized. This often includes information about the actual practice itself (legal, medical or another type of profession) that would be unknown to computer scientists in distant research laboratories.
- Methods people adopt to achieve what they need to do. Studying these methods reveals a hidden reality: the exceptions, the turnarounds, the barriers, the undocumented work required so that processes run smoothly, at least on surface level.

Selecting the problems experienced in the workplace and how to address them should be the result of collaboration between interaction and experience designers with computer scientists in multidisciplinary teams. Adding a filter based on “out of the box” thinking typical of designers can help to imagine the future. It can be checked for feasibility by the scientists while still being anchored to real world user problems.
But experience design is not risk free, and must be done carefully to avoid the creation of false expectations. A work practice study can have the drawback that, when exposed as input to computer scientists, it provides a large array of options for improvement.
Experience design bridges the gap by focusing on the quality of the user experience.

In this way it can be used to leverage innovation to develop new business opportunities and accelerate the commercialisation of disruptive technology.

Using design to promote commercialisation
After the user and the technology comes the third component of experience design - the business. This piece provides the market background and research and potentially the offering as well as the development of a final product.
Research Commercialisation is a new cross-discipline event and will provide a platform for all those involved in promoting university-industry-investor collaboration, technology transfer and start-ups.
The research commercialisation field needs to think strategically about how best to build on this changing environment. There needs to be more exchange of people between business, industry and Academe; there needs to be more awareness of the needs of business in our courses, especially at Masters and Graduate level; there is also a strong case for companies engaging more closely with Universities at the early stages of technology readiness, possibly by sharing ideas and developing patents within a collaborative laboratory basis.
This will de-risk the setting up of companies at too early a stage.
A common challenge for R&D is to convey the value of what is being proposed. The visual part of experience design can help communicate ideas across organisations and businesses, especially when concepts are disruptive and theoretically complex to understand. Being able to walk the business through different scenarios with hands on experimental interaction with the prototype concept helps them to appropriate the technology. It may even generate new ideas for the offer or identify various market opportunities.
There is however an associated risk with this approach. Providing a well-shaped design proposal and working prototype can mislead the business into thinking it is developed and operational, which is far from reality. Without a clear communication strategy false expectations may be generated over availability. Regarding the mechanisms to exploit IP by importance, the priorities are:

1. Licensing the IP to existing companies,
2. Other cooperation with existing companies (e.g. joint ventures, development collaborations),
3. Formation of a new company (e.g. spin-off, spin-out, start-up),
4. Sale and transfer of the IP to existing companies (assignments),
5. Providing open access to IP by putting it in the public domain, institutional repositories, open access publications etc.

Generating additional revenues should not be the prime objective of PROs IP/KT policy.
Promoting the diffusion of scientific knowledge and technology and generating possibilities for collaboration in research and teaching were most often mentioned as very important objectives (and often as important) by the study participants. Contributing to economic growth, raising the profile, getting publicity, promoting entrepreneurship, and generating revenues are very important.
Meeting the requirements of funding bodies, supporting (private) partners, attracting and retaining faculties as well as broadening the job market for students are least important.

By definition research starts from a blank sheet which may be filled with multiple possibilities and many different paths relating to both a technology and a business point of view. Experience design can help focus projects on the right sector to pursue based on user needs or user experience.

Furthermore, experience design provides the tangible and visual support needed to facilitate the expansion and propagation of the original idea whilst often generating valuable intellectual property.

Licensing policy - *Existence and publication of a licensing policy*

The Code of Practice promotes developing and publicising a licensing policy in order to harmonise practices within the institution. The PROs are stimulated to have a licensing policy based on a written document. The existence and form of licensing policies are related to the size and age of the KTOs. Smaller and younger KTOs have such a policy less often than larger and older KTOs. The PROs are stimulated to complete licensing or IP transfer contracts.

Incentives for IP protection and exploitation

The Code of Practice suggests the introduction of incentives for becoming involved in the implementation of the IP policy, and highlights the necessity for non-monetary incentives in particular.

The European Study stated that the institutions provide at least one incentive to its employees and/or students to protect and exploit IP. On average, an institution provides 2-3 different transfer incentives to their employees; the larger the transfer office, the more incentives are provided. However, smaller KTOs are catching up and considering more often the introduction of a new incentive (0.56 “incentives planned” in the smallest KTO size class).

Models for sharing revenues.One important incentive to engage in IP protection and knowledge transfer activities can be the possibility of participating in the revenues.

Distinguishing these revenue shares we also find a few regularities which are partially easy and partially not so easy to explain:

- Inventors’ shares are significantly higher in North Europe Countries.
- The lower the R&D-density of the country the higher the share reserved for inventors and the lower the shares for the KTOs/other intermediaries and other beneficiaries. We would explain this with less institutionalized transfer arrangements and fewer institutions which contribute to achieving transfers.
- In non-university research institutes the revenue share of the institution is considerably higher (48%) and that of inventors lower (26%) than in universities – one reason for this could be cultural differences and a tradition of “academic freedom” which requires stronger incentives to motivate university researchers to become involved in KTT.
- Smaller KTOs reserve a higher share for themselves and pay more to other beneficiaries which presumably contribute some services to IP protection and commercialization which the KTO does not provide itself. Mainly inventors and their departments need to “pay” for this.
- Older KTOs pay a lower share to themselves and more to other beneficiaries and the overall institutional budget. Younger KTOs on the other hand obtain a higher direct funding contribution from the transfer revenues.

New Models of University-Industry Partnership

TTOs are increasingly charged with the task of quantifying their impact on regional economies, and one proven way to boost results is by improving corporate access to university-developed technology. The challenges typically voiced by industry, long negotiations, complicated licensing terms, red tape, and risky financial terms, mean missed research and development partnership opportunities that could mean a lot of money in funding, licensing, and new technologies being brought to market.

Some pointed programs have dramatically improved the university’s ability to land new sponsored research and licensing deals, and in the process redefined the TTO as a highly sought after partner for corporations. The program simplifies the contracting process for sponsored research and employs industry-friendly features like pre-set license terms, exclusive worldwide rights, low royalty rates, and affordable prepayments. Most recently the TTO launched the program, which allows companies to “test drive” technologies for a low flat fee before deciding on a license, eliminating risk and encouraging deal activity.

Collaborative and contract research with private sector partners

Collaborative research (all partners carry out R&D tasks) is the most common form of research partnerships with private sector partners and carried out at virtually all institutions.

Contract research (R&D is contracted out to a public organisation by a private company) is conducted by more than 90% of the partners, while service agreements (existing knowledge or

infrastructure is used, new IP is not produced by the institution) are done by more than three out of four institutions. Among other activities (7%) consulting, sponsorship, clinical trials, and use of infrastructure can be mentioned.

Rules and practices in regard to collaborative and contract research activities

- For *collaborative research* acceptance of delays of publication to facilitate IP protection, keeping IPR for further internal research, and maximising the socio-economic impact of the research receive the highest shares of agreement. In more than half of the cases the partners also agreed to maximise the commercial impact of the research, insist on the public dissemination of the R&D results and keep IPR for further research cooperation with third parties.
- For *contract research* the picture changes slightly: publication delays are accepted, ensuring the commercial impact is at least as important and IPR are kept for further internal research as well. The other statements received lower consent. In only 40% of the cases the institutions keep the IPR for further research cooperation with third parties and in a few more cases they insist on publishing the results.

Ownership, access rights and revenues for foreground and background IP

A comparison of the results with the Code of Practice recommendations reveals several points

- A minority of 25% states that their organisation usually owns the IP resulting from contract research, which – according to the Code of Practice – should indeed be owned by the private sector clients.
- The Public Research Organisations usually keep access rights to the foreground for further research, as recommended in the Code of Practice.
- Whether access rights to foreground for research/exploitation are usually granted to the private partner depends not at last on their requests. Hence, we can interpret a lower value for contract research also as the result of lower demand from private partners (as they typically issue a research contract because they do not want to engage themselves in research on a topic).
- The differences between collaborative and contract research in regard to costs and participation in revenues are mostly as one would expect. Indeed, cost covering compensations could be more common for contract and less common for collaborative research to account for the different purposes of both types.
- Regarding the background IP (already owned by institution at project start) in collaborative and/or contract research with private sector partners, there are virtually no differences between collaborative and contract research with the only exception of the revenue position, which is slightly better in collaborative research (as we would expect). In addition, for background IP non-university the Public Research Organisations maintain a stronger ownership position than universities in both collaborative and contract research. However, whereas in collaborative research it is more common to participate in the revenues, in contract research it is more common to ask for cost coverage up-front.
- Permitted universities, not-for-profits, and small businesses to obtain title to IP developed with governmental support.
- Allowed government-owned, government-operated universities and R&D organizations to grant exclusive licenses to IP created with government funding.

3.3. Drivers and barriers to more effective and efficient knowledge transfers in the view of universities and other public research organisations

A few points of key importance for being successful in the area of knowledge and technology transfer resulted from the interviews conducted with 100 universities andother PROs. They are briefly summarised in this section.

1. ***Relationship between KTO funding and staff is crucial.*** KTO funding was repeatedly mentioned in the interviews as a barrier to more transfer success. A general lack or little stability of resources can have many negative effects:

- KTOs need to look and apply for resources, e.g. in the form of project grants, which takes away time from their main tasks;

- KTOs will limit their activities and focus on the early steps of the KTT value chain, the identification and protection of institutional IP, neglecting later steps, in particulartechnology marketing and scouting in industry.

Most importantly, funding problems reduce the attractiveness of KTOs as employers, as remuneration and possibilities for career advancement will be rather low.
At the same time, KTO employees need to bring many different competencies and qualifications to their jobs: they need to have a good technical understanding of their fields of activity, and corresponding training and degrees (in engineering, biomedicine, etc.) – as also mentioned in the CoP – are essential; as brokers KTO staff need to be able to understand the interests of scholars and faculty as well as the needs of managers and engineers and know the industry in order to be effective in assessing the commercial potential and the value of an invention, helping to find users/customers for their technologies, negotiating and concluding contracts and the like; in the best case they also know the stumbling blocks of start-ups and are able to understand and support entrepreneurial faculty and students. Therefore it is logical that industry experience has been found as an important asset of transfer staff (Conti &Gaulé, 2008).

2. ***Formal collaboration between PROs in the area of IP/KTT is still in an early stage of development****.* Virtually all PROs collaborate informally on IP/KTT issues and exchange information, share good practice, lobby towards their political decision-makers, or hold joint workshops and seminars; many KTOs collaborate with or subcontract to external service providers.
However, formal, contract-based collaboration among PROs is still rather an exception: few interviewees pointed to it, and more advanced collaboration types as IP/patent pools are rarely found.
Cross-institutional collaboration could have several advantages: PROs could specialize on certain activities, realise scale economies and reach critical mass; they would increase their reach and create links to partners in industry (and academia) outside their existing networks.
It would contribute to the professionalization of the trade and a more varied institutional landscape, which is currently very much dominated by the small internal office of the university board or administration (85% of all PROs are internal, two thirds had 8 or fewer full-time equivalents of staff).
Collaboration also creates some costs, entails a loss of control and self-sustainability and eventually places additional distance to the internal audience of scientists and faculty.
But still, in the light of the survey finding that small KTOs are less versatile in regard to their KTT principles and practices it would make a lot of sense for them to further explore the possibilities of collaboration.

3. ***Having a written and published licensing policy has advantages as well as disadvantages****.*
The EC Code of practice states in its principle 10 that PROs should "develop and publicize a licensing policy, in order to harmonise practices within the public research organisation and ensure fairness in all deals."
Only a few PROs have done this, as established by the surveys conducted online. In the interviews, the KTOs pointed out that the main reason was that without a licensing policy they were more flexible and negotiations could be conducted on a case-by-case basis. In addition, communicating the principles of their licensing practice also to their partners in the industry would weaken their position in negotiations.
Another important reason was that a meaningful licensing policy would need to be quite detailed and complex to accommodate the large variety of possible issues which in turn decreases the main advantage of having it, namely transparency towards the stakeholders involved in KTT.

4. ***Using model contracts, collecting experiences and developing trust can speed-up contract negotiations****.* The frequent complaint from the company interviews in 2011 that contract negotiations with PROs have become longer and more complex over the years was followed up in the PRO interviews. The majority of PROs agreed with this opinion as well. They suggested three main roads to speed up negotiations:

- Developing and using model contracts which are backed by PROs and the private sector/industry associations;
- Building up negotiation experiences and using staff with such experience and good knowledge of the constraints and needs of the private sector in negotiations;
- Developing trust among the involved parties and reducing the importance of the legal perspective in favour of a technology- and competence-related perspective.

The latter is not a plea for being naïve about the importance of contract clauses and contractual arrangements, but more the insight gained by our interview partners that in R&D and innovation projects some developments and pathways cannot be foreseen and taken into account in the contracts.
However, if trust prevails and the parties accept that eventualities will be dealt with in a cooperative and mutually supportive manner, then lengthy haggling about possible minor contract clauses would not be necessary.

5. ***KTOs role in transfers not based on IP/patents is a difficult one.*** In an institutional IP ownership regime KTOs are the guardians of this IP. However, their role in other transfer channels is limited: R&D collaborations, contract research, and consultancy services are fully within the responsibility of faculty and staff and KTOs can do little to support them, except for influencing the framework conditions.
With regard to start-ups:

- KTOs have few tools and means to influence as well: first of all, fostering entrepreneurial spirit and generating an entrepreneurial culture are institutional, regional or even national tasks and heavily influenced by other systems outside higher education and public research. Incubators and other supportive infrastructure are of little use without a steady flow of academic entrepreneurs.
- As parts of the university administration, KTOs are not really close to the business sector themselves (which many try to remedy by outsourcing their start-up support activities).
- For one of the most pressing problems of start-ups and academic entrepreneurship, the provision of seed and venture capital, PROs usually lack instruments and resources.

*6.****Commercialisation of Research.*** The Knowledge or Technology Transfer Offices was formed to advance the Universities/Institute's key strategic goals by working with researchers to broaden their route to commercialisation.
Towards these goals, the Knowledge or Technology Transfer Office assists in identifying Intellectual Property, securing and maintaining Intellectual Property rights where appropriate and facilitating the exploitation of Intellectual Property in a fashion consistent with the Institute's values and mission.
The TTO assists the research community in:

1. Providing training and support on Intellectual Property matters
2. Assisting in formulating invention disclosures, and processing Patent Applications
3. Evaluating, in cooperation with other Universities/Institutes staff and outside experts as appropriate:
    - The commercial potential of the Intellectual Property
    - The appropriate form(s) of Intellectual Property protection to be pursued
4. Developing and undertaking an appropriate commercialisation strategy for University/Institute owned Intellectual Property
5. Assisting in the negotiation of those portions of contracts and agreements between the University/Institute and outside parties concerned with the ownership, protection and exploitation of Intellectual Property
6. Dealing with Intellectual Property issues that may arise in the administration of such agreements or contracts
7. Promoting awareness of and educating the University/Institute's research community on issues related to intellectual property protection and technology transfer;
8. Identifying, capturing and protecting intellectual property arising from research activities within all areas;
9. Developing and executing strategies for the commercialisation of technologies. The successful candidate will be expected to work closely with researchers to identify the commercial application of the invention, determine licensing strategy.
10. Preparing written non-confidential descriptions, and attending conferences, seminars and exhibitions to promote University/Institute technologies;
11. Negotiating options, licenses, Campus Company and collaborating on research agreements;

12. Supporting promoters in the assessment and development of technology and business plans for spin-outs/start-ups;
13. Developing and implementing policies, procedures and systems ensuring institutional best practice in relation to intellectual property management and knowledge or technology transfer;
14. Liaising with patent agents, industries and other external professionals, as necessary, in relation to patents and commercialisation activities.

*7.**Intellectual Property, Knowledge and Technology Transfer and Patent Training.*** The Knowledge and Technology Transfer Office provides training on a regular basis to all staff and students in the area of Intellectual Property, Knowledge and Technology Transfer and Patents.
The training will give participants, at least:

- A general overview of Intellectual Property Knowledge and Technology Transfer and Patents
- Innovation management
- Intelectual Property Management - General principles and guidelines
- Knowledge and Technological transfer. General principles and guidelines
- Assessement of the innovation capabitity and of the innovation management performance
- Guidance on searching patent databases
- Ability to identify potentially patentable inventions
- Explanation of the forms and procedures relating to IP.
- An understanding of particular issues pertinent to their research area

The training can be customised to the various fields of interest.

*8.**The old university paradigm of receiving funding without a knowledge mobilization strategy is dead.*** Universities see themselves to be in a risky situation as a result of economic pressures combined with increasing demand for quality research to provide social benefit. In a climate of uncertain funding, greater demand for valuable research, understanding how knowledge mobilization can bring opportunities to improve research, create social, economic innovation, affect government policy needs to be considered.
When this is done it leads to important social, economic change.
Community-University partnerships and engagement are not new and have been around for at least a decade. Some examples include CUPP Brighton UK, CUP Alberta, Canadian Social Economy Hub, Emory University Center for Community Partnerships, and Concordia University's Office of Community Engagement. In an informative journal club post David Phipps also discusses Mobilising knowledge in community-university partnerships.
So some universities get it and are definitely ahead of the game as the public sector benefits from these community-university collaborations. Yet there are other universities who continue to ignore the broader benefits of such synergies.
This is where greater work needs to be done to help the universities who continue to be stuck in old academic-infrastructure paradigms and help sustain community-university partnerships programs that do exist by the institutions themselves.
Developing long-term knowledge mobilization and social innovation strategies involves commitment and greater cooperation from all bodies of the university – staff, students, faculty, deans, vice-presidents, and governing councils; and most importantly from the University President.
It's about multi-disciplinary and inter-departmental conversations to provide differing views from varying capacities to create an academic environment that provides social benefit *that includes engagement within and beyond the walls of the university from many directions*.
The greater return on investment for social benefit requires a broader approach to have faculty, university research services, knowledge mobilization unit, knowledge brokers and university industry liaison offices work together across sectors instead of as separate university contacts and entities.
A great start of this integrated approach comes from the University of Alberta which has amalgamated the Industry Liaison Office, the Research Grants Office and components of Research and Trust Accounting into an integrated Research Services Office.
The University of Alberta thinks "the move to a "one-stop shop" provides researchers with more effective and streamlined services, with enhanced accountability, productivity."
However, a truly integrated approach that maximizes the impact of university research would also include a knowledge mobilization unit.

3.4. Drivers and barriers to more effective and efficient knowledge transfers and impressions on the impact of the Code of Practice in the view of companies from research-intensive sectors

On average in 2009, the companies had a large ratio of R&D expenditure to total sales (R&D-intensity of 12.1% compared to 3.6% for the population of companies in the Industrial R&D Investment Scoreboard) and they invested 83 mEUR in R&D. Roughly half of the companies had internal R&D activities at global level, i.e. in Europe and at least two further world regions.

All but one company cooperated with PROs in their home countries, 80% with partners in other European countries and nearly 60% with partners in North America. Companies used both formal and informal mechanisms. Communication in personal networks, at conferences, etc., the recruitment of academics and graduates and the reading and evaluation of scientific publications were the most common *informal* mechanisms.

Collaborative and contract R&D were the most common *formal* mechanisms: only three companies (all in the software industry) were not engaged in one or the other. The use of several formal mechanisms is closely related to company size.

We differentiated between nine types of incentives for and barriers to KTT: competence related, technical, informational, financial, organizational, legal, sociocultural, spatial and others. Competence-related incentives are by far the most important driver to take part in KTT (mentioned by 9 out of 10 companies). Organizational and sociocultural are the most frequently mentioned barriers across the board. In regard to academic patents, technical incentives/barriers related to the outcome of research; the quality and the relevance of the technology were also stressed. Distinct incentives and barriers were mentioned for Europe, the US and Asian countries.

Furthermore, incentives and barriers are related to certain characteristics of the companies, above all their size, R&D-intensity, the geographical extension of their internal R&D and the degree of central R&D coordination.

We note in particular, that not only SMEs with less than 250 employees, but also medium-sized companies with up to 1000 employees encounter financial barriers.

It is a challenging task to evaluate the impact of the European Commission's Code of Practice:

1) The code was issued only three years ago and we would not expect an immediate effect;

2) There are other, not necessarily fully consistent initiatives and policies on IP management and KTT at national or regional levels;

3) The collected data refer only to the current situation and comparable data from the period before the publication of the CoP is not available.

Still, we compared the interviewees' experiences with IP management and KTT practices in PROs with the CoP (predominantly principles 8-18 which address KT policies and collaborative and contract research) and looked at the trends and changes to get an understanding of the likely significance of the CoP for KTT.

The results can be summarised in three key points:

1. ***Limited contribution of PROs to innovation.***Though universities and other public research organisations may undertake considerable efforts to turn their research into socio-economic benefits and use a broad set of exploitation mechanisms and partners, the perception of the interviewed companies is overshadowed by problems of setting-up, executing efficiently and concluding successfully joint projects. All in all, the contribution of PROs to innovation is seen as limited.

2. ***The current rules, practices and incentives don't serve the purpose of converting knowledge into socio-economic benefits very well.*** First and foremost, many interview partners strongly opposed the view that giving PROs strong ownership positions for the IP generated with their involvement, focussing then on exploitation via licensing activities,and establishing an incentive scheme in which PROs and their scientists give the monetary returns for research results. IP's first priority is really beneficial to better converting knowledge into socio-economic benefits. According to their opinion this can cause in the worst case:

- False conceptions of the importance of PROs in innovation and bureaucratic behaviour in university administrations and KTOs, leading to long lasting contract negotiations, unrealistic price expectations for patents or licences, stalled project proposals and, in the end, less joint research and less valorisation of scientific knowledge and creation of socio-economic benefits.

- A reduced willingness of scientists to engage in an open and uncensored informal exchange of information with private enterprises and waste of time in internal discussions and negotiations with their administrations.
- Less interest of private enterprises in cooperating with European scientists, increased search for expertise and technology from other sources or world areas, strategies to bypass IP regulations and university bylaws.

3. ***No "one-size-fits-all" approach and collecting experiences are important.*** Thanks to the continued and intensified cooperation, PROs – both administrations/KTOs and scientists –and companies have developed a better mutual understanding of needs, constraints, regulations and requirements. This would constitute a good basis to intensify the cooperation. Negotiations and haggling over IP ownership, access rights, and licence fees repeatedly constitute a burden and stumbling block.
In a number of cases the interviewees from different industries lamented the fact that regulations, practice and KTO staff are biased to a considerable extent by the extraordinary conditions and opportunities in the biotechnology and pharmaceuticals industry. They are unfamiliar with the situation in other industries and unable to adjust their approaches to exploitation and interaction with industry.
This lengthens negotiations and complicates or even impedes commercialisation projects.

Common challenges of knowledge transfer
Before drawing conclusions and formulating policy implications, it is useful to answer a key question about knowledge transfer: Why is knowledge transfer such a difficult and often unsuccessful activity? Based on research for this study and on the growing amount of related literature, the following general challenges of knowledge transfer can be distilled. The list does not claim to be complete but to cover the most important issues.

Challenges related to PROs:
Competing objectives within PROs: Knowledge transfer is sometimes referred to as the "third mission" of universities beside teaching and research. Universities are currently facing numerous challenges such as adjusting to governmental regulations about degrees and curricula as well as sustaining or improving the university's position in competing about students and research funds. KT may thus often be third priority behind research and teaching and not necessarily viewed as supporting the other two objectives. Even in PROs where KT currently enjoys high recognition, this may change with shifting PRO management. The challenge is to establish KT as a fully recognised objective of PROs that also contributes to excellence in research and teaching, sustainably backed by the university's management.

Incongruence of KT costs and benefits: Costs and benefits of the knowledge transferred may frequently be with different organisations on different geographical levels. While the university may have to bear the costs of transferring the knowledge, e.g. in funding KTOs, patenting and supporting spin-offs, benefits may be highest for the regional economy or the society at large. While income generation may be a primary objective of PROs in KT operations, only some will achieve a position of covering KT expenses with income from KT. This is even the case in the US. The challenge for PROs is to develop a KT strategy, KT operations and forms of KT organisation which address this issue.

Academic rationales in favour of publishing: Academic culture may generally not be tuned towards valorisation of research findings or not even towards engaging in research that might lead to potentially commercialisable outcomes. Following established incentive schemes, academic researchers may be more interested in publishing their findings in academic journals. They may thus obstruct or at least not support commercialisation. The challenge is to set incentive towards engaging researchers in relevant research, invention disclosure and in valorisation, to instruct researchers and students about IP, and to establish more or less systematic "technology scouting" within PROs.

Conflicts of interest: Engaging researchers in strong links with commercial enterprises may lead to conflicts of interest, i.e. researchers may (partly) abandon their neutrality in favour of commercial interests. Neutral, open and unbiased research is however a basic characteristic of academic work which serves wider social and also economic goals. The challenge is to establish and enforce rules not obstructing researchers' interaction with commercial enterprises while ensuring academic neutrality.

Challenges related to the nature of the goods and markets concerned:

Imperfect information about commercial potential: When a research finding is disclosed, PROs have to assess its valorisation potential and how to deal with it.
When the PRO sees such potential they may protect IP and offer it to commercial enterprises. However, information about the commercial potential of an invention is imperfect, so enterprises may not necessarily be ready to pay the "price" for the IP. The challenge is to establish viable procedures for assessing the commercial potential of research findings.

Lack of market transparency: Knowledge transfer may suffer from an intransparent market: There are numerous "suppliers" of inventions at a large number of universities and other PROs on the one hand, and numerous enterprises as potential customers on the other hand. Capacities for becoming acquainted with each other are limited on both sides.
PROs may have to focus on a selected number of relationships. The challenge for PROs is to establish KT networks and links with enterprises for mutual benefit.

Lack of KT professionals: Knowledge transfer is a complex business. It requires knowledge and skills in at least three fields – technology, business and law.
Experts with such expertise are not easily available, particularly not for KTOs of PROs which may not be able to pay salaries as high as in commercial enterprises. The KTO profession is still developing in Europe and it is not a widely known and acknowledged profession. KTOs may thus end up with experts who are not sufficiently qualified.
The challenge is to develop a viable KT profession in Europe.

Challenges related to cooperation with commercial enterprises:

Cultural differences between PROs and companies: There are cultural differences between sellers, i.e. universities and other PROs, and customers, i.e. commercial enterprises.
The objectives pursued, the personal characters involved and the language used by the different parties may be different, making negotiations difficult.
The challenge is to manage conflicting expectations and behaviour on both sides.

Not-invented-here phenomenon: Enterprises may not necessarily be ready to adopt a technology that was invented elsewhere. First, successful implementation of the invention may depend on personal knowledge which is with the inventor who remains at the PRO.
Secondly, scientists within the enterprise may oppose the adoption of an outside invention, badmouthing it because it may harm their own esteem.
The challenge is to establish trustful relationships between PROs and enterprises that lead to successful transfer of knowledge.

Lacking IP expertise in enterprises: While PROs are often blamed for not developing powerful KT, there may also be deficits in professional management of IP on the part of commercial enterprises. This may particularly be the case in SMEs.
There is thus also a challenge to develop KT absorption capacities and skills in commercial enterprises.This list shows that knowledge transfer is a complex phenomenon that may consequently require a complex approach.

4. Knowledge Transfer Practices

4.1. From laboratories to the market

Key results about knowledge transfer policy themes and measures

Knowledge transfer policy is generally accepted as an important issue in Europe:
The vast majority of countries (90%) said that national and regional governments promote policies and procedures for the management of IP resulting from public funding.
Within the policy measures for fostering KT strategy development asked about in the survey, non-legal measures were found to be widespread.
Legal measures to support KT strategy development were found to be less prevalent.
Almost all countries (92%) said that national and regional governments support the development of KT capacity and skills in universities and other Public Research Organisations- PROs.
The lowest score for this theme was found for "model contracts for KT activities". 38% of the countries said that model contracts as well as related decision-making tools are available.
Further 15% of countries plan to introduce model contracts.
As regards international RDI cooperation, 67% of the respondents said that their country cooperates with other countries to improve the coherence of IP ownership regimes.
This share may be considered as remarkably low – one might have expected that all or almost all countries in the European Research Area co-operate in improving the coherence of ownership regimes.

Knowledge transfer and Intellectual property

The protection of intellectual assets is essential to the competitiveness of most organisations, private or public, and to their attractiveness for investors.

There is a need to **properly balance intellectual property systems**, to ensure that they offer suitable incentives to invest in research and innovation, while at the same time ensuring that the diffusion and further development of research results are not stifled.

In the European research policy perspective, the proper management of knowledge (such as R&D results) and intellectual property also raises further issues.

On the one hand, there is the scope to make European intellectual property systems more responsive to the rapid evolution of both research processes and emerging knowledge and technological areas. This calls for a number of **R&D-related IPR questions** to be tackled (e.g. the research exemption). In addition, special emphasis needs to be placed on specific issues relevant for R&D collaborations and knowledge and technology transfer between public research organisations and industry, as "**university-industry relations**" are an increasingly important way of enhancing the impact of scientific achievements on European competitiveness.

On the other hand, actions are needed to promote the optimal use of intellectual property rights systems in Europe, by suitable **awareness and training** actions, with a special emphasis on academic institutions and small businesses.

Models for sharing revenues

One important incentive to engage in IP protection and knowledge transfer activities can be the possibility of participating in the revenues. Several studies have shown that inventors' shares of the revenues are positively related to license incomes in US research universities.
Studies outside the US have found positive links of inventors' shares with licence income in Spanish universities and income from industry in Japanese universities, and with patent applications in Italian universities.
Some studies show that in the US lower shares for inventors raise the likelihood that patents are assigned not to the university but to start-ups in which the inventor is a principal.
Lower shares to inventors may thus create an incentive to have patents assigned to start-ups and/or reduce the disclosure of inventions to the university.
This is also cited as possible explanation for the negative relationship between inventors' royalty shares and the number of start-ups in other studies.
Not only revenues to the inventors themselves, but also to their departments and institutes have been found to be effective for raising licence income.
But there is no effect on generating start-ups. Established clear principles for the sharing of knowledge transfer revenues among the organisation and inventors, exist in two thirds of the

institutions.
The percentage of PROs not deducting any expenses reaches 30% and seems to be high.

The **Knowledge Transfer Study** realized by the European Commission (EC) showed in June 2013 that inventor(s) usually do not receive a share of the revenues generated from the IP; institutional units don't receive a share and (20%) of the respondents answered that the PRO is not entitled to revenues.
The knowledge transfer office does **not** receive any direct revenues in the large majority of PROs (70%), 40.7% of the revenues are given to the inventors and researchers of the institution; 18.8% to the respective department, institute or other institutional units with which inventors are affiliated; 31.6% are allocated to the institution as a whole and 7.6% to its KTO; 2.3% go to other beneficiaries.
The inventor's share tends to be lower in Western European PROs and in non-university PROs, where the percentage of revenues kept by the institution is larger.
The average percentage given to inventors is very similar to that found in the US where institutions attribute approximately 40% to inventors; the revenue share for inventors' departments is one fourth lower which on average gave 26% to departments.
Distinguishing these revenue shares by types of respondents we also find a few regularities which are partially easy and partially not so easy to explain:

Inventors' shares are significantly higher in Scandinavia, which is due to 10 Swedish responses which give an average share of inventors of 90% (which is in line with the Swedish legal situation in regard to IP).

The lower the R&D-density of the country the higher the share reserved for inventors and the lower the shares for the KTOs/other intermediaries and other beneficiaries. We would explain this with less institutionalised transfer arrangements and fewer institutions which contribute to achieving transfers.

In non-university research institutes the revenue share of the institution is considerably higher (48%) and that of inventors lower (26%) than in universities – one reason for this could be cultural differences and a tradition of "academic freedom" which requires stronger incentives to motivate university researchers to become involved in KTT.

Smaller KTOs reserve a higher share for themselves and pay more to other beneficiaries which presumably contribute some services to IP protection and commercialization which the KTO does not provide itself. Mainly inventors, their departments need to "pay" for this.

Older KTOs pay a lower share to themselves and more to other beneficiaries and the overall institutional budget. Younger KTOs on the other hand obtain a higher direct funding contribution from the transfer revenues. The differences for inventors and departments shown in Exhibit 4-10 are not significant at the 5%-level.

Qualifications of the KTO staff and training offers
CoP suggests training actions for staff (and students). Entrepreneurial training is available in 50% of all PROs for employees and in 75% for students.
This is in line with the recent finding (based on US data) that start-ups are more commonly founded by graduates than by university staff and that graduate-founded start-ups are not of inferior quality.
It is not surprising that entrepreneurial training for students (and less so for staff) is more common among universities than among non-university research institutions.
In addition, it is considerably more common in the EU countries than in other European countries.

Performance related to research expenditures
The performance in terms of economic efficiency or the estimated cost in million Euros to produce each output. For example, it costs universities in Europe on average €3.2 million of research expenditures to produce 1 invention disclosure.
With the exception of license income, universities outperform other research organisations when research expenditures are used to standardise the results.

This should not be surprising, since government and non-profit research institutes have a substantially larger research budget per staff member and are likely to perform more applied research than universities.

Indicators for knowledge transfer performance by research expenditures

- Invention disclosures
- Patent applications
- Patent grants
- Start-ups established
- Successful start-ups
- License agreements
- License income (million €)
- Research agreements

A comparison of European performance with American PROs shows that the latter are more efficient producers of invention disclosures, patent applications and license income.
While European universities spend €113.5 million to generate €1 million in license income, American public research institutes only spend €24.4 million to generate €1 million in license income.
This shows that European PROs are not that effective yet as American PROs when it comes to commercialising research results. Conversely, European performance exceeds that of the US for the number of start-ups and the number of license agreements.

Knowledge Transfer Offices characteristics

Most European Knowledge Transfer Offices (KTOs) are young, with more than half, established after 2000. Furthermore, more than half have fewer than five employees.
These results suggest that most KTOs in Europe are still developing experience and capabilities with managing the IP produced by their affiliated university or research institute.
Furthermore the regression results in this report have shown that the size of the KTO measured by its employees has a significant and positive impact on the number of invention disclosures, license agreements, license income and start-ups.
Many KTOs could therefore be struggling with a lack of sufficient and experienced staff in catching up with the performance of their peers in the US.
European KTOs with experience both from 2010 and 2011, performed better in 2012 on invention disclosures, patent application, USPTO patent grants, start-ups established and license agreements.

Relationship between institutional policies and performance

In order to analyse the relationship between institutional policies and practices and knowledge transfer performance, the policy variables were regressed on a set of six performance measures (invention disclosures, patent applications, licence agreements and revenues, start-ups, R&D agreements with companies).

We found:

1. Universities and other Public Research Organisations - PROs having policies on Intellectual Property, licensing and start-ups also are more successful in the different areas of KTT. In particular, if these policies are in written form they can contribute to a consistent management of different projects.

Publishing the content of these policies as well as the patents available, license offers, or new start-ups is not linked to a better performance; to the opposite, institutions with a lower KTT performance tend to publish more, presumably with the intention to raise awareness and improve their performance in the future.

Whether this is successful cannot be answered with the cross-sectional data available.

2. While the European Commission's Code of Practice puts forth in principle that institutional incentives to the faculty in order to raise awareness and involvement in IP and transfer issues should not only be monetary, our regressions clearly show that non-monetary incentives are rather

ineffective. In institutions where inventors are entitled to a share of the revenues and/or they receive higher salaries the transfer performance measures are significantly higher.

However, the percentage given to inventors is not related to performance, contrary to studies using the US AUTM dataset.

We explain this with the still rather heterogeneous IP ownership situation for university faculty in Europe and a lower degree of IPR law enforcement than in the US.

3. Knowledge transfer services can either be provided internally, i.e. by the KTO or other offices of the PRO, or externally by service providers on a contract basis. We evaluated whether either form of service provision is related to any of the performance measures.

Two findings are remarkable:

- Drafting patent applications is the only service that is predominantly provided externally, in roughly 70% of all PROs. However, institutions (also) providing it internally do not only have significantly higher patent applications, but also higher licence revenues. The ability to draft a patent application requires considerable technical and legal understanding, the existence of which is obviously also conducive to commercialization.
- Serving as a broker between faculty and companies is done mostly internally – by 60% of the PROs – and only by one out of six PROs externally. For raising licence revenues it is beneficial if the service is provided externally and not by the KTO itself; however, for closing R&D agreements the opposite is the case and the KTO is in an advantageous position helping companies to overcome entry barriers.

Supporting start-ups with preferential IP access, infrastructure, management and capacity-building services (training, coaching etc.) is correlated with the number of startups.
Providing scientific, technological or financial support and having an incubator are insignificant.

4. Among the different marketing channels, personal channels, such as open days, business roundtables, or personal contacts are rather ineffective for marketing IP and closing licence agreements.

Print and electronic channels and in particular the World Wide Web, on the other hand, correlate positively with performance measures.

4.2. Current and emerging issues

Strategy-related issues:

- *Level of strategy development*: Even in countries that are further advanced in KT and IP management practice, there seems to be considerable room for further development of related strategies at universities and PROs.
- *KT programmes*: National support programmes can have positive effects on KT performance, but sustainability may be difficult to achieve. National KT programmes may have positive effects on KT strategy and capacities development, but after the end of the programme PROs may reduce their KT activities again.
- *Prevention of IP loss*: The prevention of IP loss to industry and countries outside Europe without adequate compensation.
- *KT standardisation*: Currently there are several parallel initiatives for KT professional certification in Europe which might need to co-operate and align their activities.
- *KT governance*: The development of good KT governance was found to be an issue in many South-Eastern European countries.
  A deeper understanding of strategy development for KT and IP management needs to be developed, including e.g. issues to be covered and acknowledgement of the complexity of KT. The European Commission may need to consider this in its future KT policies.

Operations-related issues:

- *Model contracts* were mentioned as an issue in many workshops. They were mainly assessed as positive, while it was often stressed that they provide not more and not less than guidelines for concrete negotiations.

- *Commercialisation support services* were presented and discussed mainly with regard to the Commercial Edge, an initiative which is about to spread to a larger number of universities.
  Such services may be promising, but their proliferation requires high-profile service providers with in-depth deal-making expertise.
- *PRO's IP capacity and skills* were found to be an issue in practically all European countries. The strength and sustainability of KT office services is often questioned, for example when the KTOs deal primarily with research contract issues rather than valorisation or when there is relatively few KTO staff compared with the amount of tasks to be accomplished.
  Even more basic, in the South-East of Europe there is also a need to strengthen the R&D base from which opportunities for KT may arise.
- *Firm's IP capacity and skills* may also be limited, and responsibilities may be unclear, which hampers interaction about IP between PROs and business.
- Developing KT and IP awareness among researchers are apparently an issue even in more advanced countries; it was found to be an even stronger issue in less advanced countries, particularly in Eastern Europe.

Organisation-related issues:

- *(De-)centralisation of KT* was discussed in several workshops. It may be important to allow different types of universities to pursue different types of KT strategies and activities, and it may be important to decide about centralisation or decentralization of KT services with respect to how researchers' needs can best be fulfilled.
- *S*mall countries in particular may benefit from central KT functions carried out by an organisation serving several PROs – or, vice versa, it is neither efficient nor effective for every PRO to try to build up an own KTO. KTOs should in any case be able to focus on directly communicating with the researchers at their PROs, which is their essential task.
- *New KT models*: In a related session at the Nordic workshop, it was mentioned that enterprises are increasingly asking for "strong IP" in the form of IP portfolios and "patent families" because single IP may not carry sufficient commercial value.
- However, cases of actually combining IP and creating patent families were found to be rare. The bottom line for strong IP may be the quality of research.
- The importance of *KT through people*, in contrast to KT by patenting, licensing and spin-offs, was mentioned as an issue particularly in the workshops where countries with less advanced IP management capacities were involved (e.g. Baltic, Polish).

Measurement-related issues:

- Several similar surveys on KT indicators are conducted regularly in Europe, putting strain on the TTOs requested to answer them and probably reducing the response rates (unless the surveys are obligatory). Furthermore, since there are no standardised definitions, TTOs may be unsure how to properly answer the questions.
- The importance of good KT indicators for assessing KT practice and for designing good policies was substantiated, but currently there may be too much focus on patents.
  Counting the number of patents does not reveal the success of academic research or of knowledge transfer. It may be desirable to have impact measures.

Funding-related issues:

- An apparent lack of proof-of-concept funding was mentioned in many workshops but not discussed more in-depth; this lack would hamper KT because promising inventions often cannot be developed to a commercialisable stage.
- State aid rules' ambiguity was mentioned in many workshops but hardly ever discussed more deeply; the current revision of these rules by the EC was welcomed.

4.3. Measures to improuve

Supporting PROs' KT strategy, policy and procedure development

The EC should support the development of Green and White Papers on KT and IP management to start a Europe-wide consultation process among different stakeholders in governments, universities

and other PROs, business associations and companies and mobilise considerable resources and discussion on KT regulations and activities of public research organisations.
Exploring and supporting the development of non-monetary knowledge transfer incentives as well as formal KTO collaboration could also be beneficial.

Improving knowledge transfer capacities and skills
There is a need for "more KT about KT", to be filled for example in the form of workshops on more specific KT issues, a KT good practice manual and a KT Europe Network.
The benefits and possible downsides of the following issues should be further explored and subsequently supported in adequate ways: KT standardisation and certification; internships and expert visit programmes for KTOs; deal making support through intermediaries; and SME requirements in KT and their capacities to interact with PROs.

Promoting broad dissemination of knowledge while protecting IP
An analysis of the publication activities should explore the benefits and risks of publishing KT strategies and policies. It should find out what content should be published in what media to achieve the best possible visibility for the outcomes of academic research and development.

Facilitating cross-border research and KT
The globalisation of research collaboration and knowledge transfer requires further research on its consequences and the conditions under which, for instance, knowledge generated at European PROs will or will not be made available to non-European companies.

Introducing or adapting national guidelines and legislation
As regards improving legal framework conditions for KT, it is crucial to evaluate closely the existing IP ownership and access regulations in Europe and their consequences for the commercialisation of knowledge.
As regards de-bureaucratisation of KT processes, a constant review of existing funding and project regulations in Europe, creating the possibility for "fast track" applications and evaluations under certain conditions, could be considered.

Improved monitoring of policy measures and KT performance
There are three problems of current KTO surveys: they do not cover all leading KTOs, they are not being combined into one data set, and answering to several surveys distracts KTOs from their usual business.
Options for improving the data include encouraging cooperation between the different professional organisations so that data can be pooled, funding national statistical offices to conduct national surveys, and funding professional associations to survey KTOs that are not part of their membership.

New insights in research - business cooperation for knowledge transfer
Some of the key insights into research - business cooperation for knowledge transfer are summarised as follows:

Multiple* research - business cooperation – knowledge transfer *actors need to work cooperatively and in an integrated manner to affect and increase the cooperation
There are many actors playing a role in research - business cooperation including support actors (e.g. regional development agencies, politicians, students, business angels, venture-capitalist, businessmen and managers).
The cooperation between science and industry will turn out to be successful only if all actors positively perceive, develop and drive their respective areas of responsibility and parts.
If only one of the actors does not perform actively, the disruptive influence might be considerable enough to inhibit the whole momentum causing new obstacles, disappointments and blockades.
Research - business cooperation and knowledge transfer is a very complex ecosystem.
All actions need to be handled simultaneously at all levels and actors have to be addressed as a whole.

Research - business cooperation is complex and integrated

In order to have a complete view of research - business cooperation, one cannot only concentrate on certain aspects of the research - business cooperation ecosystem; since many factors and cause variables are closely linked and dependant on each other affecting positively or negatively.
Rather, an integrated approach involving many elements of the research - business cooperation ecosystem is required.
The benefit of this is that the development of activity in one element of the ecosystem is likely to benefit others.
Because of this integration however there is no easy or fast method for improving research - business cooperation.
Instead understanding the elements in the ecosystem and how they interrelate, then having patience and persistence should be the hallmarks of an integrated approach to improving research - business cooperation.

The focus of* research - business cooperation *should be on the relationships between the academic and the business
The focus of activities to foster research - business cooperation should be on researchers and teaching staff, the actual players within the higher education institutions involved in research - business cooperation relationships.
Without their passion and inner drive, there would be no research - business cooperation and knowledge transfer.
Therefore, all measures and corresponding effects should aim to target academics with the impact to be validated internally within the higher education institutions.
In the marketing of products and services, a 'pull' technique or a "pull" concept is always preferable to a 'push' system. Comparatively, 'push' techniques in research - business cooperation are the least successful techniques to encourage research - business cooperation within academics.
The degree of development of 'pull' techniques such as incentive systems targeting academics is still very low; showing that there is still much room for improvement.
For that purpose, additional levers such as recruiting, rewarding, promoting, providing incentives or fostering contract frameworks can be used to motivate academics to cooperate.
The belief that research - business cooperation is a 'people business' is also supported in a growing body of literature. Some authors argue that the key to successful knowledge transfer is a process of continuous dialogue, a build-up of social networks.
This success is a function of development of strong personal (as opposed to institutional) relationships over time which leads to the creation of trust (a key element in entrepreneurial activity).
It has even been argued that too much focus upon transactional mechanisms such as licenses and patents may distract from the development of personal intimacy and trust.

Research - business cooperation is closely connected with mind-set, attitude and willingness
Research - business cooperation and knowledge transfer is founded on an attitude or a mind-set rather than on isolated factors. It is driven by intrinsic and psychological elements (trust, mutual commitment, shared goals) rather than by rules (e.g. commercial orientation) or quantifiable elements (e.g. funding, access to knowledge and resources).
Likewise, age, gender, experience and background also represent factors that are based on human elements than on rationality.
Those academics remaining inactive do not see the benefits for research - business cooperation and therefore will see the need for action to be outside their own area of responsibility.
People with a high degree of research - business cooperation and knowledge transfer activity will instead recognise benefits and identify drivers finding ways to make it happen.
Thus, in order to increase cooperation within the academic ranks, higher education institutions have to create a positive environment, communicate advantages, demonstrate best practice, use role models and establish a series of appropriate incentives, and reward systems.

There is a difference in development between those types of UBC with clearly measurable, direct and potentially large financial benefits and those without
For both academics and higher education institutions, those types of research - business cooperation providing more measurable, direct and potentially large financial benefits for either the

higher education institutions or the students have a higher level of development than those providing benefits academically or a more indirect contribution.
This is evident in the greater development of R&D cooperation and commercialisation as well as the mobility of students compared to those cooperation types providing indirect and long-term benefits within the higher education institutions such as curriculum development and delivery, mobility of academics and governance.
Finding methods for firstly measuring or benchmarking the second group of UBC cooperation types would provide an approach for managing the development of these cooperation types.
Furthermore, by creating mechanisms that encourage and reward these 'indirect' research - business cooperation types, the higher education institutions can create the required drivers for activity in these types.

In terms of income, only a small part of third party-funds derives from cooperation with business
The extent of research - business cooperation undertaken is generally low and only very few higher education institutions derive a high amount of third-party-funds from companies.
Whilst the amount may differ depending on the type of higher education institutions, there clearly is too little income being earned through research - business cooperation and knowledge transfer. Money is not necessarily a success factor but it is an indicator of the authenticity and substance of cooperation.
Contrastingly, the largest part of the third-party-budget derives from public funding of the EU or national programmes.
That means that there is still a reliance on public funding and therefore substantial room for development in this aspect.

Removing barriers is not enough: research - business cooperation drivers and the presence of obvious benefits (motivators) are also needed to foster knowledge transfer. Further, these drivers and benefits also have to be obvious to the academics
We must focus not too much on barriers, drivers must to be identified and aply.
It must be emphasised that clearing the path of barriers (obstacles) alone would not be enough.
Even if there were no barriers, development in research - business cooperation would not occur. Only by the existence of drivers and a demonstration of the benefits for all involved parties can the momentum in research - business cooperation be created.

5. Conclusions and recommendations related to the themes of the KTBest Practice

5.1. Knowledge transfer as a strategic mission of Public Research Organisations

Ensure that all public research organizations define knowledge transfer as a strategic mission.
The list of **facilitating practices** includes the following:

- Knowledge transfer between universities and industry is made a permanent political and operational priority for all public research funding bodies within a Member State, at both national and regional level.
- The subject clearly falls within the responsibility of a ministry, which is charged with coordinating knowledge transfer promotion initiatives with other ministries.
- Each ministry and regional government body that carries out knowledge transfer activities designates an official responsible for monitoring their impact. They meet regularly in order to exchange information and discuss ways to improve knowledge transfer.

Green and White Papers on KT and IP Management

On the conceptual level, involving universities' and other PROs' strategies, statutes and procedures, the KTS found that the EC's Recommendation on IP management in KTcontributed to proliferating acknowledgement of the importance of KT in Europe.
Political decision makers apparently have been using and are still using the Recommendation to convince universities and PROs about the importance of KT. However, there might be a need for going a step further.
While the importance of KT and KT strategies is more or less widely acknowledged, details need to be developed: This includes knowledge about what items such a KT strategy should consider – e.g. technologies emphasised, mode of commercialisation emphasised, regional collaboration –, what alternative strategies exist and how to make them live in everyday practice.
Beyond general guidelines and principles, each PRO needs to develop its own approach towards KT, suiting its specific profile, objectives and regional environment.
There is no single successful approach towards KT. There might now be a need for further,more detailed alternative concepts for developing KT strategies – and also policies and procedures – in order to root KT more deeply and more widespread in universities' and other PROs' identity and practice.
Such a publication could be something like a "White Paper on KT and IP Management in PROs". It could also be or be preceded by a staff working paper.
There is still considerable uncertainty about the consequences of different regulations of IP ownership and access as well as KT strategies.
A Green Paper could start a wide consultation process among different stakeholders in governments, universities and other PROs, business associations and companies and mobilise considerable resources and discussions. It would be an appropriate measure to ensure that the way of knowledge transfer does not simply become a copy of the US Bayh-Dole model, inheriting its weaknesses, but at least in some environments lacking its strengths.

5.2. Policies for managing IP. Supporting PROs' IP policy and procedure development

Encourage public research organisations to establish and publicise policies and procedures for the management of intellectual property.
The list of **facilitating practices** includes the following:

- The proper management of intellectual property resulting from public funding is promoted, requiring that it should be carried out according to established principles taking into account the legitimate interests of industry (e.g. temporary confidentiality constraints).
- Research policy promotes reliance on the private sector to help identify technological needs and to foster private investment in research and encourage the exploitation of publicly-funded research results.

Exploring and supporting the development of non-monetary knowledge transfer incentives

The KTS Code of Practice (CoP) survey among universities and other PROs showed that monetary incentives for becoming involved in IP protection/exploitation are pervasive among the responding

European PROs. Other incentives, like social rewards, inclusion in tenure decisions, or additional funds for R&D, are less common, in particular in countries with more developed research systems.
The study team thus assumes that the value and positive effect of non-monetary incentives on IP protection and valorisation have been tested and proven in prior studies, though the study team has not yet reviewed this issue systematically. Provided the value of non-monetary incentives is proven, their further design and development would benefit from the special assistance of the EC in particular areas:

- Identifying and evaluating examples for non-monetary incentives in different countries, types of organisations and academic disciplines in regard to their positive and negative effects and side-effects as well as their specific implementation context.
- Creating case studies on these examples and disseminating them widely among European PROs and the stakeholders of research and KT.
- Supporting innovative human resources models in PROs which try to integrate IP and KT performance into promotion and career decisions.
- Promoting the creation of awards and prizes which honour KT success by private enterprises, business associations, research councils, governments and other organisations, also on European level.

Better addressing SME requirements
Requirements and constraints for IP ownership and access as well as KT preferences and practices vary by industry, business model, and company size, among other characteristics. Incentives for and barriers to working with PROs differ systematically between various types of companies.
For instance, firms with up to 1,000 employees more often mentioned financial and informational barriers to work with PROs, generally a lack of internal resources to identify and fund R&D partners and services from PROs,whereas larger companies pointed more often to legal barriers (e.g. related to IPownership and access, export laws, labour market regulations or the like).
Small and medium-sized enterprises – with fewer than 250 employees, but also larger companies with fewer than 1,000 employees – have less resources to work with PROs directly, for example in contract research, but also to evaluate existing support mechanisms at national and sub-national levels and direct KT offers of PROs.
Future activities in the areas of assessing good KT practice, building a KT knowledge base, exchanging information on IP and KT issues among PROs should consider this and raise awareness that there is no“one-size-fits-all” model for IP and KT.
PROs and their KT practices can generally improve in assessing and addressing the needs of SMEs and less science-driven industries. The crucial question is how PROs and SMEs can easier interact with each other and what measures facilitate cost-effective relationships between them. It is beyond the scope of this study to answer this question comprehensively.
Therefore, we would suggest as a first step a review of the existing literature and data on innovation, technology transfer, R&D cooperation, university-industry linkages and the like with a particular focus on results obtained on the situation of SMEs.
Based on more in-depth insights about PRO-SME relationships, policy makers at EU and national level could develop specific offers and support schemes and put additional effort into reaching out to SMEs.

5.3. Improving knowledge transfer capacities and skills

Support the development of knowledge transfer capacity and skills in public research organisations, as well as measures to raise the awareness and skills of students – in particular in the area of science and technology– regarding intellectual property, knowledge transfer and entrepreneurship.
The list of related **facilitating practices** includes the following:

- Sufficient resources and incentives are available to public research organisations and their staff to engage in knowledge transfer activities.
- Measures are taken to ensure the availability and facilitate the recruitment of trained staff (such as technology transfer officers) by public research organisations.
- A set of model contracts is made available, as well as a decision-making tool helping the most appropriate model contract to be selected, depending on a number of parameters.

- Before establishing new mechanisms to promote knowledge transfer (such as mobility or funding schemes), relevant stakeholder groups, including SMEs and large industry as well as public research organisations, are consulted.
- The pooling of resources between public research organisations at local or regional level is promoted where these do not have the critical mass of research spending to justify having their own knowledge transfer office or intellectual property manager.
- Programmes supporting research spin-offs are launched, incorporating entrepreneurship training and featuring strong interaction of public research organisations with local incubators, financiers, business support agencies, etc.
- Government funding is made available to support knowledge transfer and business engagement at public research organisations, including through hiring experts.

More KT about KT

KT capacity and skills development as well as the KT profession in Europe were found to be young and developing. Most European KTOs are young and small: 61% were established after 1999 and 52% have fewer than five employees. KT professionals (or would-be professionals) will not everywhere have access to a sufficient knowledge base and experiences.

At the KT capacity and skills level there is thus a need for "more KT about KT", i.e. a need for spreading information about good KT strategies, policies and practices to decision makers in public policy, universities and PROs, intermediaries and also commercial enterprises.

The following are suggested:

- Further **workshops** are meaningful, in particular targeted towards specific issues in specific countries, as well as towards less developed countries. Considering the mainly positive workshop evaluation results, the workshops were apparently valuable for the KT community to become informed about the KT situation in the country, in the region beyond the country and in Europe as a whole and to discuss related issues.
- Several times participants stressed the importance of looking in more depth at specific subjects. Such issues include many of those explained: KTO collaboration, KT incentives, KT standardisation and certification, KT internships and visiting fellow programmes, benefits and risks of deal-making support by intermediaries, international R&D collaboration, addressing SMEs' requirements, expanding women's participation in KT, and legal framework conditions for KT.
- Impressions gained support the idea that more in-depth descriptions of good practice in KT would be helpful for many KT actors. A **KT good practice manual** could be drafted, based on experiences in many countries and describing good practice for countries in various development stages and in various languages. Such a manual could include an extensive link list to service and capital providers.
- The benefits of a **KT Network** should be evaluated. This could include a website portal similar to the Enterprise Europe Network. Such a platform could offer semantic search functions in order to be really user-friendly and helpful. This could constitute a wide communication and networking mechanism to learn from other KTOs about successful techniques to commercialise IP. However, such networks could also be seen as natural tasks of KT professional organisations. Professional organisations should be consulted.

The EC should facilitate such "KT about KT" for instance by means of organising or funding workshops, producing good practice and supporting the development of a KTEurope Network.

European model contracts for KT

Model contracts – a term also frequently used is "sample agreements" – may support KT and IP management in PROs. They may be used in joint research with commercial enterprises, spin-off creation and licensing. Model contracts are in use in 16 of the 39 European countries covered and planned in further six. While there was some controversial discussion about model contracts and while there are arguments against European model contracts, successful national examples such as the "Lambert agreements" in the UK may justify the development of model contracts on a European level. Those countries that did not yet develop model contracts for their PROs and which may not have sufficient resources for developing their own model contracts may benefit from European-wide templates. Other countries may want to review their model contracts against the European

templates, while a third group may have well-elaborated model contracts and see no need for revisions.

KT standardisation and certification

Good standards for KT and the developing KT profession may need to be established because currently there is no common understanding in Europe of what KTOs and KTO are. To the knowledge of the KTS team there are parallel efforts to develop standards for KT and certificates for KT professionals.

Before supporting certification of KT professionals or KTOs or recommending certification, a number of questions should be answered in a structured manner:

- Where does KT certification exist and what experiences were collected?
- What type of certification appears to be most beneficial and why?
- What are possible downsides of KT certification?
- What stakeholders should be involved in KT certification in what way?

Exploring and raising formal KTO collaboration

The size of a knowledge transfer office (KTO) is an influential variable for the development level of IP and KT practices in PROs and their performance. At the same time, cross-institutional collaboration seems to be still at a rather low level: in EU, only 20% pool IP in general or patents in particular across organisations, though further evidence on such collaborations is certainly necessary.

An example for pooling resources and joining KTOs across PROs: the Swiss Unitectra that is owned by two universities and mandated by three further universities, three university hospitals and two non-university PROs.

This bottom-up collaboration between PROs should not be confused with institutions created top-down by governments such as the patent valorisation agencies in Germany and the Societies for Accelerated Technology Transfer (SATTs) in France.

Following from these findings, it might be advisable to extend interaction between KTOs to formal arrangements which are established, for instance, with the intention of pooling resources for dividing labour and specialisation benefits across KTOs. In other words, KTO interaction should not be limited to the informal level, to networking and the exchange of information and good practice in transfers.

By identifying, analysing and presenting cases of IP and KT collaborations at various levels, the European Commission should contribute to growing awareness of the conditions, strengths and weaknesses of formal collaboration in IP management and KT.

This would in the best case give birth to new organisation models which improve the use of resources for IP and KT services.

However, the extent to which any pooling and formal collaboration is possible will depend very much on national regulations and practices, the position of KTOs within or outside of PROs and their set of tasks and activities.

It is therefore necessary to assess the situation in every country separately and evaluate the experiences gained in different settings. The EC should stimulate such assessments and discussions within and across Europe.

Internships and expert visit programmes

Internships and expert visit programmes may support KT. There are several examples in Europe. The Portuguese example of arranging professional internships at US TTOs may be interesting for other European countries. In Portugal, the University Technology Enterprise Network (UTEN) arranges and finances such internships; at the Iberian workshop we obtained positive comments from KTO professionals on the value of these internships for improving transfer skills.

Another example is the Knowledge Transfer Partnership Programme in the UK. It involves three parties: a company partner (which may be from a broad spectrum of sectors and of any size), a PRO or college (public or privately funded), and so-called “KTP Associates”.

Each partnership employs one or more high calibre Associates, transferring the knowledge the company is seeking into the business via a strategic project.

Certainly, more experienced European PROs could also share their knowledge by having interns from weaker PROs and lagging countries. Related programmes should be developed.

However, smaller PROs and KTOs will not be in a position to let their staff members go away for a longer period of time. Instead of outgoing internships, incoming expert visits from experienced (possibly retired) transfer managers for short-term visits would be an alternative. It is hard to imagine negative aspects of such exchange schemes, except that they might not produce any material effects if competencies cannot be transferred easily between organisations or countries.
However, an exploration of the Portuguese experiences and ideally similar programmes could be a first step of finding out more. Then, pilot projects in various countries would be suitable to find out what works best in different contexts.
The EC should collect further knowledge on the exchange of KTO staff and experts between organisations, possibly set up a funding scheme in coordination with the Member States and call for participation from European PROs and KTOs.

Enhance staff mobility between science and industry
In order to increase understanding about the cultural differences between PROs and enterprises, mobility of staff between the two spheres should be further enhanced. The EC is already actively promoting such mobility across Europe, e.g. through the Framework Programme "Marie Curie Industry–Academia Strategic Partnership" scheme.
The importance of such schemes may further be promoted on national and regional level.

Fostering the representation of women in KT
The KT Recommendation does not make any specific statements about women in research and KT, but the issue was taken up as a parallel session in the Alpine workshop. In terms of research and inventions, Europe shows a deficit in diversity. Only 8% of all patent applications at the European Patient Office are filed by women.
This percentage varies throughout the various countries. As stated in the Communication on the Europe 2020 Strategy, the only way to deal with current and foreseeable social, economic and ecological challenges is innovation.
However, Europe stays way behind its innovation capabilities with regard to under-representation of women in the innovation process.
The creative and economic loss of highly educated, ambitious women in terms of knowledge transfer can hardly be put into figures, but is easily conceivable.
Following the discussions in the Alpine workshop session and further material available, it may be worthwhile for the EC to deal with this subject in its efforts to promote knowledge transfer.
Future policies could continue to promote special training for the development of a female spirit of invention, such as building up entrepreneurial skills and confidence.

Deal making support
Whenever the capacities and skills of KTOs to valorise research findings are not sufficient, intermediary organisations could offer support. Such intermediaries have been established by public law such as the regional patent valorisation agencies in Germany and *France Brevet* currently being introduced in France.
Intermediaries may also be commercial. Organisations such as the Commercial Edge Initiative which was presented and discussed at the KTS workshops in Dublin and Tallinn offer solutions for universities and PROs with a distinct interest in contract research and co-operative research as well as commercialising results of research findings.
Establishing on-demand deal making support services in larger parts of Europe could be part of a solution to the issue of KTO's capacities and skills as well as bridging academic and business cultures. Such support organisations could offer services related to R&D and technology assessment and provide links with industry.
In particular, support may be advisable when a university or other PRO seeks to license IP, which tends to be a form of KT which enterprises do not prefer.
However, intermediaries may also add further organisational objectives and they certainly add further partners to which trust needs to be established; thus they may also complicate negotiations.
Considering these possible downsides of intermediaries, it would be prudent at this stage to analyse the various aspects around such intermediaries before piloting and testing them in different national and organisational contexts.
The EC should support these analyses and ensure an exchange of the experiences collected.

5.4. Promoting broad dissemination of knowledge while protecting IP

Promote the broad dissemination of knowledge created with public funds, by taking steps to encourage open access to research results, while enabling, where appropriate, the related intellectual property to be protected. The list of **facilitating practices** includes the following:

- Open access is implemented by public research funding bodies with regard to peer-reviewed scientific publications resulting from publicly-funded research.
- Open access to research data is promoted, in line with the OECD Principles and Guidelines for Access to Research Data from Public Funding, taking into account restrictions linked to commercial exploitation.
- Archival facilities for research results (such as internet-based repositories) are developed with public funding in connection with open access policies.

Assessing the value of a wider publication of IP and KT policies and successes

It is necessary to plan, implement IP policy, licensing/start-up policy, to consider the awareness of the importance of monitoring institutional performance and progress.There are several questions on which further scientific research would need to be conducted and good practice examples should be made public:

- What are the best communication channels and media for bringing various types of content from PROs closer to the private sector?
- What content should be published to the benefit of the PRO? Could, for instance, the publishing of licensing policies possibly harm PROs in their efforts of getting fair deals for their organisations?
- How does the type of content, such as regulations and bylaws, research capacities, research results or available technologies, influence the choice of channel and medium?

You should support related studies and the dissemination of their findings.

5.5. Facilitating Trans-national cooperation, research and KT

Cooperate and take steps to improve the coherence of their respective ownership regimes as regards intellectual property rights in such a way as to facilitate crossborder collaborations and knowledge transfer in the field of research and development.

Ensure equitable and fair treatment of participants from Member States and third countries in international research projects regarding the ownership of and access to intellectual property rights, to the mutual benefit of all partners involved.

The list of **facilitating practices** includes the following:

- In order to promote transnational knowledge transfer and facilitate cooperation with parties from other countries, the owner of intellectual property from publicly-funded research is defined by clear rules and this information, together with any funding conditions which may affect the transfer of knowledge, is made easily available. Institutional ownership – as opposed to the “professor’s privilege” regime – is considered the default legal regime for intellectual property ownership at public research organisations in most EU Member States.
- When signing international research cooperation agreements, the terms/conditions relating to projects funded under both countries’ schemes provide all participants with similar rights, especially as regards access to intellectual property rights and related use restrictions.

Globalisation of research collaboration and knowledge transfer

The KTS enterprise interviews suggest that European companies, if geographically expanding their internal R&D, in many cases expand R&D to Asian countries, above all to China and India. This is not a new trend. In the KTS sample of interviewed companies, growth in Asia did not correspond to a reduction of R&D at other sites.

European countries are also the target of R&D-motivated foreign direct investments from non-European companies, traditionally from the US, but also more and more from Asian and other catching-up economies.

Consequently this geographical expansion of internal company R&D also leads to an expansion of the network of academic partners.

The CoP mentions non-European partners only once with a negative connotation (CoP). The question is whether this is doing justice to the rather complex matter of costs and benefits of KT, and there are several related questions:

- To what extent do PROs actually collaborate with enterprises whose headquarters are located outside of Europe?
- What are the consequences of these collaborations and the presence of non-European corporate R&D investment for academic research?
- This area requires further investigation, research focusing on the opportunities as well as the threats of the globalisation of research collaboration, assess the practice in other world areas.

The Network should contribute to clarifying these questions.

5.6. Introducing or adapting national KT guidelines and legislation

Use the principles outlined in this Recommendation as a basis for introducing or adapting national guidelines andlegislation.
Take steps to ensure the widest possible implementation of the Code of Practice, whether directly or through the rules laid down by national and regional research funding bodies.
Examine and make use of the best practices taking into account the national context.

Improving legal framework conditions for KT

As regards the legal framework for KT, over the last quarter of a century many countries have followed the US Bayh-Dole model and decreed that the IP generated by publicly funded research in PROs is by default owned by the institution.
The harmonisation if IP ownership may bring several benefits, such as easier collaborative research and the reduction of information and other transaction costs. In addition, it creates an additional incentive for PROs to dedicate time and effort to commercialisation activities.
However, there is growing empirical evidence that neither in the USA nor in Europe the high-level expectations of these legal changes could be met.
Along the same lines, the KTS interviews with R&D-intensive companies suggest that institutional ownership and a focus on the protection and commercial exploitation of IP might have negative consequences for converting knowledge into socio-economic benefits: the interviewees suggested that it complicates and lengthens contract negotiations, reduces the willingness of scientists to engage in an open and uncensored informal exchange of information with private enterprises, and creates incentives to develop strategies which circumvent IP regulations and university bylaws or look for partners elsewhere.
Combining these findings and experiences, it would be valuable to monitor and evaluate the existing IP ownership regulations and their outcomes: CoP: “Develop and publicise a licensing policy, in order to harmonise practices within the public research organisation and ensure fairness in all deals. In particular, transfers of ownership of intellectual property owned by the public research organisation and the granting of exclusive licences should be carefully assessed, especially with respect to non-European third parties”.
Licences for exploitation purposes should involve adequate compensation, financial or otherwise.

- What is the impact of a strong focus on institutional IP ownership versus a weaker focus on institutional IP ownership?
- How do other set-ups, such as “professor’s privilege” (Italy, Sweden) perform in comparison to institutional ownership?
- What other paths to commercialisation have proven effective in what context, e.g. University of Glasgow’s “Easy Access” model? What are their drawbacks?

De-bureaucratisation of KT processes

The companies mentioned several barriers to more effective and efficient knowledge transfer related to bureaucratic processes: organisational barriers such as varying and complex rules on R&D, IP or licence contracts, cumbersome application procedures and complex rules for funded projects, long time frames of project applications and decisions and the like.
These comments referred to procedures at various levels, with sub-national, national or European scope.

A constant review of the existing funding and project regulations in Europe, creating the possibility for “fast track” applications and evaluations under certain conditions, and providing more qualified support in the process could be solutions to this.

5.7. Improved monitoring of policy measures and KT performance

The list of **facilitating practices** includes that the necessary mechanisms should be put in place to monitor and review the progress made by national public research organisations in knowledge transfer activities, e.g. through annual reports of the individual public research organisations.
This information, together with best practices, is also made available to other Member States.

Improving the KT data basis

Public KT policy, e.g. legislation, funding and information proliferation, should be evidence-based to be effective and efficient. An important part of this evidence base are the statistical data about KT performance and Knowledge Transfer Offices objectives. It would also help PROs benchmark their own KT practices. However, currently there is a multitude of Knowledge Transfer Offices surveys being carried out in Europe on an annual basis. Some countries such as the UK and Denmark carry out national surveys; professional organisations also carry out surveys in some countries.
There are three problems of current European KTO surveys:

1. The multiple existing surveys do not cover all leading European KTOs – there are large gaps in survey coverage.
2. Due to insufficient cooperation and concerns over confidentiality, nobody has been able to combine all surveys into one data set. A single data set would be very useful for both research and for the construction of indicators.
3. Answering to several surveys may put Knowledge Transfer Offices under pressure and distract them from their usual business.

Thus there is a need for unifying surveys.

There are a few options for improving the data:

a) Encourage cooperation between the different professional organisations –so that data can be pooled, plus find alternative methods of obtaining data for non-members of these organisations. The latter would require a third player (such as the Knowledge Transfer Study) to collect non-member data.
b) The EC funds national statistical offices to conduct national surveys. The data can be provided to Eurostat for pooling. This model is used for the Community Innovation Survey, but it has a few problems, such as slow data delivery and some countries refusing to submit their microdata.
c) The EC funds professional associations to survey Knowledge Transfer Offices that are not part of their membership.

Supporting PROs’ KT strategy development

Ensure that all public research organizations define knowledge transfer as a strategic mission.

6. Abbreviations:

EC – European Commission

EU – Europe Union

ESL - English as a Second Language

IP - Intellectual Property

IPR - Intellectual Property Rights

DEA - Data envelope analysis

HR - Human Resources

PROs - Public Research Organisations (comprising universities and other public research organisations)

KTOs - Knowledge Transfer Offices

KTT - Knowledge and Technology Transfer

TTI – Technology Transfer and Innovation

CoP - Code of Practice

HEI - Higher Education Institutions

UBC – University/research - Business Cooperation

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