Experiences on the US knowledge transfer and innovation system

April 2007

This report is based on the insight gained during a visit of European Union and Member States officials and the chair of ProTon Europe to the United States of America. The visit consisted in a seminar on the US innovation system held in Washington DC, 26 March 2007 followed by meetings with university staff at four selected US universities with an outstanding record in successfully transferring knowledge and technology to industry.

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Summary

The fact that economic growth has largely been driven by the pursuit of scientific understanding and continual technological innovation are key features throughout the history of the United States as much, if not more, than that of any other developed economy.

As technologies and new industries are becoming more sophisticated, universities are playing an ever more important role in the processes of invention, innovation and commercialisation.

With the adoption of the Bayh-Dole Act in 1980, US universities came to the forefront of commercialisation of results of scientific research by being able to claim legal rights to innovations developed by their faculty using federal funds. This piece of legislation is generally accepted to have catalysed the process of technology commercialisation from research to industry and thus contributed substantially to the competitiveness of the US economy. Still, there are today some dissenting voices, and criticism about the role of Technology Transfer Offices as the gatekeepers of Intellectual Property. These criticisms are largely centred on the life sciences sector. The broader aspects of Knowledge Transfer, those that encourage open innovation and greater interaction between industry and university research do not appear to be as well developed in the US as they are in certain parts of Europe.

Almost 30 years on, many elements of the US system of knowledge transfer and innovation have been emulated in many parts of the world. The vigour of the US economy, in terms of productivity growth and strong entrepreneurship has coincided with a period of reflection in the European Union about the need to bolster research and innovation to underpin economic growth.

In the US, government funding for research is channelled to universities through federal agencies. It appears that fewer than 300 universities benefit in a significant way from this but the competitive process based on peer reviews often leads to excellence in research and produces many world-class results. On the other hand, funding seems to concentrate in no more than 5 US States, although those universities actually enjoying the bulk of the funding may change for year to year. According to the AUTM Survey (2005) only 7% of the total funding of research is provided by industry, though these figures do not include philanthropic donations by industry, which constitute a significant research revenue stream for US universities (worth approx 240bn$ per annum of which about a quarter is given to universities[1]).

Furthermore, the role of philanthropy in support of entrepreneurship, education and innovation should not be forgotten. A long standing tradition in the US, philanthropic foundations, such as the Kaufmann Foundation, fund every year a multitude of initiatives in these fields, which would otherwise struggle to obtain funding.

[1] http://www.futureofphilanthropy.org/files/usPhil_3PhilanthropyByTheNumbers.pdf

Part of the federal research funding (2.5%) is reserved to small enterprises through the Small Business Innovation Research contracts. The SBIR programme is well considered by companies because of its stability, reasonable opportunity cost of bidding and its “certification effect” for investors.

An experienced and motivated body of knowledge and technology transfer professionals liaises continuously with industry to negotiate favourable terms for the commercialisation of research results. A number of operating models for knowledge or technology transfer offices co-exists, some integrated in the university structure, whilst others are completely independent. Knowledge transfer professionals have been organised through a professional body, the American University Technology Managers Association, since the 1960s.

Social networking to achieve business outcomes is a marked facet of the US system. The value of “contacts” and of personal knowledge was emphasised by everyone. It was noticeable that in all buildings space was allocated for networking and these areas were both well presented and extensive. Furthermore, time was always made for social interaction and this was encouraged by employers. The development of a community spirit, be it linked by geography, industrial sector or business transactions is of prime importance as it enables business to be transacted more easily and quickly.

This dynamism in the interaction with industry regarding the commercialisation of IP is matched by a very active and mature venture capital industry, constantly seeking new investment opportunities. Venture capital seems to be concentrated in both coasts and a number of inland innovation hot-spots. The early stages of investment in research spin-off companies tend to be dominated by angel investors. The average investment by an angel investor in the US is of the same order of magnitude than the average venture capital investment in the European Union (450K$).

The overall effect of the above described elements of the US knowledge transfer system is an efficient mechanism to turn scientific discovery into new and exciting products and services in the marketplace and generate added value, wealth and jobs. This, sometimes called the “third mission” of the university, seems to be quite naturally accepted by the research community.

1. Introduction

1.1 The EU-US innovation initiative

Transatlantic trade between the European Union and the United States of America is still the largest between any two economic blocks in the world. This is reflected in the continuous and intense policy dialogues which take place between our respective public administrations.

Knowledge transfer and innovation are fields which have been increasingly attracting the attention of policy-makers and governments on both sides of the Atlantic in recent years. To foster more transatlantic cooperation in innovation policy, European Commission

Vice-President Verheugen and US Commerce Secretary Carlos Gutierrez agreed in 2006 to organise an exchange of innovation policy-makers. This exchange is commonly referred to as the EU-US innovation initiative.

It is widely acknowledge that innovation and entrepreneurship are at the heart of the competitiveness of the US economy and that knowledge transfer from research and a dynamic venture capital industry play an important role in fuelling company creation and growth. It is for these reasons that the European Commission focused the first leg of this exchange on the recent US experiences in these fields.

A group of 10 officials from the European Commission, national Ministries / Innovation Agencies in Member States and the chair of ProTon Europe[2] visited the US for one week to study its knowledge transfer and innovation system (see Annex 1 for the composition of the delegation). This report summarises the observations and insights gained during this visit.

The visit consisted of a one-day seminar on the US innovation system organised by the Department of Commerce Washington in DC, followed by visits to three US States (North Carolina, Wisconsin and Massachusetts), where universities are playing an outstanding role in transferring technology and knowledge to industry. Within each university, the focal point of the visit was the office of knowledge/technology transfer, and this was complemented by visits to research spin-offs and campus facilities (i.e. business incubators).

1.2 Scope and objectives of this report

This report aims to describe the features of the US knowledge transfer and innovation system based on the insights gained during said visits. Given that the number of universities visited is only a small sample of those active in knowledge transfer to industry throughout the US, this report takes a more qualitative view.

Nevertheless, the one week visit allowed the EU team to get a good overview of some of the reasons why US universities are world leaders in working with industry to transfer knowledge and technology. This report will look into some of these reasons and will draw lessons to be learned.

With this report the delegation would like to share their experiences with colleagues, policy-makers and the knowledge transfer community at large.

2. What changed with the enactment of Bayh-Dole

Before Bayh-Dole

The growth of federal research funding in the USA after World War II was phenomenal, but title to inventions arising from federally funded research rested in the federal

[2] ProTon Europe is the pan-European network of Knowledge Transfer Offices (KTOs) and companies affiliated to universities and other Public Research Organisations (PROs).

government. By 1980, the federal government held title to approximately 28,000 patents, of which fewer than 5% were licensed to industry for the development of commercial products.

The Bayh-Dole Act

In December 1980 the US Congress enacted the 'University and Small Business Patent Procedure Act', co-sponsored by senators Bayh and Dole, which states that the policy and objective of the Congress was to:

"Use the patent system to promote the utilization of inventions arising from federally supported research or development; to encourage maximum participation of small business firms in federally supported research and development efforts; to promote collaboration between commercial concerns and non-profit organizations, including universities; to ensure that inventions made by non-profit organizations and small business firms are used in a manner to promote free competition and enterprise without unduly encumbering future research and discovery; to promote the commercialization and public availability of inventions made in the United States by United States industry and labour; to ensure that the Government obtains sufficient rights in federally supported inventions to meet the needs of the government and protect the public against non-use or unreasonable use of inventions; and to minimize the costs of administering policies in this area."

The Act created the first uniform federal patent policy and essentially changed the whole approach to intellectual property derived from federally-funded research as it brought with it **rights and obligations** for institutions receiving such funds. With the passage of the Act, ownership of IPR developed by federally funded research lies with the institution[3] where it was developed. The Act confers on recipients of public research funding a 'duty of stewardship'. Institutions are entitled to elect title to inventions but are obliged to be diligent in the identification, reporting and transfer of such technologies for the public good.

The provisions of the Act apply to all inventions, whether wholly or partially funded by federal funding (except grants for the training of students and post-docs). Institutions are obliged to report each new invention to the funding agency and must decide within 2 years whether they wish to retain title to the invention. If it is decided not to retain title, the funding agency may take title to the invention. If the institution decides to retain title, it must file a patent within one year.

The institution is responsible for the procedures and costs associated with protecting its invention, i.e. patenting and marketing the invention to potential licensees. It also enjoys the right to all royalties and other monies flowing from the licensing of its invention to others. In certain circumstances, e.g. if the invention is not brought to practical use within a reasonable time, the government may take title and grant licenses itself (march-in rights).

[3] The provisions of Bayh-Dole apply to all institutions receiving federal research funds, whether they be universities, hospitals, companies (e.g. SMEs receiving SBIR grants) or institutes (e.g. the National Institutes of Health intra-mural programs).

Institutions are obliged to have written agreements with its faculty and technical staff requiring disclosure and assignment of inventions, and must share with the inventor(s) a portion of any revenue received from licensing the invention. Any remaining revenue must be used to support scientific research or education.

In their marketing of an invention, institutions must give preference to SMEs (less than 500 employees). However if a large company has also provided research support that led to the invention, that company may be awarded the license. Any company holding an exclusive license that involves sales of a product in the US must substantially manufacture the product in the US[4]. The US government retains a non-exclusive right to practice the patent throughout the world.

Responsibility for overseeing the implementation of the Bayh-Dole Act lies with the US Department of Commerce.

Impact of the Bayh-Dole Act

The Report of the President's Council of Advisors on Science and Technology (PCAST) in 2003 found in essence that the federal legislation put in place on the early 1980s works and should not be changed. It found that the legislation had "dramatically improved the nation's ability to move ideas from R&D into the marketplace and into commerce. Equally important, the transfer of publicly funded technology is a critical mechanism to optimizing the return for this substantial taxpayer investment".

The Association of University Technology Managers (AUTM) Licensing Survey 2005 (which includes data from 228 organizations) reports that 527 new commercial products were launched that year. Invention disclosures received rose 3.5% to 17,382, and total patents filed increased to 15,115. Survey respondents reported 4932 new licenses/options in 2005, for a total of 28,349 active licenses, which represent on-going relationships with existing companies.

Licensing to small companies dominated total licensing; the majority of all licenses were non-exclusive. The survey also reported 628 new spin-off companies created in 2005 – bringing the total of new spin-offs since Bayh-Dole was introduced in 1980 to 5,171. These figures compare favourably to European metrics which suggest that we lag significantly behind the US in terms of all indicators bar the number of spin outs created over the past few years.

It would therefore appear that uniform licensing and patent procedures across the whole country are key ingredients for successful technology transfer in the US. However an equally important aspect of Bayh-Dole is the 'certainty to title to inventions' as:

- A private company can work with a university/research institution, confident that the university/institution owns the IPR and is entitled to license exclusively[5].

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[4] However, subject to a specific authorization by the federal funder, this requirement to manufacture in the US can be waived.

[5] Although the Bayh-Dole act permits exclusive license, it does not require it. The 2002 AUTM licensing survey reports 46.5% exclusive and 53.5% non-exclusive. 39% of licenses to large companies were exclusive, 45% to small companies were exclusive and 91% of licenses to start-ups were exclusive.

- Institutions have established highly professional Technology Licensing offices with contacts to the industrial world and knowledge of the needs and expectations of potential licensees[6].
- Even if an institution receives partial funding for a project from a private company, the IPR always remains the property of the institution and This point is not negotiable since it is set in law. Funding companies can however negotiate licensing rights to the technology.

The limitations of Bayh-Dole

Certain concerns about the implementation of Bayh-Dole have been voiced. Widespread patenting, overestimation of the value of patents and restrictive licensing terms can hamper, rather than promote, technology transfer from universities to industry and may even obstruct the process of scientific research. Concerns are also growing that the target market of companies manufacturing in the US is being eroded by global market changes and that thus the value of this protectionist element in Bayh-Dole is also being eroded.

The Act places an important administrative burden on the awardee institution. There are strict reporting requirements and periodic audits. This requires investment in infrastructure and competent personnel. But the technology licensing offices are not necessarily ‘profit centres’. Most find it difficult to break even annually[7]. Furthermore, the cost of patenting a technology is high. A successful technology licensing office must therefore be discerning in deciding whether or not to elect title to an invention. It must be able to recognize the cases where the likely return is not worth the investment in patenting. The 2004 AUTM survey reports that only about 0.6% of active licenses earn more than $1 million per year.

Finally, the government's march-in right allows the funding agency, on its own initiative or at the request of a third party, to effectively ignore the exclusivity of a patent awarded under the act and grant additional licenses to other "reasonable applicants." This right is strictly limited and can only be exercised if the agency determines, following an investigation, that one of four criteria is met. The most important of these are a failure by the contractor to take "effective steps to achieve practical application of the subject invention" or a failure to satisfy "health and safety needs" of consumers. Though this right is in theory quite powerful, no federal agency has exercised its march-in rights to date.

Conclusions

From all of the discussions held with US participants, it was clear that the Bayh-Dole act and supporting subsequent legislation such as the Technology Transfer Act of 1992 is widely accepted as being relevant in today's society. Indeed, the greatest benefit of the act appears to have been the change in mentality of senior academic management (university rectors etc), who now recognize both the importance of and benefits of good

[6] In 1979, the year before Bayh-Dole was enacted, there were 113 members of the Association of University Technology Managers, AUTM, by 2003 that number had reached 3000.
[7] In 2004, the average net income among the technology transfer offices that responded to the AUTM survey was about $7 million but 75% of universities earned less than $5 million and 40% reported income less than $1 million. In 2005, half of the offices surveyed had more than 5 staff members. Therefore, these offices can cost more than they actually earn.

IPR management. The requirement of the act to disclose inventions has also meant that scientists and engineers do this as a matter of routine, facilitating the role of the knowledge transfer officers. Furthermore, negotiations between universities and industry have been greatly facilitated by the Bayh-Dole act, since questions of ownership and exclusive licensing are rarely discussed.

In sum, all of the various elements, acting in concert, of the Bayh-Dole act appear to still have significant positive effect and their impact has been considerable. The greatest question for Europe is to decide on how these elements should be enacted (i.e., through legislation, funding requirements or other similar mechanisms) and at what level (National or European). It is important to note that this debate has been opened in the context of the European Research Area green paper and the related public consultation (which was launched on the 1st May 2007[8]).

3. Federal programmes for research and technology transfer

3.1 Technology transfer in the US federal labs: the Agricultural Research Service

The other piece of federal legislation having had a major impact in government-business cooperation to enhance technological cooperation in the US is the Stevenson-Wydler Technology Innovation Act of 1980. This Act mandates Federal Laboratories to actively seek cooperative research with State and local governments, academia, non-profit organizations or private industry, disseminate information, establish the Centre for the Utilization of Federal Technology at the National Technical Information Service, establish and define the basic activities of an Office of Research and Technology Applications at each federal laboratory, and set aside 0.5% of each laboratory's budget to fund technology transfer activities.

Stevenson-Wydler effectively authorised federal labs the licensing of inventions exclusively, but with a fair and transparent process by:

- requiring Federal Register Notice of intent to licence exclusively
- imposing the obligation to resolve objections to notice of intent to license exclusively (through negotiation)
- limiting the licensing to US companies and US manufacturing

Federal labs can preferentially license to small business, but cannot select one small business over another. To license with foreign companies and establish Cooperative Research and Development Agreements (CRADAs), they must consult first with a US Trade Representative.

The Agricultural Research Service (ARS) is one of the ten US federal labs more active in technology transfer. ARS is largest agricultural research organisation in the world with a

[8] See http://ec.europa.eu/research/era/index_en.html

yearly $1.1 billion budget. It counts 100 research locations, co-located in different campuses. At any time, it manages over 2000 extra-mural R&D projects.

The ARS follows a centralised approach in the definition of research and licensing policy and approval of agreements, but decentralised in their negotiation and implementation.

The establishment of research priorities in the National Programmes follows a 5 year cycle of planning, implementation and evaluation. In the definition of these priorities, the opinion of stakeholders (customers, scientists, etc…) is sought through workshops.

The Office of Technology Transfer of the ARS manages all intellectual property issue on behalf of the Secretary of Agriculture. It has furthermore the authority to develop and sign Cooperative Research and Development Agreements (CRADAs) and license any inventions developed within any of the US Department of Agriculture agencies.

Since 1986, the ARS has concluded 13444 CRADAs, of which approximately 220 are still active. This has led to the granting of 32 licenses and the development of over 100 new products, plus a number of utility and plant patents.

3.2 The Small Business Innovation Research Programme (SBIR)

The Small Business Innovation Research (SBIR) program and the Small Business Technology Transfer (STTR) programs provide science and technology funding for small businesses in the US.

The main purpose of these programmes is to support “scientific excellence and technological innovation through the investment of federal research funds in critical American priorities to build a strong national economy, one small business at a time.” These two US federal government programs are designed to help small businesses (defined as firms with fewer than 500 employees) innovate.

Under the SBIR program, federal agencies having an annual external research and development budget of more than $100 million must reserve 2.5 percent of these funds for award to small businesses. Under the STTR program, agencies with annual external research and development budgets of more than $1 billion, must reserve 0.3 percent of these requirements for award to collaborative efforts between small businesses and non-profit research institutions.

SBIR and STTR are coordinated and monitored by the Small Business Administration (SBA), but the participating federal agencies are fully responsible for funding and administering the programs. The participating agencies have unilateral procurement authority (i.e., each of the Federal agencies participating in the program determines its own needs without input from the Small Business Administration[9]).

The 1982 legislation that created SBIR designated four major goals: stimulate technological innovation, use small business to meet federal R&D needs, foster and

[9] Furthermore, the Small Business Administration (SBA) does not designate any of the topics cited in solicitations and the SBA itself does not fund or disseminate the SBIR/STTR awards.

encourage participation by minorities and disadvantaged persons in technological innovation, and increase private-sector commercialization innovations derived from federal R&D.

The Small Business Innovation Research (SBIR) program is a competitive three-phase award system which provides qualified small businesses with opportunities to propose innovative ideas that match the specific research and development priorities of the Federal Government. SBIR encourages small businesses to engage in federal R&D with potential for commercialization. SBIR represents 2.5% of the US federal R&D budget.

- Phase I is a feasibility study to evaluate the scientific and technical merit of an idea. Awards are for periods of up to six months in amounts up to $100 000. [Conceptual Design Phase]

- Phase II is to expand on the results of and further pursue the development of Phase I. Awards are for periods of up to two years in amounts up to $750 000. [Prototype Development Phase]

- Phase III is for the commercialization of the results of Phase II and requires the use of private sector or non-SBIR Federal funding. [Commercialization Phase]

Eleven federal agencies participate in SBIR. Each of these agencies earmarks 2.5% of its extramural R&D budget for these programs. Some of these agencies use public procurement, others issue grants and some use both mechanisms.

Besides having fewer than 500 employees (including subsidiaries), an applicant firm must meet the following requirements: be independently owned and operated; principal place of business is located in the United States; is at least 51% owned or (in the case of a publicly owned business) at least 51% of its voting stock is owned by US citizens or lawfully admitted permanent resident aliens.

3.2 The Small Business Technology Transfer Programme (STTR)

STTR is a competitive program that reserves a specific percentage of federal R&D funding for award to small business and non-profit research institution partners. It used by 5 federal US departments and funding agencies. STTR combines the strengths of SMEs and non-profit research laboratories by introducing entrepreneurial skills to high-tech research efforts. The technologies and products are transferred from the laboratory to the marketplace. The small business profits from the commercialization, which, in turn, stimulates the U.S. economy.

STTR facilitates cooperative R&D between small businesses and U.S. research institutions – with potential for commercialization. STTR represents 0.3% of the US federal R&D budget.

- Phase I is the start-up phase for the exploration of the scientific, technical, and commercial feasibility of an idea or technology. Awards are for periods of up to one year in amounts up to $100,000. [Conceptual Design Phase]
- Phase II is to expand Phase I results. During this period the R&D work is performed and the developer begins to consider commercialization potential.

Awards are for periods of up to two years in amounts up to $500,000. [Prototype Development Phase]

- Phase III is the period during which Phase II innovation moves from the laboratory into the marketplace. There is no STTR funding in this phase. [Commercialization Phase]

Small businesses must perform at least 40% of the work, and research institutions must perform at least 30%. Both the small business and the partner research institution must be located in US territory.

The role of the Small Business Administration

Since its founding in 1953, the U.S. Small Business Administration[10] has delivered about 20 million loans, loan guarantees, contracts, counseling sessions and other forms of assistance to small businesses. It is an independent agency of the executive branch of the US government (like NSF, EPA, and NASA). It has about 3 900 employees and 2003 spending of $1.6 billion.

The mission of SBA's Office of Technology is to strengthen and expand the competitiveness of US small high technology research and development businesses in the American marketplace. It also assists in achieving the commercialization of the results of both the federal research and development programs mandated by three pieces of federal legislation: the Small Business Innovation Development Act of 1982, the Small Business Research and Development Enhancement Act of 1992, and the Small Business Innovation Research Program Reauthorization Act of 2000.

The SBIR and STTR programs are two of dozens coordinated by the SBA as a whole, but they are the two primary vehicles of the SBA's Office of Technology. The SBA's Office of Technology has authority and responsibility for monitoring and coordinating the government-wide activities of the SBIR and STTR programs and reporting its results to Congress, but it does not make awards. The federal agencies participating in SBIR and STTR have the responsibility for: a) selecting topics, b) releasing solicitations, c) evaluating proposals, and d) awarding funding on a competitive basis.

Conclusions

The SBIR and STTR are highly competitive funding mechanisms – only 1 in 5 proposals are accepted for phase 1 monies and 40% of Phase 1 recipients manage to leverage Phase 2 funding.

Both mechanisms make use of external experts for the evaluation, and this pool of experts includes retired venture capitalists and CEOs of companies in order to examine the business cases carefully. The evaluation also considers the technical merits of the proposals separately (using Governmental experts).

Due to the high rejection rate, and the high quality of the evaluation panels, the awards are recognized by private investors as being a good metric on which to base funding

[10] The current head of the SBA is Administrator Hector V. Barreto. The current head of the SBIR/STTR programs is Assistant Administrator Edsel M. Brown, Jr.

decisions. Furthermore, it is evident that the close involvement of former CEOs and VCs who will still maintain contact networks will assist in highlighting particularly hopeful projects to private investors.

That said, discussions with SMEs in science parks suggested that these schemes are mainly used by micro enterprises, with the larger SMEs finding that the mechanisms are too slow and the rejection rate too high for them to be worth the investment in time.

Some States provide additional support for those companies winning federal grants – for example, in North Carolina, the State matches the Federal grant (i.e., doubles it's worth) at all phases whilst other States provide no matching funds. Such a differentiated approach appears to be largely based on past success of the region in attracting SMEs to it and the creation of new ones.

Comparison between SBIR and STTR

	SBIR	**STTR**
Set Aside of Agency Budget	2.5%	0.3%
Award Guidelines		
Phase I	$100k / 6 mos	$100k / 12 mos
Phase II	$750k / 2 yrs	$500k / 2 yrs
Subcontracts allowed		
Phase I	• 33.3%	• 60%
Phase II	• 50%	• 60%
Research Partner	not required	> 30%
Business Employment of PI	• 50%	n/a

4. Operational models for Knowledge transfer offices

4.1 Different models in operation

Under the Bayh-Dole legislation of 1980 every university in receipt of federal funds for research had to have a technology transfer function. Most set up separate offices around the Technology Licensing function, normally as an internal administrative function rather than the model that exists in some parts of Europe of a wholly-owned subsidiary company.

Research funding awarded to academic staff was, and continues for the most part to be, processed by an Office of Sponsored Programmes. Those offices as often as not handle research awards from industry as well as from federal and other sources. Both offices (Sponsored Programmes and Technology Licensing) might, with fund raising from philanthropic and alumni sources, come under an overarching office of something such as Corporate Development headed by a Vice President (often a senior academic post).

The mission of the Technology Licensing Offices would be to exploit IP generated under the terms of the Bayh-Dole legislation and that generated from other funding. Until 1980 licensing activity had been much less extensive across the sector.

Now, in 2007 around 140 universities are reporting metrics on IP exploitation from a base of many thousands of universities in the US. These include private universities (of which Harvard is one) but also many major State universities which have an explicit mission to support development of the State economy and the quality of life in the State in which they are located.

The level of government investment in research in the US is very different from that in Europe and it is focussed on 200 or so universities, creating a strong and focussed research base. Industry funding of research is low; figures quoted ranged from 5% of research turnover to 20% at MIT. The result is that those 200 or so universities have a huge amount of research outputs and are creating IP in significant amounts. As a condition for federal funding, under the Bayh-Dole Act each academic must disclose IP and each university must provide a Technology Transfer function and preferably license to small (<500 employees) companies manufacturing in the US.

One aspect of Knowledge Transfer which is actively encouraged but not "managed" as it is in Europe is the provision of consultancy services. Academics in the US are expected to devote around 20% of their time to "private" consultancy, the drafting of research grant proposals, etc. These activities are not regulated by the universities other than through annual "Conflict of Interest" declarations. This means that companies find it easy and effective to use consultancy services for which they pay the academic directly and university bureaucracy does not come into the equation. It is a requirement however that those academics must not use university facilities or services which were funded from government funds to provide consultancy services. One outcome has been that academics seek funding from other sources to build their own research laboratories, and have a strong financial incentive to do so.

As a result of various factors in the economic and political landscape the models in the US are evolving and becoming more complex as universities revisit their missions and align resources, structures and goals to support those missions.

All of the models seen on this visit are in existence in Europe. The models are:

- "traditional " internal administrative technology licensing office (it is unusual in the US for this function to be outsourced although elements may be "bought in" from third parties)
- external entity which manages IP exploitation on behalf of the university
- business development unit developed to create stronger links of all types between industry and academia
- business development integrated alongside technology licensing with the aim of increasing industrial funding of research.
- partnership development in respect of Science Park companies, working alongside a technology licensing function with the aim of attracting and retaining companies on the (University owned and managed) Park.

The differences between the US and European offices within each model appear to lie in:

- The articulation of the university and thus of the office mission, and support and resourcing by senior university leaders for the alignment and delivery of KTO activity

- Common (shared & agreed) benchmarking measures
- The sheer availability of money. In some regions of the US (but not all) the proximity to both industry which invests in research and other forms of KT including student education, and to VC investment is unmatched in Europe
- More generally, a significant difference is that in the US the experience of many senior staff covers 20+years and thus a significant volume of deals and situations, often through employment in more than one university. Also, the community is well networked and recognises the value of introducing new staff to the networks of peers.

Limitations of existing models

The universities have quite rigid internal governance structures and change can take a long time; it seems easier to create a new function, than to alter an existing one. Harvard for example noted that it took a year to make a successful case for industrial research contracts to become the responsibility of the Office of Technology Development rather than the Office of Sponsored Programmes.

The metrics used measure input, and output but not impact. Europe and the US could and should work together on this matter in order to ensure that their respective assessments provide comparable data which will lead to the creation of global benchmarks.

This visit highlighted some examples of major changes in ethos in significant US universities, many of whom are moving towards the European concept of knowledge transfer or "sharing", as it is becoming known.

4.2 North Carolina State University

Philosophy

The focus is on partnership development in respect of Science Park companies, working alongside a technology licensing function with the aim of attracting and retaining companies on the (University owned and managed) Centennial Campus.

This is a land grant[11] university and a State university which has a clear mission to support development of the State economy. The chosen strategy is to attract and retain companies on the Centennial Campus by engaging them with all aspects of the university.

The development of the Campus is overseen by the Associate Vice Chancellor for Technology Development & Innovation which is an administrative role. Major changes in the research base in 2005/6 saw the establishment of several cross disciplinary Institutes and Centres each with an industry or user focus e.g., The Semiconductor Power Electronic Center; The Center for Research in the Nano/Bio Material Interface. Each such grouping, all of which were proposed by academic staff, creates critical masses of talent to attract both partners and research funds.

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[11] A land grant is an agreement whereby a party (in this case the university) agrees to hold ownership of a piece of land for the benefit of another party (the government)

Policy & Strategy Implementation

The form of partnerships adapts to meet the needs of the specific companies but the goal is to have the company integrated with the university in that it will take students on placements; employ graduates; use consultancy expertise and services and fund research. Over 70 companies or government agencies are based on the Campus, some in buildings shared with the university. The planning of the campus encourages the physical intermingling of staff from both sectors, and this will be further promoted by development of residential housing and a golf course; the power of networking and building trust has been recognised and is addressed.

One result is the first Strategic Alliance that the university has entered into with a company on the Campus. It was noted that to obtain this the university had to change some of the standard terms of contracts, but the value of having the company on the Campus clearly outweighed the difficulties in changing "standard practices and terms".

Licensing overseas is not a significant activity because of the costs and bureaucracy involved. It was unclear if the OTT met the costs of licenses or transferred them to the licensee as is the norm elsewhere. It is more likely that the costs of actively marketing overseas were the deterrent.

It was noticeable that companies could and did use university resources for testing or analysis or development for prototypes; that no mention was made of difficulties in accessing those services because they were being used for teaching or research purposes. It was also noticeable that academic staff was very willing to assist and to work with the companies to explore how the university resources could be used.

Resourcing

The annual research spend is around $300M from an SET base. Primary sources are the NSF and the department of Agriculture. Industry spend is around 14% of total as against a quoted average of 5-6% on average in the US. However, many of the Institutes and Centres were founded by industry and address problems related to a specific industry.

The structure of research and TT support is quite complex by European standards. There is 5 Licensing staff, supported by 6-7 administrative staff. Each handles around 350 cases at a time, which suggests that they are not engaged in active seeking of licensees or active contract negotiations. Staff marketing the Campus and the potential for partnerships numbered around 7 and estimate that around 200 of academic staff are "engaged" with Campus based companies.

On average each year around 200 invention disclosures are notified by academic staff, 110 patents are filed and 40 license deals are done. Obviously the disclosures may not result in patents or deals until some years afterwards. In 2006 6 companies were formed based on IP from the university although there are 18 new companies in incubators on the Campus. NCSU takes 5-10% equity in each company created from university IP. 81 license options were agreed. (NB: in Europe these options would normally form part of the research funding package IF industry was involved in the funding.)

The value of license income is approximately $3.6m and the comment was made that most TTOs either operate at a loss or just break even. There were repeated comments in all visits about "one big hit" making reputations, meaning that often a university licensing stream will come from one large license; all the others would be relatively small.

Good Practice

There are several examples of integrating companies with the research agenda and activity. Most cited focussed around Textiles where the State had to contend with a declining cotton industry. The main activity is in non-woven textiles. This Centre was pump-primed by State funding but is now self-sufficient, charging 64 industry and a 100 "other" members a membership fee based on their turnover[12].

Members are both producers and non-users. Twice a year they meet for a week to agree the research agenda to generate core findings applicable across the industry. Although some licenses are created the real KT activity comes from the delivery of service agreements and through employment of graduates. University funded staff undertake the basic research that then feeds into the more applied agenda in Non Wovens.

4.3 Wisconsin Alumni Research Foundation

The Wisconsin Alumni Research Foundation (WARF) was established in 1925 as a tax exempt, non-for-profit organisation and was arguably the first organisation of its kind in the world. It has ever since consistently ranked among the top ten US universities in intellectual property production.

WARF's mission is to support scientific research at the University of Wisconsin (UW) by moving inventions arising from research to the marketplace, for the benefit of the university, the inventor and society as a whole. WARF invests the licensing revenues in funding further research at university. WARF enjoys an endowment of $1,5billion under its management, which secures a sound future for its university research.

Each year, WARF receives more than 400 invention disclosures, 60% of which are accepted for Intellectual Property protection by the Disclosure Committee. Over 100 new technologies are licensed each year and the accumulated stock of license proceeds generates between $50 and $55 million to the University of Wisconsin every year.

WARF is structured in a way that staffs (Intellectual Property Managers) dealing with the protection of inventions that arise from university research are separate from those in charge of licensing and transferring rights to access marketplace value. WARF's activities are overseen by an independent Board of Trustees composed of UW alumni.

[12] Membership fees are $100K = $1B; $25K =$200M, members get a Board position on an Advisory Board and one vote no matter what fees they pay. Associate members pay $5K and get a place on the Board for every 5 Associate members, but no vote. Membership fees pay for 25 graduate students per year and a "few" faculty posts.

As of March 2007, 36 start-up companies spun off from research results at the University of Wisconsin are active in the biotechnology, pharmaceutical, medical devices, software and telecommunications sectors.

The University of Wisconsin's Office of Corporate Relations

In addition to the WARF technology transfer office, the University of Wisconsin established in 2003 an Office of Corporate Relations (OCR), a new "front door" that was designed to respond to the growing needs of the business community by facilitating access to the range of resources available from the university. OCR addresses its core mission in two fundamental ways:

Proactively reaching out to businesses in Wisconsin and beyond to present a menu of resources that are available to companies

Responding to inquiries and requests from businesses in search of ways to help them grow and flourish, and connecting them with the assets available on campus.

The university has total research funding of $750M of which $20-30M comes from industry.

The office does not undertake licensing or research award management directly; it exists to liaise with industry, to bring industry into the university where others can then agree and close the deals. It provides a portal that ranges across graduate recruitment; student placements; continuous professional development (CPD) delivery; testing and analysis and consultancy; licensing; market information sources and entrepreneurship training.

It aims to build a portfolio of contacts with current major company contacts and then present the university portfolio to the company (and presumably identify gaps where the company could benefit from use of university resource).

The metrics it uses to measure success are: company contacts; presentations to companies; requests for information/assistance; referrals to campus units. Office staff is very good at networking and boast very relaxed personalities, probably because they do not have to close deals, and so they facilitate the contact sport.

The unit has 7 staff; 4 Business Development staff including the Director, each assigned to support a faculty, plus support and marketing staff. The annual operating costs are $900K supported entirely from private resources of the university and the unit is housed on the Science Park close to companies in high quality accommodation. Each faculty has a designated "liaison" person, reporting to the Dean, through which the Office works to access resources in that faculty.

4.4 MIT Technology Licensing Office

Philosophy

The Technology Licensing Office (TLO) of MIT has existed in its present form with a well defined remit for many years. It does not articulate that in a statement of values but the MIT band is world renowned and is recognised as the most important factor in bringing investors and potential licensees to MIT.

It has benefited from the environment in and around Boston and contributed to the creation of that environment. The result is that the TLO is able to take a reactive role; investors and licensees come to the office and do not have to be sought out. It can be assumed that industry investment in academic research is also relatively readily available to academic staff. The office does not have a role in creating research links with industry.

Policy & Strategy Implementation

MIT gets a very high percentage of research income from industry at 20%. Intellectual Property arising from that is licensed to the founder on a non-exclusive basis although they will have the right of first option on an exclusive license. Around 100 licensing deals are done each year and with senior staff who have been in post for a significant number of years in the TLO that means there is a wealth of understanding of deals, a depth of understanding that is absent in most European KTOs.

MIT licenses the start-up IP to around 20-30 new companies each year, although it was unclear how active a role the TLO played in the decision to start a company and to develop it, it does seem that the huge and active VC community must play a dominant role in those decisions and academic staff may interact more directly with the VC community than they do in Europe – simply because the VCs are always looking for opportunities.

It was noted that some VC funds in the Boston area are now over $800M so they need deals of around $20-30M to make the effort worthwhile. Around 12-15 VC companies in Boston are doing deals at the "start-up" level. The comment was made that "amateurs" managing company incorporation on behalf of some universities (ie KTO staff) actually inhibited company growth in Europe because they did not "stand up to" academics; did not challenge them when they wanted to manage the companies as CEOs and to operate the company while holding down an academic role and did not bring in professional company managers.

The absence of funds and access to such managers in Europe, especially when compared to the environment in Boston, may play a role in this situation in Europe but the comment about "standing up to " academics rings true for many KTOs who are not supported by senior university managers in such disputes.

Resourcing

The TLO takes 15% of the income (after deduction of costs) from any license before the royalties are allocated. Budgets are allocated annually and appear to use the zero-based methodology. $10M is spent on patent costs and the royalty income is around $40M (CHECK). On occasion the MIT's TLO may take 3-5% of equity in lieu of royalties but this is unusual.

Good Practice

Conflict of Interest management appears to be a major role for the TLO. Academics can do the normal 20% of time on consultancy as long as they do not use federal/State funded facilities (testing and analysis services and access to facilities is managed and charged out by university procedures).

Consultancy is seen as something to be encouraged; it is a key part of the ecosystem in bringing industry thinking into both teaching and research. As part of the Conflict of Interest management system academics cannot accept funding for their research from a spin-out in which they hold equity.

4.5 Harvard School of Engineering and Applied Sciences

Philosophy

The TTO in Harvard was known as the Office of Technology and Trademark Licensing until 2005, a title which described clearly what it did. Its current title is the Office of Technology Development (OTD) and this reflects a major change in philosophy to make technology have an impact. The change reflects the thinking of an appointment to lead the office from outside the US; the intention was to be seen to move from being reactive to being proactive, to be more than an administrative unit "just to file patents".

Structure

The Office now has 8 Directors of Business Development (DBD) with another 20 associates supporting them. Each Director has responsibility for specific areas of the University and is active in approaching academic staff and seeking ways to assist them. As an example the Engineering DBD liaises with around 65 academic staff.

As part of the drive to identify IP, the Office has taken on, from the Office of Sponsored Programmes, the responsibility for handling industrial research awards. This enables capture of IP potential but it also facilitates integration of the Office in the research programme development and in the academic-industry relationship. The DBDs work as a team, enabling the bundling of technology but also the development of cross disciplinary research projects by presenting "packages" to industry. Around 10% of sponsored research at Harvard is industry funded.

Policy & Strategy Implementation

The Office is closely aligned with university strategy – to increase the level of funded interactions with industry. It has articulated a set of values, similar to those to be found in UK universities. Much of the focus of these is around standards of service; enhancement of public benefit; advancement of technology and trust. Income generation does not feature.

Similarly, in the metrics used, although the traditional measures remain the intent is to increase those and the emphasis is on the number of deals concluded not the value. This reflects the drive to increase interactions with industry in order to increase industrial funding of research. Again, service standards are an important factor. These are evaluated in the frequent conversations the director has with academic staff.

Harvard creates on average 12 new companies a year from IP the University owned. The income from licensing, after deduction of direct costs such as patent agent fees, is split as follows:

- Under $50K, the inventor gets 35% and balance goes to department/school etc
- Over $50K, the inventor gets 25%.

The OTD does not take a percentage in any case, but is funded directly by the department or school, ensuring that their existence and staff allocation are not directly linked to short-term performance metrics, but more towards the added value as seen by their peers in academia.

Resourcing

Precise figures were not made available but the office supports 30 or so staff; it spends $6-7M on patent costs each year and it generates $20M in royalties. Patent costs are recovered as part of the license; it was not clear whether costs recovered were reported as part of the $20M or not. As a general rule of thumb the DBD we met suggested that costs should be around 50% of income raised (1/3 investment to 2/3 income).

Good Practice

Harvard wants to grow its engineering – which differentiates itself by being based on science disciplines – from 65 staff to 100 staff. The Office of Technology Development (now) has moved towards Business Development model and as part of that they have days with companies where they get company and academics and arrange the day around technology areas. The aim is to start the conversation and that each should go away thinking the day was useful. They pose the question to the industrial participants – often just one company – of "what are you development challenges over the next 5-10 years?"

On average one such day in 20 results in sponsorship for research by industry but OTD believes it is good investment and is resourced to deliver these days. For industry these days encourage investment in research to make them more competitive. Smaller companies tend to take up licenses but large ones a)want competitive advantage; b) are too bureaucratic and have product cycles that are too long to use licenses advantageously. The Harvard name means that both small and large companies are willing to attend such days.

The OBD at Harvard registers on an internal system any industrially funded research projects likely to generate IP and stay in touch with the academics to check progress and stop leaks. This practice is already common in some European university (i.e., Heriot-Watt).

5. Financing Innovation: Angel Investors and Venture Capital

Angel investors and venture capital have historically played a crucial role in the commercialisation of the results of research in the US. Over the last 35 years, venture capital has funded more than 23.500 companies. The US National Venture Capital Association estimates that almost 17% of the country's GDP stems from venture capital backed companies ($2.1 trillion). These companies are responsible for 9% of the US private sector employment.

Historical examples of entrepreneurs having resorted to angel investor when banks refused to fund their companies include Alexander Graham Bell, Henry Ford and Jeff Bezos' Amazon. Google started with $1 million funding from angels, followed by $25 million from venture capital. Today, Google has a market capitalisation of $30 billion.

Angels are sophisticated investors, with university degrees, normally in their mid forties, and with entrepreneurial and investment experience to protect them. They are often retired business owners or executives, who may be interested in angel investing for other reasons in addition to pure monetary return. These include wanting to keep abreast of current developments in a particular business arena, mentoring another generation of entrepreneurs, and making use of their experience and networks on a less-than-full-time basis. Thus, in addition to funds, angel investors can often provide valuable management advice and important contacts.

According to the Center for Venture Research, there were 225,000 active angel investors in the U.S. in 2005. Angel groups are generally local organizations made up of 10 to 150 accredited investors interested in early-stage investing. In 1996 there were about 10 angel groups in the U.S.; as of 2007 there are over 250, with a roughly equal number in all other countries combined.

Typically angel investors hold over $1 million in assets. They are the single most important source (90%) of independent seed and start-up equity funding for new and growing companies in the US. They tend to focus on young companies at the cutting edge of new technologies, with innovative new products and services.

It is estimated that angels invest $20 billion in 45.000 new companies every year. There are between 250.000 and 400.000 potential angel investors in the US alone. The typical investment range varies between $25k and $250k per deal per angel.

Venture capital

Angels and venture capitalists (VCs) both invest in private companies. VCs are limited partnerships and take money from limited investors (pension funds, insurance companies, university endowments) to invest it with limited time horizons, after which they disinvest and expect to reap benefits.

In 2003, one third of venture capital disbursements in the US went to seed and early-stage finance and almost half to expansion capital. Venture capital funds can range from $100m to several billions of dollars. The size of VC funds is important to be able to invest in the companies with the highest growth potential. The average seed deal is $4m. In 2004, almost 900 VC funds were managing a staggering $261 billion.

Angels and VCs tend to concentrate in different stages of funding company growth. Angels normally address the funding gap of $500.000 for the commercialisation of results of R&D and productising prototypes. They may also be involved in early-stage deals of between $2 and $5m. Above these levels of funding, it is normally VC that tends to predominate.

Access to finance for research spin-offs seems to be readily available, although it seems to be concentrated in both coasts and a reduced number of other inland innovation hot-spots. This makes a different for the growth potential of new spin-off research companies. A remarkable fact that summarises well the different situations on both sides of the Atlantic is that a typical seed investment by a US angel is often of a similar size than a venture capital deal in Europe.

After the "irrational exuberance" that led to the dot-com crash in 2000, the role of the US government in the private equity market has become clearly more important. The SBIR program and the Advanced Technology Program both offer unique assistance and facilitate the development of high growth entrepreneurial ventures, which are used as business plan experts during the evaluation phase. Such close linkages have helped ensure that due diligence etc is performed before a deal is brokered between recipients of a grant and the potential investors.

6. The role of philanthropy in promoting innovation and entrepreneurship

Among the factors contributing to the success of the U.S. economy over the past decade—as reflected in the doubling of productivity growth compared to the preceding two decades—is the continued transformation of the U.S. economy toward a more entrepreneurial form of capitalism. Philanthropy has played an important role in this transformation.

Since the times of Andrew Carnegie or John D. Rockefeller, the United States has had a strong tradition of philanthropic support to entrepreneurship and innovation. Philanthropy is considered by many as a mechanism for inter-generational transfer of wealth.

Today there are more than 68,000 foundations in the US. Some of the biggest ones, like the Ewing Marion Kauffman Foundation include in their mission statement “the promotion of research and policies that initiate and grow innovative, sustainable enterprises”.

It is estimated that, in 2005, philanthropic associations invested $260billion to support of research, innovation and entrepreneurship. By comparison, US Federal funds for research, development, and R&D plant amounted to $106billion in 2005. It is expected that between 2006 and 2021, charitable contributions will reach anything between $21 and $55 trillion.

Philanthropic sources often fund endeavours that no one else is ready to fund because they do not offer the right return-of-investment perspectives. Philanthropic expectations often need to be matched with actual research needs. An increasing share of this funding is going into life sciences.

Entrepreneurs often report that the most significant constraint on the growth of their companies, and on the growth of future entrepreneurs, is the difficulty in finding and attracting talent, this is, highly skilled entrepreneurial workers. This is the reason why Kaufmann and many other foundations are very active in supporting initiatives in education and higher education.

Philanthropic foundations are very active in stimulating alternatives ways to commercialise the results of public research, such as open source collaboration, non-exclusive licensing or the development of social networks for graduate students and faculty. Many foundations are also active in influencing public policy on research and knowledge transfer.

7. Research parks and regional economic development

University research and science parks are seen as a path through which innovation flows from the lab into the marketplace. These parks aim to harness the power of education and research, new jobs, new industries and solutions to age-old problems are found.

The parks visited also tended to provide training to new companies in such areas as intellectual property and business planning to help these fledgling businesses to succeed. There was no indication that these services were restricted to companies that had been created on the basis of University IP; rather all new companies appeared to be welcomed and the university owned parks undertook a role that in Europe is often delivered by government agencies or the private sector. Universities, in turn, greatly benefit from their exposure to the business world, and the “spin-in” of the business acumen and cutting-edge research being conducted outside their walls within industry. This spin-in aids faculty researchers and their universities or labs by ensuring that they are kept current on developments in their disciplines.

The Research Triangle Park is an excellent example of how a research park set out to stop the “brain drain” from a rural, agricultural region, which was then dependent on the tobacco and textile industry. Created as a partnership between the State and private companies such as Glaxo SmithKline Beecham the focus has been on attracting R&D activity and corporate headquarters. The three universities around the park (Duke, North Carolina State and the University of North Carolina) formed part of the strategy and worked closely to develop the linkages and communities that fostered the R&D activity. Today, it is home to some of the world’s most advanced high technology businesses which employ over 40,000 people. Manufacturing takes place in the areas surrounding the park, providing a significant boost to the state economy through demand for housing and services as well as providing jobs.

The State of North Carolina has been a key driver in its success, providing generous incentives for high-tech businesses including R&D tax incentives and matching funding for SBIR award winners.

Centennial Park, which is outside the Research Triangle Park, is also built upon a land grant whereby the Government gave a certain amount of land to North Carolina State

University who in turn lease buildings to start ups or to companies which wish to work closely with the university. In some cases the buildings are dual purpose, shared by company and university research labs. This ensures knowledge transfer between the research labs with students and staff being able to work part-time for private companies easily (as interns) and companies being able to identify the best new students / researchers in the university easily. It also has significant benefits for the university as the companies often provide free lectures / business advice and they tend to contract the university to conduct research / provide consultancy services when needed.

The science parks visited provided a comfortable environment for businesses and emphasises the necessity of encouraging social interaction in order to foster the goals of all the parties – the NCSU even providing a golf course which is used by the university in order to help provide a good infrastructure for their students of golf green management studies and by industry and the university to develop and strengthen corporate relations.

8. Observations and lessons learned

The following is a non-exhaustive list of the key observations and lessons learnt during the course of our visit. In our opinion, these help to explain the dynamic and efficient system of knowledge and technology transfer from research to the marketplace in the United States. Their immediate applicability of these observations to the European situation may be limited due to many historical and institutional reasons, but they may nonetheless inspire European policy makers in their endeavours.

- **There is no single, centralized approach on how R&D aid should be delivered.** In the US federal system, each level of government can be a potential source of funding for R&D. Expenditure for R&D programs is mixed with other types of expenditure in the budgets of more than 20 Federal Agencies or Departments. For some of those agencies, such as the NSF, the NASA, and the NIH, R&D is the dominant activity.

- **Most of the federal government's R&D funding is mission-oriented**, this is, it is intended to serve the larger goals and objectives of the agency that provides the funds (such as the Department of Agriculture). The only exception is NSF whose mission is to support basic and applied research, primarily in academic Institutions, across a wide range of disciplines and target areas.

- **A clear, predictable legal framework to manage intellectual property provides certainty in negotiations** – In general, the provisions made in the Bayh-Dole Act often allow university staff and corporations to reach mutually beneficial agreements, while concentrating in the core missions. However, successful technology transfer seems to be concentrated in a handful of research intensive universities.

- **The knowledge transfer profession is well organised and represented in policy making** – Since the 1960s, the American University Technology Managers Association has watched over the interest of knowledge transfer professionals in the US and Canada, providing training and facilitating their professional development, as well as giving them a voice in policy making.

- **Federal research funding provides an excellent base for the commercialisation of technology transfer** – In most universities successful in technology transfer, a substantial share of research funding comes from the federal government (e.g., US Department of Defence, National Institutes of Health, National Science Foundation). The competitive nature of the process leading to the allocation of funds fosters excellence.

- **Foundations play a major role in fostering innovation and entrepreneurship** – Philanthropic sources provide a level of funding for research, higher education, innovation and entrepreneurship initiatives that exceeds that of federal funds. These activities would most likely not be funded by other public or private sources.

- **Research spin-offs have ready access to early-stage seed capital –** Faculty entrepreneurs embarking in starting new companies have access to seed capital from private funds and angel investors. In the visited universities, entrepreneurs are offered assistance with business plan development and access to potential investors.

- **An entrepreneurial culture at university is nurtured by facilitating access to key resources –** Instilling an entrepreneurial mindset in graduate students requires many ingredients. Having opportunities to network with potential investors, corporate clients and other entrepreneurs is a key feature is the most successful universities in technology transfer. Technology transfer offices will often facilitate interaction with venture capitalists and corporations. Furthermore, student internships in science park companies are actively promoted by academia and industry alike, instilling a practical dimension into students' career development.

- **Many successful universities have incubators and research parks –** Often in partnership with the private sector and with the support of State authorities, many universities develop science parks with the aim of attracting and retaining companies (e.g., Centennial Campus in North Carolina).

- **Social networking fosters business transactions** and the value of knowing on a personal level those with whom they are doing business, in order to close the deal more easily and quickly is very high on the agenda of US universities and companies. Social networking is conducted for a purpose and its value is recognized by government and State authorities**.**

- **The discussion on how best to transfer innovations from university to industry continues –** Although the effect of the Bayh-Dole Act in spurring the transfer of research results to industry for almost three decades is widely acknowledged, some voices advocate the need to pay more attention to alternative pathways such as open source collaboration, non-exclusive licensing and the development of social networks for graduate students to commercialise all types of innovation.

Annex 1. Composition of EU delegation

Innovation visit to the US, 26th – 30th March 2007

Cesar Santos Cesar.santos@ec.europa.eu GSM 00 32 495 207788	European Commission	DG Enterprise and Industry
Frank Moeschler Frank.moeschler@ec.europa.eu	European Commission	DG Research
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Juan Antonio Serrano Fernandez jasf@cdti.es	Spain	CDTI – Spanish Centre for the Development of Industrial Technology – Head of Department
Jarmo Raittila Jarmo.raittila@tekes.fi	Finland	TEKES – Finnish Innovation Agency Senior Technology Advisor
Gillian McFadzean g.mcfadzean@hw.ac.uk	ProTon Europe	Chair

Annex 2. Visit programme

United States – European Union Summit

On the occasion of the first U.S.-E.U. Experts Exchange on Innovation

Conference:

Innovation in the United States

March 26, 2007

Hosted by the U.S. Department of Commerce

Co-organized by the U.S. Department of Commerce and the European Commission Delegation in Washington

1401 Constitution Avenue, N.W.
Washington, D.C.

Conference Room 4830
(4th Floor)

U.S.-E.U. Experts Exchange on Innovation

Innovation in the United States

at the U.S. Department of Commerce

March 26, 2007

Schedule of Topics and Speakers

8:30 am **8:45 am** **9:00 – 9:10 am**	**Opening Session** **Welcome to Participants** Dr. David A. Sampson Deputy Secretary U.S. Department of Commerce **Participant Introductions**
9:10 – 9:50 am	**Knowledge Transfer in the European Union** Cesar Santos Gil European Commission Gillian McFadzean Proton Europe
9:50 – 10:30 am	**The Role of U.S. Federal Labs in Technology Transfer and Innovation: Case of the Agricultural Research Service** Richard Brenner Agricultural Research Service, Department of Agriculture
10:30 – 10:50 am	**Coffee Break**
10:50 – 11:30 am	**U.S. Universities and Technology Transfer** John Fraser Association and University Technology Managers (AUTM) and Florida State University
11:30 – 12:10 pm	**Innovation and U.S. Competitiveness** Deborah Wince-Smith Council on Competitiveness
12:10 – 1:30 pm	**Lunch**
1:30 – 2:10 pm	**U.S. Small Business Innovation Research (SBIR) and Advanced Technology Program (ATP)** Sujai Shivakumar Board on Science, Technology and Economic

	Policy National Research Council

2:10 – 2:50 pm	**National Science Foundation's Ongoing Activities on the Science of Science and Innovation Policy** Kaye Husbands Directorate for Social, Behavioral, and Economic Sciences National Science Foundation Mary Frase Division of Science Resources Statistics National Science Foundation

2:50 – 3:10 pm	**Coffee Break**

3:10 – 3:50 pm	**Financing Innovation: The Role of Angel Investors and Venture Capital** Tony Stanco Council of Entrepreneurial Technology Transfer and Commercialization The George Washington University

3:50 – 4:30 pm	**The Role of Philanthropy in Stimulating Innovation and Entrepreneurship** Lesa Mitchell The Kauffman Foundation

4:30 – 4:45 pm	**Conclusion** Mark Boroush Technology Administration, Department of Commerce Cesar Santos Gil European Commission

U.S.-E.U. Experts Exchange on Innovation

Innovation in the United States

at the U.S. Department of Commerce

March 26, 2007

Roster of Participants

United States

MODERATOR

Mark Boroush
Senior Policy Analyst
Technology Administration, U.S. Department of Commerce

Richard Brenner, Ph.D.
Associate Administrator
Office of Technology Transfer, Agricultural Research Service
U.S. Department of Agriculture
(speaker)

Mary Frase, Ph.D.
Deputy Division Director
Division of Science Resources Statistics
National Science Foundation
(speaker)

John Fraser
Executive Director, Office of IP Development and Commercialization, Florida State University
And Immediate Past President, Association of University Technology Managers (AUTM)
(speaker)

Kaye Husbands-Fealing, Ph.D.
Science Advisor for the Science of Science Policy
Directorate for Social, Behavioral, and Economic Sciences
National Science Foundation
(speaker)

Sujai Shivakumar, Ph.D.
Senior Program Officer
Board on Science, Technology, and

European Union

CO-CHAIR

Cesar Santos Gil
DG Enterprise and Industry, European Commission
(speaker)

Mary Kavanagh, Ph.D.
Counselor, Science, Technology, and Education
European Commission Delegation in Washington D.C.

Frank Moeschler, Ph.D.
DG Research, European Commission

Gillian McFadzean
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Economic Policy
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Lesa Mitchell
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Tony Stanco, J.D.
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(speaker)

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Head of Department
Institute for Industrial Promotion, Italy

Willem Zwalve, Ph.D.
Director
SenterNovem (Dutch Innovation Agency), The Netherlands

27 March 2007, Tuesday (Washington DC to Raleigh NC)

AM: Travel to Raleigh North Carolina

08.55 Departure from Dulles – flight UA 7139
09.58 Arrival at Raleigh airport – shuttle to Hotel

Visit Centennial Park[13]

11.15 Pick-up at hotel

12.00 – 12.45 Working lunch with Dr. Dave Winwood
Associate Vice Chancellor, Technology Development & Innovation, Centennial Campus

12.45 – 14.00 Centennial Campus Overview and Walking Tour
Leah Burton, Partnership Developer

14.00- 15.00 Visit: MeadWestvaco
Meeting with: Fred Renk (Research Director, Papers Division)
(a packaging company established on campus)
(www.meadwestvaco.com)

15.00 – 15.30 Visit: Institute of Textile Technology
Meeting with: George Edmunds, Vice President
(http://www.itt.edu/)

15.30 Depart Centennial Campus

16.00 – 17.00 Visit SAS (www.sas.com)
(largest privately held software company in the world)
Meet: David M. Trebing, Director, US State Policy, Global Policy Division

19.00 Dinner at Angus Barn (self pay)
9401 Glenwood Avenue, Raleigh, NC

Contacts: Leah D. Burton, Partnership Developer
Centennial Campus Partnership Office
1005 Capability Dr., Suite 229
NCSU Box 7005
Raleigh, NC 27695
Phone: (919) 515-7036, Fax: (919) 515-1390
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[13] http://centennial.ncsu.edu/overview/index.html

Shirreef Loza
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28 March 2007, Wednesday (Madison)

AM : Travel Raleigh NC to Madison, Wisconsin

07.49	Departure Raleigh airport – flight UA 7114
09.05	Arrival Chicago (IL) O'Hare airport
10.20	Departure Chicago O'Hare airport – flight AA 3952
11.10	Arrival at Dane County airport
13.30 – 15.30	Meeting with: Michael Falk, Chief of Staff, Director of Intellectual Property Wisconsin Alumni Research Foundation (WARF) and Discovery Institute Project, www.warf.ws
16:00 - 16.45	Meeting with: Anne Miner, Executive Director, INSITE, and State government representatives. Venue: Pyle Center (http://www.bus.wisc.edu/insite/)
17.00 – 18.30	"Innovation in the EU – The impact of union" Venue: Pyle Center (public audience) Seminar given by the EU delegation (as part of the 50th anniversary of the EU celebrations in the US)
18.30 – 20.00	Reception to celebrate the 50th anniversary of the signing of the Treaty of Rome, hosted by Jonathan Zeitlin, EU Center of Excellence director, and Dean Gilles Bousquet of the International Institute

29 March 2007, Thursday (Madison)

09.00	Pick-up Best Western Inn Towner and Highland Club by Office of Corporate Relations van for U-W Science Park
09.30	Meeting with Allen Dines, Assistant Director, Office of Corporate Relations, University of Wisconsin - Madison (topics:INSITE, resources for entrepreneurs, Kauffman Initiative)
10.30	Visit to onsite startup (Selector or Quintessence) TBC
11.30	Departure in van to Tomotherapy Visit Tomotherapy – large SME – spin-off from U.W.
13.00	Drop-off at Best Western to pickup luggage.
Contacts:	Elizabeth Covington, Executive Director, European Studies Alliance Tel: 608-2654778 Email: eecovington@wisc.edu Allen Dines, Assistant Director, Office of Corporate Relations Tel: 608-262-2797 Email: ajdines@wisc.edu

PM: Travel from Madison, Wisconsin to Boston, Massachusetts

16.04	Departure Madison, WI airport – flight UA 7905
16.59	Arrival Chicago (IL) O'Hare airport
18.00	Departure Chicago O'Hare airport – flight UA 878
21.17	Arrival at Boston Logan International airport

30 March 2007, Friday (Boston)

9.30 – 10.45 Meeting with: Dr. Tom Esselman

Technology and Entrepreneurship Center,

Harvard School of Engineering and Applied Sciences
http://www.deas.harvard.edu/tech/

11.00 - 12.00 Meeting with: Dr. Fawwaz Habbal,

Associate Dean for Research and Planning,

Harvard Industrial Partnership Programme,

Harvard School of Engineering and Applied Sciences

http://www.deas.harvard.edu/partnerships/about.html

12.00 – 13.30 Lunch hosted by Dr Tom Esselman at the Harvard Faculty Club

14.00 – 15.00 Meeting with Dr. Lita Nelsen, Director,

MIT Technology Licensing Office

http://web.mit.edu/tlo/www/

Annex 3. Contacts and further information

References for Bayh-Dole

- The Bayh-Dole Act: A Guide to the law and Implementing regulations, Council on Government Relations, 1999. http://www.ucop.edu/ott/bayh.html

- University Licensing and the Bayh-Dole Act; Thursby and Thursby, Science Vol 301, p 1052, 2003

- The US Bayh-Dole Act of 1980: An assessment of its application in an Irish context, M. Mullins, 2003.

- AUTM Licensing survey, 2004, http://www.autm.net/index_ie.html

- PCAST report on Technology Transfer, http://www.ostp.gov/PCAST/pcast2003rpt.html

- Principles and Guidelines for recipients of NIH research grants and contracts on obtaining and disseminating biomedical research resources, http://ott.od.nih.gov/NewPages/RTguide_final.html

- Bayh Dole Act Bad for Computing Research?: http://www.cra.org/CRN/articles/jan04/foley.html

- Schissel et al. Nature 1999, 402:118

- Cho, M.K. et al., Molecular Diagnostics 2003; 5:53-58

References for SBIR

- http://sba.gov/sbir/indexsbir-sttr.html
- http://app1.sba.gov/faqs/
- http://www.sbirworld.com
- http://crisp.cit.nih.gov - CRISP database of NIH funded biomedical research projects conducted at universities, hospitals, and other research institutions