ELAN

European and Latin American
Technology based Business Network

C.A.3.1- IDENTIFICATION OF GOOD PRACTICES OF EUROPEAN UNIVERSITIES IN TRANSFERRING AND COMMERCIALISING RESEARCH RESULTS

UNIVERSIDAD POLITÉCNICA DE MADRID

SEPTEMBER 2016

Report coordinated and written by:

Centre of Support for Technology Innovation - CAIT

Universidad Politécnica de Madrid (Spain)

Date **September 2016**

Work Team

Natalia Dévora Quintero
BS Chemistry; MSc Economics and Innovation Management; MS Management of Technology
Senior Technology Transfer Manager at Centre of Support for Technology Innovation (CAIT)
Universidad Politécnica de Madrid
Calle Ramiro de Maeztu, 7, 28040 Madrid, Spain.
Email: natalia.devora@upm.es ; 0034 913369801

Gonzalo León Serrano
Professor of Telematics Engineering
Centre of Support for Technology Innovation (CAIT) Director and Rector´s Deputy for Strategic Programs
Universidad Politécnica de Madrid
Calle Ramiro de Maeztu, 7, 28040 Madrid, Spain.
Email: gonzalo.leon@upm.es; +34 913364686

Note. This report has been written by the Centre of Support for Technology Innovation (CAIT) of the Universidad Politécnica de Madrid for TECNALIA in the framework of the project "*Creation of a European and Latin American self-sustainable innovative cooperation Network (ELAN) of research and innovation (R&I) actors and industry partners to foster co-generated technology-based business opportunities*"

1. OBJETIVES

Knowledge has progressively increased its importance in the global economy. In fact, the creation and application of new knowledge is the primary factor that drives sustainable economic growth.

In this new scenario, **universities**, which are important sources of new knowledge, become a key element of the innovation system. Besides teaching, and through their R&D activity, universities and public research labs are able to offer new technical and methodical knowledge which is mainly needed in innovation activities oriented towards developing new technologies, new materials, new devices and for supporting the introduction of innovative products to the market.

Moreover, universities must be able to **convert scientific breakthroughs and technological achievements into industrial and commercial successes**.

Nowadays, universities become entrepreneurial and are expected to play this new role. For doing this, an intense and productive relationship with industry is critical. This collaboration can take many forms: from contract research or collaborative R&D, technology consulting or among others, the shared use of university equipment and facilities. Furthermore, **the commercialization of research through licensing and creation of new companies** have received increasing attention during last decades due to their capacity to generate direct economic impact in the nation, region or sector (new jobs, tax income, and technology businesses that can compete internationally) and therefore, by **transforming the local and national economy**.

Even if the commercialization of research becomes critical for strengthening the role of universities in society, many studies indicate that this new role is not performed equally at all universities and nor it is equally rewarding everywhere. Indeed, the commercialization of university research (judged by numbers of patents issued, royalties form licensees or new companies created) remains differentially successful and largely concentrated in just a handful of universities.

It might then be tempting to cut and copy the strategy of these successful universities, but every university has its own history, and a set of internal and external condition that affect its behaviour, therefore, there is not a single set of recipes or any unique strategy to follow for improving the commercialization of university research. A pragmatic solution may be based through the identification of best practices or successful approaches and, after their deep understanding to translate them to the target reality and context of specific

universities. Then, mutual learning fed up by best practices analysis seem a useful approach.

This report identify **ten new and innovative activities and methodologies in transferring and commercialising research** results found in the European context, which may be translated, with the adaptation needed, to other countries.

Universities or other organizations manage the cases presented in this report and they address different phases at the technology commercialization process, therefore a wide range of possibilities is offered to universities and other triple helix stakeholder depending on their objectives and desired results.

2. METHODOLOGY

The overall objective of this work is to present a wide variety of cases with diverse stages of development, types of interaction and activity that allow readers to get new ideas for transferring and commercialising research results from universities and research centres to industry.

Consequently, for the purpose of this work a "best practice" in transferring and commercialising research results must be understood as an innovative way to approach that issue, which should be reviewed critically for potential users and adapted to each university innovation ecosystem.

Ten best practices have been identified, by undertaking the following methodology:

- In a first stage, 20 European universities were analysed taking into account different criteria that will be exposed later in this document.
- These 20 cases, will allow identifying several best practices managed by the chosen university or in which universities have an active role, but are coordinated by another triple helix stakeholder.

2.1- Phase I: European Universities Selection

With the objective of detecting best practices and successful exemplary cases in transferring and commercialising research results, **20 European** universities have been identified and analysed.

Selected entities should have the potential and the institutional goal to implement programs of technology transfer; this goal means to focus on technical universities, R&D Centres or research institutes in regions with an industrial environment or at least with the ability to establish sound stable partnerships with established companies.

The universities have been selected considering the following criteria:

Geographical scope

A representative sample of universities belonging to different European countries were considered. The countries represented in the sample are UK, Finland, Italy, Germany,

France, Netherlands, Spain, Switzerland, Sweden, Ireland, Portugal and Norway (see figure 1)

Positions in international rankings

Universities that appear in important positions in international rankings such as the Times Higher Education World University Ranking, QS World university rankings or ARWU, also known as the Shanghai list.

Other issues

In same cases, the university is included due to important facts such as to have Nobel Prizes among its researchers (Norwegian University of Science and Technology), be the pioneer in the protection of intellectual property in its country (Instituto Superior Tecnico Lisboa) or be the leading university in its country with regard to patents filed and the creation of spin-off companies (Universidad Politécnica de Madrid).

For each university a matrix to interrelate them has been built based on the following fundamental aspects:

Basic Data

Founded year, number of researchers, staff and students, global ranking positions and other relevant data are included.

Technology Transfer Units

Universities are creating new facilities and support structures, which are helping to identify, valuate and commercialize R&D results. Among these structures are technology transfer office, business incubators, research parks, etc. The support structures may depend exclusively on the university or be established in partnerships with other triple helix stakeholders.

Partnership and internationalization

In the open innovation paradigm, universities engaged more and more with the environment and not work anymore as an isolated island. In fact, universities are offering external courses to local companies, collaborating in R&D projects with national or international companies, fostering the creation of new companies in the region or offering its equipment to companies for testing and calibration as external services. Thus, it is critical to analyse the international and partnership strategy developed for each university, because that strategy will define university behaviour in the triple helix ecosystem. Specifically:

Internationalization: activities carry out with an international dimension (training and research mainly).

Partnerships: alliances established with local or international partners in order to implement university strategy.

Main indicator related to patent activity and spin off creations

These data will provide and idea about the potential impact of university technology transfer strategy in the ecosystem.

Best practice pre-identified. At this stage a preliminary identification of good practices was done.

Considering these criteria, the universities selected were the following ones:

- **Imperial College London**. London, UK

In 1907, the Royal College of Science, the Royal School of Mines and the City & Guilds College were combined to form Imperial College London. Nowadays, Imperial College London is a public science-based university with an international reputation for excellence in teaching and research. The college is home to medical and healthcare institutes, including the Parkinson's UK Brain Bank, which supports more than 100 research projects and has more than 6,000 registered potential tissue donors.

http://www.imperial.ac.uk/

- **University of Helsinki**. Helsinki, Finland.

The University of Helsinki is the Finland's largest, oldest and internationally most esteemed research university. It was established in 1640 and it has repeatedly been ranked among world's top universities.

https://www.helsinki.fi

- **University of Trento**. Trento, Italy

The University of Trento is a medium-sized university, founded in 1962. In 1982, the University (until then private) became public, with a statute that guaranteed self-government. The University of Trento ranks 1st in Italy for scientific production in the medium-sized Italian universities in the ANVUR Report 2013 (Italian National Agency for the Evaluation of the University and Research Systems

http://www.unitn.it/

- **Technische Universität Berlin**. Berlin, Germany

Located in Germany's capital city, Technische Universität Berlin (TU Berlin) is one of the largest universities of technology in Germany. Additionally, TU Berlin has one of the highest percentages of international students among German schools – nearly 20 percent of the student body. The TU Berlin was established under its present name in 1946, but its history reaches back much further into the past, to institutions such as the Mining Academy, Building Academy and the Vocational Academy, established in 1770, 1799 and 1821 respectively.

http://www.tu-berlin.de

- **Université Pierre et Marie Curie**. Paris, France

Pierre and Marie Curie University (UPMC) is a leading French Scientific and Medical University. UPMC is joining other institutions to form the new Sorbonne University. A successor to the historic Sorbonne, it is one of the most comprehensive university centers in France. The Shanghai 2014 University list ranks UPMC 6th in Europe and 35th in the world; 4th in the world for mathematics

http://www.upmc.fr/

- **Delft University of Technology**. Delf, The Netherlands

Delft University of Technology is the oldest and largest technical university in the Netherlands. It was founded in 1842 by King William II in order to train civil engineers. TU Delft (from the Dutch name Technische Universiteit Delft) received its current name in 1986.

http://www.tudelft.nl/

- **Universidad Politécnica de Madrid**. Madrid, Spain

The Universidad Politécnica de Madrid (UPM) was created in 1971 from on the pre-existent engineering schools attached to a number of ministerial departments. Even today, the UPM only addresses engineering and architecture studies and the "engineering schools" continue to be the basic structure of the university life. Nowadays, is the largest technical university in Spain and the leading Spanish university with regard to the participation in European R&D projects, patents filed and the creation of spin-off and start up companies.

http://www.upm.es/

- **Swiss Federal Institute of Technology in Zurich**. Zurich, Switzerland

The Swiss Federal Institute of Technology in Zurich (ETH Zurich) is the university for science and technology. It dates back to the year 1855, when the founders of modern-day Switzerland created it as a centre of innovation and knowledge. Situated in the heart of Europe, the university has 90 patent applications and 200 invention reports every year.

https://www.ethz.ch/

- **KTH Royal Institute of Technology**. Stockholm, Sweden

KTH is the largest technical university in Sweden and represents a third of all Swedish technical research and engineering education at university level. KTH has more spin-offs per SEK invested in research than MIT, Stanford or Cambridge. The number of patents per SEK invested is comparable to other top level universities globally

https://www.kth.se/en

- **Trinity College Dublin - The University of Dublin**. Dublin, Ireland

Trinity College Dublin, the University of Dublin, is Ireland's oldest university, founded in 1592. The school's three faculties include the arts, humanities and social sciences; engineering, mathematics and science; and health sciences.

https://www.tcd.ie/

- **Politécnico de Milano**. Milan, Italy

Founded in 1863. The Politecnico di Milano comprises four schools and 12 research departments spread throughout seven campuses that train engineers, architects and industrial designers. Politecnico is one of the top universities in terms of projects funded by the European Commission, with about 281 current projects pulling a total of €90 million in investment from the European Union. It also collaborates with numerous other public and private entities, signing about €500,000 worth of contracts in the past five years

http://www.polimi.it/

- **Eindhoven University of Technology**. Eindhoven, The Netherlands

Eindhoven University of Technology (TU/e) is a research university specializing in engineering science & technology. It was originally founded in 1956 to supply electronics giant Philips with the highly-skilled graduates it needed for its laboratories, which went on to create the first audio and video cassettes, CD and laserdisc players. Its considerable links to Philips remain important, but TUE's links to other businesses in the so-called 'Brainport' area are arguably as important in the 21st century. The area is the corporate

home of ASML, NXP, DAF Trucks and DSM, as well as several Dutch R&D institutes, and is the European region with the highest number of patents.

https://www.tue.nl/en/

- **Instituto Superior Técnico Lisboa**. Lisboa, Portugal

Instituto Superior Técnico (herewith designated as IST) is the largest school of Architecture, Engineering, Science and Technology in Portugal, involving a community of over 10,000 people. Founded in 1911, IST was pioneer in Portugal in the protection of intellectual property and currently is the Portuguese institution with the largest number of patents registered. Since July 2013, it part of the ULisboa that acquired its current status following the merger of the former Universidade Técnica de Lisboa and Universidade de Lisboa.

https://tecnico.ulisboa.pt/pt/

- **Technical University of Munich**. Munich, Germany

The Technical University of Munich (TUM) is one of Europe's leading universities for research with a range of disciplines, unparalleled in Germany, including engineering and natural sciences, life sciences and medicine, management and social sciences. Founded in 1868 TUM is one of the five most innovative universities in Europe, according to the new ranking "Reuters Top 100." 53th in THE 2015/2016. 13 Nobel prizes have been awarded to TUM professors and alumni since 1927

https://www.tum.de/

- **Université Paul Sabatier**. Touluse, France

The Université Paul Sabatier (UPS) is part of the Toulouse University. Created in 2007 (under the Research Programme and Orientation Act) Toulouse University brings together most public institutions of higher education and research in Toulouse and the Midi-Pyrénées region. The system is composed of 4 universities and 17 schools of engineering or other specialized subjects. UPS offers multidisciplinary education in the fields of science, health, engineering, technology and sports, developing one of the most important scientific research clusters in France.

http://www.univ-tlse3.fr/

- **University of Strathclyde**. Strathclyde, UK

The University of Strathclyde is a leading international technological University located in the heart of Glasgow, Scotland's biggest city. It was established in 1796.

https://www.strath.ac.uk/

- **Universidad Politécnica de Cataluña**. Barcelona, Spain

The Universitat Politècnica de Catalunya · Barcelona Tech (UPC) is a public institution dedicated to higher education and research, specialised in the fields of architecture, engineering and technology. In 1971 was founded University of Barcelona (UPB) , formed initially by the technical colleges of Industrial Engineering of Barcelona (ETSEIB) and Terrace (ETSEIT), the School of Architecture of Barcelona (ETSAB) and some research institutes. Later, in 1984, it was renamed to Polytechnic University of Catalonia (UPC).

http://www.upc.edu/

- **Technical University of Denmark**. Copenhagen, Denmark

H.C. Ørsted —the father of electromagnetism— founded the university in 1829 to develop and create value using the natural sciences and the technical sciences to benefit society. The Technical University of Denmark (DTU) has research and test facilities throughout the country, and three campuses

http://www.dtu.dk/

- **Aalto University**. Helsinki, Finland

Aalto University was founded in 2010 as Helsinki University of Technology, the Helsinki School of Economics and the University of Art and Design Helsinki were merged. Nowadays the university consists of six schools, each with dean and an academic committee: School of Arts, Design and Architecture; Chemical Technology; Business; Electrical Engineering; Engineering and Science.

http://www.aalto.fi/en/

- **Norwegian University of Science and Technology**. Trondheim, Norway

Norwegian University of Science and Technology (NTNU) is Norway's largest and leading provider of engineers and graduate engineers, educating roughly 80% of all engineers in Norway. NTNU was formed in 1996 by the merger of the Norwegian Institute of Technology (NTH), the Norwegian College of General Sciences (AVH), the Museum of Natural History and Archaeology (VM), the Faculty of Medicine (DMF), the Trondheim Academy of Fine Art and the Trondheim Conservatory of Music (MiT). Again in 2016, The Norwegian University of Science and Technology – NTNU merged with the University Colleges in Gjøvik, Sør-Trøndelag and Ålesund to form a single university. The merger gives

the university more comprehensive course offerings and larger research groups. NTNU is now Norway's largest university and also has the broadest study offerings of any Norwegian university in the different technological and artistic and aesthetic disciplines.

https://www.ntnu.edu/

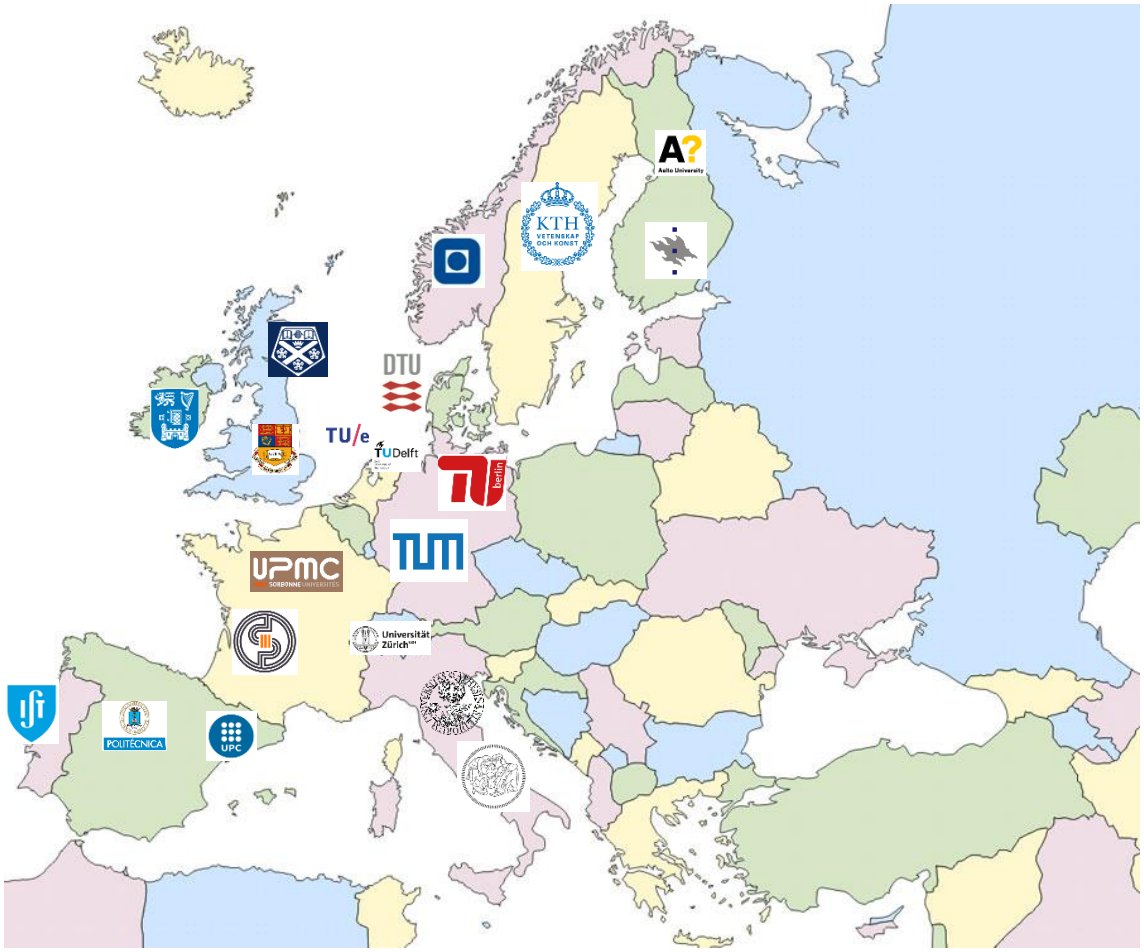


Figure 1. Geographical distribution of the universities selected

2.2- Phase II: the identification of ten best cases

The twenty European universities selected in the previous phase, allow identifying several best practices managed by the university or in which universities have an active role but are coordinated by another triple helix stakeholder (commonly national or regional governments).

As commented earlier in this document for the purpose of this work a "best practice" should be understood as an innovative way to approach the issue, which should be reviewed critically for potential users and adapted to each innovation ecosystem.

Once the best practice was identified, the case was written using the ELAN best practice template. Information was gathered from institutional websites and institutional presentation. An email was sent to each unit in charge of the initiative, inviting to check the document, validate the information or add, modify or delete any detail if they were not accurate or not possible to deliver externally due to internal regulations (an example of the email sent is available in Annex I).

Eleven cases were written and sent to their responsible research and innovation actor. Eight of them agreed to validate the information, one neglect the opportunity due to time constraints and two of them never reply. Finally, ten cases are presented in this document.

3. THEORETICAL FRAMEWORK

Open innovation is the paradigm that assumes that firms can and should use external as well as internal ideas in order to create value (Chesbrough, 2006). Moreover, open innovation assumes that useful knowledge is widely distributed, and that even the most capable R&D organisation must identify, connect to, and leverage external knowledge sources as a core process in innovation. Thus, combining external search with internal R&D capabilities provides firms with a larger spectrum of technological options (Perkmann and West, 2014).

In this new scenario, an entrepreneurial university (and a public research organisation) as an important source of new knowledge, become a key element of the innovation system both as human capital provider and seed-bed of new firms (Etzkowitz et al., 2000). Indeed, governments see universities as economic actors with capacity to transform the local and national economy. On the other hand, public universities across the world are becoming conscious that the effort made by governments and other public or private institutions to support university research needs to be complemented by a sound institutional strategy to transfer potentially useful results to global markets. Universities have also the strong convincement of the benefits derived from this effort in order to increase the revenues obtained from knowledge and technology transfer as an additional source of funding for public universities and for the positive effect in improving their relationships with other industrial partners for future contract or collaborative research.

The fact is that beside teaching, and through their R&D activity higher education institutions are able to offer new technical and methodical knowledge which is mainly needed in innovation activities oriented towards developing new technologies, new materials, new devices and for products very new to the market (Polt et al, 2001). Moreover, universities are offering external courses to the local companies, collaborating in R&D projects, fostering the creation of new companies in the region or offering its equipment to the companies for testing and calibration. Having a variety of activities is important because universities can contribute to local innovation processes in a variety of ways (Lester, 2005).

Unfortunately, many of the potentially useful research results obtained by universities or research centers from the execution of applied research activities (activities which are conceptually closer to innovation and market needs than fundamental research) have not

fructified in the development of new products or services neither they were introduced into the market in spite of their potentiality.

From this perspective, the R&D public effort has been lost as a driver to boost innovation; consequently, public administrations are struggling to reverse the situation with the launching of specific programs and policy tools. In addition to services offered at the university level, the creation of new boundary physical facilities (sometimes in partnership with other organisations) such as business incubators, living labs, science parks or proof of concept centers are helping public universities to perform better as "entrepreneurial universities".

While licencing traditionally has been the most popular mechanism to commercialize the university intellectual property (Siegel et al, 2003), the creation of new companies is gaining interest among universities (Siegel et al, 2007). Licensing agreement and university spin off can result in additional revenues to the universities, but many studies and best practices on technology commercialization indicate that this new role is not performed equally at all universities, nor it is equally rewarding everywhere (Owen-Smith and Powell, 2001; Rasmussen et al, 2006; Breznitz & Ram, 2013). Indeed, commercialization of university research (whether judged by numbers of patents, licensing of revenue, or new companies formed) remains differentially successful and largely concentrated in just a handful of universities (Litan et al, 2007).

The commercialization of university research

Even the process of university technology commercialization is made up of three main phases (Scientific discovery & Invention disclosure; Evaluation & Maturation; Commercialization & Market introduction) there is a previous step that it is very important to take into account: the establishment of "good" (stable and intense) relationship with industry and government.

Previous Phase

Universities work increasingly with companies, and the relationship between may range from an occasional contact to an in-depth long-term relationship. In the first case, the interaction commonly may be define as a transaction that involved running an individual R&D project, solving a specific technical problem, or calibrating an equipment for example. In the latter, this relationship may be part of the firm's R&D strategy. Thus, it is important to cultivate and develop a close relationship among researchers and industry and between the university and the national or regional government.

Phase I – Scientific discovery & Invention disclosure

Due to universities research activity, alone or more commonly in national or international partnerships (with companies, hospitals, other universities, etc.) R&D results are reached. The results are commonly published in the open literature and available to the whole society. However, conducting open science is not necessarily in conflict with commercial exploitation, and research results that have been published in the open literature may be in parallel protected and commercialized. At this stage, researchers communicate to the unit assigned by the university's rector, the scientific discovery through a document named (commonly) "invention disclosure".

Phase II - Evaluation; Maturation

Commercially viable intellectual property generated by university research is usually either an invention that can be protected by patenting or a computer programme that can be protected under the Copyright. Industrial secret is another option. At this phase, the university must decide the more convenient protection strategy to follow and evaluate among other issues commercial applications and potential customers.

Moreover, a maturation phase could be needed due to the development stage in which results normally are. Specifically, R&D results are characterized by high uncertainty due to the fact that at such an early stage of development no one knows if the invention will eventually result in a commercially successful innovation or not. During this earliest stage, it must be a verification of the commercial concept through laboratory work and an identification of what looks like an appropriate market, and perhaps the creation of protectable intellectual property (Auerswald & Branscomb, 2003). Moreover, before and after this critical phase there is available funding (before from governments that fund national and regional R&D programs and after from private investors interested in promising technologies) but in-between, resources are scarce.

Phase III - Commercialization and market introduction

Marketing R&D results is a critical activity because commonly universities produce technologies in a broad spectrum of sectors and therefore to be able to identify the right market for every technology is a complex task. Moreover, the market for university-based technologies, which normally are at non-commercial stage of development, is different to mass consumer products.

After marketing the R&D result, when a suitable partner is found, the university negotiates a licensing agreement with firms or spin off companies. A license agreement is the establishment of a legal contract between the university and the licensee (a firm or a spin company), from which the university will grant the latter the right to produce and sell goods

or use patented technology in exchange of an economic compensation. When an agreement is reached, the technology is officially licensed (Bradley et al., 2013) and commercialized.

The commercialization takes place between the university and an established firm or the university and a recently created spin off company. In addition, the technology can be used in one of the several business lines or be the cornerstone of its product strategy which more common in the case of a spin off company.

4. EUROPEAN UNIVERSITIES MATRIX

Imperial College London

www.imperial.ac.uk

London, United Kingdom

- Founded in 1907
- The Times Higher Education World University Ranking 2015-16: 3rd in Europe and 8th in the world
- Subject rankings: Clinical, pre-clinical and health, 4th in Europe (5th joint); Engineering and technology, 4th in Europe (9th); Life Sciences, 3rd in Europe (6th): Physical Sciences, 5th in Europe (16th);
- QS World university rankings 2015–16: 8th in the world; Academic ranking of top 500 world Universities 2015: 23rd in the world

Basic Data

- Total full-time students 15,290 (Home/EU: 9,989; Overseas: 5,301); Of them research postgraduate 2,973 (Home/EU: 2,079; Overseas: 894) (2014–15 full-time student)
- 8,000 staff of them 3,782 full time academic and research staff (2015)
- The College focuses on the four main disciplines of science, engineering, medicine and business and is renowned for its application of these skills to industry and enterprise.

Technology Transfer Support Structures

Internal units:
- ThinkSpace (Tecnology Park + Incubator) located in the White City Campus
- Imperial College Create Lab: Foster and encourage entrepreneurship among students.

External unit:
- Imperial Innovations Ltd. (licensing IP and the formation of a spin-out company). Private company founded in 1986 as the technology transfer office for Imperial College. Adittionally made investment in early technology businesses based on IP from University of Cambridge, Oxford and College.

Internationalization

- Imperial is an International community, attracting undergraduates from more than 125 countries.
- One fifth of the students (over 3,000) come from EU and EEA countries. Many departments further offer the option to spend a year abroad at a European partner institution.
- One quarter of the staff (almost 2,000) come from EU and EEA countries
- More than half of Imperial College London's international research collaborations are with European partners. 12% of the College's research funding comes from the European Commission, mainly via Horizon 2020.

Partnership

- The College's model for private sector partnerships has traditionally been academic-led.
- Seed funds initiatives for funding early-stage collaboration with MIT (USA) and FAPESP, the Research Foundation in the State of São Paulo in Brazil.
- League of European Research Universities (LERU, association European universities promoting conditions and opportunities for basic research)

EIT KICs:
- Climate; ICT Labs; Raw Materials; Health

Main Indicators

- Invention disclosure 306 (2013)395)
- High flow of invention disclosure but one of the lowest rates of patent filings among UK universities (39%; US peers 49-54%)
- Total Patents filed between 2008 and 2013: 279

Best Practices pre-Identify

- Imperial Business Partners – exclusive forum which stimulates open dialogue between executive level representative from business and academia. Several key benefits offered to industry.

University of Helsinki

www.helsinki.fi

Helsinki, Finland

- Established in 1640 - The oldest and largest university in Finland
- In 2015, it placed 76th in the Times Higher Education World University Ranking, 96th in the QS World University Ranking and 67th in the Shanghai Ranking

Basic Data

- 34,833 students (all levels; in 2014); Doctoral degree: 4,682 students
- 8,000 staff. Of them, 55% represent teaching and research staff.
- Annual Budget: 715 million €
- 11 faculties
- 4 campuses: City Centre, Kumpula, Meilahti and Viikki. In addition, the University has research stations in Hyytiälä, Värriö, Kilpisjärvi and Kenya.

Technology Transfer Support Structures

Helsinki Innovation Services Ltd. University of Helsinki – owned
- Licensing and selling university IPR
- Conducting the related negotiations together with legal counsels from the University's Research Affairs. Once an agreement is reached, the Director of Development at Research Affairs signs licensing and sales agreements on behalf of the University of Helsinki

Helsinki Think Company (University of Helsinki + City of Helsinki). Co-working space open to non-University of Helsinki students.

Internationalization

- Institutional strategy is built on internationalisation. University of Helsinki encourages students and staff to be internationally mobile and appreciates international experience in recruitment.
- 2,000 international Master's and doctoral students.
- Approximately 800 students embark on a student exchange every year. Meanwhile, the University of Helsinki receives approximately 1,000 incoming exchange students every year.
- Of the University of Helsinki's teachers and researchers, 22% are from outside Finland.

Partnership

- The prevailing idea is to engage with the best possible partners regardless of their home country, to add as much value to international co-operation.
- The most fruitful partnerships are most often built on prior academic cooperation and collaboration, and it's also taken into account when selecting new partners.
- League of European Research Universities (LERU, association European universities promoting conditions and opportunities for basic research)

Main Indicators

- Spin off: 6 (2015)

Best Practices pre-Identify

- TEKES TUTL funding. Proof of concept fund managed by TEKES, Finland Innovation Agency

University of Trento

www.unitn.it

Trento, Italy

- Founded in 1962. In 1982, the University (until then private) became public, with a statute that guaranteed self-government
- A medium-sized university.
- The University of Trento ranks 1st in Italy for scientific production in the medium-sized Italian universities in the ANVUR Report 2013 (Italian National Agency for the Evaluation of the University and Research Systems

Basic Data

- 16.319 students (2014-2015)
- About 587 professors and researchers (31/12/2015).
- 657 technical and administrative staff (31/12/2015).
- 10 Departments, 60 research laboratories and 3 Centres (Centre for Integrative Biology; Centre for Mind/Brain Sciences; School of International Studies

Technology Transfer Support Structures

- Scientific Research and Technology Transfer Division: support to research, from the application for funding to the transfer of the results to the society, by means of patenting, spin-off foundations and contracts with enterprises

Internationalization

- Partner of the "Invest your talent in Italy" programme which offers the opportunity to students (among other from Colombia or Mexico) to attend selected Master's courses in English in prestigious Italian universities

Partnership

- EIT Row Materials (through Trento Rise)
- EIT Digital

Main Indicators

- 9 patents/patents applications (at March 2016)

Best Practices pre-Identify

- University of Trento make a distinction between a start up and a research start up. The university participates in the share capital (less than 10%)

Technische Universität Berlin

www.tu-berlin.de

Berlin, Germany

- Founded in 1946, but its history reaches back in 1770
- TU Berlin has one of the highest percentages of international students among German schools

Basic Data

- Students 32.508 (June 2016)
- Staff 8296; Teaching and research staff: 3388 (June 2016)
- State funding 302,6 Mio. € plus external research funding acquired by TU scientists amounted to 177,5 Mio. € (June 2016)
- 7 faculties; Several campus locations throughout the city

Technology Transfer Support Structures

- Department of Research: depending on the Department of Research. Units: Research Contracts, Patents, Corporate Investments Department and Center for Entrepreneurship
- IPAL GmbH (profit-oriented company of the Investment Bank Berlin and the universities of Berlin)

Internationalization

- International students from more than 130 countries make up about 20 percent of the student body. In addition, around 10% of all TU students study abroad each year.
- TU Berlin currently offers 26 dual-degree programs in conjunction with partner universities in England, France, Poland, China, Russia and Chile, in addition to 17 English-language Master's programs.
- TU professors alone were involved in 1500 cross-border cooperation projects between 2009 and 2011. In 2012, around 120 international science agreements were in force at the central university level

Partnership

- EIT Climate Change
- EIT Digital

Main Indicators

- Total Patents Filed between 2008 and 2013: 106

IPAL GmbH Data (November 2012)

- Portfolio : 286 technologies
- 1,594 invention disclosures; 543 priority patent applications
- 124 license and patent purchase agreements; contract volume > 16.5m EUR
- Total revenues EUR 3.4 million

Best Practices pre-Identify

IPAL GmbH:

- Evaluation, patenting and commercialization of university technologies
- Advice and support concerning industrial property rights for small and medium-sized companies
- Validation measures for the IBB Technology and Development Fund

Université Pierre et Marie Curie

www.upmc.fr

Paris, France

- UPMC is a leading French Scientific and Medical University
- With other institutions form the new Sorbonne University
- The top French University. The Shanghai 2014 University list ranks UPMC 6th in Europe and 35th in the world. 4th in the world for mathematics

Basic Data

- 31,000 students ; 3,000 doctoral candidates
- 9,600 in staff, of which 3,750 are professor-researchers
- 100 research laboratories; 8 main teaching hospitals; 8,500 publications per year (approx. 11% of the publication in France)
- 7 UFR (Research and Training Units) in Chemistry, Engineering, Mathematics, Medicine, Physics, Life Science, plus Earth and Environmental Sciences and Biodiversity. It also incorporates the Ecole polytechnique universitaire, the Paris Astrophysics Institute, the Henri Poincaré Institute and three marine stations at Roscoff, Banyuls-sur-Mer and Villefranche-sur-Me

Technology Transfer Support Structures

External Units:

- SATT LUTECH for maturing technology (Technology Transfer Office)
- Agoranov for startup incubation
- Quadrivium venture capital

Internationalization

- 20% of the students are international

Partnership

- EIT KIC: Climate, ICT Labs and Health
- League of European Research Universities, LERU
- European University Association, EUA

Main Indicators

Total Patents Filed between 2008 and 2013: 270

Innovation Facts and Figures (Data 2014):

- Approximately 20 patents each year; 514 patent families
- 50 software programs
- 1.07 million euros per year in licensing revenues
- 55 spinoff companies in the last 10 years (Data 2014)

Best Practices pre-Identify

Delft University of Technology

www.tudelft.nl

Delf, Netherland

- Delft University of Technology is the oldest and largest technical university in the Netherlands.
- It was founded in 1842 by King William II in order to train civil engineers.
- TU Delft (from the Dutch name Technische Universiteit Delft) received its current name in 1986.

TU Delft Delft University of Technology

Basic Data

- Student population 19613 (PhD Students 2575; Master degrees 2251)
- Professors (fte) 232; Publications (scientific) 5139; Promotions 371
- Scientific staff (fte) 2668; Scientific staff (head count) 2935
- Professional services (fte) 1898; Professional services (head count) 2168Equity 357,9 mln; First income stream 398,5 mln; Second income stream 47,7 mln; Third income stream 127,7 mln
- Bachelor programmes 16; Master programmes 31

Technology Transfer Support Structures

Internal:
- Valorisation Centre
- Delft Enterprises

External:
- YES!Delft (business incubator)
- Science Park Holland

Internationalization

- International students 3151 (2015)
- All our Master's programmes are taught in English, as well as the Bachelor's programmes Aerospace Engineering and Applied Earth Sciences.
- The number of available courses taught in English in the TU Bachelor programmes will continue to increase in the coming years. Currently, over 250 of available bachelor courses are taught in English.

Partnership

- Science Port Holland a regional collaborative partnership between the Cities of Rotterdam and Delft and Delft University of Technology
- YES!Delft is the high-tech entrepreneurs centre founded in 2005 by the TU Delft, TNO companies and the municipality of Delft

Main Indicators

- Total Patents Filed between 2008 and 2013: 123

Best Practices Identify

Universidad Politécnica de Madrid

www.upm.es

Madrid, Spain

- Founded in 1971
- The largest technical university in Spain and the leading Spanish university with regard to the participation in European R&D projects, patents filed and the creation of spin-off companies.

Basic Data

- Teaching and research staff 3.043; administration and service staff 2.023; contracted researchers 535
- Undergraduate 35.353 masters' degree 2.226 phd 3.407 permanent postgraduate training qualifications 2.484
- Total financing (€m) 293,7
- Schools and faculties 18 research and development centres 17 ; research groups 201

Technology Transfer Support Structures

Internal units, all depend on UPM's Rector

- CAIT - Centre of Support for Technology Innovation
- UPM Vice-Presidency for Research
- Scientific and Technology Park

Internationalization

- International relations agreements with universities 1.617
- National and international Erasmus mobility (received/sent) 1.786/1.829
- Spanish Chinese Exchange Program: foster scientific and technical communication with the P.R of China. The program contribute to stablish links vital to mutual future interests

Partnership

- EIT Row Materials
- Health
- EIT Digital

Main Indicators

- Patents (applied for/granted) 66/488 (2014)
- Spin offs and start ups (created /total) 19/164 (2014)

Since 2012:
•+ 100 UPM technologies available to be commercialized
•+ 150 UPM technologies identified and evaluated
•+ 50 commercial agreements closed with industry for more than 1,5 million €

Best Practices Identify

- Comercialization Trainning Program

ETH Zurich

www.ethz.ch

Zurich, Switzerland

- Founded in 1855
- 9th in THE ranking; 9th in QS ranking; 20th in ARWU ranking
- 21 Nobel Prize winners, including Albert Einstein and Wolfgang Pauli; 1 Fields Medal winner; 2 Pritzker Prize winners

Universität Zürich[UZH]

Basic Data

- Students: 19,233 from over 120 countries, of whom doctoral students: 4,026
- Professors (full-time equivalents): 503; Personnel (full-time equivalents): 9,026; of whom scientific staff: 5,829
- Financing (operating revenue) (CHF million): 1,712, of which federal contribution: 1,265; of which third-party funding: 376
- 16 departments
- ETH Zurich has campuses in Zurich, Basel and Lugano

Technology Transfer Support Structures

- Internal unit: ETH transfer, the technology transfer office of ETH Zurich
- ETH transfer supports the ETH community in all questions relating to cooperation with industry, inventions, patent applications and licensing, as well as setting up an ETH spin-off company

Internationalization

- Most Master's programmes and doctoral study are in English
- Mandated by the State Secretariat for Education, Research and Innovation, ETH is the Leading House for the bilateral research collaboration of Switzerland with China, Japan, and South Korea.
- The Singapore-ETH Centre for Global Environmental Sustainability (SEC) in Singapore was established in 2010 as a collaboration between ETH Zurich and the National Research Foundation of Singapore
- International Knowledge Base (IKB): website which contains information on ETH Zurich's international contacts, exchange programmes and collaboration links

Partnership

- In general research collaboration (internationals included) lies in the responsibility of the individual research units – departments, institutes and chairs
- IARU – International Alliance of Research Universities. Sustainable solutions on climate change as one of key initiatives
- IDEA League - an alliance of four leading European universities of technology and science
- The International Sustainable Campus Network
- The Global University Leaders Forum (GULF) is a community of presidents of leading universities, initiated by the World Economic Forum
- GobalTech is an alliance of ten of the world's leading technical universities
- UNITECH International is a network of leading European technical universities and multilateral companies

Main Indicators

- Total Patents Filed between 2008 and 2013: 274
- 90 patent applications; 200 invention reports every year
- 330 spin-offs since 1996

Best Practices pre-Identify

- Pioneer Fellowships: After completing their doctorate or Master degree, young graduates from ETH Zurich can apply for a grant for 12 to 18 months to carry out applied research and development work, the intention being that their research at ETH Zurich will result in a product or service

KTH Royal Institute of Technology

www.kth.se

Stockholm, Sweden

- Founded in 1827
- Times Higher Education (2015): Ranked as 155th best university; 74th best university in Europe; Engineering and technology universities in the world ranked as 19 th; Europe ranked as no. 10
- QS (2015): KTH's position in the total ranking : 92; Ranked as 44th best university in Europe ;The 16th best university specialising in engineering and technology in the world;

Basic Data

- 12,424 full time students; 1,902 active research students (at least 50 per cent activity) (2014)
- 5,157 employees, the equivalent of 3,672 full time positions (2014)
- 311 professors; 258 associate professors (2014)
- MSEK 4,637 in total turnover (of which MSEK 394 transfers)
- Five campus areas in the Stockholm region. The centralcampus is in the Stockholm city centre

Technology Transfer Support Structures

Internal units:

- KTH Innovation works to ensure that research results and business ideas from researchers and students at KTH are developed and encounter the market.

KTH Holding. KTH Holding is a public limited company managed by KTH University Board. It is used among other things as KTH tool for managing intellectual property through licensing / sale. Moreover, it invests in new companies from KTH research.

Internationalization

- When it comes to establish new collaborations within education and research, KTH focuses on four selected regions; Brazil, China, India, and Southeast Asia. These priorities primarily form a base for recruiting non-European master's students.
- Large number of Master's programmes in English
- KTH has approximately 250 exchange agreeements. During 2013, KTH had 1058 incoming and 618 outgoing exchange students
- KTH manages and participates in a large number of international projects. The majority are funded by EU cooperation programmes

Partnership

Strategic partnerships

- Aalto University
- University of Illinois at Urbana-Champaign

EIT KICs:

- InnoEnergy
- ICT Labs
- Raw Materials
- Health

Main Indicators

- 50 patent applications submitted & 40 patents granted (2014)
- 22 commercial agreements were signed with customers based on KTH research (2014)
- The commercialization project supported by KTH Innovation has altogether received approximately SEK 33 million in financing, including from the Vinnova-financed Verification for Growth programme handled by KTH Holding AB.
- 38 companies were formed during the year, 12 student companies; Four companies were included in the Sting business incubator and 11 in other Swedish, European and American incubators (2014)

Best Practices Identify

Trinity College Dublin

The University of Dublin

www.tcd.ie

Dublin, Ireland

- Founded in 1592. Ireland's oldest university
- Trinity College Dublin is recognised internationally as Ireland's leading university
- It ranked in 78th position in the top 100 world universities by the QS World University Rankings 2015. In the Times Higher Education World University Rankings for 2015, Trinity is ranked 160th in the top 200 world universities and 78th in Europe.

Basic Data

- 16,729 registered undergraduate and postgraduate students in 2013/14. A total of 12,355 (or 73.8%) students were registered on undergraduate programmes, 4,309 (25.8%) on postgraduate programmes and 65 (0.4%) on foundation courses
- Three faculties: Arts, Humanities and Social Sciences; Engineering, Mathematics and Science; and Health Sciences.
- The city center campus occupies some 51 acres

Technology Transfer Support Structures

- Internal unit: Trinity Research & Innovation (TR&I)
- Launchbox is Trinity's student incubator

Internationalization

- Since 2008, Trinity scholars have co-authored papers with partners in more than 120 countries across Asia, North America, South America, Africa, Australia and Europe. According to Leiden Rankings, Trinity College Dublin ranks in the top 40 universities worldwide for international collaboration.
- Agreement with Beihang University, one of China's top universities, will enable both institutions to cooperate in teaching and research, and will facilitate exchanges for students and researchers.

Partnership

- Trinity engages with more than 400 industry partners and collaborators
- R&D Collaboration with Intel: develop a variety of technologies to help the elderly and infirm live independent lives
- Trinity College Institute of Neuroscience has partnered with 76 companies to tackle health issues, and has spun out three companies involved in drug discovery and development, and cancer treatment

Main Indicators

- Total Patents Filed between 2008 and 2013: 91
- 58 disclosures
- 23 new patent applications
- 30 commercialization licenses
- 4 Trinity Campus Companies (spin off)

Best Practices Identify

Politecnico de Milano

www.polimi.it

Milan, Italy

- Founded in 1863
- QS RANKINGS 2016 by SUBJECT: First in Italy in 9 research areas; In the top 10 European universities in 5 research areas. QS RANKINGS 2015: In the general ranking: 1st in Italy; 187th in the world; In the subject Engineering & Technology: 1st in Italy; 7th in Europe; 24th in the world

Basic Data

- 37,984 enrolled students (1.12.2015), of which: 6,957 architects; 3,542 designers; 27,485 engineers
- Teaching staff (31.12.2015) = 1,316; Technical administrative staff (31.12.2015) = 1,207
- 7 Campuses. Politecnico di Milano is made up of seven campuses distributed in the cities of Milano (Leonardo and Bovisa campuses), Como, Lecco, Cremona, Mantova and Piacenza
- 12 Departments; 4 Schools

Technology Transfer Support Structures

Internal unit:
- The TTO is the University service supporting the technology transfer activity (form invention assessment to commercial explotation).

External unit:
- PoliHub is the Startup District & Incubator of Politecnico di Milano

Internationalization

- More than 500 active international agreements with non-EU Institutions. The most frequent types are: Framework Agreements that involve the whole Institution at large; Exchange Agreements allowing students to spend a period of time abroad at a partner university and Double Degree Agreements.
- Since 1998 TIME: programme devoted to engineering students who, after attending classes for two years in a foreign university, can achieve a double degree.
- Programmes taught in English (a.y. 2015/2016): 32 Master of Science programmes; 1 Bachelor of Science programme; 18 PhD programmes

Partnership

Strong regional connetion:
- PoliHub is the business incubator of the Politecnico di Milano managed by Fondazione Politecnico di Milano and supported by the Milan Municipality
- Fondazione Politecnico. Founded by Politecnico in partnership with the local organizations and companies. It promotes applied research, technological transfer.
- CEFRIEL. It conducts research activities of advanced training and consultancy in the framework of ICT technologies. CEFRIEL shareholders include several Italian universities, Public Authority (Lombardy Region) and leading multinational companies.

Main Indicators

- Total Patents Filed between 2008 and 2013: 120
- 463 inventions
- 1109 patents
- 28 Spin-offs since 2000 (27 still active) - consolidated turnover 2013: 13.5 millions Euro

Best Practices Identify

Eindhoven University of Technology

www.tue.nl

Eindhoven, Netherland

- Founded in 1956
- 144th place in 2015/2016 Times Higher Education World University Rankings. TU/e is ranked 49th for engineering in the ARWU ranking of the best universities worldwide 2015

TU/e

Basic Data

- 4,973 BSc students (4% international); 3,238 MSc students (16% international); 290 technological designers (PDEng); 1,210 doctoral candidates (PhD)
- 3,055 employees (33% international); 2,044 academic staff
- 9 departments

Technology Transfer Support Structures

Internal units:
- Innovation Lab (from IP advice to spin off creation)
- Support in intellectual property, technology transfer and business incubation

External units:
- Twinning & Catalyst business centres for new companies located in TU/e Science Park
- TU/e Science Park: home of companies and research units

Internationalization

- Partnerships with universities in countries such as Australia, India, Brazil or China

Partnership

- Part of the network of scientific excellence 'EuroTech Universities - Excellence in Science and Technology with headquarter in Brussels.

Strategic partnership with universities in Netherlands:
- University of Utrecht and the UMC Utrecht: cooperation lies in renewable energy, medical imaging, stem cells and regenerative medicine. The partners invest jointly in research, realize the appointment of part-time professors, and offer all their students access to their range of educational programs.
- University of Maastricht: the Biomedical Engineering Department's programs are jointly run with the University of Maastricht and the university hospital Maastricht. The engineering subjects are taught by TU/e staff while the biological and medical knowledge comes from Maastricht

Main Indicators

- Receives over 40 invention disclosures
- Negotiates approximately 20 new option and license agreements
- Total Patents Filed between 2008 and 2013: 53
- In the past years: 60 TU/e patents; 500 patents with third parties; • 60 licenses
- In the past years: 120 spin-off companies; 40 start-ups

Best Practices Identify

Instituto Superior Tecnico Lisboa

www.tecnico.ulisboa.pt

Lisboa, Portugal

- Founded in 1911
- Since 2013 part of the ULisboa (Universidade Técnica de Lisboa + Universidade de Lisboa)
- IST was pioneer in Portugal in the protection of intellectual property

Basic Data

- Approximately 11.458 students enrolled
- 853 faculty and researchers
- 3 campuses. Taguspark campus in at the Science and Technology Park
- Annual Budget 2014: 316 MC (ULisboa)

Technology Transfer Support Structures

IST's Technology Transfer Office
- Support in intellectual property, technology transfer and business incubation

Internationalization

- IST participates actively in several international networks and programs aimed at mobility, degree programs or graduate school, internships or research projects
- Magalhaes network: group of Universities of Science and Technology European, Latin America and the Caribbean in the area of Science, Engineering and Architecture

Partnership

- KIC Inno Energy
- EIT Health

Main Indicators

- The IST SPIN-OFF community consists of 49 companies
- Currently is the Portuguese institution with the largest number of patents registered

Best Practices Identify

Technical University of Munich

www.tum.de

Munich, Germany

- Founded in 1868
- TUM is one of the five most innovative universities in Europe, according to the new ranking "Reuters Top 100." 53th in THE 2015/2016
- 13 Nobel prizes have been awarded to TUM professors and alumni since 1927

Basic Data

- 39,081 Students; 22% international (1,117 from China)
- 6142 research and teaching staff; other staff: 3207
- 528 Professors research and teach at TUM
- 13 departments; 3 Integrative Research Centers; 6 Corporate Research Centers
- Budget: EUR 1,258 million were available to TUM in accounting year 2014 (including the university hospital).

Technology Transfer Support Structures

- TUM ForTe: IPR management
- UnternehmerTUM: Entrepreneurship
- Bayerische Patentallianz GmbH: On behalf of its partner universities the company negotiates all option, licensing and transfer contracts with the companies

Internationalization

- TUM has offices and re-search centers on several con-tinents: Africa, Asia, north and south America and Europe
- The first campus of a German university abroad was founded in 2002 in Singapore: The German Insti-tute of Science and Tech-nology (GIST) - TUM Asia Pte. Ltd. - a wholly-owned subsi--diary of TUM
- Together with Tongji Uni-versity, TUM offers a double degree in elec-trical engin-eering and infor-mation tech-nology. In 2009, TUM and Peking University agreed to commit to the exchange of students, researchers and administrative staff
- TUM has begun to oper-ate the Liaison Office in Sao Paulo since 2012

Partnership

- TUM maintains close links with industry, signing around 1,000 cooperation agreements every year.
- It has also forged strong alliances with external research institutes, in particular Max Planck Institutes, the Helmholtz Zentrum München and the Fraunhofer Society.
- TUM has cultivated long-standing partnerships with global giants like Siemens, General Electric, BMW and Audi.
- EuroTech Uni-ver-sities Alliance: TUM is a found-ing member of the EuroTech Uni-ver-sities Alliance based in Brussels
- Member of the Global Alliance of Technological Universities

Main Indicators

- 13 Nobel prizes have been awarded to TUM professors and alumni since 1927
- Total Patents Filed between 2008 and 2013: 153
- 165 inventions were made by scientists from TUM in 2014 as a result of their research work.
- 69 patents for inventions from TUM researchers were submitted to Patent Offices 2015

Best Practices Identify

- The Bayerische Patentallianz GmbH was founded on January 1, 2007, by The University of Bavaria e.V. and The Bavarian Universities of Applied Sciences e.V. and continues the work of the BayernPatent project in the form of a company owned by the universities.

Université Paul Sabatier - UPS

www.univ-tlse3.fr

Touluse, France

- Founded in 1969
- The primary descendant of the Université de Toulouse, itself founded in the 13th Century, making Toulouse one of the oldest university towns in Europe, alongside Bologna, Oxford, Paris and Salamanca

Basic Data

- 32 000 registered students
- 2,609 teachers and teacher-researchers
- 1,980 administrative and technical staff
- 247-hectare campus; 407,200 m2 of premises, with 127,600 m2 dedicated to research
- 65 research laboratories

Technology Transfer Support Structures

- Regional unit: Toulouse Tech Transfer assumed all the activities related to technology transfer (proof of concept included).
- It is a technology transfer company founded in 2012 with € 70 million by the France government through the National Research Agency under the "Programme of Investments for the Future. Stakeholders: Université Fédérale Toulouse Midi- Pyrénées 42%, CNRS 25% et CDC 33%.
- TTT has access to 4500 researchers in 115 laboratories in the region.

Internationalization

- Several geographical axes are considered priority such as Axis Mediterranean Basin or Axe Africa / Madagascar

Partnership

- There is a Vice-president for Partnership directly attached to the office of the President

Main Indicators

Data from Toulouse Tech Transfer In 2015

- 108 invention identify
- 29 patents filed
- 52 maduration projects funded with a commitment of more than € 6 million
- 21 license agreements

Best Practices Identify

University of Strathclyde

www.strath.ac.uk

Strathclyde, United Kingdom

- Founded in 1796
- 7th in the UK for spin-out company creation. The research is in the top 20 in the UK
- The Engineering faculty is largest and best rated in Scotland in terms of research power and is rated in the top five in the UK for some of its disciplines.

Basic Data

- Nearly 16,000 students (over 15,000 undergraduates, of which almost 10% are overseas students from more than 100 countries around the world)
- More than 3,000 staff

Technology Transfer Support Structures

- Internal unit: Research & Knowledge Exchange Services (RKES). It provides a range of professional services to: optimise the commercial potential of the University's intellectual property; support funding applications; manage contractual agreements; and develop engagement with businesses, organisations and strategic partners.

Internationalization

- A growing portfolio of international research contracts
- Every Faculty at Strathclyde has international representation in its staff
- More than 200 collaborative agreements with institutions in over 50 countries – and an estimated 2000 informal links around the world

Partnership

- New Technology & Innovation Centre designed to increase partnership working. The centre has collaboration with companies like GlaxoSmithKline, AstraZeneca, SSE, ScottishPower and the Weir Group

Main Indicators

- Current IPR portfolio includes around 100 licensing opportunities.
- One of the UK's top 10 institutions for licence royalty income.
- A cumulative royalty income of £42 million
- UK Top 5 for spin-out and start-up
- Over 50 spin-out companies, making annual sales of £80 million and employing more than 700 people, mostly in West of Scotland.

Best Practices Identify

- Enterprise Campus is a joint initiative between the Universities of Aberdeen, Edinburgh and Strathclyde to support postgraduates (researchers and masters students) from any Scottish University who want to set up their own business. The initial focus is on encouraging new high-growth business start-ups.

Universidad Politécnica de Cataluña

www.upc.edu

Barcelona, Spain

- Founded in 1971
- Shanghai Ranking (2015): One of the 500 best universities in the world; QS Top 50 under 50 (2015): One of the 50 best universities in the world; QS World University Rankings by Faculty (2015): The leading Spanish university and one of the world's top 100 universities in Engineering and Technology

Basic Data

- Students: 27,324 bachelor's, first- and second-cycle students 3,063 master's degree students; 2,378 doctoral degree students
- 2,968 teaching and research staff members; 1,865 administrative and service staff members
- UPC Budget for 2015 €310,5000,000
- 1,051 new agreements and research projects; 2,436 companies and other entities that have signed collaboration agreements with the UPC

Technology Transfer Support Structures

- Internal units: CTT - Centre for Technology Transfer: R&D management; SGI - Service Innovation Management: IPR management and spin off creation
- External units: CIT - UPC Technology Center: foster relationship with companies; PC Park - Research Park and Innovation: space and value add services to new and established companies

Internationalization

- The UPC offers courses taught in English, joint degrees with international universities and student mobility programmes: 57 international double-degree agreements with 62 universities; 2.670 students on international mobility programmes; 323 educational cooperation agreements with international institution
- 11 international networks with the UPC as a member; 4 UNESCO chairs
- SINO CAMPUS. University campus set up in conjunction with the Technical University of Madrid at Tongji University (China).

Partnership

- KIC InnoEnergy
- UP4: Alliance of the four technical universities in Spain: the Technical University of Madrid, the Technical University of Cartagena, the Universitat Politècnica de València and the UPC.

Main Indicators

2015

- 65 patents filed
- 15 license agreements ; Royalties income: 200k€
- 11 start up created and 6 spin off (Innova programm)
- 4 partially owned technology-based companies; 24 in total
- Disinvestment operations in 3 partially owned technology-based companies

Best Practices Identify

- Participation in the Catalan Industrial Doctorates Plan. An industrial doctorate project is a strategic research project carried out by a company in partnership with a university or research centre and which will form the basis for a doctoral thesis, enabling doctoral students to begin their research training and career in a dual business and academic environment

Technical University of Denmark

www.dtu.dk

Copenhage, Denmark

- Founded in 1829
- QS World University Ranking Engineering and Technology 10th in Europe and 46th in the world. THE World University Rankings Engineering and Technology 9th in Europe and 31st in the world

DTU

Basic Data

- 7041 students; 3,270 master students; 1,493 PhD students
- 5,813 total staff employed by DTU. 34 % have an international background. 90 nationalities are represented at DTU
- 2,080 researchers and educators. 36 % have an international background.
- 2,532 in support functions. 16 % have an international background.
- DTU has research and test facilities throughout the country, and three campuses. All three campuses are located near Copenhagen, one of Europe's most popular and progressive capitals

Technology Transfer Support Structures

- Internal unit: Office for Innovation and Sector Services (IPR, commercialization and entrepreneurship)
- DTU Skylab is an innovation lab where students can put their entre-preneurial skills to the test.
- 2 affiliated companies: Business incubator + Research Park

Internationalization

- 200 exchange partners; 28 MSc programmes in English, several of which include joint international programmes offered in collabo-ration with chosen alliance partners
- Students for more than 100 countries. 860 international exchange students came to DTU in 2014, and 554 Danish exchange students went abroad half of the PhD students are recruited from abroad
- More than 60 per cent of publications by DTU researchers are co-published with researchers from international universities. More than one third of the scientific staff are highly qualified researchers of international backgrounds.

Partnership

- Nordic Five Tech (N5T). Strategic alliance of five leading technical universities in the Nordic countries
- The EuroTech Universities Alliance
- Strategic partnership with the leading technical university in Korea, KAIST (Korea Advanced Institute of Science and Tech-nology.
- Sino-Danish Center (SDC)
- Climate-KIC

Main Indicators

- 82 registered patents
- 152 registered inventions (every year more than 150 inventions are reported by DTU staff and students)
- 51 new start-up companies
- 79 new companies established in the 2012-14 period.

Best Practices Identify

- Living Lab at campus

DTU Smart Avenue. 106 new LED lamp posts have been installed on Lyngby Campus. The lamp posts boast sensors, Wi-Fi, and computer devices that facilitate installing and connecting power and data. The purpose is to convert the central avenue on Lyngby Campus into a '**living lab**', where research-ers and students can test and demon-strate 'Smart City' technologies at an early conceptual stage

Aalto University

www.aalto.fi

Helsinki, Finland

- Founded in 2010 (as Helsinki University of Technology, the Helsinki School of Economics and the University of Art and Design Helsinki were merged)
- QS - Engineering & Technology: 1st in Finland, 42nd in Europe

Aalto University

Basic Data

- Nearly 20 000 students
- Staff overall 31.12.2015: 4 424; Number of professors: 409
- 4 campuses (the main campus is located in Otaniemi in Espoo, Finland. The other campuses are in Töölö and Arabia in Helsinki; six schools

Technology Transfer Support Structures

Internal unit:

- Aalto University Innovation Services. It is a part of the bigger Research and Innovation Services (RIS) entity, which vice-principal Tuija Pulkkinen is leading. Innovation Services is located in campuses in Espoo and Helsinki. It evaluates, develops and transfers the research project results and inventions to commercial use in close co-operation with researchers
- Aalto Center for Entrepreneurship (ACE) which depend on Innovation Services, connects Aalto University entrepreneurship activities with the surrounding ecosystem of incubators, accelerators, and investors

Internationalization

- The proportion of international teaching and research staff now stands at 33%
- Agreements with Tongji University in China and Stanford for students and staff exchange and research.

Partnership

- EIT Digital
- TAF Technology Academy, which awards the Millennium Technology Prize
- At regional level, there are key partnerships with the City of Espoo, City of Helsinki and VTT. Cooperation takes place within the framework of various cooperation programs.
- Aalto University partner with Startup Sauna Foundation (Co-working space)

Main Indicators

- About 30 patent applications every year
- No data about spin off are published but every school website publish a list of spin off created based on its research activity

Best Practices Identify

Norwegian University of Science and Technology

www.ntnu.edu

Trondheim, Norway

- Founded in 1996 due to a merge among different institutions
- Norway's largest participant in the EU's Horizon 2020 (H2020)
- NTNU professors May-Britt Moser and Edvard Moser were awarded the 2014 Nobel Prize in Physiology or Medicine for their discovery of cells that constitute an "inner GPS" in the brain

Basic Data

- 39 000 students, of which half study technology and the natural sciences (33000 students in Trondheim, 3500 students in Gjøvik and 2500 students in Ålesund).
- 6553 graduated with a completed degree in 2014; 6000 participants in continuing education courses in 2014; 3000 international students; 340 doctoral degrees awarded in 2015.
- 14 faculties and 70 departments and divisions; Approximately 120 laboratories. Premises: 734 000 square meters either owned or rented.
- Annual budget: NOK 7.6 billion.
- FTE: 6700, of which 4053 are in teaching, research and outreach positions. Staff 6 733

Technology Transfer Support Structures

- NTNU Technology Transfer AS is the commercialization arm of the Norwegian University of Science and Technology (NTNU). The company was established in 2004 and is 100 % owned by NTNU

Internationalization

- Priorities: Europe and China. International mobility and international researcher education.
- Approximately 350 international MoUs for cooperative research and teaching efforts.
- 11 % of NTNU's students are international students.
- 41 % of NTNU's graduated PhDs are international students (2012)
- Students and employees from more than 90 countries.

Partnership

Close cooperation with:

- SINTEF: one of Europe's largest independent research institutes. Together, NTNU and SINTEF are responsible for six national research centres for eco-friendly energy.
- St. Olavs Hospital
- NTNU Social Research AS

Main Indicators

- NTNU technology transfer 2003-2013
  - Ideas: 1045
  - Patents: 401
  - Deals: 124
- Since 2004, more than 70 new companies established

Best Practices Identify

- NTNU Discovery: it funds development, verification and quality control activities related to potentially commercializable research results. It serves to close the funding gap between NTNU's innovative communities on the one hand and other public programmes and funding schemes on the other (FORNY, Innovation Norway, seed investors, etc.)

5. TEN BEST PRACTICES

5.1. - BayPAT - the technology patent portfolio of Bavarian universities and universities of applied science

Title of the Good Practice	BayPAT - the technology patent portfolio of Bavarian universities and universities of applied science
Responsible Research and Innovation Actor	Bayerische Patentallianz GmbH (onward BayPAT); Its shareholders are: • The University of Bavaria e.V.: the Foundation of the Universities of Bavaria, founded in 2003 by rectors and presidents of the Bavarian universities: 11 universities represented. It has its own office and a sustainable structure. • The Bavarian Universities of Applied Sciences e.V.: the non-profit Association of the Bavarian Universities of Applied Sciences: 20 UAS 17 public an 3 ecclesiastical Universities of Applied Sciences.
Precise theme/issue tackled by the practice	University patent evaluation and commercialization
Timescale	Since January 2007

Objectives and expected results of the practice	The aim is to bridge the gap between science and industry, bringing the results of academic research into industrial applications more quickly and accurately. Objectives: • Providing safe and affordable processes for universities in the field of IP • Completion of the highest possible number of exploitation contracts • Evaluation, patenting and commercialization of university technologies • Advice and support concerning industrial property rights for small and medium-sized companies Expected Results: Be able to build an interested technology portfolio that allow to: • Improve the number of license and patent purchase agreements • Increase total revenues
Location	- Germany - Bavaria Region
Detailed description	The Bayerische Patentallianz GmbH (onward BayPAT) was founded on January 1, 2007, by The University of Bavaria e.V. and The Bavarian Universities of Applied Sciences e.V. and continues the work of the BayernPatent project in the form of a ***company owned*** by the universities. The goal is to make the proprietary inventions of the Bavarian universities and universities of applied sciences commercially exploitable for industry. Nowadays, BayPAT is the ***central access to a technology pool of 28 Bavarian universities and universities of applied science***, offering to the industry innovative technologies of more than 18,000 scientists mainly in the fields of Life and Physical Sciences. In fact, the patent portfolio is one of the most interesting ones in Germany. BayPAT Methodology:

	• Together with the technology transfer patent consultants at Bavarian universities, the company assists the scientists in identifying and evaluating inventions which are of interest commercially as well as in the financing, application and maintenance of patents. • On behalf of partner universities, the company negotiates all option, licensing and transfer contracts with the companies. BayPAT coordinates and controls the complete marketing process and also close the agreements with the companies. Services offered to universities: • Evaluation of inventions with the aid of comprehensive market and technology research • Proprietary protection of inventions, including patenting • Marketing of inventions • Achieving financial benefits for universities and inventors • Monitoring. BayPAT particularly take care of two aspects: The timely payment of all monies due and the compliance with all contractual obligations. Since January 2013 BayPAT also offers support and consulting services to ***small and medium businesses*** regarding proprietary protection and marketing of inventions as one of the WIPANO-Partner for Bavaria. [*WIPANO - Knowledge and technology transfer via patents and standards - is a funding program by the Federal Ministry for Economic Affairs and Energy]* Results In 2015 BayPAT has: • evaluated 292 invention disclosures • initiated and managed 75 patent applications • marketed 16 inventions to industry • gained 1,96 Mio. EURO net for partner universities

	In the period 2007-2015 BayPAT has: • evaluated 2.500 invention diclosures in the fields of life sciences and physical sciences • generated 1.800 active customer contacts • initiated and managed 600 patent applications • closed more than 220 agreements with industry • generated a revenue of about 7 Mio Euros with these agreements Considering the university-industry-government relationship, the company helps to bridge the gap between universities and companies supporting the commercialization of university technologies. BayPAT is owned by University of Bavaria eV and the Bavarian Universities of Applied Sciences. BayPAT helps universities putting knowledge to use, creating new opportunities for business and new jobs. At a regional level, BayPAT may help SMEs to be more innovative, incorporating university technologies in new materials, new devices and new products. The overall objective is to transform the local and national economy. BayPAT offers a broad and interesting technology portfolio for companies (SMEs and lager firms). Companies interested in incorporating new technologies, have access to an extensive portfolio in a single door (it is not necessary to visit 28 universities websites); therefore the probability to find the technology needed is higher.
Why it is considered as a Good Practice?	A technology transfer office is an intermediary unit between university researchers and industry which role is to facilitate commercial knowledge transfers through the licensing of inventions or other forms of intellectual property resulting from university research. Sharing support offices, such as technology transfer office, and infrastructures at regional level or by sector is an optimal approach for delivering services expensive or high specialized. As Baldini (2010) commented, patenting activity in European universities may not be large enough to justify the investment in a Technology Transfer Office. The same may apply for universities located in Latin American or other countries. This approach will suit well especially for universities and research centres with not too much patent production and therefore, without the opportunity to develop the experience needed for delivering high-specialized services. Moreover, the low patent activity may not justify the inversion needed for delivering them. However, the services provided do also

	suit well for bigger universities, because a highly specialized organisation may work more efficient and accumulated more experience than a single university. Thus, pooled services may be the right solution for universities and research institutes located in the same region.
Could it be transferred?	This best practice is desirable for universities with low and high levels of patent activity. For universities and R&D centres with a low number of patents, it would be difficult to develop the expertise needed for evaluating technologies, patenting and commercializing them. Reaching an agreement with universities in the region for starting up a company in charge of these activities will allow developing the knowledge and expertise needed for offering these services with high quality. Moreover, the possibility of building a technology portfolio wide enough will attract more interest from the industry sector, growing the probability to find the right customer for each technology.
Contact information	• Bayerische Patentallianz GmbH Destouchesstraße 68 DE - 80796 Munich • T: +49 89 54 80 177 0; kontakt@baypat.de
Other background information of interest	• http://www.baypat.de/ • The University of Bavaria e.V: http://www.unibayern.de/ • The Bavarian Universities of Applied Sciences e.V: http://www.uas.bayern/

5.2. - Catalan Industrial Doctorates Plan

Title of the Good Practice	Catalan Industrial Doctorates Plan
Responsible Research and Innovation Actor	Generalitat de Catalunya (Secretariat for Universities and Research)

Precise theme/issue tackled by the practice	- Phd Trainning (+some specific training in cross-disciplinary business-related skills) - Knowledge and Technology Transfer through collaborative research projects
Timescale	Since 2012 with a pilot experience. 2013 was the first call
Objectives and expected results of the practice	The Industrial Doctorates Plan is an initiative of the Government of Catalonia in partnership with the Catalan university and research system. Its aims are: 1. To boost the competitiveness and internationalisation of Catalan industry; 2. To retain home-grown talent and attract international talent; 3. To give doctoral students and future doctorate holders the opportunity to work on R&D&I projects with companies. Annual objectives: to initiate 75-100 new industrial doctorate projects (collaborate research projects between industries and academia –universities and research centres-) Current outcomes (2012-2015) More than 240 projects, 176 different companies, 34 million euros invested in R&D projects (2/3 from private sources), participation of 10 Catalan universities (public and private) and 16 research centres, 2 large research infrastructures (CELLS, BSC).
Location	- Spain - Catalunya
Detailed description	An industrial doctorate project is a strategic research project carried out by a company in partnership with a university or research centre and which will form the basis for a doctoral thesis, enabling doctoral students to begin their research training and career in a dual business and academic environment. Industrial doctorate projects are open to researchers in all fields, to companies of all sizes, from start-ups to large industries, and to future doctoral students of any nationality. To encourage the development of such projects, the Government of Catalonia, via the Agency for Management of University and Research Grants (AGAUR), provides funding to the research project (at least 50% of the total cost). The eligible cost are: company supervision and management, funding to the research group, tuition fees at public prices, mobility fund to the doctoral students and a 30 hours-course in cross-disciplinary business-related skills.

	The participation procedure is the following: - The Government of Catalonia promotes in academia (mainly) and industries the Industrial Doctorate scheme. The aim of this action is to increase the visibility of the R&D Scheme, the funding and its benefits. - Academia and Industry do an Industrial doctorate proposal. - Academia and Industry looks for candidate that better fits the profile of the R&D project and doctoral thesis - Academia and Industry apply to the grant - The Government of Catalonia decides which projects are going to be funded 4 times per year (March, July, November, January t+1) - When Academia and Industry get the grant, the industry hires the candidate and he/she get enrolled in the PhD programme. The initiative, which is mainly supported by the government, links universities and companies through PhD students. Four actors are involved in this action: Academia (universities and research centres), Industry (from any sector and size), Candidates (future doctoral students) and Public Administration (Government of Catalonia). The benefits for each group are: Industry - Attracting personnel with high added-value knowledge and skills, who they will help to train to meet their needs and who may become future leaders in innovation and research. - Accessing cutting-edge groups at universities and research centres and their equipment and infrastructure. - Obtaining financial assistance to develop their research projects that is compatible with other grants. - Tax deductions and rebates for R&D&I activities. Academia - Better mechanisms for transferring knowledge to the business sphere, access to knowhow, a better understanding of the needs of today's businesses and the opportunity to contribute to Catalonia's economic development. - Establishing solid, long-term relationships with organisations in all industrial sectors. - Boosting the academic value of agreements between universities and businesses, including thesis guidance, articles, publications, conferences, patents, etc. - Access to additional funding that is compatible with other R&D&I grants.

	Students - The opportunity to participate in an R&D&I project in a company that is committed to research and innovation and is at the cutting edge of scientific knowledge. - Working on projects with highly qualified researchers and company staff. - Developing contacts and building relationships in order to share experiences and further their career prospects. - Access to a mobility fund to finance placements abroad and trips to international congresses and workshops. - Training in highly sought after skills which are vital for a career in the business sphere. For industries and academia, it is a unique opportunity to foster collaborative research projects and knowledge and technology transfer from academia to industries and from industries to Academia. The Catalan Industrial Doctorate Plan have been explained at European Commission Seminar on Intersectoral mobility and industrial talents (DG Directorate-General for Research and Innovation)
Why it is considered as a Good Practice?	From one hand, this initiative is intended to address the challenges involved in transferring to the business world the advanced, world-beating technology developed by Catalan universities and research centres in the last decade, thereby ensuring this technology and knowledge is used to further Catalonia's own economic and social development. On the other hand, Doctorate holders are mainly employed in public sector both in Catalonia and Spain, but only a few in private sector (industries, non-profit organizations and other private institutions). Also doctorate holders are not well-known in the private sector as industries do not really know the added-value of a doctoral degree and what it really involves and defines. Finally, an Industrial Doctorate let the student to identify a new professional career outside academia where to apply. - Industrial doctorates vs. traditional doctorates* - Industrial doctorates earn, on average, 6% more than traditional doctorates - They have a higher rate of employment. - 80% work in private companies, unlike traditional doctorates, where this percentage is below 50%. - Brain drain is very limited in the case of industrial doctorates. - There is an increased probability of being given management responsibilities. *[The Effect of the Industrial PhD Programme on Employment and Income. Oxford Research A/S. December 2012]

Could it be transferred?	The Catalan Industrial Doctorates Plan is based on programmes developed in other countries, such as France's Conventions Industrielles de Formation par la REcherche (CIFRE), Denmark's Industrial PhD Programme and the European Commission's European Industrial Doctorates (EID). It could perfectly be transferred and adopted in other regions and countries.
Lessons learnt from the practice	To be implemented in other regions, countries, they should take into account: - Current situation of industry and academia collaborations - Related national or regional laws - Specific characteristics of its industries and academia system - Management of research grants, especially those who are focused in industries - Funding scheme - Communication Plan: strategic point of view, activities, involve all parties (academia, government, industries, etc.) - Among others.
Contact information	Academic director: Dr. Albert Sangrà, doctorats.industrials.sur@gencat.cat Project Manager: Jordi Alba, jordi.alba@csuc.cat
Other background information of interest	- http://doctoratsindustrials.gencat.cat/en - Complete description of the Catalan Industrial Doctorates Plan: introduction, benefits, characteristics, funding scheme and application procedure: http://doctoratsindustrials.gencat.cat/app/webroot/upload/files/Document_suport_DI2016_CA_EN.pdf - Workshop focus on 2016 Industrial Doctorates call (in Catalan language): https://www.youtube.com/watch?v=DFFNMI6g-Ro - Experiences from on-going projects and thesis defences: https://www.youtube.com/playlist?list=PL03Cw3J9XrDc-3haLZS0OHUsHg_3co-sU

5.3. - ETH Zurich Pioneer Fellowships

Title of the Good Practice	ETH Zurich Pioneer Fellowships
Responsible Research and Innovation Actor	ETH Zurich and ETH Zürich Foundation • ETH Zurich: University founded in 1855; 21 Nobel Prize winners, including Albert Einstein and Wolfgang Pauli; 1 Fields Medal winner; 2 Pritzker Prize winners. • ETH Zürich Foundation is an independent, non-profit organisation under private law with the aim of promoting teaching and research at ETH Zurich.
Precise theme/issue tackled by the practice	Proof of concept
Timescale	Since 2011
Objectives and expected results of the practice	Pioneer Fellowships enable the most talented and ambitious researchers to develop their ideas into highly innovative commercial products or services for the benefit of society. • Develop new product and service based on university technology and introduce them into the market • Create new companies and jobs
Location	- Switzerland - Zurich

Detailed description	Pioneer Fellowships is one of the ETH programmes which target to Master and Doctoral students at ETH Zurich and has the objective of encouraging young scientists (after their Master or PhD) to develop a highly innovative product or service based on their own research results. The initiative is jointly funded by ETH Zurich and ETH Zürich Foundation. The Pioneer Fellowship is awarded to ***candidates who want to become entrepreneurs based on their own research*** carried out during their Master or Doctoral Thesis at ETH Zurich. They are the result of a competitive process to ensure the innovation potential of the successful application. Twice a year, the most promising candidates are selected by a panel of experts and receive up to CHF 150,000 in seed capital and coaching for a maximum period of 18 months. The fellowship is given to one or two individuals intending to perform applied research leading towards a highly innovative product or service and to evaluate the potential for the commercialization of such products or services. The duration of a Pioneer Fellowship is 12 months for a team of 2 persons or 18 months for one person. An evaluation of the progress is carried out after 6 months based on agreed milestones. The evaluation criteria are: • Innovation potential and economic attractiveness and viability: entrepreneurial suitability, market potential, feasibility, sustainability, as well as criteria of sociopolitical and environmental relevance • Scientific quality: relevance, originality and timeliness of the underlying scientific work • Individual aptitude: scientific record and performance of the applicant, personal motivation and entrepreneurial spirit <u>Results</u> • Since 2011, 61 Pioneer Fellowships have been awarded to teams of one or two members. • Until today, 34 supported Fellows have already founded their own spin-off. Pioneer Fellowships offer scientists the opportunity to test their research results and become entrepreneurs. Luckily, these professionals will have strong links with the university during their whole career, creating new collaboration channels between the university and the industry. The actors involved in this initiatives are:

	• Young scientists that want to become entrepreneurs based on their own research carried out during their Master or Doctoral Thesis at ETH Zurich. • The research team that they belong to are also a critical element in this program. Scientists may belong to any research field; therefore, it is possible to introduce products and services into any economic sector.
Why it is considered as a Good Practice?	Universities are producing a high number of R&D results that remain on shelves and never reach the market. Some of the reasons behind this fact are: - University research results normally are early-stage inventions or are in a certain degree of prototyping. - There is a funding gap between scientific discovery and a prototype validation, which make difficult to prove a proof of concept. Pioneer Fellowship is an initiative design to cover this gap. Scientist will have the opportunity to perform applied R&D and prove their concept. Moreover, the coaching and training offered would help them to identify of what looks like an appropriate market.
Could it be transferred?	This initiative may easily transfer to other universities but taking into account the following issues: - Funding scheme - National or regional laws related to spin off creation - Specific characteristics of universities and researchers (entrepreneurial role accepted?
Contact information	ETH Zurich - ETH transfer Dr. Marjan Nienke Kraak marjan.kraak@sl.ethz.ch HG E 49, Rämistrasse 101. 8092 Zürich, Switzerland
Other background information of interest	- https://www.ethz.ch - https://www.ethz-foundation.ch - https://www.ethz.ch/en/research/research-promotion/eth-internal-programmes/pioneer-fellowships.html

5.4. - Proof of Concept Fund at TU Delft

Title of the Good Practice	Proof of Concept Fund at TU Delft
Responsible Research and Innovation Actor	Delft Enterprises, the participation and facilitation organisation for spin offs of the Delft University of Technology. Delft University of Technology is the oldest and largest technical university in the Netherlands. It was founded in 1842 by King William II in order to train civil engineers. TU Delft (from the Dutch name Technische Universiteit Delft) received its current name in 1986.
Precise theme/issue tackled by the practice	Pre-seed money (Convertible Loan)
Timescale	Since 2013
Objectives and expected results of the practice	The Proof of Concept Fund is created to ***fund early stage startups***, in a phase that is often ***too risky for other investors***. This money will help entrepreneurs to overcome the so-called Valley of Death. Support the creation of new companies linked to the university New jobs creation in the region
Location	- the Netherlands - Delft (South Holland)
Detailed description	The fund was created by Delft University of Technology (TU Delft) to provide funding for proof of concept studies on new technical inventions and it is one of the instruments by which the university can support companies at a very early stage. It is runned by Delft Enterprises, the unit in charge of empowering and speeding up the development of startups, as part of the ambition of the university to turn scientific knowledge into economic value.

	It is aimed at starting businesses that have a strong link with the TU Delft and that have a solid business plan with a clear vision. This vision includes the role of the team and an analysis of the relevant market as well as a scalable revenue model. It provides a convertible loan up to 250.000 euros and at a fixed interest rate of 8%. The loan is paid out in multiple tranches, which are linked to the achievement of milestones. Apart from a pre agreed conversion mechanism that enables the fund to convert the loan into shares in the company, the entrepreneur does not need to provide additional guarantees. The company pays interest and repayment, but no 'success fee' or other costs which may be related to the loan. When the loan is granted, the entrepreneur will be coached by an investor or experienced entrepreneur to prepare for the next financing phase: venture capital (seed capital). Results A total of 22 starting companies have been granted a Proof of Concept loan since the end of 2013. The companies are now in various stages of development with various bigger and smaller success stories. The fund offers companies tied to the university the opportunity to test their (business) concept. Creating new collaboration channels between the university and the industry. The link between company and university is mostly established as a result of technology developed at the TU Delft being at the heart of the company. Often, but not necessarily the entrepreneurs have a tie to the university as former students PhD's or professors.The startups are active in a a variety of fields, as broad in spectrum as the research performed at TU Delft.
Why it is considered as a Good Practice?	Generally, entrepreneurs need support during the early stages of firm launch and growth. Physical resources (office or laboratories), business assistance and access to networks (and investors) are the most common. However, entrepreneurs coming from universities need also to prove the technologies because R&D results normally are often generated in the lab, after which the concept should be proven to work in a commercial setting. This fund helps entrepreneurs to validate the prototype and identify the right market. After achieving these phases, it should be easier to attract investors.

Could it be transferred?	In this case, the university is indirectly taking a percentage of shares in the company. Therefore, universities must check if their national laws allow them to take part in a private company.
Contact information	info@delftenterprises.nl Mekelweg 4 2628 CD Delft
Other background information of interest	- http://www.delftenterprises.nl/

5.5. - New knowledge and business from research ideas

Title of the Good Practice	New knowledge and business from research ideas
Responsible Research and Innovation Actor	Tekes, the Finnish Funding Agency for Innovation. TEKES is the publicly funded expert organisation in charge of financing research, development and innovation in Finland. It works with the top innovative companies and research units in Finland and every year finances some 1,500 business research and development projects, and almost 600 public research projects at universities, research institutes and universities of applied sciences. Tekes does not derive any financial profit from its activities, nor claim any intellectual proprietary rights.
Precise theme/issue tackled by the practice	Exploring the most promising commercialisation route for R&D results
Timescale	

Objectives and expected results of the practice	Bringing the results of academic research into industrial applications more quickly and accurately. The funding allow researchers to ***examine possible paths to utilisation and the most promising route*** and method for taking the idea further, either in the form of a new company or as a new business conducted by an existing company.
Location	- Finland
Detailed description	The "New knowledge and business from research ideas" is one of the funding scheme offers by Tekes. This call allows the project team prepares the commercialisation of the research idea. The project must explore possible paths to utilisation and the most promising route and method for taking the idea further. Therefore, several alternative commercialisation possibilities should be considered. The possibilities of using the idea in a new company to be set up or developing it into new business in an existing company should be investigated. The project produces knowledge and competence that are significant for utilising a research idea. The research part of the project focuses on issues that play a key role in the commercialisation of the concept. Two application rounds for research projects take place annually, in the spring and the autumn. Are eligible for funding among others, the following activities: examination of the research idea from the perspective of commercialisation (Proof of Relevance); examinations of novelty; determination of customer value; surveys of competitors; examinations of intellectual property rights; experimental verification of the viability of an idea (Proof of Concept); mapping of funding models; mapping of business models. This tool address mainly to one of the stakeholder in the ecosystem: universities or R&D centres as producers of knowledge, but it helps to bridge the gap between universities and the industry. R&D results could be translate into the market in the form of new products and processes, improving the national economy.

	Supported by the Finish government, this instrument allows universities and research centres to explore path for achieving the commercialization of R&D results. This initiate helps to introduce new products and services into the market.
Why it is considered as a Good Practice?	University research results normally are early-stage inventions or are in a certain degree of prototyping. It is needed verifying the technical concept and identifying the market, but there is a funding gap that make difficult to prove it. This initiative allows researchers to explore different commercialization routes and unlike other initiatives, it is possible to consider licensing the innovation to established companies and not only to start up a company. This approach may be more attractive, not only to researchers thinking to become entrepreneurs, but also to researchers that want to see their ideas into the market while continuing their activity at the university.
Could it be transferred?	The research organisation must be able to transfer the rights to the results to the party commercialising the idea after the project
Lessons learnt from the practice	To be implemented in other regions, countries, they should take into account: - Related national or regional laws - Specific characteristics of its industries and academia system - Funding scheme
Contact information	Kimmo Kanto, Director Tekes Tel. +358 (0)29 50 55852 kimmo.kanto@tekes.fi
Other background information of interest	- https://www.tekes.fi/en/

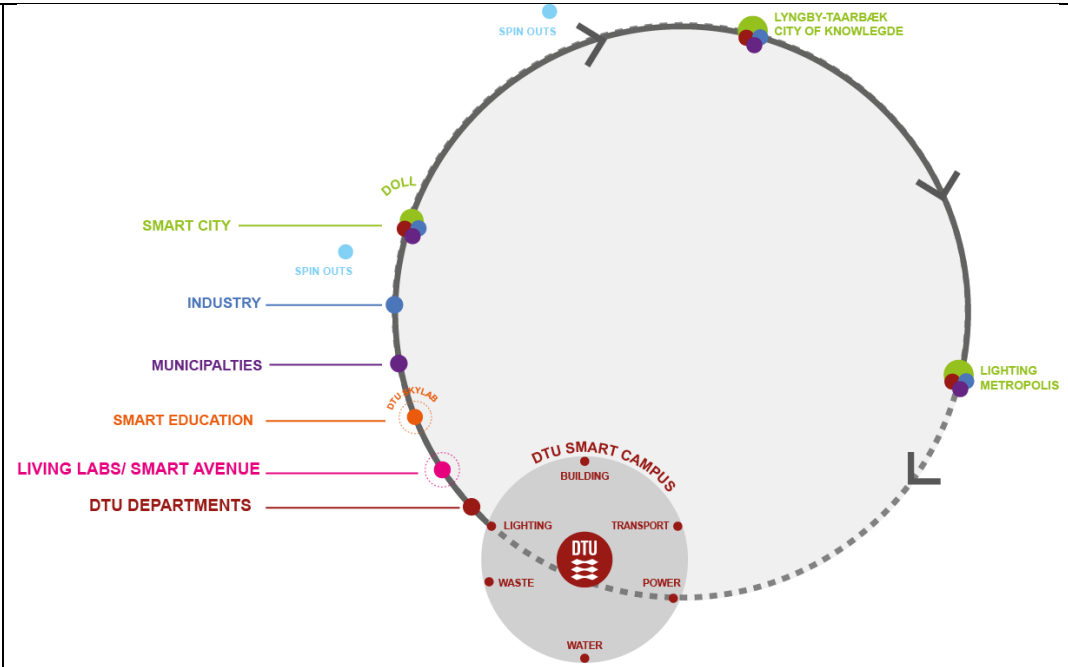
5.6. - DTU Smart Campus - *rethinking the role of the campus as a testbed*

Title of the Good Practice	DTU Smart Campus - *rethinking the role of the campus as a testbed*
Responsible Research and Innovation Actor	Technical University of Denmark H.C. Ørsted —the father of electromagnetism— founded the Technical University of Denmark (DTU) In 1829 to develop and create value using the natural sciences and the technical sciences to benefit society.
Precise theme/issue tackled by the practice	Living Labs
Timescale	2015
Objectives and expected results of the practice	The overall objective is to create value for DTU and the overall society within innovation, education, research and the daily operations at Campus. Specifically: - Prototype technologies developed at the university by faculty, students and industry. - Improve and make the curricula more attractive. - Test smart technologies. - Access, collect and analyse data to carry out both qualitative and quantitative studies.
Location	- Denmark - Lyngby-Taarbaek Municipality, part of Greater Copenhagen
Detailed description	The Technical University of Denmark is developing a smarter way of using its Campus for research, innovation and education. The University is creating new out and indoor living labs where to test smart city technologies. The vision is to turn the campus into a real living lab, where students and researchers can develop, test and present smart technologies and access and analyse the collected data to carry out both qualitative and quantitative studies.

	A part of this wision is to make Smart Campus a part of the innovation ECO-system at DTU and in the external Smart City landscape. The first step is to include the users at DTU in the discussion of ideas and tools, for how to take Smart Campus in science, education and entrepreneurship to an even larger scale. During 2016 two smart living labs are running: Smart Avenue and Smart Library (2017) Smart Avenue 106 intelligent street lights have been installed on campus. All of them have a special compartment with power and internet access that allow setting up prototypes for easy plug'n play test and demonstration. The street lamps also have smart installations such as movement sensors, wired data connection, z-wave wireless communication and an intelligent street light control unit. The university encourages students and scientists to test and demonstrate in a live environment their ideas. In some cases, funding is given to cover the equipment necessary for the project. Past and present student projects include tests on waste management, urban flood modelling, and measurements on CO2, NOX, Noice, and dus from construction sites at campus. Additionally, a pilot is being set up at 20 lamp posts for testing micro climate in the urban space. The main purpose of the pilot is to make the Smart avenue infrastructure more available for projects, so the 20 lamp posts have been equipped with raspberry Pi's to make it easy for students and researchers to attach various sensors of their own. Smart Library By 2017 the 3000 m2 library space will be an indoor living lab,where students, researchers and entrepreneurs can develop, test and demonstrate SMART technologies, analyze the collected data and conduct research- and student projects, while optimizing the indoor climate, lighting and acoustics and therefore boosting the chances of learning. This will be carried out by building a physical infrastructure with sensors and a digital infrastructure to collect, store and extract date – real time or historical. Additional activities and living labs planned: - A Smart City data hub in DTU Skylab (http://www.skylab.dtu.dk/) where challenges from the municipality or industry can be adressed by students.

	- Selfdriving busses at campus to work both as research facilities and as part of the overall transport solution for the university. Even though this initiative takes place on campus, living labs are an excellent opportunity to build partnerships with industry. Industry can participate in projects as a machinery and tools providers, and most important as observers (and future buyers) of new university technologies which are being tested on living labs. Living labs bring together facilities staff, faculty and students to study the campus infrastructure and make improvements. This initiative require careful planning and collaboration especially between university facilities staff and faculty. Examples include students who were given access to data on temperatura managements and provided suggestions for better management to the facilities staff. Moreover, living labs offer the opportunity to faculty to test products in a real world environment, therefore generating new business opportunities DTU Smart Campus is in cooperation with DTU Photonics a partner in the project Lighting Metropolis: http://lightingmetropolis.com/ (Interreg – European Regional Development Fund))
Why it is considered as a Good Practice?	Living lab is a well-known initiative to deal with innovation in products and services that have social aspects and location based aspects. It allows users prototyping, validating and refining solutions in multiple and evolving real-life contexts. The labs are an opportunity to faculty to research, test, and in some cases, take apart and reinstall, improving the probability to commercialize prototypes validated in real conditions. From the curricula point of view, a living lab on campus provides students hands-on learning opportunities and the chance to develop real-world skills. Moreover, the university has a path to meet its sustainability goals. In this specific case, DTU invests more than 500 million Euro in an ambitious campus transition process. The construction projects include all aspects of energy efficiency technologies and are used to demonstrate new building technologies. The transition process of DTU campus is an opportunity to think wide and big with regard to smart power solutions, smart lighting, smart waste, smart transport etc. By providing students and scientists, companies and municipalities access to parts of the campus infrastructure, building management systems and data, the university is rethinking the role of the campus as a testbed for smart city solutions.
Could it be transferred?	To be implemented in universities, they should take into account: - Universities characteristics - Current situation of industry and university collaborations

	- Specific characteristics of its industries - Funding scheme
Lessons learnt from the practice	To involve students and researchers two main learnings should be raised: - First, the infrastructure should be able to accomodate different needs of students and researchers. I.e. while students often have very limited time spans and need "plug and play" solutions to quickly be able to use the infrastructure, researchers often need more flexibility for their projects. - Second, it's important to initiate 'ownership' by the teachers. They are ambassadeurs of introducing the opportunities by taking the livings lab facilities into education.
Contact information	Dorthe Skovgaard Lund - Project Manager, Office for Innovation and Sector Services - +45 21 36 26 97; dslu@dtu.dk Jens Dahlstrøm Iversen - Innovation Consultant, Office for Innovation and Sector Services - +45 93 51 17 15; Jend@dtu.dk SMART CAMPUS Building 101. Anker Engelunds Vej 1. 2800 Lyngby
Other background information of interest	- http://www.smartcampus.dtu.dk/ DTU Smart Campus – 'value chain'

5.7. - swiTTlist - Technology Opportunities from Swiss academic research institutions

Title of the Good Practice	swiTTlist - Technology Opportunities from Swiss academic research institutions
Responsible Research and Innovation Actor	Swiss Technology Transfer Association

Precise theme/issue tackled by the practice	Marketing universities technologies
Timescale	The Association was founded in October 2003; swiTTlist is available since January 2006
Objectives and expected results of the practice	To support the Swiss research institutions in technologies promotion and to provide a nation-wide, comprehensive and searchable overview of current technology opportunities for industry. Expected Results: Rising the economic exploitation of research results from the institutions involved in this initiative.
Location	Switzerland
Detailed description	The Swiss Technology Transfer Association manages the swiTTlist, a unique portal with current technology opportunities from Swiss public research institutions available for licensing and development by industry. The Swiss Technology Transfer Association is the association of technology transfer professionals who are active in the transfer of technology from institutes of public research and education, university hospitals, and other not-for-profit research organizations to the private sector. It was founded in October 2003 with the mission of: Facilitates and strengthens the co-operation and the technology transfer between Swiss public research institutions and the private sector; Offers professional development for its members and other practitioners involved in technology transfer within the public institutions and the private sector; Provides services of common interest to its members, their institutions and other stakeholders involved; and Maintains an active dialogue with the research institutions, the private sector and the authorities to foster optimal processes and regulatory framework/regulations. swiTT currently has more than 100 members from all parts of Switzerland. Most of them work in technology transfer at public research institutions, others are employed in the private sector. swiTTlist swiTTlist carries well over 100 technology offers for companies and is continually updating its new technologies from universities and other institutes of higher education. The technologies presented can form the basis of new product development in co-operation with business partners.

	A brief technical description and contact information is provided for each invention and technology. This initiative put in contact universities, research centres and companies. The Swiss public research institutions lists technologies on this searchable portal which have an economic potential and which are available for licensing and development by industry. With the help of an automatic alert system, company representatives are informed immediately each time a new technology is available in their field of interest. The technologies presented in the website belong to ten sectors (Biotechnology & Pharmaceuticals; Chemical Processes & Compounds; Information & Communications Technology; Electrical & Electronics Engineering; Advanced Materials; Mechanical Engineering & Aerospace; Medical Devices; Sensors & Analytics; Diagnostics; Micro- & Nanotechnology) therefore generating a wide range of business opportunities.
Why it is considered as a Good Practice?	In order to market technologies and reach the right clients wherever they are located, universities are publishing in their website information related to all the technologies developed and ready to be commercialized. From an industry point of view visiting all universities websites looking for the right technology is a time-consuming activity with few possibilities to succeed. An optimal approach is to establish a national, regional or sectoral alliance strategy, and to reach agreements with other organisations and publish all the technologies in a single web, creating more web traffic.
Could it be transferred?	This practice could be easily transferred to other contexts but it is needed an agreement among the universities and the commitment for funding the common marketplace.
Contact information	swiTT, Swiss Technology Transfer Association case postal CH-3000 Bern Tel. +41 79 909 59 76
Other background information of interest	www.swittlist.ch

5.8. - Executive Directors Designate Programme

Title of the Good Practice	Executive Directors Designate Programme (EDDP)
Responsible Research and Innovation Actor	University of Strathclyde The University of Strathclyde is a leading international technological University located in the heart of Glasgow, Scotland's biggest city. It was established in 1796.
Precise theme/issue tackled by the practice	Supporting the creation of spin off based on university technology
Timescale	
Objectives and expected results of the practice	- Increase the number of spin-out companies - Improve the chances of raising seed funding for these spin-out companies - In the longer term, improve chances of returns for shareholders in these companies, including the University The University of Strathclyde has formed over 50 spin-out companies, making annual sales of £80 million and employing more than 700 people, mostly in the West of Scotland (UK).
Location	- UK - Scotland
Detailed description	EDDP is a programme funded by the European Regional Development Fund and available for use by all Scottish universities. The University of Strathclyde is one of the universities making use of this fund for supporting the creation of new companies based on technology developed on campus. The programme provides to the university funding for hiring external professionals called Executive Director Designates (EDDs). Each EDD works with an opportunity team proposing to spin out a company to commercialise University-owned technology.

	The programme allows the University to pay consultancy fees of individuals sourced from outside the University, or buy out the time of academics, to allow them to focus on spinning out these companies. The EDDP can fund CEO, Sales Director, Technical Director, Finance Director and Executive Chairman Designates. The EDDP can sometimes fund more than one individual for an opportunity. An EDD will be contracted for a pre-start spin-out and the usual length of contract with an EDD is six months, pre-formation only, and EDDs are typically appointed on the basis that it should be possible to launch the relevant spin-out shortly after this time period. Payment is on the basis of a monthly fee. Contracts are terminated if in the view of the EDD, the academic team, or the university, the process no longer appears likely to result in a spin-out. The choice of the preferred candidate is based upon: - chemistry with the opportunity team - relevance of experience - likely attractiveness as Executive Director of spin-out to potential funders - willingness to engage with the University at budgeted fee level, on basis of fee well below conventional consulting day rates - long-term commitment, and a desire for a shareholding in a growth technology company - appropriate due diligence being carried out by the university (track record with early stage companies, conflicts of interest, previous directorships, prior knowledge of individuals) - appropriate references With the objective to spin out companies based on university technology, it is needed to identify individuals beyond university boundaries. It is critical to have strong links to the local ecosystem for being able to identify and attract people with skills and competences that are not usually available on campus. The actors involved in this initiative are the academic team, the university and an external entrepreneur with business management skills. This combination will allow doing a business opportunity evaluation considering technical and market criteria. Business opportunities may appear in all the areas in which the university in doing R&D.
Why it is considered as a Good Practice?	University entrepreneurs need both technical and business management skills to be successful. Commonly, they have very good knowledge related to the technology, but they lack business management skills, range from financial control

	to human resource management, necessary for the day-to-day operations of a company. This initiative give them the opportunity to complete the team with competences and skills that they generality do not have.
Could it be transferred?	This initiative may easily transfer to other universities but taking into account the following issues: - Links to the community for being able to identify and attract people with business skills - Funding scheme - National or regional laws related to spin off creation - Specific characteristics of universities and researchers (entrepreneurial role accepted?)
Contact information	Research and Knowledge Exchange Services. University of Strathclyde +44 (0) 141 548 3707; rkes@strath.ac.uk
Other background information of interest	- https://www.strath.ac.uk/

5.9. - UPM Course of Technologies Commercialization

Title of the Good Practice	UPM Course of Technologies Commercialization
Responsible Research and Innovation Actor	The Centre of Support for Technology Innovation - CAIT at the Universidad Politécnica de Madrid The Universidad Politécnica de Madrid (Universidad Politécnica de Madrid, UPM) was created in 1971 from on the pre-existent engineering schools attached to a number of ministerial departments. Even today, the UPM only addresses engineering and architecture studies and the “engineering schools” continue to be the basic structure of the university life.

	Nowadays, is the largest technical university in Spain and the leading Spanish university with regard to the participation in European R&D projects, patents filed and the creation of spin-off and start up companies.
Precise theme/issue tackled by the practice	Training target to researchers from university and research centres
Timescale	Since October 2012 (*one or two editions a year*)
Objectives and expected results of the practice	- Develop in researchers who work in universities and research centres, new competences associated to technology commercialization that frequently are not offered in their training as scientists. - Provide researchers with specific knowledge to identify and assess the commercial potential of technologies developed in the laboratory. - Increase the researchers' awareness on these issues and produce a mentality change. - Increase the number of university technologies commercialized
Location	- Spain - Madrid
Detailed description	The Centre of Support for Technology Innovation - CAIT at UPM coordinates Innovatech, a new program to support an innovative technology commercialization model. ***Innovatech***, was an institutional program introduced in 2012 as a ***new technology commercialization model*** which twofold mission is to increase the commercialization outputs and to accelerate a cultural change in researcher's mentality making them more akin to the commercialisation of technologies. The intention within the UPM community is to share the view that the commercialization of R&D results is an institutional aim which benefits all parties involved. Among other activities, Innovatech is in charge of the UPM Course of Technologies Commercialization. The "**UPM Course of Technologies Commercialization**" course addressed specifically to researchers who have a R&D result or a potentially marketable technology. Its main objective is to train researchers in a minimum set of core skills to participate in commercialization activities and encouraging them to incorporate indicators related to exploitation of results in their routines. Furthermore, the intention is to add new technology/solutions to the UPM technology portfolio.

	During one month, the program offers training sessions aims to reinforce participant's skills in technology evaluation, marketing or agreement negotiation. In addition, researchers are invited to design a marketing plan for their own technology allowing the application of theoretical knowledge to a real case study. At the end, the researchers present their technologies to a group of investors and partners and receive feedback about their technology based solutions. Moreover, the best three technologies are expound in the UPM - Innovatech International Workshop organized by CAIT every year in December. This workshop is open mainly to industry. During the last years five editions has been organized target to UPM researchers and another one target to researchers and technology entrepreneurs from other organisations (universities, R&D centres and high technology companies). Between 25 and 30 people have participated in each edition. At the time of writing this report, a new course is about to start. For this edition, CAIT based on the success of previous courses, has evolved the initiative and launched a new program called **2T (Technology Transfer) Innovatech Challenge**. 2T Challenge will award the best three UPM technologies of the year based on their innovative and market potential. Researchers must prepare a pitch and expound it in front of a panel made up of industry people and investors. The **UPM Course of Technologies Commercialization** is offered to all the researchers that applied to the call with the objective to prepare them for the competition. The best technology will win 5000€ in cash and advertising material valued at 1000€. The 2nd and 3rd technologies will win advertising material valued at 1000€. With this new approached, CAIT continues to meet the objectives planned for the **UPM Course of Technologies Commercialization** and adds new ones such as communicating to the community that the commercialization of R&D results is an institutional goal. Some results: - 150 participants in five editions; the course was assessed by 98% of researchers as high satisfaction or excellent; 100% of them would recommend to pairs. - New technologies have been added to UPM Marketplace - New research groups are working with Innovatech - The most important: after several editions, UPM researchers' groups are integrating technology commercialization as a common activity in their professional career, which offer them the possibility to get additional economic funds for the sustainability of their teams (through royalties). This activity gives them also the possibility to see the results of years devoted to R&D, incorporated into products in the market.

	This tool address mainly to one of the stakeholder in the ecosystem: universities or R&D centres as producers of knowledge. The training will help researchers to develop a minimum set of core skills to participate in commercialization activities and to incorporate indicators related to exploitation of results in their routines. Be able to identify more R&D results and evaluate their commercial opportunity, will allow the university to have a broad portfolio of technologies ready to be use by companies and therefore to create more business opportunities around technologies develop by universities.
Why it is considered as a Good Practice?	- The course help to develop new competences associated to technology commercialization that frequently are not offered in the training of new scientists - Among the course advantages is that it helps to improve researchers' capacity to identify research results, evaluate and communicate them to companies and governments. Thus, it would increases the likelihood of R&D commercialization and therefore, the incorporation in new products and process. - The course meet researchers from different backgrounds and schools, therefore new opportunities (R&D projects) may appear. - A positive side effect is to close the contacts of researches with Innovatech team which facilitates further interactions. - Moreover, this course is positioning CAIT as a reference at national and international level in the technology transfer field.
Could it be transferred?	UPM is offering the course to other organizations in different locations (Latin America mainly due to cultural proximity). There are two possibilities: on line or in situ. Another possibility is to advice other organizations about how to design this course and to follow-up its implementation. Precisely because of its specificity and characteristics, this training programme is of a great interest for research centres and technological companies at national and international level. In fact, several Latin American Universities have shown their interest in the course: several people from Chile received this training and researchers from Mexico, Colombia and Chile are interested on it.
Lessons learnt from the practice	It is critical to apply the theory to a real case. For that reason researchers are invited to design a marketing plan for their own technology allowing the application of theoretical knowledge to a real case study.
Contact information	Universidad Politécnica de Madrid UPM innovatech- Centro de Apoyo a la Innovación Tecnológica (CAIT)

	innovacion.tecnologica@upm.es
Other background information of interest -	- www.upm.es - Innovatech blog: http://upminnovatech.blogspot.com.es/ - Interviews of participants in several courses edition are available in right column: http://upminnovatech.blogspot.com.es/ - LinkedIn Innovatech profile: https://www.linkedin.com/profile/view?id=215343163&trk=nav_responsive_tab_profile - UPM Marketplace: www.upm.es/observatorio/ - 2T (Technology Transfer) Challenge: http://www.upm.es/Investigacion/Apoyo/OTRI/InnovacionComercializacionTecnologias

10. - Imperial Business Partners

Title of the Good Practice	Imperial Business Partners
Responsible Research and Innovation Actor	Imperial College London Imperial College London is a public science-based university with an international reputation for excellence in teaching and research. In 1907, the Royal College of Science, the Royal School of Mines and the City & Guilds College were combined to form Imperial College London. The college is home to medical and healthcare institutes, including the Parkinson's UK Brain Bank, which supports more than 100 research projects and has more than 6,000 registered potential tissue donors.
Precise theme/issue tackled by the practice	Networking – builindig strategic partnerships
Timescale	Since 2010

Objectives and expected results of the practice	Imperial Business Partners is an exclusive forum, which stimulates open dialogue between executive-level representatives from business and academia, offering its members the chance to explore shared strategic issues and to find solutions with Imperial thought leaders and influential policy makers. The forum goal is to open up new ways to collaborate, share knowledge and exchange insights between Imperial College London and the industry and policy makers.
Location	- UK - London
Detailed description	Imperial Business Partners is a collaborative group of business and technology leaders and some of the world's top scientists, engineers and medics. The forum shares insights on how to accelerate the pace of innovation, demonstrating a unique partnership between business and science to foster extraordinary outcomes. Belong to this group included several benefits such as: annual programme of events, access to professional development and Imperial's world-renowned research expertise, access to up three days' free consulting with Imperial Consultants, annual VIP entrepreneurship showcase from Imperial Create Lab, preferential rates for executive education courses run by Imperial Business School. This initiative main objective is to put in contact all the stakeholders in the ecosystem. Bringing people together from different institutions and across sectors may foster the establishment of new collaborations. The Imperial College London is the main actor in charge of the development of such network. Industry, financial institutions and government partners are invited to participate in this network. Opportunities may appear across sectors.
Why it is considered as a Good Practice?	In an open innovation scenario, neither companies, nor universities have all the resources – scientific and economic - needed for doing frontier research and implement innovations in the market. Therefore, the establishment of strategic alliances and partnerships is critical.

	Universities are developing strategies to establish partnership with industry. One of them, it could be the development of a network. Through "Imperial Business Partners", the university is cultivating its connections and creating an environment that encourage contacts and exchanges beyond the institution's own boundaries.
Could it be transferred?	To be implemented in other regions, countries, they should take into account: - Current situation of industry and academia collaborations - Specific characteristics of its industries and academia system
Contact information	Julia Zanghieri Imperial Business Partners Programme Manager Tel: +44 (0) 20 7594 2910 e-mail: j.zanghieri@imperial.ac.uk Imperial College London Faculty Building, Level 3 South Kensington, London, SW7 2AZ
Other background information of interest	- http://www.imperial-business-partners.com/

6. CONCLUSIONS

Ten best practices have been identified along the whole commercialization technology path previously described in the theoretical section to cover the technology development at different stages. Some of them are coordinated by the universities and other by other triple helix stakeholders.

The figure 2 shows the ten best practices classified according to the organization in charge of, versus the technology maturity.

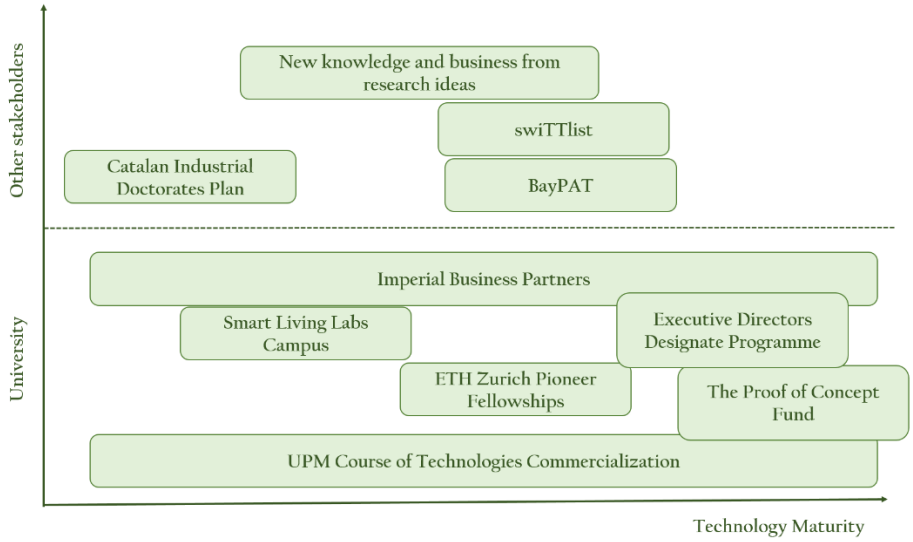


Figure 2. Responsible organisation vs. University technology maturity

In relation to the organisation in charge of the initiative, universities managed six of them, such as:

the **Imperial Business Partners** (Imperial College London); **Smart Living Camps** (Technical University of Denmark); **UPM Course of Technologies Commercialization** (Universidad Politécnica de Madrid); **ETH Zurich Pioneer Fellowships** (ETH Zurich together with ETH Zürich Foundation) and the **Proof of Concept Fund** (Delft University of Technology). The **Executive Director Designate Programme** was set up by the University of Strathclyde, even it is is funded by the European Regional Development Fund and is available for use by all Scottish universities.

National or regional government coordinates other two initiatives: **Catalan Industrial Doctorates Plan** (coordinated by Secretariat for Universities and Research - Generalitat de

Catalunya) and **New knowledge and business from research ideas** (Finnish Funding Agency for Innovation).

Lastly, two initiative are drive or supported by universities but through another organization such as the **swiTTlist** managed by the Swiss Technology Transfer Association and **BayPAT** a company owned by the Bavarian universities and universities of applied science.

Considering the technology development stage, the best practices identified address different phases in the process:

...which can lead to future commercialization

In an open innovation scenario, neither companies, nor universities have all the resources – scientific and economic - needed for doing frontier research and implement innovations in the market. Therefore, the establishment of strategic alliances and partnerships is critical. Thus, as a previous phase in the technology commercialization process, it is crucial for a university to establish good relationships with companies and national and regional governments. In these networks, (formal or informal) universities may promote research capabilities and technologies and identify industry necessities. These relationships may results in new R&D projects.

In line with this idea, the initiative **Imperial Business Partners** is a good example of networking. Imperial Business Partners is an exclusive forum managed by Imperial College London in London, UK, which stimulates open dialogue between executive-level representatives from business and academia, offering its members the chance to explore shared strategic issues and to find solutions with Imperial thought leaders and influential policy makers. Through “Imperial Business Partners”, the university is cultivating its connections and creating an environment that encourage contacts and exchanges beyond the institution’s own boundaries.

Another mechanism for transferring knowledge to the business sphere, access to know how and to have a better understanding of the needs of today's businesses it the **Catalan Industrial Doctorates Plan**, coordinated by Generalitat de Catalunya (Secretariat for Universities and Research) in Catalunya, Spain.

The Industrial Doctorates Plan offers students participate in a strategic research project carried out by a company in partnership with a university (or research centre) and which will form the basis for a doctoral thesis. From one hand, this initiative is intended to address the challenges involved in transferring to the business world the advanced, world-beating technology developed by Catalan universities and research centres. On the other hand,

Doctorate holders who commonly are mainly employed in public sector, may have a new professional career outside academia.

...To mature and experiment with technologies

The Technical University of Denmark in Copenhagen is developing a smarter way of using its Campus for research, innovation and education. The University is creating new out and indoor living labs where to test smart technologies. The **Smart Living Labs Campus** are open for students, scientists and partners

The vision is to turn the campus into a real living lab, where students and researchers can develop, test and present smart technologies and access and analyse the collected data to carry out both qualitative and quantitative studies. During 2016 two smart living labs are running: Smart Avenue and Smart Library. The labs are an opportunity to faculty to research, test, and in some cases, take apart and reinstall, improving the probability to commercialize prototypes validated in real conditions. From the curricula point of view, a living lab on campus provides students hands-on learning opportunities and the chance to develop real-world skills. Moreover, the university has a path to meet its sustainability goals.

Tekes, the Finnish Funding Agency for Innovation in Finland offers an interested initiative for exploring the most promising route of commercialization while maturing the technical concept. The "**New knowledge and business from research ideas**", one of the Tekes funding scheme allows the project team prepares the commercialisation of the research idea. The project must explore possible paths to utilisation and the most promising route and method for taking the idea further. Therefore, several alternative commercialisation possibilities should be considered.

...to market university technologies

In the process of identifying and marketing technologies, it is critical to involve the researcher community. They, as inventors, know better than anyone the technology but lack competences related to commercialization. Aware of this need, the Centre of Support for Technology Innovation - CAIT at the Universidad Politécnica de Madrid (Spain) has been offering for several years the **UPM Course of Technologies Commercialization.**

The course addressed specifically to researchers belong to the Universidad Politécnica de Madrid (UPM) who have a R&D result or a potentially marketable technology. The program main objective is to train researchers in a minimum set of core skills to participate in commercialization activities and also encouraging them to incorporate indicators related to

exploitation of results in their routines. The intention is to add new technology/solutions to the UPM technology portfolio from convinced researchers.

Otherwise, from an industry point of view visiting all universities websites looking for the right technology is a time-consuming activity with few possibilities to succeed. An optimal approach is to establish a national, regional or sectoral alliance strategy, and to reach agreements with other organisations and publish all the technologies in a single web, creating more web traffic

In Switzerland, the Swiss Technology Transfer Association manages the **swiTTlist**, a unique portal with current technology opportunities from Swiss public research institutions available for licensing and development by industry. The association currently has as members more than 100 technology transfer professionals from all parts of Switzerland. Most of them work in technology transfer at public research institutions; others are employed in the private sector.

switt List carries well over 100 technology offers for companies and is continually updating its new technologies from universities and other institutes of higher education. The technologies presented can form the basis of new product development in co-operation with business partners. A brief technical description and contact information is provided for each invention and technology.

Just like this, **BayPAT** is the central access to a technology pool of 28 Bavarian universities and universities of applied science, offering to the industry innovative technologies of more than 18,000 scientists mainly in the fields of Life and Physical Sciences. In Bavaria region, Germany, BayPAT a company owned by the Bavarian universities and universities of applied science, has a patent portfolio that probably it is one of the most interesting ones in Germany.

The company together with the technology transfer patent consultants at Bavarian universities, assists the scientists in identifying and evaluating inventions which are of interest commercially as well as in the financing, application and maintenance of patents. Also, on behalf of partner universities, the company negotiates all option, licensing and transfer contracts with the companies. In summary, BayPAT coordinates and controls the complete marketing process and also close the agreements with the companies. This approach allows to Bavarian universities sharing a critical support office at regional level and it is an optimal way for delivering services expensive or high specialized.

...Supporting the creation of spin off

ETH Zurich and ETH Zürich Foundation in Switzerland offer through the **ETH Zurich Pioneer Fellowships**, a grant to candidates who want to become entrepreneurs based on their own research carried out during their Master or Doctoral Thesis at ETH Zurich. Pioneer Fellowships target to Master and Doctoral students at ETH Zurich and has the objective of encouraging young scientists (after their Master or PhD) to develop a highly innovative product or service based on their own research results. The fellowship is given to one or two individuals intending to perform applied research leading towards a highly innovative product or service and to evaluate the potential for the commercialization of such products or services. The duration of a Pioneer Fellowship is 12 months for a team of 2 people or 18 months for one person.

In this line, Delft Enterprises (the participation and facilitation organization for spin offs of the Delft University of Technology) in Delft (the Netherlands) provides funding for proof of concept studies on new technical inventions. **The Proof of Concept Fund** is one of the instruments by which the university can support companies at a very early stage.

It provides a convertible loan up to 250.000 euros and at a fixed interest rate of 8%. Apart from a pre agreed conversion mechanism that enables the fund to convert the loan into shares in the company, the entrepreneur does not need to provide additional guarantees. The company pays interest and repayment, but no 'success fee' or other costs which may be related to the loan.

Moreover, university entrepreneurs need both technical and business management skills to be successful. Commonly, they have very good knowledge related to the technology, but they lack business management skills, range from financial control to human resource management, necessary for the day-to-day operations of a company. The **Executive Directors Designate Programme** may address this problem.

The University of Strathclyde in Scotland, UK participate actively in the Executive Directors Designate Programme. The programme provides to the university funding for hiring external professionals called Executive Director Designates (EDDs). Each EDD works with an opportunity team proposing to spin out a company to commercialize University-owned technology. The EDDP can fund CEO, Sales Director, Technical Director, Finance Director and Executive Chairman Designates. The EDDP can sometimes fund more than one individual for an opportunity. This initiative give them the opportunity to complete the team with competences and skills that they generality do not have.

As a summary, we can conclude that it is clear that knowledge has progressively increased its importance in the global economy. Universities as important sources of new knowledge

are becoming a key element of the innovation system due to their capacity to transform the local and national economy.

Indeed, besides teaching, and through their R&D activity, universities are producing scientific breakthroughs and technological achievements but they not are able to transform them into industrial and commercial successes. Actually, the commercialization of university research remains differentially successful and largely concentrated in just a handful of universities.

Given this fact, not only the universities, but also the whole ecosystem is designing and putting in place new strategies to reverse the situation. In this report, we offer ten new and innovative activities and methodologies in transferring and commercialising research results found in the European context, which may be translated, with the adaptation needed, to other countries.

Universities or other organizations manage the cases presented in this report and they address different phases at the technology commercialization process, therefore a wide range of possibilities is offered to universities and other triple helix stakeholder depending on their objectives and desired results.

BIBLIOGRAPHY

Auerswald, P. E., & Branscomb, L. M. (2003). Valleys of death and Darwinian seas: Financing the invention to innovation transition in the United States. *The Journal of Technology Transfer*, *28*(3-4), 227-239.

Bradley, S. R., Hayter, C. S., & Link, A. N. (2013). Models and Methods of University Technology Transfer. Foundations and Trends® in Entrepreneurship, 9(6), 571-650. doi: http://dx.doi.org/10.1561/0300000048

Breznitz, S. M., & Ram, N. E. E. L. A. (2013). Enhancing economic growth? University technology commercialization. *Creating Competitiveness: Entrepreneurship and Innovation Policies for Growth: Edward Elgar Publishing*, 88-115.

Chesbrough, H. (2006). Open innovation: a new paradigm for understanding industrial innovation. *Open innovation: Researching a new paradigm*, 1-12.

Etzkowitz, H., Webster, A., Gebhardt, C., & Terra, B. R. C. (2000). The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm. *Research policy*, *29*(2), 313-330.

Lester, R. (2005). Universities, innovation, and the competitiveness of local economies. *A summary Report from the Local Innovation Systems Project: Phase I. Massachusetts Institute of Technology, Industrial Performance Center, Working Paper Series*.

Litan, R. E., Mitchell, L., & Reedy, E. J. (2007). The university as innovator: Bumps in the road. Issues in Science and Technology, 23(4), 57.

Owen-Smith, J., & Powell, W. W. (2001). To patent or not: Faculty decisions and institutional success at technology transfer. *The Journal of Technology Transfer*, *26*(1-2), 99-114.

Perkmann, M., & West, J. (2014). Open science and open innovation: sourcing knowledge from universities.

Polt, W., Gassler, H., Schibany, A., Rammer, C., & Schartinger, D. (2001). Benchmarking industry—science relations: the role of framework conditions.*Science and public policy*, *28*(4), 247-258.

Rasmussen, E., Moen, Ø., & Gulbrandsen, M. (2006). Initiatives to promote commercialization of university knowledge. *Technovation*, *26*(4), 518-533.

Siegel, D. S., Waldman, D., & Link, A. (2003). Assessing the impact of organizational practices on the relative productivity of university technology transfer offices: an exploratory study. *Research policy*, *32*(1), 27-48.

Siegel, D. S., Wright, M., & Lockett, A. (2007). The rise of entrepreneurial activity at universities: organizational and societal implications. *Industrial and Corporate Change*, *16*(4), 489-504.

POLITÉCNICA
"Ingeniamos el futuro"

CAMPUS
DE EXCELENCIA
INTERNACIONAL

ELAN

ELAN

European and Latin American
Technology based Business Network