

# Enhancement of technology transfer between university and industry – tools and proposals elaborated in a joint project between the Polish Ministry of Science and Higher Education and University of California, Berkeley

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## Abstract

*The United States have developed effective models of cooperation between academia and industry. The political and economic breakthrough in the Eastern European countries at the end of the last century had a great impact on funding of research and development activities, industry structure and technology transfer from the university to industry: the old models became no more applicable and new ones were not in place yet. At present, Eastern European countries are in the process of developing institutional, financial, legal tools to stimulate innovative and pro-commercialization attitudes. A unique program developed by the Polish Ministry of Science and Higher Education “TOP 500 Innovators” is an inspiring example of a strategic approach and a governmental activity in this field. A training course was designed by the Ministry and leading American universities: UC Berkeley and Stanford University, and addressed to Polish scientists. The goals were: to teach scientists skills facilitating getting into the market with products or technology developed during research and to prompt these individuals, familiar with the reality at the academia, to propose new tools and solutions to brake the existing barriers between the industry and the academia. The solutions shall be effective also in other countries of the region.*

**Keywords:** *Technology transfer, Academia-industry relationships, Commercialization, Innovation, Long-life education.*

## 1. Introduction

The political and economic breakthrough the East European countries were faced with at the end of the last century had a great impact on funding of research and development, industry structure and, as a consequence, the technology transfer from the university to industry: the old models became no more applicable and new ones were not in place yet. At present, East European countries are in the process of developing tools – institutional, financial, legal – to stimulate innovative and pro-commercialization attitudes in the scientific environment and to enhance cooperation between university and industry. A unique program developed recently by the Polish Ministry of Science and Higher Education “TOP 500 Innovators – Science-Management - Commercialization” is a very interesting and inspiring example of a

strategic approach and a governmental activity in this field. A training course was designed by the Ministry and leading American universities: UC Berkeley and Stanford University, and addressed to Polish scientists to assist them in their attempts to get into the market with products or technology worked out as a result of their research and to prompt them as individuals familiar with the barriers at the academia to propose new tools and solutions to break the barriers. The program has a form of a 2 months' course for individuals qualifying for the program. The course takes place at one of the highest ranked universities worldwide and focuses on topics connected with the issue or research results commercialization, research management, developing of soft skills. Generally, it fills in the gap in education of research and teaching academia staff. The existence of such a gap is a universal phenomenon, noticeable not only in the new EU member countries. Within the program a project concerning enhancement of technology transfer from academia to industry was run by the authors of the paper. Already existing tools serving that purpose were presented, the current state analyzed and new tools implementable by academia proposed. Poland and other East European countries share many similarities in the context of university-industry relationships. Though worked out specifically for Poland, the solutions shall be effective in other countries of the region, too.

## 2. Objectives

The study has two aims: first, to give an outline of the program Top 500 Innovators – Science – Management – Commercialization as a unique example of a governmental activity addressed to individuals to achieve effects on a country scale in the field of research management and commercialization of research results; second, to present the end-results of a team project carried out by the authors within the aforementioned program. The project concerns the issue of enhancement of the tech-transfer between academia and business. It includes both: analysis of the current situation and existing institutional tools as well as proposals of new initiatives and activities applicable in academia to achieve higher effectiveness in the field of tech transfer.

## 3. Program Top 500 Innovators

Program Top 500 Innovators was designed as a tool to stimulate individuals employed within academia or institutions involved in research results commercialization to take a pro-active and pro-commercialization approach. This is an innovative strategy to change the landscape of a whole sector of economy through changing individuals. The program started in 2012 and is planned to run till 2015. A general outline of it is given below. [1]-[2]

**Program general description.** Participants take part in a 9 weeks training course at one of the best ranked universities worldwide, eg Stanford University, University of California – Berkeley, University of Cambridge. The program started in 2013. By the end of 2015 five hundred participants shall have graduated from it.

**Target group.** The program is addressed to two groups: 1) science and research employees holding at least a master degree whose research activity concerns one of the following areas: technical, agrarian, forest, health, physical culture, medical and veterinary and life sciences; 2) employees of centers of technology transfer who are involved in commercialization of research results obtained in the above-mentioned areas.

**Goals.** The program aims at improving qualifications of research and development staff in the field of cooperation with business and industry, research management and commercialization of research results. Realization of the project shall contribute to optimization of national and European funds allocation in the field of research so that R&D results are effectively transferred into practice and industry. The participants shall be given an opportunity to visit companies in which commercialization of research results plays an important role, meet entrepreneurs and representatives of venture capital.

**Financing.** The program is financed from the funds of the Human Capital – National Cohesion Strategy by the Polish Ministry of Science and Higher Education. The Ministry funds the costs of the training, transportation, accommodation, visas, insurances and grants daily allowances to the participants.

**Training content and schedule.** The training includes 240 hours of activities in form of: lectures, workshops, discussion panels, site visits in companies, internships in companies and at the university, meetings with entrepreneurs and investors. An example of a weekly program schedule template is shown in table 1. The lectures and workshops focus on: research management, team management, practical aspects of commercialization, legal aspects of commercialization, spin off and spin out companies, cooperation of the academia with business, commercialization of advanced technologies, innovation strategies, fund obtaining, soft skills like the art of leadership, decision making, design thinking, effective communication, risk and conflict management, time management. During the training the participant is assigned to develop, take part in and finish three distinct projects: 1) internship project; 2) personal development plan; 3) ministry project.

Table 1. An example of a weekly program schedule template. [3]

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Breakfast						Sight-seeing Sport Integration
Morning I	Lecture I	Site visit I	Internship	Internship	Individual and group mentoring	
Morning II	Lecture II					
Lunch						
Afternoon I	Workshop I	Site visit II	Internship	Internship	Independent study	
Afternoon II	Workshop II					
Evening						

**Evaluation and post-program activities.** Every week during the course the participants are asked to fill in transportation and meals quality. After completing the program the Ministry shall support the participants in their activities in the field of innovation, technology transfer and commercialization. The participants are expected to give feedback to the Ministry in form of a report, filling in of a questionnaire, presenting a commercialization plan.

The realization above-enumerated foundations of the program was of highest quality, especially when teaching/coaching staff, rank of the companies visited and the institutions offering internships are concerned. The participants were invited for guided visits, including meetings with top managers and experts, in such companies and institutions as NASA, Google, You Tube, Cisco, Autodesk, Mckesson, Institute for the Future, LBL Advanced Light Source - UC Berkeley, Molecular Foundry – UC Berkeley NASA, which does not complete the list. Internships were carried out eg at UC Berkley Department of Bioengineering and Department of Material Science and Engineering. Among the lecturers there were personalities of international renown, eg: Mark Rittenberg – a top specialist in coaching, communication and leadership trainings; Clark Kellogg - design and design thinking teacher at UC Berkeley in both the College of Environmental Design as well as the Haas School of Business, a director of the Spark Design Award; G. Scott Hubbard – a NASA specialist with over 25 years of experience in research, development and management of space science missions, an expert in project management, technology transfer and negotiating large scale public financing of research .

#### 4. Ministry projects

Participants of the program Top 500 Innovators are assigned a task to elaborate and realize a team project with tangible, implementable benefits for the Polish Ministry of Science and Education. The topics proposed by the program creators in the autumn program edition 2013 were as follows: 1. Reconsidering the role of the faculty member: allocation of time and incentives across research, teaching and consulting; 2. Improving teamwork, creativity and innovation within the universities; 3. Enhancing technology transfer between universities and businesses within Poland; 4. Enhancing cooperation between Polish and American businesses; 5. Entrepreneurship: encouraging risk taking and failure through culture, process

and organization and rewards; 6. Creating ‘T-shaped’ leaders within the scientific community; 7. Creating networks between industry and Polish universities; 8. Developing leadership programs within universities for future business leaders. [3]

The topics are related to issues of highest importance for upgrading of skills of academia research and development personnel, academia teachers and academia decision makers. These topics define areas of existing deficits in the education of academia staff and, at the same time, areas of chances and improvement still to be achieved. As a consequence, this improvement shall be of benefit for the whole society and country economy. Though addressed to a specific target – Polish scientific and academia employees, the above-mentioned aspects are of global concern. The model of the team work was founded on five rules: team member number 2 – 8 people, project scope determined by teams, topics suggested by the organizers, 30 minutes’ presenting of the outcomes followed by question and answers and feedback, end-results to be reported to the Polish Ministry of Science. The work track embraced several steps as presented in table 2 and was realized in a series of internal team meetings and consultations with a coach.

Table 2. Tasks and deliverables within Ministry Projects. [3]

TASK	DELIVERABLE
Assignment of teams and definition of project topic	Project topic
Refinement of project scope and data gathering sources	Project scope, resources list
Team collaborative plan and project management	Project plan
Converging: refining hypotheses	4 slide project summary
Project feedback	Draft project presentation
Final project presentations	Final project presentations
Reporting to the Ministry	PDF presentation or a www link

## 5. Project: *Transferology* - enhancing technology transfer between university and business within Poland

The authors created a team to develop a project concerning the topic “enhancing technology transfer between universities and businesses within Poland”. The scope was set up and included: analyzing already existing tools promoting technology transfer; considering the economic factors and determinants; presenting examples of handling the issue in the UC Berkeley; proposing specific activities implementable at Polish universities taking into consideration the fact that they function in different environment and under different conditions than the American counterparts. It has to be underlined that proposing of simple and feasible for a university changes was the aim of the authors.

### 5.1. Existing tools

Polish administration and decision maker at the governmental level have realized the necessity of introducing some institutional tools to stimulate innovative scientists and entrepreneurs and to create a platform for academia –business exchange. At present the following institutions that were established by legal acts passed by the Parliament, are involved in promotion of technology transfer:

**The National Centre for Research and Development** – the implementing agency of the Minister of Science and Higher Education. It was appointed in 2007 as an entity in charge of the performance of the tasks within the area of national science, technology and innovation policies. It operates under the Act on National Centre for Research and Development dated 30 April 2010. It was the first entity of this type, created as the platform of an effective dialogue between the scientific and business communities. In addition, the National Centre for Research and Development functions as the Mediation Institution in three operational programmes: Human Capital, Innovative Economy and Infrastructure and Environment. The institution is one of the greatest innovation centres in Poland. [4]-[5]

**Academic Business Incubators and Technology Transfer Centers** – these type of institutions were introduced by the Law on Higher Education, Article 86 that states: “1. With a view to fostering the optimal use of the intellectual and technological potential of higher education institutions and the transfer

of research findings to the economy, higher education institutions may establish academic business incubators and technology transfer centres. 2. An academic business incubator shall be established with the aim of supporting the economic activity of the academic community or staff and students of a higher education institution. 3. An academic business incubator can be established in the form of: 1) unit at the institutional level; 2) business entity or a foundation. 4. A technology transfer centre shall be established with a view to trading research and development findings or transferring same to the economy without charge. 5. A technology transfer centre established in the form of: 1) unit at the institutional-level shall operate on the basis of regulations to be approved by the senate of the higher education institution concerned; 2) business entity or a foundation, shall operate on the basis of the relevant documents regulating its status.” [6] Many universities have taken the opportunity and created such incubators and centers, among them there are: the Jagiellonian Centre of Innovation, Poznan Science and Technology Park, Gdansk Science and Technology Park. [7]

## 5.2. Economic and statistical landscape of tech-transfer

There are tremendous differences between countries and regions concerning expenditures made on research and development that have a great impact on the function and effectiveness of this sector and on technology transfer. Another observed phenomenon is that companies prefer running their own R&D departments than to look for an external partner, which a university could be. This is not positive news for academia. Polish situation is extremely weak because of very low expenditures on R&D and the dependency on public funds, more about it in the text below (Figures 1, 2).

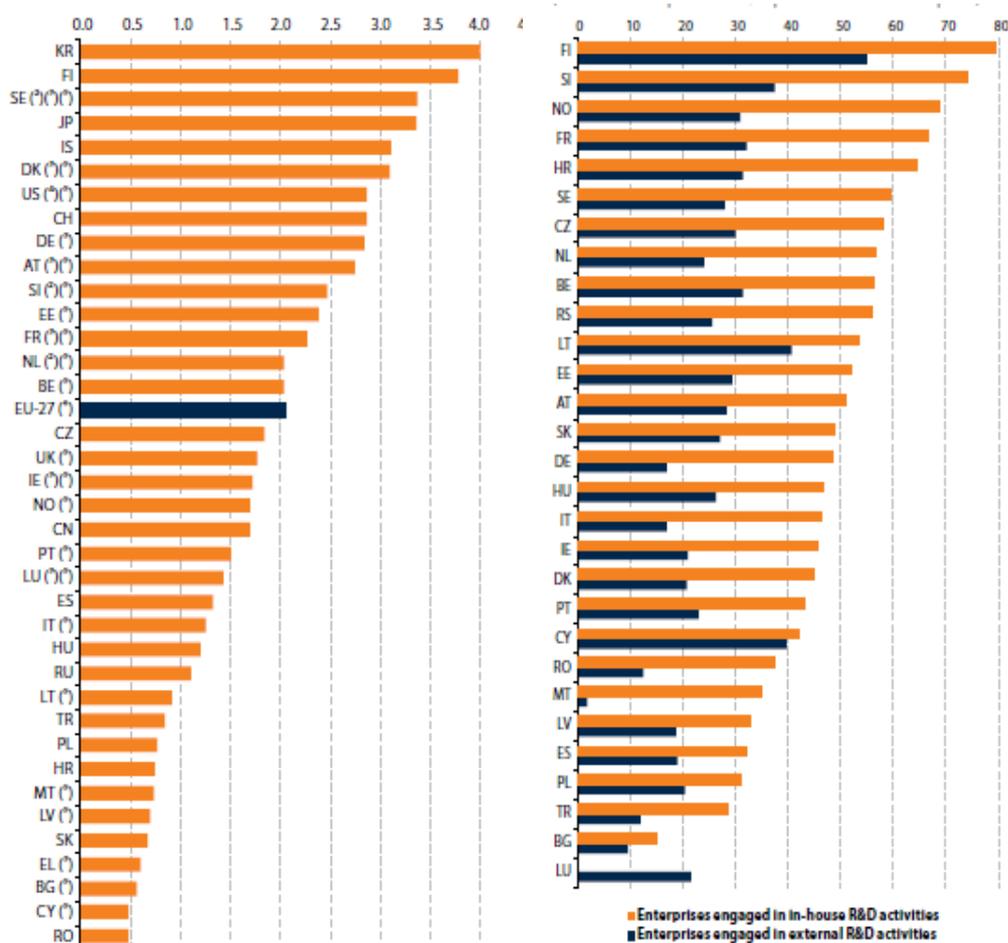


Figure 1. R&D intensity/expenditures as % of GDP 2011. Figure 2. Product or/and process innovative enterprises doing in-house or external R&D 2008-2010. Source: Eurostat 2013. [8]

According to Eurostat, in 2010, the government sector financed 34.6 % of total R&D expenditure in the EU-27, while business enterprise financed 53.9 %. More than 49 % of R&D expenditure in Cyprus, Poland, Romania and Slovakia was funded by the government sector. On the other hand, the business enterprise sector was heavily involved in financing R&D activities in R&D-intensive In the EU as a whole, the business enterprise sector was the largest sector, employing more than half of R&D personnel (1.4 million FTEs). However, this pattern differed at national level for certain countries. In Bulgaria, most of the R&D personnel were employed in the government sector, while the higher education sector accounted for the highest shares of R&D personnel in Estonia, Greece, Cyprus, Latvia, Lithuania, Poland, Portugal, Slovakia, Croatia and the United Kingdom. [8]

### 5.3. How do they do it in the UC Berkeley

UC Berkeley is a very good example of an academia institution where certain traditions and pathways in maintaining relationships with business and industry are well established. The modus operandi of university-business cooperation can be presented in form of a schema (Figure 3).

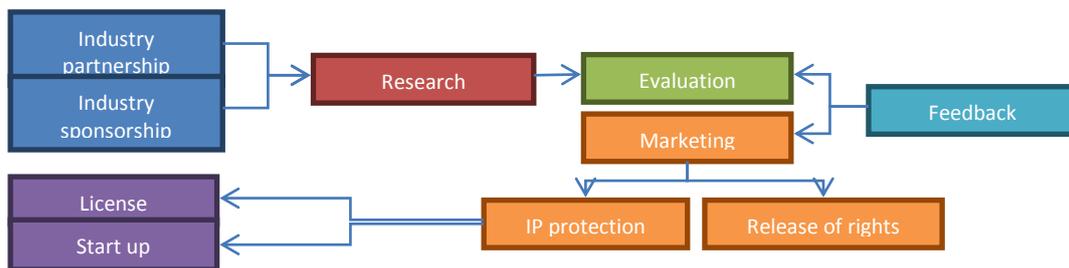


Figure 3. An algorithm: from university-industry cooperation to commercialization.

Effective functioning of that model is possible to a great extent due to existence of a specialized university unit - UC Berkeley's Office of Intellectual Property and Industry Research Alliances (IPIRA) It was created to provide a platform for industry research partners to interact with the campus. IPIRA's mission is to establish and maintain multifaceted relationships with private companies, and thereby enhance the research enterprise of the Berkeley campus. These relationships include sponsored research collaborations, and intellectual property commercialization. This office consists of two groups: the Office of Technology Licensing, and the Industry Alliances Office. [9]

### 5.4. Proposals of tools to be applied by academia

Participants of the course were asked to point out main factors that would contribute to enhancement of technology transfer and pro-innovation activities of academia as such and its employees. After the list was completed a voting took place in which every participant pointed out three most important. The list and the scores are shown in Table 3.

Table 3. Factors important for technology transfer potential in course participants' opinions and results of voting on the most influential factors.

Proposal	Score	Proposal	Score
Industry internships for students	13	Promote researchers who are innovative	5
Simplicity of legal process for business creation	11	Knowledge up-grade for decision makers	5
Success stories of university employees	10	Networking events	5
Teach entrepreneurship early	10	Forget the hierarchy, present your opinions	4
Teach team working	9	Pro-industry government policies	2
Pitch competitions in universities	8	Build alumni social relations	2
Curricula should encompass entrepreneurship	8	Micro-grants for technology maturation	1
Build a brand for the academia	5	Increase social life on campus	0

The voters were representatives of a wide range of academic fields. Therefore we came to the conclusions that the list and voting results have a universal importance for the academia and are a good starting point for proposing some new tools: simple and feasible but at the same time with a big potential. We focused

on four aspects that are depending on academia will and not the readiness of government to pursue a definite policy. And these are: 1. Success stories; 2. Attracting industry affiliates; 3. Pitch competitions; 4. Promotion of academia by presence in media and on industry fairs. This way an entrepreneurship and tech-transfer stimulating environment can be created as well as mutual trust between university and industry. The details are shown below in Table 4.

Table 4. Selected tools for academia to create an environment stimulating technology transfer.

<p><b>Promotion of Academia</b>  <b>Principle:</b> be present in media and trade  <b>How:</b> activate or create Public Relations units, grant additional points in employee assessment for publication in trade and journals or popular periodical, take part in trade fairs (scientific congresses are not enough), present technology, models and not only brochures  <b>For whom:</b> researchers  <b>Financing:</b> mini-grants for constructing models for presentation, fair participation costs covered by the university  <b>Benefits from fairs:</b> mutual networking opportunities, learning the needs and potential of industry and presenting university's potential to the industry, a starting point for cooperation, personal meetings  <b>Benefits from media presence:</b> building university brand, dispersing information on university technical offer</p>	<p><b>Industry Affiliates</b>  <b>Principle:</b> companies pay the university a contribution yearly depending on the company's size  <b>Benefits for the company:</b> access to the best students and potential future employees, access to the results of research, access to appliances, joint projects co-financed from public funds – lowering own costs, potential influence on curricula, promotion of the brand among the students, seminars by faculty members for company employees  <b>Benefits for the university:</b> funds source, possibility of internships for students – especially important for some faculties where there is a legal requirement of such internships  <b>Financed:</b> by the industry affiliates</p>
<p><b>Success stories</b>  <b>Principle:</b> dispersing information of successful young investigators, researchers, spin off entrepreneurs  <b>For whom:</b> students, researchers, spin off entrepreneurs  <b>How:</b> media, university internet page, official gatherings  <b>Benefits for both:</b> the individuals and university, reputation, brand creation, increasing the chances of cooperation with new partners, creating a "success-friendly" environment within the university  <b>Financing:</b> university, foundations, public funds</p>	<p><b>Elevator Pitch Competitions</b>  <b>Principle:</b> to present an outline of a business concept within 90 seconds as if told a person in an elevator. It should be delivered concisely and interestingly. The purpose is to pique the interest of the audience and make them want to know more. No notes or audio-visual aids are allowed.  <b>For whom:</b> researchers and students  <b>Organization:</b> by university, finals open to public, with the participation of investors and industry representatives, cash prizes to attract participants, integration meeting after the award ceremony  <b>Financed by:</b> university, foundations, venture capital, industry, public funds</p>

## 6. Final Remarks

Program Top 500 Innovators is addressed to representatives of different parts of the academic world. Every participant (40 persons in the edition concerned) has got own expectations concerning the goals to achieve through the program. That situation was very smartly described by Professor Andrew Isaacs, one of the American organizers from UC Berkeley Haas School of Business: *"In fact, we have to do not with one program but with 40 individual programs"*. General conclusion concerning implementation of the content learnt is that there are no cop-paste solutions. The United States and Europe have different determinants, tradition, mentality of people. Still, many mechanisms and approaches can be adopted to serve the society. One cannot change the whole world at once but it makes sense to start doing it step by step. The idea to start positive changes on a country scale by changing the approach and broadening the knowledge of individuals, is a very interesting idea that might turn out very effective. Proposals of solutions for tech-transfer enhancement though adjusted to Polish academia-industry relationships may be of benefit for other countries of the region. The program Top 500 Innovators is an outstanding example of an effective international cooperation in the field of education of scientists and engineers

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