

Technology Transfer – Case of Slovak Academic Environment

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Abstract. Innovativeness and subsequent technology transfer is essential for universities and research institutions in order to remain competitive. However, Slovak universities or research institutions have not been successful in these transfer initiatives. The purpose of this paper is to analyze the current technology transfer activities of the University of Žilina in Žilina as well as propose recommendations in order to ensure further successful and sustainable technology transfer.

Keywords: Technology transfer · Sustainability · Cooperation · Research · University · Slovak universities · University of Žilina

1 Introduction to the Topic

Technology transfer (TT), which is closely related to knowledge transfer (KT), has already become an object of interest in Slovak republic, not only for universities and businessmen, but also for politicians, regions and various research organizations. The main reason is changing view on the role of research and development (R&D) by supporting economic growth of the country or region. TT is able to generate both significant financial and other advantages for all involved subjects, as we can see on examples from USA, Great Britain or Germany [1].

There are several *meanings* of the term TT. It can be understood in one of the following ways [2]:

- as an effort to develop backward countries by providing them technology from developed countries,
- as a movement of technology in the commercial sphere between companies or within one company among its organizational units,
- as a transfer of research and development results into practice, which means also transfer of technology from academic environment to commercial.

There are also various *definitions* of the term TT. Following two definitions are the most accurate. “Technology transfer is a process of transferring scientific results from one organization to another in order to achieve its further development and

commercialization. This process usually involves (i) identifying new technologies; (ii) protecting technology through patents and copyrights; (iii) preparing strategies for the development and commercialization, marketing and providing licenses to private companies or creation of new technology start-up companies” [3]. TT is a technical term that means not only transmission of technology. In a broader context, when it comes to the transmission of any knowledge, it is possible to use the term *knowledge transfer*, which is justified by the second definition, which says: “Technology transfer is a process through which is technology extended. TT may or may not have be secured with legally binding agreements, but it includes the transfer of knowledge (through an intermediary) from provider to recipient” [4]. TT can be considered as successful if the recipient is able to use the technology effectively in practice.

TT should be seen as a complex process of applying industrial proprietaries (inventions, technical solutions, designs, etc.), which are results of R&D realized on universities, in economic and social practice for purpose of financial evaluation. The role of universities in TT is to adapt their research and development for the needs of market, while businesses are required to ensure that the final product is produced and placed on the market to customers, eventually to help research organization with research costs.

The technology transfer process is the “process of conducting basic research that is developed into commercializing new technologies” [5]. It consists of numerous complex activities whereby multiple factors influence university performance during the transfer. Process of TT itself can be divided into two main *phases*:

- protection of intellectual property - in this phase the research takes place and is generated the actual subject of intellectual property,
- commercialization - includes especially the choice of a particular method of commercialization and finding partners for its implementation.

Commercialization represents “financial evaluation of intellectual property of the institution” [6]. Depending on how is the intellectual property commercialized, the process of TT can be implemented in several ways, for example joint research, realizing research on order, transfer of intellectual property rights (or sale), licensing, establishing spin-off companies etc. [2].

There are many potential *reasons* for both universities and companies to participate in joint R&D, but there is no general agreement as to which are the most important. Empirical surveys of companies participating in such collaborations, as well as case studies and game theoretic models, processed by the authors in their study [7], point to the following incentives:

- economies of scale in research,
- economies of scope in research,
- ability to finance costly projects,
- avoidance of unnecessary duplication of research,
- risk management,
- access to know-how of the network,
- obtaining a window on related technologies,
- exploitation of partners’ complementary positions,

- internalizing the externalities created by research spillovers.

Importance of joint R&D consist in fact that it is a way how to improve competitiveness. R&D is an expensive activity, but it is also an essential source of innovations which bring competitive advantages. Joining resources can overcome costingness of the process and makes possible to perform it more effectively (e.g. Emilia-Romagna High-Tech Network) [8].

One of the main identified *problems* is that although TT or KT occurs frequently, it is often incomplete, or it is just declared [9]. Another important issue is how to organize cooperation between academia and industry so that TT and KT occur and generate benefits for everybody involved in the cooperation.

2 Situation in Slovak Republic

The current situation in Slovakia is in the phase of implementing projects aimed at supporting cooperation between research organizations and business entities. The institution that launched such a project is called *Centre of Science-Technical Information of Slovak republic* (CVTI SR). It is a national information center and also a specialized scientific public library of Slovak Republic focused on technical disciplines and selected areas from natural sciences, economic sciences and humanities established in Bratislava [10]. The name of the project is *National infrastructure for supporting technology transfer in Slovakia* (NITT SK) and is co-financed by the European Regional Development Fund (under the Operational Programme Research and Development). The strategic objective of the project is creating and implementing a system of national support of transferring technology and knowledge acquired in R&D activities into economic and social practice in order to promote the development of knowledge-based society. The system of national support of TT and KT involves building a soft infrastructure (a system of support services) and marginally building also physical infrastructure mainly relating to the completion of information systems supporting TT, i.e. realizing professional expertise and support services [11].

There is also *Industrial Property Office* (ÚPV SR) as a part of the TT management scheme in Slovakia on the next level after CVTI SR. The mission of ÚPV SR is to grant protection of industrial property, such as inventions (patents), utility models (so-called small patents), trademarks, designs, topographies of semiconductor products, designations of origin of products, and geographical indications of products. ÚPV SR provides services and products to the public in the field of industrial-legal information and supports the development of technical creativity and its protection, education and popularization of intellectual property [12].

The importance of the national supporting of TT consist in realizing R&D activities based on the specific needs from the business sector, which will result in increased rates of application knowledge and technologies acquired in research activities into industrial practice. The system should also significantly contribute to creation and development of long-term R&D cooperative partnerships of academia and industry [11].

The present condition of science parks in Slovakia could be described as in the stage of building. *Eight science parks* are planned to be built close to *six universities* in

Slovakia. Minister of education signed contracts on co-financing these projects with Slovak University of Technology in Bratislava (STU), Slovak University of Agriculture in Nitra (UNIAG), The Technical University of Košice (TUKE), Comenius University in Bratislava (UK), The University of Žilina in Žilina (UNIZA) and Pavol Jozef Šafárik University in Košice. Signed contracts include multi-source financing with using money from EU funds under the Operational Programme Research and Development, as well as from the state budget [13].

One of the first parks should be university science park “*Campus MTF STU*” built in the area of Material Technology Faculty of the STU in Trnava. The project will build a new scientific infrastructure at the global level focused on the research field of materials engineering, plasma and ion technologies, and automation of industrial processes. STU builds another *University Science Park* in Bratislava, which will have two workplaces. First workplace will deal with research in the field of information and communication technology, electrical engineering, automation and control systems, and nanoelectronics and photonics. The second one will have research oriented on modern technologies - chemistry, industrial biotechnology, the environment and the safety and reliability of buildings [14]. *University Science Park* of UK in Bratislava will operate in the field of molecular medicine, environmental medicine and biotechnology [15].

TUKE together with its partners presented the project “*University Science Park TECHNICOM for innovative applications with the support of knowledge technologies*”, whose main mission is an effective support of active development of applied R&D, innovative culture and competitiveness for concerned and customer organizations of production and services from both public and corporate environment [16]. Science Park will be focused on applied research in information and communication technology, electrical engineering, automation and control systems, mechanical engineering, civil engineering and environmental engineering. TECHNICOM is designed as an intelligent building providing space for start-ups in High-Tech formed by linking teams from universities and practice [17].

The strategic objective of the project *AgroBioTech Research Centre* in UNIAG Nitra is building a complex research, innovation and competence regional center in the field of agronomy, agroecology, biotechnology and bioenergy, which will integrate top applied research through partnerships with Constantine the Philosopher University in Nitra and the Institute of Plant Genetics and Biotechnology of Slovak Academy of Sciences in Nitra [18]. AgroBioTech will consist of three separate centers which will be based on the areas of all three partners within the project [19].

Technical University in Zvolen (TUZVO) also introduced a project of Science Park named *ENVIRO-TECH*, which will deal with complex research of forest ecosystem, research of intelligent usage of wood as the most important renewable raw material through ecological and environmental research and research in the field of environmental and innovation management [20].

UNIZA has also two projects - *University Science Park* [21], and *Research Center* [22], which will be further mentioned in the next chapter.

2.1 Case of UNIZA

The *vision* of UNIZA declared in the Long-term plan of the University of Žilina for the years 2014–2020 is: “the use and recovery of educational and scientific potential on the top European level, the broad development of international cooperation with educational and research organizations, permanent deepening of attachment to social practice” [23] and into its cross-sectional tasks were also included innovation and transfer of knowledge/technology, a technology cooperation, which includes:

- protection of intellectual property (IP),
- creating partnerships and support mechanisms for implementation of research results and innovation in practice (the creation of new business units, incubators etc.),
- applied research supported by partners from practice with direct TT.

Technology transfer at UNIZA was made primarily by enthusiastic research individuals, however most of the time they excluded university from this process. IP protection of these technologies was often lacking so it was hard to ensure that competitors would not copy the solution. UNIZA usually have not known about the transfer initiatives of individual researchers so it could not claim shares in spin-off company or on the solution.

UNIZA’s Department of science and research has been responsible for technology transfer of research results. One person has been primarily responsible for the whole technology transfer process at UNIZA. However, there have been no formal rules guiding this person. UNIZA has been lacking documents, mostly directives which would determine e.g. share in spin-off company. Several reasons such as missing directives caused apathy of researchers in technology transfer. Thanks to the NITT SK project universities across Slovakia have been provided by the possibility to gain help with technology transfer for free. NITT SK project has been a big step in increasing the technology transfer awareness among researchers.

In the future UNIZA wants to possess a complex concept supporting the process of TT and KT which would involve all its departments (primarily its faculties and scientific institutes). Therefore is UNIZA realizing projects *University Science Park* (UVP) and *Research Center* (VC), which should bring especially evaluation of the university’s potential. To this project is also engaged the Transport Research Institute, Inc. in Žilina (VÚD). Both projects had been preparing for nearly two years and they are mainly financed from the Operational Programme Research and Development. VC and UVP will be built on UNIZA campus [24].

There have already been some organizational units dealing with TT and KT at the University of Žilina. These include the *Institute for Competitiveness and Innovation* (ÚKaI), which main objectives are R&D in High-Tech and transfer of the latest technology, knowledge and innovation from this area in industry (designing methods, strategies, processes and technologies to improve the competitiveness of companies), as well as supporting the development of UNIZA by implementing technological, product and process innovations [25].

There has been only one technology transfer success story – Central European Institute of Technology (CEIT) which is a spin-off of UNIZA. CEIT provides solutions

in various areas, e.g. product, technological and process innovation, industrial automation, material innovation and biomedical engineering [26].

Based on our analysis we have identified the following major problems related to UNIZA technology transfer activities:

- lack of department which deals with technology transfer and have experiences with it as it can be seen at any foreign university where it is usually called Center for technology transfer,
- lack of directives which determine the rules of establishing a spin-off company, shares of UNIZA in spin-off company, IP protection, etc.
- lack of success stories that would show researchers that it makes sense to deal with technology transfer,
- focus on basic research more than applied research,
- poor research infrastructure,
- lot of time spent with teaching of students resulting in lack of time for research,
- unwillingness of researchers.

These problems are not new and universities across Slovakia have been aware of them for many years, however, they are still not able to solve them. New EU projects for building science parks and research centers across Slovakia should bring help to universities with all of the mentioned issues.

What should the science park and research centre projects bring and what problems it should solve:

- creation of Centre for technology transfer not only for science park but also for university itself which should help mainly with the problem of lacking department, directives and experienced people who understand technology transfer,
- focus on applied research,
- sufficient research infrastructure by getting excellent technologies which will be procured,
- new buildings where this technology will be placed,
- new excellent researchers,
- decrease in brain drain.

Building of science parks and research centers seemed promising, however, technology transfer have not been done yet. One of the main reasons is that we do not have buildings; they are still under construction so when new technologies arrive we have no place to store them and moreover to use them.

When technologies arrive some might be already obsolete because it takes so much time to specify them when writing the project and then to procure them. Some technologies are getting obsolete so quickly because of the rapid change on the market so researchers will be not be able to come up with an unique idea and be competitive using them.

There is certain time required for researchers to learn how to use new technologies. If they get them at the end of project it might be not possible to immediately produce research results which will be then commercialized. It will take time until some success arrives.

When researchers have no technologies they are not able to do research and they are losing patience.

Moreover, the Ministry of Education, Science, Research and Sport of the Slovak Republic promised new calls for projects which will build on previous experiences and infrastructure so research will be sustainable. However, the Ministry still has not released information about new calls. Therefore many researchers are worried about their future in science parks and research centers.

3 Discussion

Concept of sustainability in socioeconomic area is nowadays well known and used. E.g. sustainability performance of companies could be evaluated [27] in order to analyze and project more efficient solutions (economical, strategical, marketing, etc.). According to Galpin and Whittington “Sustainability now appears to be the strategic imperative of the new millennium and is building momentum similar to the excellence, quality, and reengineering movements of the late 20th century” [28]. They also emphasize that sustainability could be an integral part of corporate strategy with significant impact on its effectiveness. In older work of Dyllick and Hockerts is sustainability defined as integrating element of economic, ecological and social aspects (triple-bottom line) in a corporation [29]. In all above mentioned works is the concept of sustainability oriented on organization’s value creation (economic aspect), effective management of stakeholders (economic and social aspect) and on long-term sustainability of an organization in its environment (strategical aspect).

What are the main recommendations for making the technology transfer process in Slovak academic environment sustainable?

- *Partnership*. All strategies and real actions are oriented on development of long-term partnerships between crucial stakeholders [30]. This partnership must be in general beneficial for each partner; relations are based on mutual trust.
- *Management system* strategy and performance are oriented on effective cooperation creation and its sustainability [31, 32].
- *Positive externalities*. Effective cooperation based organizational forms could have significant impact (positive) on its wider socio-economic environment [33, 34].
- *Continuous Innovativeness* will ensure sustainability [33, 34]. This must be also a part of management strategy. Results of R&D activities must be sufficiently innovative in order to be successful in academic area or in commerce market.

The problems experienced at the universities across Slovakia that arose from analysis are considerably complex and therefore their solution requires comprehensive approach. We proposed a set of practical recommendations that are crucial for effective and sustainable technology transfer at universities and research institutions.

- *Willingness of researchers*. Researchers need to have motivation to conduct serious applied research.
- *Motivating directives*. University needs to prepare official formal documents supporting the knowledge transfer process, especially directives determining rules of

establishing a spin-off company by researchers, shares of university in spin-off company, etc.

- *Proper help from university side.* Universities have to make sure they have experts in various fields who can provide sufficient help to researchers when thinking about establishing spin-off company and transferring their research results into practice. These experts should be in the field of IP protection, marketing and sales, finance, law, etc.
- *Sufficient research infrastructure.* Universities should have excellent technologies thanks to the recent projects for building science parks and research centers. When these technologies are procured, researchers should be able to conduct extraordinary research.
- *Less teaching, more time for actual research.* The trend in Slovakia is increasing teaching hours per teacher while decreasing the number of teachers at faculties. This trend results into lack of time for carrying out research.
- *Focus on getting support for performing applied research.* Researchers should be focusing more on getting grants and other forms of support, e.g. sponsorships for their research. Applied research is lagging behind so strengthening the activity focusing on doing research for companies will help to bring money for supporting further research activities and ensuring sustainability in research.
- *Faster publishing of new calls for research projects by the Ministry of Education, Science, Research and Sport of the Slovak Republic.* Ministries have very important role in education. They are responsible for publishing calls for submitting projects. They need to foster the research process by being flexible and fast in publishing calls concerning education and research.
- *Improvement of procurement process which requires changes in law.* Research and technology transfer process would not be easier without encouraging responsible people to propose amendments to law.

4 Conclusions

Slovakia is one of the countries where technology transfer is very poor mostly due to the lack of knowledge and experiences with it as well as awareness about the need of intellectual property protection prior to the actual transfer and commercialization of research results.

There have been extensive debates in Slovakia during the last few years if these problems could be solved by building science parks and research centers where researchers can find the best environment for their research. However, these institutions are not enough for solving the problems we identified from our analysis. Without motivation of researchers to conduct serious applied research which would be then commercialized even the best condition would be negligible. Problems with Slovak law are also negligible. This problem is complex and requires significant changes.

This paper, therefore, investigates the current technology transfer activities at the University of Žilina in Žilina. This investigation shows that although the University of

Žilina in Žilina has a big projects for building the University Science Park and Research Centre, technology transfer activities are not yet sufficiently developed.

Based on our analysis, we proposed set of recommendations for sustainable technology transfer which require not only change at the universities but further changes in law and other related fields.

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