

**Jana KUNDRÍKOVÁ**

University of Žilina, Faculty of Management Science and Informatics,  
Department of Management Theories, Slovak Republic  
jana.kundrikova@fri.uniza.sk

**TECHNOLOGY AND KNOWLEDGE TRANSFER  
AND ITS APPLICATION IN COOPERATION BETWEEN  
UNIVERSITIES AND BUSINESS**

**Key words**

Cooperation management, knowledge transfer, literature review, technology transfer, technology transfer institution, university's research commercialization.

**Abstract**

This paper deals with the topic of technology and knowledge transfer. It is a literature review explaining terms such as cooperation management, technology and knowledge transfer, technology transfer institutions, and university's research commercialization. It also describes ways how university as a research organization provides commercialization of intellectual property developed on premises of a university. Benefits from participating in technology and knowledge transfer are defined for each group, i.e. research organization (or university), researcher, business and region.

**Introduction**

Cooperation is becoming one of the key tools for achieving strategic competitiveness. In the university environment, cooperation focuses on the commercialization of research solutions into practice through **technology transfer** (TT). Universities are beginning to realize various projects oriented at building-up science parks with the purpose of bringing together the best people

from universities, research, and business in one place. It is an effective way to support both the transfer of knowledge and innovative ideas directly into industry or other commercial practice.

The term **cooperation** is defined as *a complex system whose elements are stakeholders aiming to achieve certain benefits that would be difficult to achieve individually.* [5, 9, 14] Creating cooperative interconnections allows the spreading of innovative activities and helps to increase the global competitiveness of the participating organizations, because globalization means that internal efficiency is not enough to achieve international competitiveness. [14] “Cooperation management” is a common term in literature within the context of cooperation.

**Cooperation management** is *“effective and efficient management of relationships in a cooperation between separate and relatively independent organizations or individuals with the goal of improving their competitiveness.”* [15].

## 1. Technology transfer

There are several **meanings** of the term TT. It can be understood in one of the following ways [3]:

- As an effort to develop developing 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; or,
- 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. The 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 licensing to private companies or the creation of new technology start-up companies.”* [2] TT is a technical term that means more than 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** (KT), 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 been secured with legally binding agreements, but it includes the transfer of knowledge (through an intermediary) from a provider to a recipient.”* [17]. 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 the results of research and development realized in universities in economic and social practice for the purpose of financial evaluation. The role of universities in TT is to adapt their research and development for the needs of the 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 process of TT can be divided into two main phases:

1. *Protection of intellectual property*: In this phase, the research takes place and is generated, making it the actual subject of intellectual property.
2. *Commercialization*: This especially includes the choice of a particular method of commercialization and finding partners for its implementation.

**Commercialization** represents "*financial evaluation of intellectual property of the institution.*" [11]. Depending on how the intellectual property is commercialized, the process of TT can be implemented in several ways, which include following [3]:

- **Joint research**: Realizing research through cooperation means multilateral cooperation with a minimum of two partners, where each of the partners brings a deposit (research potential, capital, feasibility of producing outputs, connection to practice, etc.). It usually focuses on larger and more difficult projects, which often involve a share of basic research; therefore, the expected results are specified rather general.
- **Realizing research for a specific order**: Research is realized following a contract, where the sponsor (company) determines the research task (or outcome) that a scientific research institution (university) realizes. The result is the generation of a subject of intellectual property owned by the sponsor and to which the law is carried out depending on the form of the signed contract.
- **Transfer of intellectual property rights (or sale)**: In case the holder of intellectual property rights (especially industrial rights) wants to avoid the risk of the obsolescence of the intellectual property (because its further use would be ineffective and would cease to be profitable), the best strategy is the transfer of property rights to the intellectual property. Payoff for the transfer of rights is usually a one-time exchange and with immediate maturity.
- **Licensing**: If the holder of the rights to the subject of intellectual property is not able to place it on the market or ensure its commercial success in the required range by himself, a good strategy is to license. The holder of rights grants permission to another person to use the intellectual property following the mutually agreed terms. The specific conditions and financial reward are defined in a closed licensing agreement.

- **Establishing spin-off companies:** This form of TT is chosen in order to independently use and develop intellectual property of academic or research institutions and to create a product or service for the market. The activities of a spin-off company usually concerned the authors of the intellectual property. Intellectual property is provided to the spin-off company through a license agreement or transfer of rights. The institution may obtain shares in the spin-off company.

TT between universities and businesses is important for both sides. Gains for the university can have the form of funds, feedback on their competence and performance in research, and participating in the identification of new research areas. Enterprises benefit from access to external knowledge and support in building specific competencies with the help of universities. These benefits may appear, but it is important to realize that they are not automatically guaranteed [7].

The **goal of TT** is to transfer research results from research and development organizations to the business sector. **Benefits** of the process of TT can be sorted and described in relation to the following actors who are involved in this process [13]:

- *Research organization:* Although receipts from the selling of licenses will never make the most of its revenues, this component may have a significant impact on the budgeting of the institution, which leads to increasing the quality of its research and teaching process. Such funds are often used for creating spin-off companies or to further support the whole process of TT. Cooperation with industry is also improved, which leads to greater financial support for research from companies. The main non-financial advantage is to improve the prestige of the university and the acquirement of new initiatives in applied as well as basic research. Universities can use it to attract outstanding scientists and more students.
- *Researcher:* The application of inventions in practice can bring to researchers considerable financial resources and prestige in the scientific community and the public. The possibility of applying research results in practice motivates scientists to perform better which improves their expertise and furthers cooperation with industry.
- *Business:* Financial benefits are of primary importance to entrepreneurs. Among the non-financial benefits can be included improving the company's image among the public, improving cooperation with the academic sector, and improving the mobility of workers between the business and research sectors.
- *State/region:* TT has a direct impact on the economy of the state or region. The main financial benefit for the state is improving economic development and the competitiveness of the country. TT also supports the development of business environment and leads to increasing corporate profits and tax

revenues. More job positions are created, and they have higher added value. New technologies also improve population health and the quality of life in general. Benefits include improving the image of the country, which is seen as friendly for innovative solutions, which can increase foreign direct investment.

Although there are always mentioned positive effects in discussions on the topic of TT and KT, the process has several risks. These include the following [13]:

- Financial return proportionally depends on the possibilities to commercialize the invention in practice.
- There is the risk of partial or complete loss of control over intellectual property by providing a license or selling a patent.
- There is a difficult choice between publications vs. patents, which involves deciding whether the research organization should prioritize maximizing revenue from the sale of patents or publish a new discovery.
- Research activities must be balanced with commercial activity, which means finding an appropriate proportion between business activities at the university (e.g. enable spin-off companies to exploit research organization facilities) and research or education.
- Basic research and applied research funding allocations must be in a proper proportion.

## 2. Knowledge transfer

KT is the practical problem of transferring knowledge from one organization to another, or transferring knowledge from part of the organization to another (or all other) parts of the organization [19]. **The goal of KT** is organizing, creating, capturing, or distributing knowledge and ensuring its availability for future users. KT is considered to be a complex problem, because knowledge resides in organizational members, tools, tasks, and their sub-networks [1], and much knowledge in organizations is tacit or hard to articulate [12]. The subject has been taken up under the title of Knowledge Management.

KT can be defined as the means by which expertise, knowledge, skills and capabilities are transferred from the knowledge base (for example, a university or college, a research centre, or a research technology organization) to those in need of that knowledge (for example a company, social enterprise, or not-for-profit organization). [8] Hence, KT involves the interface between universities and business, and it involves the commercialization of skills and expertise possessed by higher education. The purpose of KT is also to catalyse and facilitate innovation. Examples of KT are the following [8]:

- The UK Technology Strategy Board (TSB) Knowledge Transfer Partnership [18] (KTP) product;

- Spin-off companies;
- Incubators and entrepreneur schemes;
- University-industry contracts and consultancy;
- Licensing of university-originated intellectual property;
- Other modes of knowledge transfer and technology transfer, e.g. work-based learning projects;
- The knowledge transfer, knowledge origination and knowledge exchange process; and,
- Innovation, open innovation and the generation of new ideas.

Cooperation between universities and business is mostly oriented in joint research and development (R&D). Companies want to implement current technology and modern concepts, but they do not have enough information about them and/or they are not able to apply them in specific conditions in their companies. [4] It also often happens that companies have good ideas, but they are not able to realize them primarily because of the insufficiency of necessary knowledge.

There are many potential reasons for companies to participate in joint R&D, and there is no general agreements 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 [16], point to the following incentives:

- Economies of scale in research,
- Economies of scope in research,
- The ability to finance costly projects,
- The avoidance of unnecessary duplication of research,
- Risk management,
- Access to know-how of the network,
- Obtaining a window on related technologies,
- The exploitation of partners' complementary positions, and
- Internalizing the externalities created by research spillovers.

One of the main identified problem is that, *although TT or KT occurs frequently, it is often incomplete, or it is just declared* [1]. As for the relationship between the concept of "technology transfer" and "knowledge transfer," literature confirms that KT is a broader term that involves the process of TT.

### 3. TT and KT through technology transfer institutions

TT and KT can be realized through a **technology transfer institution** (TTI), which represents a part of the research organization that provides the commercialization of intellectual property. TTI is a *"specialized facility that may arise near the academic or scientific research institution, and whose mission is to provide information and services needed to protect intellectual property and its commercialization."* [11]. Fundamental activities of TTI are identifying and evaluating scientific discoveries, ensuring the protection of intellectual property, the sale or licensing of patents, establishing spin-off companies, or the administration of capital for start-ups.

The main task of TTI is the intermediation of R&D from the parent institution to its practical application (business sector, public administration). TTI acts within the institution and, with the help of scientists, tries to identify inventions with commercial potential. It also provides guidance, reduces the administrative burden on research employees, and manages patents and licenses. On the other hand, outside the institution, it provides the patenting of R&D results, its marketing, the identification of potential customers, makes contacts with business, the sales of licenses, and acquires external funding for further research. An important factor is also in marketing TTI itself, because the centre must be visible not only between workers of the research organization, but also between companies.

The three **types of TTI** are distinguished from the aspect of the legislative form [6] illustrated in Figure 1 as organized in a joint R&D. The types are the following:

1. TTI as an organizational unit or specialized department within research organization;
2. TTI as a subsidiary organization working outside of a research organization, connected to a specific research organization or a specific department of a research organization; or,
3. TTI as a public or private, independent intermediary serving more than one research organization.

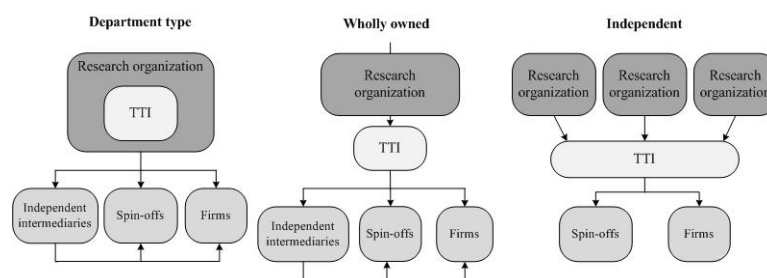


Fig. 1. Models of TTI

Source: Technology Transfer Institutions in Europe [6].

Competencies and activities of TTI may vary from centre to centre. It depends on how they are set up by the parent organization of the TTI. Implementation of individual tasks in TTI depends mainly on its organizational structure, budget, the number of employees, and the quantity of the results of intellectual property created in the research organization.

### **Conclusions**

Discussing the topic of TT is important because universities are now trying to apply the results of their R&D into commercially usable products or services. One of the ways to get the product from the university to the market is establishing spin-off companies through various activities such as incubators operating in universities. The topic of both TT and KT has a huge potential for further analysis and investigation.

Both universities and companies profit from TT and KT. Universities are interested in cooperation with business because of the possibility to verify their theoretical hypotheses and research solutions in practice or to find new relevant research topics. The financial aspect is also very important, because universities need to finance their further research activities and continuous development and progress.

Companies want to implement modern technologies into their processes in order to increase productivity and effectiveness or help with solving a problem they are not able to handle on their own and need assistance from experienced experts; or they are interested in technical expertise, which be done by universities' research workers quickly and relatively cheaply (compared to expert services provided by specialized companies).

### **Acknowledgements**

This paper was supported by the Slovak scientific grant VEGA 1/0621/14 Marketing management in cooperative environment – Proposal of strategic cooperation management implementation model.

### **References**

1. Argote L., Ingram P.: Knowledge Transfer: A Basis for Competitive Advantage in Firms. Pittsburgh 2000. [online]. [cit. 2014-01-30]. <<http://www.sciencedirect.com/science/article/pii/S0749597800928930>>.
2. Association of University Technology Managers. AUTM's About Technology Transfer. [online]. [cit. 2014-03-05]. <[http://www.autm.net/Tech\\_Transfer.htm](http://www.autm.net/Tech_Transfer.htm)>.



3. Center of science-technical information SR: Duševné vlastníctvo a transfer technológií. Bratislava 2012. ISBN 978 -80 -89354 -07-8. [online]. [cit. 2014-04-03]. <[http://nptt.cvtisr.sk/buxus/docs/Dusevne\\_vlastnictvo\\_a\\_transfer\\_technologii\\_1.pdf](http://nptt.cvtisr.sk/buxus/docs/Dusevne_vlastnictvo_a_transfer_technologii_1.pdf)>.
4. Coates P., Arayici Y., Koskela L.: Using the Knowledge Transfer Partnership model as a method of transferring BIM and Lean process related knowledge between academia and industry: A Case Study Approach. Washington DC 2010. University of Salford Institutional Repository. [online]. [cit. 2014-03-18]. <[http://usir.salford.ac.uk/12890/2/Using\\_the\\_Knowledge\\_Transfer\\_Partnership\\_model\\_as\\_a\\_method\\_of\\_transferring\\_BIM\\_and\\_Lean\\_process\\_related\\_knowledge\\_between\\_academia\\_and\\_industry-IssueA.pdf](http://usir.salford.ac.uk/12890/2/Using_the_Knowledge_Transfer_Partnership_model_as_a_method_of_transferring_BIM_and_Lean_process_related_knowledge_between_academia_and_industry-IssueA.pdf)>.
5. Czech Invest: Průvodce klastrem. [online]. [cit. 2013-02-25]. <<http://www.czechinvest.org/data/files/pruvodce-klastrem-63.pdf>>.
6. European Commission, DG Enterprise: Technology Transfer Institutions in Europe. 2004. [online]. [cit. 2014-04-06]. <[ftp://ftp.cordis.europa.eu/pub/innovation-policy/studies/studies\\_tti\\_typology.pdf](ftp://ftp.cordis.europa.eu/pub/innovation-policy/studies/studies_tti_typology.pdf)>.
7. Hofer F.: The Improvement of Technology Transfer. Weisbaden 2007. ISBN: 978-3-8350-0904-2.
8. KES International. Innovation through Knowledge Transfer. <<http://www.innovationkt.org/>>
9. Ketels CH. et al.: Innovation Clusters in the 10 new member states of the European Union. Luxembourg 2007. ISBN 92-79-03196-1 [online]. [cit. 2013-02-25]. <[http://www.isc.hbs.edu/pdf/Clusters\\_EU-10\\_2006.pdf](http://www.isc.hbs.edu/pdf/Clusters_EU-10_2006.pdf)>.
10. Kundráková J.: Effective cooperation management between university and business environment [diploma thesis], University of Žilina 2014.
11. National portal for technology transfer. Slovník pojmov. [online]. [cit. 2014-04-07]. <[http://nptt.cvtisr.sk/sk/transfer-technologie/slovník-pojmov.html?page\\_id=300](http://nptt.cvtisr.sk/sk/transfer-technologie/slovník-pojmov.html?page_id=300)>.
12. Nonaka I., Takeuchi H.: The Knowledge-Creating Company. New York, NY: Oxford University Press, 1995.
13. Slovak organization for research and development activities: Základné koncepty, nástroje a prístupy k transferu technológií vo svete - prehľadová štúdia. Bratislava 2011. [online]. [cit. 2014-04-01]. <[http://nitt.cvtisr.sk/buxus/docs/Studia\\_II\\_o\\_TT\\_NITT\\_SK.pdf](http://nitt.cvtisr.sk/buxus/docs/Studia_II_o_TT_NITT_SK.pdf)>.
14. Solvell O., Lindqvist G., Ketels CH.: The Cluster Initiative Greenbook. Stockholm 2003. ISBN 91-974783-1-8 [online]. [cit. 2013-02-25]. <<http://www.cluster-research.org/greenbook.htm>>.
15. Soviar J. et al.: Kooperatívny manažment. University of Žilina 2013. ISBN 978-80-554-0813-2.

16. Tripsas M., Schrader S., Sobrero M.: Discouraging opportunistic behavior in collaborative R & D: A new role for government. Cambridge 1995. [online]. [cit. 2014-01-30]. <<http://www.sciencedirect.com/science/article/pii/004873339300771K>>.
17. United Nations Conference on Trade And Development. Transfer of Technology. New York a Geneva, 2001. [online]. [cit. 2014-04-01]. <<http://unctad.org/en/docs/psiteiitd28.en.pdf>>.
18. University of Salford Manchester. About the Partnerships Office. <<http://www.salford.ac.uk/ktp/about>>
19. WhatisKT – Knowledge Transfer.  
<http://whatiskt.wikispaces.com/Knowledge+Transfer>

### **Transfer wiedzy i technologii a współpraca pomiędzy sektorem nauki i biznesem**

#### **Słowa kluczowe**

Zarządzanie współpracą, transfer wiedzy, analiza literatury, transfer technologii, ośrodki transferu technologii, komercjalizacja wyników prac badawczych.

#### **Streszczenie**

W artykule poruszono kwestię transferu wiedzy i technologii. Dokonano przeglądu literatury, zaprezentowano podstawowe pojęcia związane z przedmiotowym obszarem badawczym, a następnie omówiono sposoby komercjalizacji wyników badań naukowych podejmowanych w jednostkach naukowo-badawczych. Wskazano korzyści wynikające ze współpracy środowisk naukowych z przedsiębiorcami w procesie transferu dla poszczególnych instytucji zaangażowanych w ten proces, jak i dla regionów, w których są zlokalizowane.