Marcin KARDAS
University of Warsaw, Faculty of Management
m.kardas@mail.wz.uw.edu.pl

ORGANIZATIONAL ASPECTS OF KNOWLEDGE TRANSFER AND COMMERCIALIZATION OF PUBLIC RESEARCH AT POLISH UNIVERSITIES

Key words

Technology Transfer Office, Special Purpose Vehicle, knowledge transfer, university, innovation policy.

Abstract

The paper discusses organizational aspects of knowledge transfer and the commercialization of public research at Polish universities. It presents the evolution of national legislation in the field of knowledge transfer and commercialization and distinguishes four basic organizational models of these processes at universities: administrative, technology transfer offices, special purpose vehicles, and mixed. The strengths and weaknesses of each model are discussed. It also presents the main challenges and problems associated with the organizational aspects of knowledge transfer and commercialization, and it proposes some possible solutions in this matter.

Introduction

For centuries, universities in addition to educational activities and scientific research have served societies and influenced the direction of societal, economic, cultural, and political changes. However, this activity was tolerated if it did not disturb the two core or basic activities of the universities: educational

activities and scientific research [23]. In contrast to the past, for the modern universities, this activity becomes as important as their two basic missions do. In the literature, it is called the third mission of universities and these universities are called “third generation universities” or “entrepreneurial universities” [7, 8, 13, 14, 23].

One of the key elements of third generation or entrepreneurial universities is knowledge transfer and commercialization, especially through establishing spin-off companies and licensing. In many countries, it is expected that universities should sell their knowledge and know-how through spin-off companies or patenting and licensing them to commercial organizations. The perspective is called product-oriented mode (EG, p. 146). It could also be called knowledge transfer and commercialisation in a narrow sense. In practice, the contribution of universities to national innovation systems outreach product-oriented mode and include other channels such as academic consulting, collaborative research, contract research, standards and standardisation, publishing, conferencing and networking, industry hiring, and student placement, or intersectoral mobility [10, 16]. These activities could be called knowledge transfer and commercialization in a broad sense. From this perspective, knowledge transfer and commercialization are related not only to the results of public research, but also to educational activities. The role of knowledge transfer and commercialization in that broad sense is growing in recent years and creates new challenges, especially expectations for the universities to actively contribute to regional transformation and development [3, 16, 17].

The entrepreneurial activities in universities began to increase in the 1980s and 1990s in countries such as the United States, Canada, the United Kingdom, Germany, France, Italy, and Sweden. These activities were stimulated by the legislative initiatives, which include granting greater autonomy to universities and getting them involved in the creation and management of intellectual property rights, i.e. as a consequence of the Bayh-Dole Act in the United States or institutional ownership of academic inventions in many European countries [16].

In many countries, governments and sub-national governments have attempted to stimulate these entrepreneurial activities. Due to the autonomy of universities, a number of organisational structures have been established in that area [1, 10]. Some universities have carried out these activities within their administrative structures, but some others have established separate organizational and institutional-level units known as technology transfer offices (TTOs) or separate entities called special purpose vehicles (SPVs). As a consequence, even in the same country or region, there is no one single model (pattern) to organize the spectrum of activities related to knowledge transfer and commercialization. Examples of universities are presented in publications that have been successful in terms of knowledge transfer and commercialization

based on specialized institutional-level units (e.g., University of Zurich: ETH Transfer) or units, which are organizationally independent from the university (e.g., University of Oxford: ISIS-Innovation) [12]. On the other hand, it is also pointed out that universities in many countries have built up an extensive infrastructure in the form of TTOs, even if it is not the case at many of the smaller universities and the potential of TTOs is not fully exploited [16]. As a consequence, there is ongoing discussion on the role and effectiveness of TTOs [7, 4, 5, 18, 22]. In the literature, there are many presented proposals aimed at improving or replacing TTOs structures by new models, such as Technology Transfer Alliances (called also hub-and-spoke models), Internet-based platforms, and the Free Agency model [16].

In Poland, the first TTOs were established in the second half of the 1990s. Currently, most national universities, including technical and medical universities, have established institutional-level units or independent entities responsible for knowledge transfer and commercialization. Despite some general rules, the national universities differ in terms of the organizational structures related to knowledge transfer and commercialization. The aim of this article is to identify the basic types (models) of organizational structures related to knowledge transfer and commercialization, as well as to analyse the strengths and weaknesses of these models. It also presents the main challenges and problems associated with the organizational dimension of knowledge transfer and commercialization.

1. The evolution of the role of technology transfer at Polish universities

The first TTO in Poland was established by Wrocław University of Technology in 1995, as a result of the EU project "Bridging the Gap Between University and Industry," run by the Wroclaw University of Technology, as well as the Universities of Stuttgart and London. In subsequent years, TTOs were formed, among others, by Cracow University of Technology (1997), The University of Warsaw (1998), Jagiellonian University (2003), and Adam Mickiewicz University in Poznan (2004). The Act on Schools and Higher Education adopted in 1990 did not laid down regulations concerning the organization of knowledge transfer and commercialization by universities. The first TTOs established in Poland in the 1990s were the results of bottom-up initiatives of scientists and university authorities. The legal status of TTOs was introduced by the new Act on Higher Education adopted in 2005. According to this regulation, universities shall cooperate with the economic environment and promote the idea of entrepreneurship in the academic community. Universities could also establish TTOs in order to sell or transfer free of charge research and development findings to the economy as well as Academic Business Incubators (ABIs) in order to support the economic activity of the academic community, and staff or students who are entrepreneurs. As a result of several amendments

to the Act on Higher Education, the provisions concerning TTO have been changed over time. Since 2011, universities have been empowered to establish Special Purpose Vehicles (SPVs) in order to conduct the knowledge transfer and commercialization process, and since 2014, they have been able to establish independent commercial companies to carry out financially and organizationally separated activities (e.g., business consulting or industry production and services). The goals of the organizational structures of universities in the field of knowledge transfer and commercialization from the perspective of the Act on Higher Education are presented in Table 1.

Table 1. Goals of the organizational structure of universities in the field of knowledge transfer and commercialization

	2005	2011	2014
Academic Business Incubators	Support the economic activities of the academic community or stuff and students who are entrepreneurs		
Technology Transfer Offices	Selling or transferring free of charge research and development findings to the economy		Direct commercialization, which includes selling or licencing research and development results and related know-how
Special Purpose Vehicles	-	Commercialisation of research and development findings	• Indirect commercialization, which includes establishing spin-out or spin-off companies by SPV (SPV acquire shares of these companies) • Direct commercialization (optionally and under the authority of the university's rector
Economic companies	-	-	Economic activity separated organisationally and financially

Source: Author's research based on the Act on Higher Education.

Initially, the TTOs and ABIs should be established as an institutional-level unit, a commercial company, or a foundation; however, since 2014, they could be established in the form of an institutional-level unit (ABIs may also operate as a company). The TTOs and ABIs shall operate based on regulations approved by senate of universities and they shall have a supervisory board. The director of a TTO or ABI shall be appointed by the rector of university after consultation with the senate from candidates proposed by the supervisory board. On the other hand, the SPV could be formed as a limited liability or joint-stock company by the rector with the consent of the senate. The SPV may be established jointly by several public or non-public higher education institutions. Dividends derived

from shares in SPV shall be allocated for the statutory activities of universities. As a result of the legislative changes introduced in 2014, the scope of tasks and division of competences between TTOs and SPVs have been clarified. TTOs deal only with the direct commercialization, and SPVs are responsible for indirect commercialization; however, in the case of a SPV, the rector may assign to the SPV, based on an agreement, the tasks related to direct commercialization. Since 2014, universities may also establish separate companies conducting business activities. It is also worth noting that, in the past, the process of establishing and functioning many TTOs and SPVs was financially supported by the Ministry of Science and Higher Education and the National Centre for Research and Development under the programs such as "Creator of Innovation", "Innovation Incubators", or "SPIN-TECH" [11, 20].

2. The organizational models of technology transfer

Taking into account the legal framework concerning knowledge transfer and commercialization at Polish universities, four organizational models could be identified:

- The administrative model, where activities in the field of direct commercialization and knowledge transfer are carried out by the administrative structures of universities (usually it applies to universities that have just started to undertake such activities or the scale of these activities is rather small);
- TTOs model, where activities in the field of direct commercialization and knowledge transfer are carried out by an institutional-level unit on the basis of its own regulations, and it is managed by the director and supervisory board (e.g. University of Łódź, West Pomeranian University of Technology in Szczecin);
- SPVs model, where activities in the field of direct and indirect commercialization are carried out only by special purpose vehicles - SPVs (e.g. Technical University of Białystok, Technical University of Warsaw, Medical University of Warsaw); and,
- The mixed model, where activities related to indirect commercialization are carried out by a SPV and the activities related to direct commercialization by a TTO, but in many cases with personal union in management of both institutions (e.g., AGH University of Technology, Technical University of Gdańsk, and Warsaw University).

Each of these organizational models presents some strengths and challenges, which are summarised in Table 2.

The organizational models of knowledge transfer and commercialization apply to all (public or non-public) higher education institutions in Poland. Knowledge transfer and commercialization in a broad sense include probably all of them (about 465 institutions in 2012–2014), but the number of these

Table 2. Strengths and weaknesses of organizational models

	Strengths	Challenges
Administrative model (unit in administrative structure of university)	• Low cost and high flexibility in resource allocation (i.e. ability to modify duties and responsibilities of administrative personnel) • University's legitimacy in relations with scientists	• "Ad hoc" type of commercialization • Lack of transparent procedures and practices • Bureaucracy and red tape • No recognizable brand and reputation among scientists and entrepreneurs • The dominance of administrative and scientific mentality (*technology push*) – poor understanding of market and business needs
TTO model (institutional-level unit)	• Close contact with scientists (based on trust and long-term cooperation – including the research phase) • The development of key competences related to commercialization • TTO is seen by scientists as a part of University (in positive sense) • Recognizable brand and reputation among scientists • Transparent procedures and practices, exploitation economies of scale	• Bureaucracy and red tape • TTO is seen by external partners as a part of university (in negative sense) • The dominance of administrative and scientific mentality (*technology push*) – poor understanding of market and business needs
SPV model	• Financial and organisational autonomy • Business mentality (*demand-pull*) – simple decision-making processes • Better cooperation with business i.e. through companies (i.e. spin-outs) established with business • Recognizable brand and reputation • Risk sharing to independent entity	• External unit to the university – limited contact with scientists (low trust and legitimation in relations with scientists) • Self-financing, profit-oriented
Mixed model (including TTO and SPV)	• Comprehensive services of commercialisation processes (better adjustment to the needs of different stakeholders) • Linking business and scientific mentality • Possible thematic and functional specialisation	• Conflicts of interest and personal conflicts between management and staff of TTO and SPV • Higher cost of activities due to doubled structure

Source: Author.

institutions is reduced significantly if we take into account the engagement in knowledge transfer and commercialization in a narrow sense. In that case, the analysis could be reduced to four types of higher education institutions: universities (18), technical universities (18), environmental and life science universities (6), and medical universities (9). These institutions are responsible for 96% of patents granted to all higher education institutions in years 2012––2014 by the Patent Office of the Republic of Poland. They also generated 85% revenues from research and development activities of all higher education institutions in 2013 (data from the Patent Office of the Republic of Poland and POLON System). This concentration of research and development activities has also been seen in previous years [6].

The organizational models of knowledge transfer and commercialization of 51 Polish universities are presented in Table 3.

Table 3. The organizational models of knowledge transfer and commercialization of universities (June 2016)

	No. of universities	Administrative model	TTO model	SVC model	Mixed model
Universities	18	2	6	2	8
Technical universities	18	3	4	3	8
Environmental and life science universities	6	-	4	-	2
Medical universities	9	2	1	4	2
Total	51	7	15	9	20

Source: own elaboration.

Many of the TTOs and SPVs have been established over the last few years, and many of them are still at the stage of organizing or developing their activities. The most popular model of knowledge transfer and commercialization in analysed group of universities is the mixed model (20 universities), then the TTO model (15 universities), and then the SPV model (9 universities). The mixed model prevails among the universities (e.g., Warsaw University, Jagiellonian University) and technical universities (e.g., Wrocław University of Technology, AGH University of Science and Technology, Gdańsk University of Technology). On the other hand, the TTO model prevails in environmental and life science universities. The SPV model dominates in medical universities (e.g., Medical University of Warsaw, and Medical University of Łódź). The administrative model appears in 7 universities, but the universities that represent this model are usually at the stage of establishing TTO or SPV (some delays results from the elections of rectors and changes in strategies of universities).

Some universities have also established other structures responsible for commercialization and knowledge transfer like science and technology parks operating in the form of a company or foundation (e.g., Adam Mickiewicz University in Poznań or The University of Zielona Góra) or they are shareholders in companies established together with the regional or local authorities (e.g., Technical University of Kielce, and Technical University of Koszalin). These entities act as regional centres (or regional hubs) supporting knowledge transfer and commercialization activities of various institutions in the city or region.

At some universities, the activities concerning knowledge transfer and commercialization are carried out by the Academic Business Incubators (ABIs), which perform the tasks of TTOs. Moreover, at many universities, despite establishing TTO and/or SPV, there are also units that belong to administrative structures of the universities and are responsible for some activities related to knowledge transfer and commercialization (especially in a broad sense). These units include academic career offices or units supporting the scientists in preparing grant applications or patent applications (according to Polish law a patent attorney is subordinate to the rector). Most of the SPVs conduct business activities such as consulting services, trainings, or small-scale production. This allows them to deliver a wide range of services related to knowledge transfer and constitute a better offer for various business partners. In many cases, TTOs or SPVs are seen as "one window" of university in relations with business and external stakeholders. It enables them to avoid the negative phenomenon of "multiplication of many beings," strengthen the coordination of many activities as well as it allows to better exploit economies of scale and effects of synergies in the field of knowledge transfer and commercialization.

In most cases, TTOs or SPVs are derived from academic administrative structures responsible for cooperation with business or the management of research projects and their establishment was a natural evolution of the growing role of the activities related to knowledge transfer and commercialization. The representatives of the universities indicate that the decision on establishing TTO or SPV was preceded by an analysis of the costs and potential benefits. In general, universities have firstly established TTO (or ABIs) and then SPV (only one exemption of this rule has been identified by now). To some extent, this situation is the consequence of the legislative changes discussed above. On the other hand, several universities formed a SPV directly without the establishment of TTO or ABI (e.g., medical universities). In some cases, a SPV was established in the place of TTO, which was closed down (e.g., Warsaw University of Technology). According to the Act on Higher Education, a SPV may be established jointly by several public universities, but there is no information about the establishment of such a SPV. On the contrary, some universities plan to establish more than one SPV, but this situation concerns universities that are active in the field of knowledge transfer. These initiatives

are aimed to integrate the potential of several universities in some thematic fields (areas of specialization) and to establish regional, highly specialized centres or platforms (hubs) for knowledge transfer and commercialization (e.g., in Poznań).

Conclusions

Among the 51 universities covered by this analysis, only in two cases were there problems with the identification of units responsible for knowledge transfer and commercialization, but according to the representatives of these universities, this situation will change by the end of this year. This confirms that the authorities of Polish universities recognize the role of the third mission of universities as well as knowledge transfer and commercialization. On the other hand, the establishment of TTOs, ABIs, and SPVs does not mean that the goals in the field of knowledge transfer and commercialization have been achieved. Establishing an effective system of knowledge transfer and commercialization at universities depends on many other conditions, such as conducting high quality and interdisciplinary research, ensuring strategic orientation to cooperate with business and transparent regulations on intellectual property, providing financial stability, as well as assuring experience personnel responsible for knowledge transfer and commercialization [16, 21]. In practice, TTOs and SPVs have limited impact on many of the above mentioned conditions, because they are dependent on legislative regulations concerning the functioning of the universities (e.g., rules concerning the ownership of academic inventions or the parametric assessment of research units and the evaluation of scientists) and the policy of the authorities of the universities (e.g., the division of labour between research and educational activities, the role of cooperation with the business and external stakeholders). Therefore, the functioning of knowledge transfer and commercialization systems at universities should be regarded as the mission of the staff and management of TTOs and SPVs as well as the strategic mission of the authorities of universities and policy makers responsible for research, innovation, and higher education policies.

Despite positive changes in the field of the organizational aspects of knowledge transfer and commercialization, there are also some questions related to TTOs and SPVs. The main challenge in the coming years will be the financial stability of TTOs and SPVs, because most of them do not have a permanent source of funding (only a few generate profits from knowledge transfer and commercialisation). There is also an important question of the assessment (measurement) of the effects or results of TTOs and SPVs activities. There are no standard measures or unquestionable indicators related to knowledge transfer and commercialization (especially in a broad sense), which makes it difficult to conduct compressions and analysis. Overcoming this problem is primarily in the interest of TTOs and SPVs, because the accountability and transparency in terms

of results and funding could help to justify their role (providing "better value for money") and allow external stakeholders to better understand their mission and day-to day activities. One can expect that the lack of funding of TTOs/SPVs or lack of critical mass in terms of the commercialization potential of some universities should lead to consolidation (integration) of their activities and the creation of regional centres or specialized platforms in specific fields of technology.

References

1. Axanova L. (2012): U.S. Academic Technology Transfer Models: Traditional, Experimental And Hypothetical, Les Nouvelles, p. 125.
2. Bozeman B. (2000): Technology transfer and public policy: a review of research and theory, Research Policy 29, p. 627.
3. Brecovitz J., Feldmann M. (2006): Entrepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development, Journal of Technology Transfer 31, p. 176.
4. Caldera A., Debande (2010): Performance of Spanish universities in technology transfer: An empirical analysis, Research Policy 39, p. 1160.
5. Debackere K., Veugelers (2005): The role of academic technology transfer organizations in improving industry science links, Research Policy 34, p. 339.
6. Ernst&Young, IBNGR (2010): Strategia szkolnictwa wyższego w Polsce do 2020 roku, Warszawa, p. 32.
7. Etzkowitz H. (1998): The Endless Transition: A „Triple Helix" of University-Industry-Government Relations, Minerva 36, p. 203.
8. Etzkowitz H. (2016): Innovation Lodestar: The entrepreneurial university in a stellar knowledge firmament, Technological Forecasting&Social Change, p. 1.
9. Expert Group Report (2010): The role of community research policy in the knowledge-based economy, Bruksela.
10. Innovation Policy Platform: Technology Transfer Offices. https://www.innovationpolicyplatform.org/sites/default/files/rdf_imported_documents/TechnologyTransferOffices.pdf (6.07.2016), pp. 1, 4.
11. Klincewicz K. Szkuta K. (2016): RIO Country Report 2015: Poland, Joint Research Centre, Seville, pp. 81, 90.
12. Krzewiński Z. (2012): Produkt finalny. Model Open Code Innovation, Poznań, p. 32.
13. Martin B.R., Etzkowitz H. (2000): The Origin and Evolution of the University Species, Paper No. 59, p. 6.
14. Matusiak K.B. (2010): Budowa powiązań z biznesem w gospodarce opartej na wiedzy, Wydawnictwo SGH, Warszawa, p. 185.

15. OECD (1996): Przegląd narodowej polityki naukowej i technicznej – Polska, Warszawa.
16. OECD (2013): Commercialising Public Research. New Trends and Strategies, Paryż, pp. 17, 56, 65, 67, 69.
17. OECD (2015): Innovation Strategy, Paryż, p. 47.
18. O'Kane C., Mangematin V., Geoghegan W., Fitzgerald C. (2015): University technology transfer offices: The search for identity to build legitimacy, Research Policy 44, p. 421.
19. OPI-PIB (2015): Szkolnictwo wyższe w Polsce w latach 2012–2014, Warszawa.
20. PAG Uniconsult, PRO Consulting (2011): Raport końcowy z ewaluacji Programu wsparcia „Kreator innowacyjności, Warszawa, p. 10.
21. Turyńska-Gmur A., Cichocki T. (2012): Przegląd europejskich doświadczeń w zakresie transferu technologii, w: Transfer wyników badań naukowych do gospodarki, (ed.) J. Koch, Wrocławskie Centrum Transferu Technologii Politechniki Wrocławskiej, Wrocław, pp. 69–71.
22. 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, p. 27.
23. Wissema J.G. (2009): Uniwersytet Trzeciej Generacji. Uczelnia XXI wieku, Wydawnictwo Zante, Zębice, pp. 35, 52.

Organizacyjne aspekty transferu wiedzy i komercjalizacji wyników badań na polskich uczelniach

Słowa kluczowe

Centrum transferu technologii, spółka celowa, transfer wiedzy, uniwersytet, polityka innowacyjna.

Streszczenie

W artykule omówiono aspekty organizacyjne transferu technologii na polskich uczelniach. Przedstawiono ewolucję krajowych regulacji prawnych w obszarze transferu technologii oraz wyróżniono cztery bazowe modele organizacyjne transferu technologii w uczelniach: administracyjny, centrów transferu technologii, spółek celowych i mieszany. Omówiono mocne i słabe strony każdego z nich. Przedstawiono również główne wyzwania i problemy związane z wymiarem organizacyjnym transferu technologii oraz propozycje rozwiązań w tym zakresie.