Knowledge and Technology Transfer in Higher Education as support for Innovation: the case of University of Ljubljana

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Abstract

University technology transfer models have evolved significantly since the introduction of Bayh-Dole Act. However, the introduction of the knowledge and technology transfer concepts in the Central and Eastern Europe has its specificities, based on both different higher education systems as well as on the history of university-industry cooperation.

Copying of US or Western European innovation models and mechanisms, more specifically of the technology transfer organization, in national innovation system of CEE has lead to smaller effects than foreseen. An example of the situation is also Slovenia, where new strategies for supporting innovation and the exploitation of scientific research results from public research organizations are being reconsidered.

The article presents the current situation and the challenges in knowledge and technology transfer in CEE from the point of view of technology transfer offices, and underlines the case of Slovenian public research institutions, most notably the University of Ljubljana. An analysis of the effects of the newly proposed strategies for Research and Innovation Strategy of Slovenia 2011-2020 and the complementary National Program of Higher Education 2011-2020 with regards to TTO services is provided. Legal and infrastructural framework is considered, continued by the specificities of the University of Ljubljana on national and regional level, and the description of its innovation system. Special attention is given to the institutions at the university that together perform classical TTO functions.

The article partially builds on experience gained in the CERIM (Central Europe Research to Innovation Model) project.

Keywords

Central Europe, Innovation, Knowledge and Technology Transfer, Technology Transfer Organization, University of Ljubljana

1. Introduction

Support for innovation processes and improvement of knowledge and technology transfer is vital if the European Union wants to keep up with the competition. The paper aims to present the case of knowledge and technology transfer (KTT) system in Slovenia's biggest university, i.e. University of Ljubljana (UL), from the view point of technology transfer office (TTO) services. It builds on the results of the analysis of the innovation systems in regions in Central Europe, as provided by the CERIM (Central Europe Research to Innovation Model), where IRI UL is a partner.

In the first part of the article, the definition of knowledge and technology transfer through a TTO is provided and the framework conditions for it in the CERIM participating regions are described. In the second part, situation in Slovenia is presented with the emphasis on the proposed drafts for the national research and innovation policy in the period 2011 – 2020. Lastly, the example of KTT system at the UL is described with the emphasis on the mission of the UL's Institute for Innovation and Development (IRI UL).

The article partially builds on experience gained in the CERIM project which is co-funded by the Central Europe Program of the European Union.

2. Knowledge and technology transfer – the case of Central Europe

2.1. Knowledge Commercialization

Though there is abundant literature on the concept of technology transfer, no single or prevailing definition of the term exists [1], [2]. By considering technology in its broadest sense as know-how, we understand technology transfer beyond the mere transfer of products and commodities [3], namely as a knowledge transfer process [4]. As we are interested in the transfer of innovations and associated research results and knowledge from a public university (and other public research institutions) to final research users, we use the term "knowledge and technology transfer", where we are interested especially in the commercialization (i.e. the end user being a company). The KTT which could be described as pedagogical activity and thus not commercialized (mentoring schemes, invited lectures etc.) is not considered here, nor is the KTT where end user is non-profit organization.

Ever since the Bayh-Dole Act in the 1980s in the USA lay rules for commercializing of results from publicly financed research, governments in the industrialized countries have been underlining the need to improve the ability of research organizations to commercialize their results. University KTT models which were first created in the USA and the UK have gained ground also in the EU countries and evolved significantly, resulting in the "triple helix" or mutual responsibility of university-government-industry for KTT [5]. Most notably, the KTT is managed by the university-established TTOs, who are in charge primarily (but not only) of the questions of intellectual property rights (IPR), licensing, and networking with the potential investors. First established in the US, the TTOs are created as specialized and decentralized unit within the university, which enables them a certain level of autonomy when creating connections with the industry and thus enable KTT. Yet the TTOs with the focus on patenting and similar type of IPR protection are not the sole KTT commercialization activities. Various links with industry are created also through forms of consulting services for companies, thus diversifying the risk on depending on patents and licences [6]. From the organizational point of view, a system that supports university KTT commercialization is thus a mix of decentralized units which provide services to university and industry for protection and transfer of researcher's knowledge in various mechanisms. The main fields of these services are:

- *knowledge valorisation and related protection* (e.g. IPR, patenting, licensing),
- *business development* (e.g. spin-offs),
- *cooperation with industry* (e.g. consulting services),
- *training* and informing the university staff on the commercialization issues.

2.2. CERIM project

Central Europe Research to Innovation Models (CERIM) project unites KTT organizations from regions of Austria, Germany, Hungary, Italy, Poland, Slovakia and Slovenia. The project mission is to develop adapted valorisation models for a more effective and efficient KTT from the universities and research institutes in Central Europe to the companies. Co-financed by the EU Central Europe programme, the project aims to contribute to a stronger sector of knowledge intensive European companies and a revitalisation of markets through innovative companies, especially in the participating regions (Table 1).

Table 1: CERIM project regions, selected data [7]

Country / Region	*Population (mio)*	*GDP pc (EUR)*	*Patents per mio inhabitants*
Austria, Salzburg	0,5	NA	NA
Germany, Baden - Wuertemberg	10,7	33.876	385,0
Germany, Mecklenburg – Vorpommern	1,7	21.439	26,1
Germany, Saxony	4,2	22.620	68,6
Hungary, Budapest	2,9	14 800	38,6
Italy, Lombardia	9,64	32.326	113
Poland, Szczecin	1,7	NA	2,36
Slovakia, Bratislava	0,6	26 400 (USD)	NA
Slovakia, Žilina	0,7	12 145 (USD)	NA
Slovenia, Ljubljana	0,5	22.286	NA

Within the project, an analysis of the regional knowledge and technology transfer situation was performed in 2009. Among other, units providing services traditionally linked to TTOs were examined.

2.2.1 The policy context for KTT in CERIM regions

The introduction of the KTT and TTO concepts in the Central and Eastern Europe has its specificities, based on different higher education systems as well as on the history of university-industry cooperation. At the national and at regional level, the governments set the parameters for the effectiveness of the commercialization of academic research and the resulting impacts on economic growth [8]. Though partner countries differ on the approaches towards KTT, all have developed policies on the issue area. Most have seen an increase in this activity after year 2000 with the changes in legislation which allowed for the university (and not state) ownership of results issuing from publicly funded research. The universities and other public research organizations are thus *obliged* to protect the intellectual property created.

Austria, Germany, and Italy have a well developed structure of national and regional systems for KTT. Poland and Hungary, also Slovakia, have managed to develop regional innovation systems, too, yet their performance does not score high on the European Innovation Scoreboard. Centralization, which is the result of building predominantly national (and not regional) institutions in innovation system, may prevent actors from realizing potential advantages associated with KTT; however, fragmentation into smaller dimensions is not good if it lacks support and contact with other levels. Italy, with a strong regional autonomy, is an example of country where even the municipal level of innovation system is important, as institutions from this dimension are considered as relevant partners at setting policies.

2.2.2 Types of institutions providing TTOs services in CERIM regions

According to CERIM RTT overview [9], the new EU members have copied the form of successful KTT organizational structures from the USA and UK – this especially being evident with the number of newly created TTOs at universities and the springing of incubators, technology/science parks and other mechanisms –, but failed to implement also the content of these mechanisms. In the partner countries, there is no single understanding of a KTT-model mix. The identified KTT-models vary, as there are also different legal and policy backgrounds for their creation. Three types of units that provide above-mentioned TTOs services exist in these regions of Central Europe (more in Table 2):

- TTOs as *units inside* the university,

- TTOs as *independent public-private-partnership (PPP) agencies*, and
- *private* institutions (mainly companies).

Table 2: Types of institutions providing TTOs services

	TTO as unit within university	*TTO as independent institution in the form of PPP*	*TTO as private institution*
Target group	Researchers, university	Researchers, region	Investors (market)
Aim	Protect academic research results (IPR)	Market university research results to benefit the region	Develop ideas with market potential & respond to industry needs
Important Services according to mission	Knowledge valorisation (IPR, patents) Business development Training Other cooperation with the industry (consulting)	Knowledge valorisation (IPR, patents) Business development Other cooperation with industry (consulting) Training	Other cooperation with industry (consulting) Knowledge valorisation Business development
Founders	university	(regional) government + universities + regional business association	various (companies, individuals, public non-profit and private for-profit institutions)
Strengths	Knowledge of the academia Proximity to the university management	Support of (regional) governing institutions Pooling of innovations from several universities and achieving critical mass	Fast response to industry proposals Good understanding of market drive
Weaknesses	Little autonomy Slow response on industry demand or proposals Huge costs for small universities Focus on patents	Competition between universities	Lack of support from government and/or academia Perceived as competition to university-based TTOs

Regardless their variety, they all serve for promotion of research results and their commercialization. Yet, the first focus on the IPR (especially patenting) and business creation, the second on the immediate market availability of results through commercialization in form of patenting and licensing, whereas the third tend to focus more on the market itself and the expressed needs of industry. Herein lie also their strengths and weaknesses. Namely, university TTOs (especially in new member states) are often bureaucratic units inside the university structure, with inhibitions coming from the slowly responsive universities with rarely institutionalized cooperation with industry, the administrative red tape and unsupportive legal framework, inadequate rewards for entrepreneurial researchers, and with lack of KTT experts. On the other hand, a form of PPP between the universities, (regional) government and individual innovation management companies (typical of Germany and Austria) has proven to be successful especially at creating a critical mass of innovations and innovation experts who can provide adequate service to the researchers. Important fact is that as government is one of the founders, this reflects also in the related (regional) policy on innovation and KTT. For example, in the case of studied German regions, several universities and institutes in the region would establish a joint patenting and valorisation agency, whereas new EU members tend to create TTOs at the universities. Such TTOs, similarly to the German agencies, provide services of patenting, valorisations, licensing and other types of commercialization. A third type, the private institution performing KTT services, is focused on the needs of the industry, and is typically present in the new member states where university TTOs are new and still have to establish themselves as relevant partner to the industry. An example of this is IRI UL within the system of University of Ljubljana.

3. IRI as part of UL TTO system

3.1. University KTT in Slovenia

There are four public universities in Slovenia, namely in Koper, Ljubljana, Maribor and Nova Gorica. The UL is the oldest and the largest in terms of enrolled students, staff, as well as research and development investments. Koper, Ljubljana and Maribor universities cover all fields of science, whereas the most recent Nova Gorica has been built upon the basis set by a strong natural sciences departments and applicative research. Traditionally, the contact with companies was established by each faculty, and usually not on the university level.

Table 3: Slovene universities

	University of Ljubljana	*University of Maribor*	*University of Primorska Koper*	*University of Nova Gorica*
Established	1919	1975	2003	2006
Enlisted students (total) 2008/09	60.284	23.363	6.490	725

On the policy level, Slovenian Development Strategy for the period 2006-2013 and the Resolution on National Research and Development Program had defined R&D as the main factor for development and competition of Slovenia. Within this, the linkage of business with academia, the restructuring of public R&D system (increased investment, efficiency, strengthening the human resources and focus on high-tech and innovative companies, definition of key research areas) and the mobility of researchers between the two sectors were underlined. The policy documents also enabled the creation and funding of innovation system mechanisms such as technology/science parks and incubators. All universities except for Nova Gorica created their own university incubators aimed at creating student- and/or professor- start-ups, as well as units that are in charge of IPR protection. TTOs within research organizations (patent offices) have been established at all four universities as well as at the Chemical Institute and Institute Jožef Stefan [10]. As these institutions can and do provide also for training of academics and students on IPR and entrepreneurship, there was little focus on providing special services to companies. The situation is mirrored in the national legislation in the field of university KTT services in Slovenia. It is namely most elaborated on the issues of IPR. The Industrial Property Act was adopted in 2006, whereas the following year saw the adoption of Job Related Inventions Act. The main change is in the concept of IPR – now the innovations created by employees in publicly financed institutions (such as university) are owned by employer who also has to decide about the patenting. There are no fixed rules about the share in the profits between inventors and the institution. University remains autonomous in the ways it collaborates with firms.

Slovenian policy documents for 2011-2020 for the national innovation programme and the national higher education programme, reveal the desire to strengthen university TTOs, predominantly by improving the legal framework for enabling public research institutions to collaborate in industrial research and by simplifying the creation of university spin-offs. The financing of university TTOs unit should aim to “reach the entrepreneurial effects of KTT within a few years and to turn the unit more entrepreneurial every year” [10]. Thus, new innovation policy moves from the innovation support mechanisms which were successfully established, to a more entrepreneurial, market-oriented KTT.

3.2. University of Ljubljana KTT system

The UL has more than 63,000 graduate and postgraduate students, approximately 4.000 higher education teachers, and 3 arts academies and 23 faculties. It practices basic, applied and development research, in all fields of science and arts, such as the humanities, social sciences, linguistics, arts, medicine, natural sciences and technology. The University co-operates with various economic institutions in both the public and private sectors, with the government and local authorities as well as other civil institutions [12].

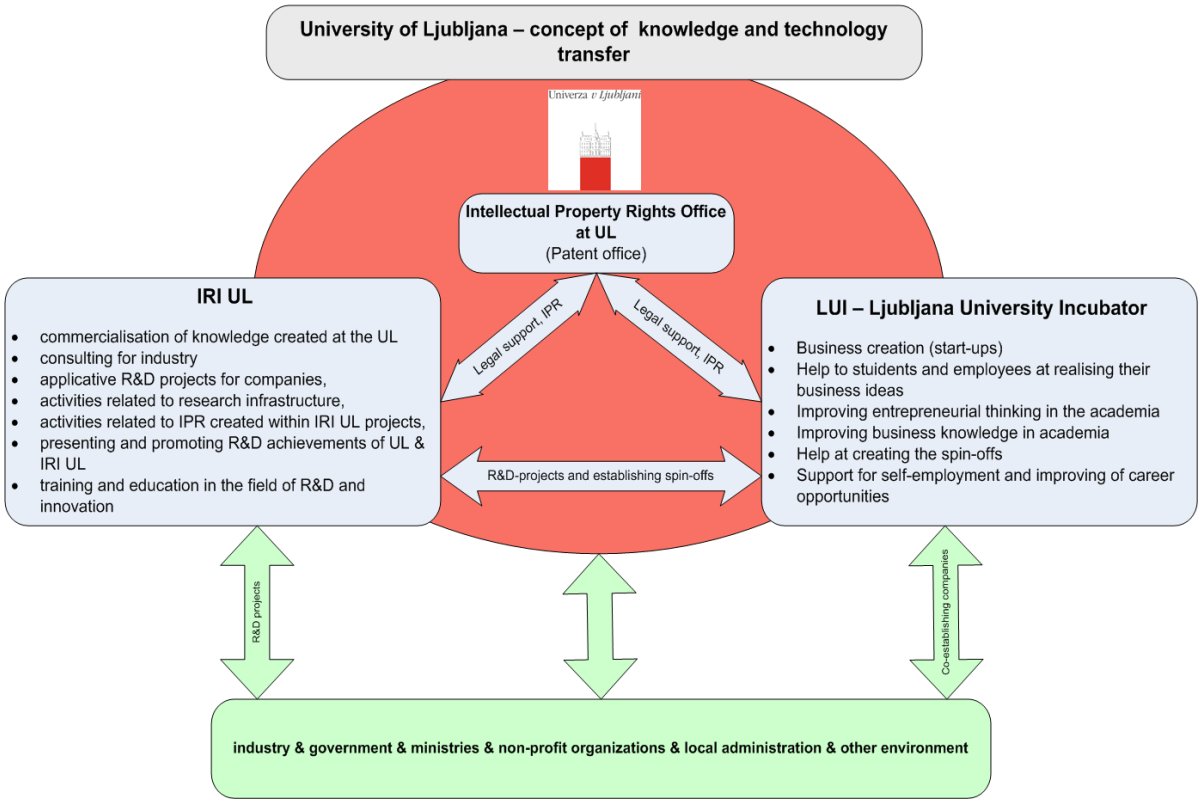
In 2004, UL founded its incubator (Ljubljana University Incubator – LUI), aimed at providing environment for developing professor or student starts-ups. LUI thus offers business development services and training services, and some IPR services. With the new IPR law in 2006, the university needed to create a special unit (patent office) for IPR. Having noted that there is no centralized institution to provide for the requests of the companies which would like to commission research or consulting on the university level, the university also decided to create the Institute for innovation and development (IRI UL). In its 2006-2009 strategy, the UL [13] defined KTT as one of its goals, comprised of a TTO as a unit within the university, of LUI which would continue functioning as a limited company, and of an independent IRI UL (more in Table 4).

Table 4: TTOs services as performed by the elements of University of Ljubljana KTT system

	IPR Office (Patent office)	*LUI*	*IRI UL*
Target group	Researchers, university	Researchers, students	Industry, research labs
Aim	Protect academic research results (IPR) and comply with 2006 IPR law	Create start-ups and spin-offs on the basis of student or professor's ideas	Develop multidisciplinary projects with market potential & respond to industry needs
Important Services according to mission	Knowledge valorisation (IPR, patents, licensing) Training and educating on IPR	Knowledge valorisation (IPR, patents) Business development Training (entrepreneurship classes for students)	Other cooperation with industry (consulting) Knowledge valorisation Business development Training (industry representatives, researchers)
Legal form	Part of the university administration	Independent company (ltd)	Independent private non-profit institute
Founders	University (obliged by law)	University of Ljubljana	University of Ljubljana + 10 Slovene companies
Strengths	Initial financial and staff support of Slovene intellectual property organization Establishing of the IPR system at university	Support of governing institutions Established and recognizable programme for students Incubator facilities (rooms, services)	Fast response to industry proposals in form of consulting or industry research projects Freedom from university bureaucracy Centralized service for all faculties Non-profit institute in public interest (University can veto potentially harmful decisions)
Weaknesses	Little autonomy Focus on patents Unrealistic expectations to create income in short term only established in 2006	focus of student ideas some companies remain in the incubator longer than 2 years	Lack of support from government Lack of recognisability

As Debackere [14] noted, decentralization of the organizational structure is important for successful KTT. Various units have several types of autonomy and can create different responses (thus provide different service) to the needs of their primary target groups.

Figure 1: the UL system scheme



3.3. IRI UL as part of University of Ljubljana KTT system

IRI UL is the innovation and development institute and service for KTT commercialization of the UL. It was established in 2007 by the UL and 10 leading Slovenian companies. It is a non-profit research and development institution whose aim is to establish a long-run and reciprocal partnership between the UL, Slovene industry and public institutions in order to foster research and development activities. Though private institute, it is in public interest as the UL has veto on any decision of the board that would harm the research mission of the university as an independent publicly financed organization. The mission of the IRI UL is to identify the research and development needs of the Slovene industry and competencies of researchers at the UL. The main aim is to enable the university staff to participate in commercial research projects and to enable researchers to consult companies.

IRI UL is the institution that is to be the intermediary between the demands of the industry and the potential of university researchers. IRI's main type of collaboration with industry is to create interdisciplinary teams of experts form UL to serve as consultants on a given issue or to perform industry research. For this purpose, IRI UL has created and is updating a network of all researchers at the university. Other activities consist of business development for ideas that do not qualify in the LUI (e.g. elaborating on the ideas and further development with international partners by applying for EU projects) or where patenting is not a viable option. As such, IRI is partner with university researchers in two EU Framework Programme 7 projects. Independent status of non-profit company enables IRI to participate with UL researchers in projects where the University or the LUI cannot be a partner, either because of the administrative constraints or because of the for-profit form.

All three institutions are to cooperate, yet so far, this has been more the case for the IPR office and LUI, as they have similar main preoccupation: protection of IPR and valorisation. On the other hand, IRI UL is more focused in the needs of Slovene industry and thus primarily searches for experts who could collaborate on research projects. Potential IPR questions are solved within the contract with company, and real IPR protection issues arise only in joint R&D projects. The UL has thus created a

system, where it provides service which meets the legal demands, the needs of the researchers and students, as well as provides a new, centralized contractual collaboration for companies.

4. Conclusion

The transfer of researcher's know-how and research results from the university to commercial users (companies) can be named *knowledge and technology transfer*. For these purposes, traditionally a TTO unit within university was created, providing services of IPR protection and knowledge valorisation, business development, training for academic researchers and other services for companies. Today the focus in CEE has moved from the researcher to the needs of the industry and the society. In order to provide a more flexible service, the innovation system must consist of institutions which are autonomous and can respond to the needs of the market. In the KTT system of Ljubljana University such an institution was created the last and is the only one primarily aimed at the needs of industry.

Given the proposed changes in Slovene innovation and higher education policy documents for 2011-2020, it seems the patenting and valorisation activities will increase, with more impact on the applicability (market pull) of the research results. Though UL seems to be prepared for it on paper, it should be aware the institutions are very young and are unlikely to bring immediate and very tangible financial results soon.

5. Abbreviations

CEE	Central and Eastern Europe
CERIM	Central Europe Research to Innovation Model
KTT	Knowledge and Technology Transfer
IPR	Intellectual Property Rights
IRI UL	Institute for Innovation and Development of University of Ljubljana
LUI	Ljubljana University Incubator
TTO	Technology Transfer Office
UL	University of Ljubljana

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