A decade of Knowledge Transfer in Slovenia

Desetletje prenosa znanja v Sloveniji

Špela Stres
Center for Technology Transfer and Innovation
Jožef Stefan Institute
Jamova cesta 39, Ljubljana
Spela.Stres@ijs.si

Levin Pal
Center for Technology Transfer and Innovation
Jožef Stefan Institute
Jamova cesta 39, Ljubljana
Levin.Pal@ijs.si

ABSTRACT

In this paper, we describe the last decade of the Knowledge Transfer development in Slovenia. Knowledge transfer is based on the development of legislative tools, governmental financial tools and performance of the Public Research Organizations in Slovenia. The overview shows and evaluates in numbers what has been achieved. It also presents the fields in which knowledge transfer experts will have to act further in collaboration with Government, Professional Associations and Public Research Organization (PRO) leaderships. Conclusions are drawn to suggest further steps on the path of KT development in Slovenia.

Keywords

spin-off, spin-out, R&D contracts, Intellectual Property Rights (IPR) sales, legislation changes, public research organizations, boundaries, conditions, technology transfer, eco-system

POVZETEK

V prispevku opisujemo zadnje desetletje razvoja prenosa znanja v Sloveniji. Prenos znanja temelji na razvoju zakonodajnih orodij, vladnih finančnih orodij in raziskovalni uspešnosti javnih raziskovalnih organizacij v Sloveniji. Pregled v številkah prikazuje in ocenjuje, kaj je bilo doseženega. Nudi tudi vpogled v področja, kjer bodo v prihodnje strokovnjaki za prenos znanja v sodelovanju z vladnimi, strokovnimi združenji in vodstvi javnih raziskovalnih organizacij (JRO) morali nadgraditi dosedanja prizadevanja. Sklepne ugotovitve predlagajo nadaljnje korake na poti razvoja KT v Sloveniji.

Ključne besede

spin-off, spin-out, pogodbe za raziskave in razvoj, prodaja pravic intelektualne lastnine, spremembe zakonodaje, javne raziskovalne organizacije, meje, pogoji, prenos tehnologije, ekosistem

1. INTRODUCTION

Slovenia is a small country with 2 million inhabitants in Central Europe and 6980 registered researchers [1], the 19th in thus measured research strength out of 127 evaluated countries.

The efficiency of the Intellectual Property Rights (IPR) management system in a country can be evaluated through the successful commercialization of patents and secret know-how originating from Public Research Organizations. The commercialization is taking place through new company creation, IPR licensing and sales and direct R&D collaboration with companies.

The efficiency of the IP management system in Slovenia can be sought from a comparison of the results of three separate time-periods in which the Slovenian governments attempted to manage IPR collectively, using different mechanisms, through Technology Transfer Offices (TTOs). These were the periods of 2009-12, 2013-2014 and 207-2019 (the instrument is active until June 2022, not yet completed).

Since the independence of Slovenia in 1991, a particular legislative system with respect to public research generated IPR has been established. The legislative system, in the case of Slovenia affects the strength and the quality of a national IP management regime.

2. THE LEGISLATIVE CONTEXT

2.1 Slovenian legislative context

The Republic of Slovenia has established universities and public research institutes (PRIs) with *Institutes Act* (1991) [2] and *The Higher Education Act* (1993) [3]. Financing of research work on universities and PRIs (jointly named Public Research Organizations, (PROs)) is implemented with the assistance of the *Slovenian Research Agency* in accordance with various regulations [4].

The researchers compete for the financing of their research plans. They do so in regular time intervals (every year for projects, every four to six years for programmes). Evaluation of the proposals is done on the basis of certain criteria. Thus, it is possible to claim that the financing of research from the public budget is project and programme organised. To a certain degree, such a frequent selection and unavailability of stable long-term financing should support positive selection in the research sphere and enable researchers to work creatively in a relatively secure environment.[1]

With the Act on inventions arising from employment (1995) [5], the Republic of Slovenia has introduced an arrangement similar to the Bayh-Dole Act of the USA. The inventions arise from PROs. All the inventions resulting from the state budget financing, are owned and managed by the PROs. Certain conditions regulate the management of the mentioned inventions. These conditions need to be met, for the PROs to become the owner of the actual invention. These conditions are described in Article 21 and 22 of the Act on inventions arising from employment and are related to the Industrial Property Act.

All EU member states (except Italy and Sweden) – manage their inventions in the way the Republic of Slovenia does, with respect to the responsible PROs. The state renounces the right of ownership of the inventions in favour of the PROs. Consequently, these PROs, as legal entities, are also responsible for commercialization of inventions. Researchers are not personally responsible for the commercialization of inventions,

[1] The status of researchers as civil servants and the absolute impact of the ARRS selection system are not discussed here.

but may capitalize financially (in Slovenia minimum is in the amount of 20 % of the gross related PRO income) in case of successful commercialization takes place. The researchers are thus incentivized to participate, and practically all PROs in Slovenia nowadays have internal PRO Acts distributing the benefits defined by the law.

With the *Supportive Environment for Entrepreneurship Act* (2007) [6] and the accompanying *Record on Keeping Rules on the Innovative Environment* [7]) a legal base for a supportive environment for innovation was created in Slovenia. Entrepreneurship incubators, university incubators and technology parks were explicitly mentioned in Article 2 of the *Record on Keeping Rules on the Innovative Environment*. Each of those supportive organizations was supposed to, in a manner described in the Record, support development and cooperation of the start-up and young enterprises. Technology transfer offices were mentioned by the *Record on Keeping Rules on the Innovative Environment* but were not financed through being part of the listed entities by the same Record.

Last but not least, based on the *Industrial Property Act* (2001) [8] the Slovenian Intellectual Property Office (Article 5 of the Industrial Property Act) was founded, with the main function to accept patent and other intellectual property right applications, manage the related procedure, related registers of rights, provide information services and represent the Republic of Slovenia at WIPO, EPO and other international organizations.

3. TECHNOLOGY TRANSFER OFFICES

In a substantial proportion, the Slovenian science and research activity is financed from public funds - in part from the national public budget, partly from the EU budget (European projects). A considerable proportion of the funding also comes directly from the Slovenian enterprises, which are the generator of public budget.

Therefore, the public research organizations (PROs) are well aware of the fact that the increase in competitiveness of the Slovenian economy also depends on the quality of the cooperation between science and industry.

However, looking at the commercialization side of Intellectual Property Right (IPR), in the end of the first decade of the 21st century, it was obvious that the knowledge and technology transfer potentials were not being fully exploited. The reasons could be sought in the less developed parts of the innovation support system – the intermediaries, which would assist in the commercialization of IPR – the Technology Transfer Offices (TTOs).

3.1 The governmental level

The legal framework for active management of the IPR generated by the PRO, has been set during the period of 1991-1995. The transfer of knowledge and inventions to the market should have been, by law, since 1995, supported by the PROs themselves. In particular the PROs should have been managing the IPR, generated/owned by the PROs. In practice the management and transfer activities should have been actively carried out by the entities, defined by legislation through the *Act on inventions arising from employment*. These entities are called the technology transfer offices (TTO) of the PROs. In addition, the Offices of technology transfer were in explicitly mentioned in the *Record on Keeping Rules on the Innovative Environment*.

Unfortunately, such offices have not been given further legitimacy until 2011, when the Resolution on Research and Innovation Strategy 2011-2021 [9] Slovenia has been adopted. Therefore, IPR in PROs was typically generated on a day-to-day basis without proper assessments of it being made, without commercialization procedures having been considered.

The question of IPR for the market has been raised several times through the years, but since there was little interest in looking at this problem from an integrative point of view, integral solutions were not implemented for almost another decade.

3.2 The institutional level

PROs in Slovenia were very agile in collaboration with the industry during the 1970's and 1980's. This resulted in some very early adoptions of internal Acts on acquiring and management of the IPR by the PRO, which enabled at least incentivizing the researchers with rewards on IPR production (if not management of IPR). The quickest to act was Institute of Chemistry (KI) in 1979, followed by Jožef Stefan Institute (JSI) in 1998, University of Ljubljana (UL) in 2006, National Institute of Biology (NIB) in 2007, University of Maribor (UM) in 2009, University of Primorska (UP) in 2010 [10]. All such Institutional Acts underwent several changes through the years.

Unfortunately, the PROs were not quick to pick up the pace with IPR management, to enable systematic, sustainable and consistent management of IPR generated, and to prevent any issues, as defined in relevant competition, integrity and corruption legislation.

The PROs were creating TTOs at different times and with different efficiencies. The first TTO in Slovenia was founded at JSI in 1996, followed by UM in 2005, University of Ljubljana in 2007, KI in 2010 (first jointly with JSI, then separated in 2012), UP in 2010, NIB in 2010, Agricultural institute of Slovenia (KIS) in 2015, Faculty of Information Studies Novo mesto (FIŠ) in 2017 [11], [12].

Several of the TTOs changed their organizational structure to become more agile and to be able to sustain themselves. Some several times, formal incorporations ranging from an outside company 100% owned by the University, through a separate and financially independent Unit of an Institute to an office or a section within some other entity (the Rectorate of the University, a Faculty or an incorporated Institute of the University).

3.3 The EU context

The *Framework for Research, Development and Innovation* suggests that the field of establishing new enterprises, arising from the knowledge, developed at the research organizations, should be regulated. According to this Framework, commercialisation via spin-offing is allowed (and desirable), if the profits from commercialisation activities are provided as funds for further research activities.

On the other hand, European and domestic competition law prohibit anti-competitive agreements. Thus, any anti-competitive provisions in commercial agreements are void and unenforceable which could lead to the entire agreement being unenforceable. However, the European Commission has produced a number of so-called block exemptions which make certain 'safe harbours' available to companies.

The Technology Transfer Block Exemption (TTBER [13]) covers technology licensing agreements in relation to most intellectual property rights (IPRs), providing a safe harbour to

companies active in this business area and in business relations with Public Research Organizations (PROs), too. If an agreement falls within the terms of this block exemption, the companies concerned can be confident that it will not be subject to scrutiny.

Furthermore, "Commission Recommendation on the management of intellectual property and knowledge transfer activities and Code of Practice for universities and other public research organizations", requests the establishment of control over the performance of technology transfer activities to the industry, which since 2013 EC countries, including Slovenia, are recommended to follow.

4. THE FINANCING OF THE TTOs

4.1 The lack of dedicated financing

Even though changes have been observed during the first decade of the 21st century, in European and national legislation, the problem of operationalization of TTOs through dedicated financing in fact remained open. A situation at the end of the first decade of the 21st century was still a gross neglect of the TTOs and their activities by the government.

On the one hand this forced most TTOs to have only 1 or two employees, mainly dealing with other issues of the institution (e.g. PR, research project administration). The two exceptions in size and activities, JSI with 6-15 employees and later TehnoCenter UM with 4-8 employees at the time, however, had little institutional financial support, and had to provide financing for their work from projects (EU projects, work for industry).

Thus, the long-lasting effort for financial support to the TTOs from the side of the government began already in 2008.

4.2 The three phases of the projects

The first partial solutions to the TTO financing started to be generated by the government with the support of the Association of Technology Transfer Professionals of Slovenia (Association SI-TT) already in 2009. Those were the KTT projects and they can be divided into three groups.

4.2.1 INO projects: 2008-2011

Firstly, the INO projects of 2008, 2009, 2011 were financed by the (former) Technology and Innovation Agency (TIA) with the support of the Ministry of Science. These projects involved partners as Slovenian Business and Regional Development Agencies, but also some of the Public Research Organizations. The glass ceiling has been broken, but the projects still focused mainly on promotion and organization of events. These projects explicitly focused on counting the number of leaflets produced and workshops organized. Less focus was devoted to actual Key Performance Indicators (KPIs) that would influence the industrial progress of the country, as number of contracts and their size, patents filed etc.

4.2.2 KTT project: 2013-2014

Secondly, the initial project KTT, lasting from 2013 through 2014, was the first project within which in particular technology transfer in Slovenia was *systematically* (albeit not sustainably) funded. During this first period national funds from the Ministry of Economy were made available for such financing. There were 6 partners involved in the project, but (due to late evaluation and late start) the project only lasted for 16.5 months.

4.2.3 KTT-2 project: 2017-2022

A long three-year period followed with no financing. During that time the Association of Technology Transfer Professionals of Slovenia (Association SI-TT) tirelessly tried to intervene with the Ministry of Science, the Ministry of Economy and the Government Office for Development and European Cohesion Policy, for the KTT project to be renewed and the TTOs to be financed again. This difficult period was intermittent only by harsh and belligerent negotiations among the existing TTOs. The negotiations were initiated by the JSI, but were difficult to lead due to different and partially articulated points of view.

There was a period of genuine despair due to government's focus on the NUTS3 division of the funds, and the unwillingness to introduce an umbrella accounting, which would affect KTT as operating throughout the country (instead of in a particular NUTS3 region). During this period, with no clear framework and leadership from the side of the government, the idea of the exclusionary operation of a possible new consortium grew among some TTOs. The idea was that some TTOs would be members, others would be left out. Consequently, the willingness of partners to rationally check their capacity, capabilities and achievements with the aim of cooperation remained low, the uncertainty caused the tensions and the competition among the partners to grew. The actions of the leaderships of the PROs, which held separate meetings for Universities and for Institutes, did not add a positive note into the confusion and distrust. Actually, the only joint meeting of the PRO leaderships was organized by JSI on June 12th 2014 in order to evaluate possible further steps, already before the KTT project (phase 2) ended.

After 3 years of turmoil, finally, in June 2017 the government decided to finance TTOs of Slovenia with a 5-year project. The current KTT project's mission is twofold: the strengthening of links and increasing the cooperation of PROs and industry and the strengthening the competences of TTOs, researchers and enterprises. Most (80%+) of the finances go to human resource financing.

As of now, all TTOs in Slovenia are jointly collaborating in this project. This *collaborative all-inclusive TTO setup* is considered by most of the utmost importance for coherent further development of the TTOs in Slovenia, but was not an initiative of the government. The government anticipated a competitive call where some of the TTOs would outbid the others, practically eliminating some or preventing others from developing skills at their institution. Such a development would have had disastrous effects on the development of the Technology Transfer scene in Slovenia. Moreover, the rules of the project prohibited active assistance from one PRO to the other, so no PRO can or could take on a case from the other PRO. Some PROs would thus in the exclusive model remain completely unsupported, as far as knowledge and technology transfer is concerned. Both of these features (long gaps between financing and the possible exclusion of some TTOs) need urgently to be rethought for further development – and prevented.

Against the spirit of the 2017 governmental call, the JSI as the consortium leader managed to join forces with all existing TTOs, small and big, some already in existence for a while and kicking-off and some just created. This was not an easy enterprise: some of the larger PROs in Slovenia were at the time interested in forming an exclusive consortium, leaving the other TTOs out of the loop, preventing their further development. Their idea was that not all the TTOs in Slovenia, but only a selected few should have access to the financial support. Against all odds, thanks to the efforts of the JSI and the timely

support of the Ministry of Science in 2017, this did not happen. In 2017 all of the institutions that could join the consortium, were invited to do so, and the coordinator made their accession possible, although with several difficulties regarding the quality of the official documentation initially provided.

The current KTT project, 2017-2022, comprises 8 partners, all public research organizations (PROs), represented by their respective technology transfer offices (TTOs), namely, 4 leading institutes and 4 renowned universities.

This helped to forge a network of TTOs in Slovenia, striving for development – competing, but under the leadership of JSI with a logic of the utmost inclusivity.

Every operational TTO in the country has its place in this current TTO project and it should remain so.

On the other hand, inclusivity also has its negative issues. In a huge project with many partners not necessarily everything is running smoothly. Sometimes also tensions tend to interrupt the day-to-day business. The issue of research competition, which appears to be rather smoothly managed by the researchers and the PRO leaderships, is often exhibited as a ruthless and futile brawl on the level of the TTOs. Such tensions are enabled and propelled by the fact that besides by the exhaustive expert work of the TTO, results can currently still also be defined and achieved in a political manner as they are not concrete and precise enough.

The situation resembles the Performance Enhancement System (PES) crisis of the Enterprise Europe Network (EEN) from the period 2014-2016, when the European Commission worked tirelessly to improve the standards of the PES results to a solid and concrete set of PES, which can be easily comparable through the EEN partners. The analytics is done by the EASME and is of utmost importance in EEN development and partner improvement. An improvement is sought from the side of the Ministry to enable such monitoring and analysis of the results in a contextual content manner, in addition to the (albeit very complicated) financial monitoring.

Based on this experience and example, the scientific approach to defining the technology and knowledge transfer KPIs is of the utmost importance in Slovenia. In particular it is necessary to enable fair comparison among the KTT partners, based on monitored, unalterable and unique parameters. It is important to ease out the tensions of the unproductive competition in the world where the Technology transfer industry itself needs still to be professionalized. The objective numbers, comparable among the partners, would enable a better standing and a community, focused purely on development instead of power games.

Lastly, a capacity of all partners to accept the creation of a community of equals who do the best they can in their own fields and on their own institutions, without making a special effort to prevent others' excellence, could also be further improved.

There are as of today no confirmed information on prolongation of this financing, thus the same issue as in 2014 will resurface in two years, in June 2022. What comes next? The system has been set up, people have been brought together to create new and larger, operational TTOs, and educated. The government should be urged to officially lay out their plans to enable planning of the TTOs' future activities.

4.3 The Center for technology transfer and innovation of JSI

The Center for Technology Transfer and Innovation at the Jožef Stefan Institute is currently the coordinator of the project KTT (2017-2022), the coordinator of Enterprise Europe Network Slovenia, and is a financially independent unit of Jožef Stefan Institute, Slovenia, involved in many different international projects.

CTT has been the coordinator of the INO projects in 2008, 2009 and 2011, with different partners (e.g. NIB, KI, UM); the coordinator of the KTT project 2013-2014 under the supervision of Ministry for economics and development; and is also the coordinator of the KTT-2 project 2017-2022 under the supervision of the Ministry of Science, Education and Sports. It should be noted, however, that the coordination of the current project KTT-2 was offered by the JSI to all other partners. In particular it was offered to the UL as the largest university in Slovenia, with similar innovation output as JSI. The offer was not accepted, not in 2017 and not in 2020, when it was repeated.

CTT prepared the project documentation and the proposed financing was split according to the size (in research FTE) of the PRO. The UM was awarded extra financing, following its proposal to coordinate the activities of the consortium in the Eastern NUTS3 region of Slovenia, and due to a claim of a significantly higher output than the corresponding one, relative to the research FTE. JSI made this increase possible by reallocating a share of their own budget to the UM. In addition, a share of the proposed KTT 2017-2022 budget was split equally among all 8 partners, disregarding their size in research capacity, to acknowledge that events and public relations activities require the same effort regardless the size of the institution and the level of results offered by the particular PRO.

The employees of CTT helped lobby for such the KTT-2 consortium project in their roles within the Association SI-TT. They worked coherently and tirelessly for more than 15 years towards a common goal: a creation of a network of Slovenian Technology Transfer Offices. This network is now partially operational. These activities resulted in an active consortium of 8 TTOs and JSI and CTT is currently responsible for executing this project financing scheme.

We urge the government to decide about further support of the TTOs in Slovenia as soon as possible to allow for planning of any transition necessary. Apart from the problem that the financing is running out in June 2022 and that the newly employed and trained personnel will need to plan their further existence, there are also two other issues to be covered.

Firstly, even though well informed from the relevant professional body, the Association SI-TT, the Ministry for Science, Education and Sports decided not to include any mention of the need for, existence or possible financing of the Technology Transfer Offices in the proposal for the new Legislative Act on Research, Development and Innovation in 2019. Several corrections have been made to the proposed Act since then, none of them explicitly denoting the role of Technology Transfer Offices in the system.

And secondly, to allow for the creation of spinoff companies with possible financial investments from the side of the Public Research Organizations, high-level parts of legislation would need to be altered, for example the Act on Public Finances. This can only be done with strong political support and understanding of all involved stakeholders, who, to a great

extent have limited understanding of the spinout/spinoff situation. The new Act on Research, Development and Innovation, proposes to overcome this obstacle by overriding the legislative background, but remains yet to be approved.

Thus, to this day, in the absence of legislative changes, there is only one option for successful and fair creation of new enterprises from the institutions of knowledge. This option is the creation of spinout companies with the ultimate requirement for the transparent accounting for the public expenditure.

5. PURPOSE OF THE TTO FINANCING

5.1 Industry relations

The goal of all of the KTT projects was and is to support the industry in Slovenia, rather than an outflow of knowledge abroad or great profit for PROs. Collaboration between PROs and SMEs in Slovenia should be strengthened.

The general process of collaboration [14] is based on several parallel processes. First the internal processes of research institutions need to provide the context and the content of possible collaboration, and with assessments of technology and market the principle decisions are taken. Then the IP rights management can commence. This phase usually lasts for more than two years in which enough time is provided to carry out the processes of finding a domestic or foreign partner for licensing, continuing R&D collaboration or to build up a team for spin-off creation.

Slovenian companies prefer contract and collaborative cooperation to buying licenses and patent rights. Also, a relatively low added value per employee and a low profit margin are not stimulating the research-industry collaboration. On the other hand, Slovenian knowledge, as high profile as it turns out to be in terms of highly cited publications per capita, is small in volume due to Slovenia's small number of inhabitants. As a consequence, the trademark of Slovenian science, IPR or R&D services is not well known abroad.

Primarily domestic, but also international R&D connections should be improved to allow for maximum development of the trademark of Slovenian science for industrial use.

5.2 Creation of new companies from PROs

Companies from PROs can be created either as spinouts (a separate legal entity, which is licensing the IPR from the PRO, but the entity is owned by the inventors) or as spinoffs (an entity owned partially by the PRO, at least in the share of the invested IPR).

The process of building a team for creation of new companies from PROs, involves team building, and education in entrepreneurship. If provided and guided, it can result in spin-off creation, VC involvement and market activities.

Issues, limiting the entrepreneurship activities, are connected to the pull-push principles of technology transfer and the conditions in the state economy. Firstly, the legislation does not allow for the Public Research Organization (with a limited option for the Universities to do so) to co-own and co-manage the newly created business. This severely limits the Organization's interest in the activity. Secondly, even if the creation of spinoffs were allowed, there is a limited capacity of business-oriented experts within the Public Research Organizations, who would be capable of monitoring and steering the spinoff company from the side of a PRO. Too rigid monitoring from the side of a PRO can ruin the spinoff's prospects for growth. Secondly, the same limitation applies for the consultancy available to the Organization, which is in addition to being inexperienced and partly professional, also costly.

The non-moderated situation with unclear options of the entrepreneurial researchers yields unregistered spinout companies of the Public research organizations. This situation is easily moderated via internal policy acts, structuring the process of company creation according to the current legislative limits. Such processes are in place at least at the JSI and UL, possibly also at other PROs in Slovenia, but not all researchers resort to take such routes.

The legislation should be adopted to allow not only for creation, but primarily for successful management of IPR as an investment in spinout companies.

5.3 Investing into IPR

Intellectual, and for the purpose of this article in particular industrial property, is of high importance for development of particular peoples, companies, countries. Indeed, the use of legally protected intellectual property for development of the country is a strategic decision that cannot be done overnight.

Patent system has many positive and less positive aspects, therefore many experts from various universities call for a reform of this system in order to realise its prime objective – "to support and encourage innovativeness".

Despite the above stated, it is important to invest in patents and other forms of intellectual property (IP). Investments in intellectual property increases licensing opportunities and the IP position of the Slovenian knowledge worldwide.

Currently IP costs can be supported within some national instruments (e.g. RRI, Eureka, some start-up funding initiatives), but mainly for companies. KTT is so far the only instrument enabling financial support for investments into IPR at the side of PROs.

Instruments that support investment - and not merely paying for intellectual property rights - should be further developed in Slovenia.

5.4 Strengthening the TTOs competences

The goal of the KTT project is to establish technology transfer centers in Slovenia as integral parts of PROs, which shall, first and foremost, strive to serve the interests of the researcher and the PRO. The TTOs shall assist the researcher throughout the entire procedure of the industry-research cooperation, by raising competences and educating, taking care of legal and administrative issues, and promote research achievements among the industry. Lastly, TTOs shall support the cooperation already established by research groups.

To achieve that goal, a further stable financing should be provided, divided into two parts: a smaller part to be devoted to further promotion activities (events, brochures etc). The majority of the financing should be devoted to actual market activities leading to capitalization of the created IPR.

It is true that a significant part of knowledge, created by the PROs, is transferred via other paths: teaching, publications, conference, STEM activities. The TTO should be involved in all of those as an information provider, when needed and appropriate.

However, the first and most important task of the TTO should be commercialization of IPR and secret knowledge, as there is no better equipped place or better educated people to do that for the benefit of the PRO and the (domestic) economy.

TTOs competences should be further developed and TTOs themselves further financially supported.

6. THE KT ACTIVITIES RESULTS: STATISTICS AND METHOD

In the following we present the results of the KT activities in Slovenia in the past decade. Metrics for collection of this data was not comparable in different periods due to different responsible bodies collecting the data and different understanding of what is actually important.

6.1 Incomparable metrics

Results on KT activities, collected during the periods of 2009-2012, 2013-14 and 2017-2019 are very diversified. One of the reasons of the diversification is the way in which the data were collected and the purpose of its collection.

For example, in the category of patents filed, data was not collected in period 2009-2012, in the period 2013-14 the number of patents filed wherever in the world was collected and in the period 2017-2019 the full report patents were sought for.

Only in the period 2009-2012 patents granted were collected and were divided between those granted in Slovenia (without full report) and elsewhere (also possible without full report, but more likely with one).

IP license and sales were collected in all three periods and R&D sales in period 2009-2012 and 2017-2019.

Number of created spinouts were collected in period 2009-2012 and 2013/2014 and not in the last period, as the Ministry for Science (somehow) concluded this was not a result of the work of the Technology Transfer Office.

Table 1: Overview results reported by the TTOs in the periods 2009-12 [15], 2013-14 [11] and 2017-2019* [16]

	Survey: 2009-2012 (36 months)	KTT: 2013/2014) (16.5 months)	KTT: 2017-2019 (24 months)
Patents filed to IPO with full report	/	/	24
Patents filed wherever	/	67	/
Patents granted in Slovenia	87	/	/
Patents granted with report (different patents in the same family count as many)	21	/	/
IP License & Sales	826.417,00 €	86.500,00 €	726.172,00 €
R&D Sales	21.296.785,00 €	/	2.723.412,00 €
Spinouts	14	6	/
Number of employed in SO companies younger than 5 years	18,4	/	/
New companies in collaboration with PROs thought TTOs	/	/	32

Number of employees in the spinouts created in the last 5 years were only collected in the period 2009-2012.

Number of new companies to be put into collaboration with the Public Research Organization was only collected in the period 2017-2019.

Numbers can be found in Table 1.

The overall results can be seen from Table 2, normalized to the length of 1 year.

Table 2: Overview results reported in the periods 2009-2012 [15], 2013-2014 [11] and 2017-2019* [16], normalized per duration of one year.

	Survey: 2009-2012	KTT: 2013/2014)	KTT: 2017-2019
Patents filed to IPO with full report	/	/	12
Patents filed wherever	/	49	/
Patents granted in Slovenia	29	/	/
Patents granted with report (different patents in the same family count as many)	7	/	/
IP License & Sales	275.472,33 €	62.909,09 €	363.086,00 €
R&D Sales	7.098.928,33 €	/	1.361.706,00 €
Spinouts	5	4	/
Number of employed in SO companies younger than 5 years	6	/	/
New companies in collaboration with PROs thought TTOs	/	/	16

6.2 The period 2009-2012

The 2009-2012 numbers were a result of a SI-TT survey [15]. Based on the collected data of the three largest Slovenian public research organizations - institutes and three universities, an analysis of the results of work in the field of technology transfer in the period 2009-2012 has been prepared.

The logic at the time was that the granted patents are of importance, not the filings. The reason for this was an active pursue of the researchers at the time to file as many patent applications at the national Patent Office, as the filing itself sufficed to gain significant extra points according to the national evaluation at the Agency for Research and Development of Slovenia.

The Association SI-TT as an association of Knowledge transfer professionals was at the time also aware of the importance of other KT categories: R&D, licensing and IPR sales contracts, spinout creation. In their survey it went into as much detail as collecting data on actual employees in these companies.

On the other hand, the numbers in this survey were not monitored or cross-checked in any way. They were self-reported by the TTOs to the SI-TT questionnaire and no proof of actual achievement of the numbers was sought for or delivered, thus their accuracy might be limited. Also, the reported data are considered to be the data about the PRO activity as a whole, not about the share of activity in which the TTO was involved.

6.3 Project results 2013-2014

The 2013-2014 numbers are a result of a reporting, done to the Ministry of Economy and Development in autumn of 2014, within the first KTT project, financed by the Ministry.

The Ministry of Economy was financing the project KTT 2013-14 with national financing. It focused on the Licensing and Sales of IPR and on spinout creation. R&D contracts were at the time considered to be less indicative for a TTO activity (and new company creation was considered to be part of the TTO activity) [11].

Some monitoring was done by the Ministry of Economy to seek proof for delivered results, so the results can be considered as partially relevant as for measuring the activity of the TTO (not the PRO as a whole).

6.4 Project results 2017-2019

The 2017-2019 numbers are a result of a reporting, done every 6 months to the Ministry of Science, Education and Sports. The results were also presented at the 12th International Technology Transfer Conference [16].

The Ministry of Science sought to finance the KTT 2 project with money from the Structural fund, meaning that a local component with direct benefit for the companies of Slovenia had to be proven during the project.

The overall project goals for 5 years (until July 2022) include 40 patent applications at patent offices that perform full examination; 300,000.00 EUR of income from license agreements; 8,000,000.00 EUR income from contract and collaborative research agreements, and 40 new Slovenian companies served according to the public call [17a].

The consortium has already delivered the required results for the new companies served and the license agreements key performance indicators, and there are reasonably optimistic results achieved in the first two out of five years in terms of number of patent applications and contract and collaborative research relations (50% and 40% of the final mark achieved, respectively) [16].

The data is mainly accurate as an indication of the part of the PRO activity in which the TTO is involved (not the activity of the PRO as a whole). Also, the ministry of Science established a precise set of data and documented proofs to be submitted before confirming the results, thus they can be considered as mainly relevant.

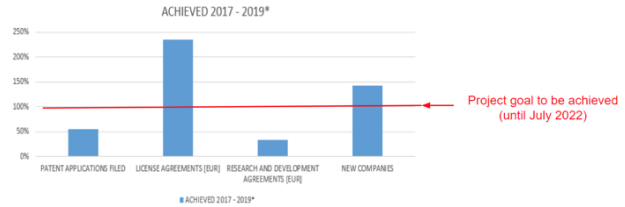

Figure 1: A comparison of 5-year goals and the 2-year performance of the KTT project.

The Ministry of Science in 2017-2019 focused on R&D contracts primarily with national legal subjects, on the new companies brought into collaboration and the national licensing deals. Spinout creation deemed to be out of the scope of the governmental support.

Nevertheless, it is possible that the majority of the reported (as requested) licensing deals are actually being done with unregistered spinout companies of the Public research organizations.

Also, since the Ministry is only monitoring the contracts and not their realization, it is not clear, how much of the reported amounts can actually be considered a PRO income (for incentive distribution).

A huge drop in R&D collaboration can be seen from the data. The KPI of both projects were predefined by the two Ministries. The difference in KPI definitions can be seen from Table 1.

To obtain comparable results in order to estimate the development of the TT profession in Slovenia, it is pertinent to use a similar metrics in every one of the time periods. However, some estimates can also be done when taking a look at the more granular level of data - how the results are distributed over the PROs in a particular year and in which particular fields.

6.5 Scientific output comparison

In an attempt to resolve the reason for the anomalies and drops in performance, an analysis of publicly available data on Research intensity and outputs was performed already in 2015, incorporating financing available to a PRO, its research staff in FTE, number of granted and valid patents (Domestic and internationally) and WoS PRO specific results.

The data was collected from yearly reports of the largest Research organizations in Slovenia: JSI, UL, UM, UP, KIS, KI, NIB and UNG, Thomson Reuters Database as of 1.10.2015, URSIL database as of 1.10.2015, ARRS webpage with financial data as of 1.10.2015, SciVal as of 1.9.2015 Web of Science as of 1.9.2015. The 8 institutions covered 79.07% of the ARRS budget at the time, meaning that 20.93% of the research institutions, financed by the ARRS were not covered by this survey. Number of students at the Universities was not considered as a relevant indicator, as the IPR generated by the students is not owned by the Universities. In addition, number of employees was also not considered, as the employments can range from a full FTE to just a few percent of work obligation, which cannot be treated equally. Also, in the category patents granted at least one university included patents granted to employees (and not the institution itself).

Results of the survey are shown in Table 3 below.

The results show a discrepancy between the amount of financing received for R&D activities from the Slovenian Agency, the number of FTE employed to perform the R&D work (teaching staff FTEs are not included) and the output in terms of number of valid and granted Slovenian patents, number of valid and granted foreign patents and number of publications. In this comparison, data on R&D contracts could not be obtained from public sources.

Table 3: 2015 Quality assessment of 8 Slovenian Research organizations made on the basis of the publicly available data.

ORGANIZATION (RO)	ARRS financing	SHARE OF FINANCING of projects / lines from ARRS funds from 8 Ros	number of employees of research FTE in JRO - group H as at 31.12.2013 *	SHARE – FTE	number of valid SLO patents as of September 1, 2015	number of granted SLO patents in the last 20 years	SHARE FROM QUALITY - SLO patents	number of valid foreign patents as of September 1, 2015	number of granted foreign patents in the last 20 years	QUALITY SHARE - FOREIGN patents	WoS publications - articles (2014, KI, UP 2013, NIB average of two quarters * 2) -no necessarily comparable source	SHARE from QUALITY - articles
UM	€9,796,995.78	**8.9%**	183	**8.32%**	27	65	**15.86%**	3	4	**16.67%**	550	**16.92%**
IJS	€32,035,245.37	**29.1%**	723	**32.88%**	44	122	**28.62%**	4	9	**30.95%**	808	**24.85%**
UL	€45,702,306.53	**41.5%**	830	**37.75%**	50	132	**31.38%**	3	8	**26.19%**	1230	**37.83%**
NIB	€3,950,023.57	**3.6%**	87	**3.96%**	1	5	**1.03%**	1	1	**4.76%**	118	**3.63%**
KI	€10,228,268.95	**9.3%**	192	**8.73%**	32	92	**21.38%**	3	5	**19.05%**	281	**8.64%**
KIS	€2,368,780.14	**2.2%**	50	**2.27%**	3	3	**1.03%**	0	1	**2.38%**	38	**1.17%**
UP	€4,061,256.28	**3.7%**	119	**5.41%**	0	0	**0.00%**	0	0	**0.00%**	196	**6.03%**
UNG	€1,866,639.01	**1.7%**	15	**0.67%**	1	3	**0.69%**	0	0	**0.00%**	30	**0.92%**
TOTAL	€110,009,515.63	**100.00%**	2199	**100.00%**	158	422		14	28		3251	

As the data covers 79,07% of all national research financing from the ARRS, it is indicative and helps us understand the distribution of knowledge transfer activities throughout the majority of the STEM oriented PROs in Slovenia. The discrepancies could assist us in understanding the year to year difference in performance as shown in Table 1 and Table 2. Further research should be done in this domain.

7. FURTHER DEVELOPMENT

At the general level, primarily domestic, but also international R&D connections should be improved to allow for maximum development of the trademark of Slovenian science for industrial use.

The legislation should be adopted to allow not only for creation, but primarily for successful management of IPR as an investment in spinout companies.

Instruments that support investment and not merely paying for intellectual property rights should be further developed in Slovenia.

TTOs competences should be further developed and TTOs themselves further supported.

Projects funded from the ERDF funds, such as KTT 2017-2022, often have relatively complicated reporting, which represents an administrative work load for TT managers and results in a diminished amount of financing spent from the ERDF in the project as a whole. The Ministry of Science needs to establish a coherent financing over the years, which is not project based.

In the Slovenian case, the Proof of concept fund is not established, which prevents research entrepreneurs to develop their inventions further towards the market. Continuing support of the Ministry and their collaboration with the SID bank could lead to a breakthrough in this domain. The SID bank should continue with a steep pace the creation of the fund to be established by the end of the 2021.

There is a lack of support for spinouts. Start-ups can enter easily a technology park and perform a day-to-day business; in contrast, a spinout has to carry out many internal procedures within the PRO from which it originates in order to start operations. On the other hand, the scale-up phase is well supported (for example, by the national project SIO). Spinout support should become part of the Technology and Knowledge Transfer policy in Slovenia.

The Slovenian legislature (ZIDR) provides incentives for inventors, when the invention is licensed or sold (min. 20% of gross royalty, in practice around 33% of net royalty). There is a lack of recognition for Technology Transfer (TT) managers (compared to inventors). The Ministry of Science should make sure that the incentives for TT officers should become part of the legislation governing the incentives for researchers.

Professionalization is also sought for. For example, the Council for science and technology (SZT) should follow the lead of the European Commission and involve not only researchers and industrialists, but also technology transfer professionals into their developments of the policy inputs. As such, the current SZT lacks a very important component, and that is the knowledge and experience of the man or the woman in between the worlds. The European Commission has already rectified this in the past years, where the TT experts participate very successfully in several high-level Advisory Boards and Expert groups. The Slovenian government should follow that lead.

Last but not least, technology transfer needs stable funding, as a TTO is generally not able to finance itself – apart from the rare cases where industry buys high licenses (a large license can support a TTO for up to 10 years), and this is not applicable to Slovenia with its IP reluctant SMEs with lower than average EU27 technology absorption capacity.

In case when the TTO is supported by the government, it is important that there is good cooperation between the TTO and the government (not just administrative supervision but also content guidelines for future work, content analysis, KPI definition fine tuning, including the development of a toolbox for successful technology transfer as a collection of contracts, good practices and business models.

In essence, a TTO is an important part of the innovation chain and has to be recognized as such.

8. CONCLUSIONS

This paper was written to give an overview of the history/genesis of the current Slovenian technology and knowledge transfer system, unfolding several issues that will need to be addressed in the future to make the knowledge transfer and innovation system of Slovenia to become fully operational. The mistakes made during the short, but significant history od knowkledge and technology transfer in Slovenia, mustn't be lost or else the same mistakes will be repeated. The paper thus describes the effects of having project-based funding of TT with varying scopes and focuses:

i. The lack of continuity makes it hard to keep staff and develop competences over long time;

ii. Changing focus leads to changes in direction (what you measure is what you get) and the mixture of results of the TTOs in Slovenia in the past decade nicely shows the effect of the changing policy;

iii. It becomes hard to keep track of the overall development of TT in Slovenia, which needs to be improved in order to enable quality control.

iv. Exact and exactly measurable KPI should be determined to prevent the reporting manipulation of the support system and the PROs.

v. Constructive, systematic, sustainable, inter-connected and consistent solutions should be sought for, without excluding TTOs. They are players in the field of public research organizations support.

In other countries, the political systems have tended to fund the start-up phases of TT, but they have also had an expectation that PRO's would take over responsibility with time. This has not always happened. Even if the basic funding of the TTO office is secured by the government or PRO, the missing PoC link funding often has to continue on national/regional level for many years for TT to mature. Also, Seed funding for spin-outs is also a long-term need that may require political support.

The recommendations of the paper require further thoughts on the need of priorities for government intervention. These priorities will hopefully be set by the governmental/political structures in Slovenia through the new law on scientific research and innovation activity. The law is at the moment being coordinated interdepartmentally within the Slovenian government. However, the principles and the recommendations and the priorities should then also be followed by the PROs.

Last but not least, Technology transfer is a young discipline. There should be a sensible amount of healthy competition also in Technology transfer. However, this competition should remain cordial and motivational, and avoid any destructive steps, especially if for the purpose of self-promotion.

Having created a Scientific Section to address the issues of Technology and Knowledge transfer within the 13th International Technology Transfer Conference, clearly shows the opportunity for further joint research (nationally and worldwide, and beyond mere best-practice examples) on technology and knowledge transfer from a scientific point of view, influencing the entrepreneurship potentials and setbacks of the researchers and businesses.

9. ACKNOWLEDGMENTS

We would like to thank the Ministry for Science, Education and Sports for their continuing support in establishing a resilient and productive KT sector in Slovenia. Special thanks also to the

four independent reviewers for their constructive comments and suggestions that improved this manuscript. Many of those were used in the conclusions. Š.Stres would like to thank her family for bearing with her during all those times of incessant work. Also, she would like to extend her gratitude to all the supportive colleagues who helped create, steer and pursue their common vision of an inclusive, vibrant, consistent and interconnected (knowledge and technology transfer) future in Slovenia.

10. REFERENCES

[1] Number of Researchers per million inhabitants by Country. [internet]. [cited on March 30, 2020]. Available from: http://chartsbin.com/view/1124

[2] Zakon o zavodih. [internet]. [cited on March 30, 2020]. Available from: http://zakonodaja.gov.si/rpsi/r00/predpis_ZAKO10.html

[3] Zakon o visokem šolstvu. [internet]. [cited on March 30, 2020]. Available from: http://www.uradni-list.si/1/objava.jsp?urlid=2003134&stevilka=5826

[4] Seznam aktov, ki vodijo delovanje ARRS. [cited on March 30, 2020]. Available from: http://www.arrs.gov.si/sl/akti/

[5] Zakon o izumih iz delovnega razmerja. [cited on March 30, 2020]. Available from: http://zakonodaja.gov.si/rpsi/r02/predpis_ZAKO5122.html

[6] Zakon o podpornem okolju za podjetništvo. [cited on March 30, 2020]. Available from: http://pisrs.si/Pis.web/pregledPredpisa?id=ZAKO5073

[7] Pravilnik o načinu vodenja in vsebini evidence subjektov inovativnega okolja. [cited on March 30, 2020]. Available from: https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/2005-01-5316/pravilnik-o-nacinu-vodenja-in-vsebini-evidence-subjektov-inovativnega-okolja

[8] Zakon o industrijski lastnini. [cited on March 30, 2020]. Available from: http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO1668

[9] Resolucija o raziskovalni in inovacijski strategiji Republike Slovenije. [cited on March 30, 2020]. Available from: http://www.uradni-list.si/1/content?id=103975

[10] Ruzzier, M., Antončič, B., Zirnstein, E., Fatur, P., Nagy, T., Sešel, L., Zelič, U., Slovša, P., Stres, Š. 2011. Slovenski raziskovalci na razpotju. Vinkler, J. ed. Založba Univerze na Primorskem, Koper. http://www.hippocampus.si/ISBN/978-961-6832-07-6.pdf

[11] Habjanič, A., Stres, Š., Zorc, A., Alešnik P., Virag, L. 2015. Prenos tehnologij na javnih raziskovalnih organizacijah v Sloveniji. Habjanič, A. ed. Združenje profesionalcev za prenos tehnologij Slovenije, Ljubljana. http://tehnologije.ijs.si/wp-content/uploads/2018/04/TT-brosura-2015_11092015_2.pdf

[12] Stres, Š.,Pal, L., Habjanič, A., Žilič, E., Blatnik, R., Lutman, T., Benčina, M, Leban, M., Lipnik, A., Oblak, M., Rener, A. 2017. Pal, L., Stres, Š. eds. Pisarne za prenos tehnologij v Sloveniji. Združenje profesionalcev za prenos tehnologij, Ljubljana. http://tehnologije.ijs.si/gradiva/Brosura%20SI-TT.pdf

[13] The Technology Transfer Block Exemption. [cited on September 9, 2020]. Available from: https://www.pinsentmasons.com/out-law/guides/the-technology-transfer-block-exemption

[14] Š. Stres, Public R&D in natural sciences as a market potential - an study of examples with assessment of situation and practical proposals for solutions, PODIM 2010.

[15] Š. Stres, P. Kunaver, Analiza rezultatov dela na področju prenosa tehnologij slovenskih javnih raziskovanih institutov ter univerz 2009 -2012, Institut »Jožef Stefan« za Združenje profesionalcev za prenos tehnologije Slovenije, SI-TT, (March 22 2013)

[16] Stres, Š. 2019. Slovenian KT system. In: Stres, Š., Pal, L., Podobnik, F., Odić, D., Blatnik, R. Proceedings of the 12th International Technology Transfer Conference – 12. ITTC. Institutu "Jožef Stefan", Ljubljana. http://library.ijs.si/Stacks/Proceedings/ITTC

[17] JR TTO. 2017. Javni razpis Spodbujanje dejavnosti prenosa znanja preko delovanja pisarn za prenos tehnologij. Ministry of education, science and sport. http://mizs.arhiv-spletisc.gov.si/si/javne_objave_in_razpisi/okroznice/arhiv_okroznic/okroznice_razpisi_in_javna_narocila/javni_razpisi/indexb365.html?tx_t3javnirazpis_pi1%5Bshow_single%5D=1550