

"TECHNOLOGY TRANSFER OPPORTUNITIES FOR SMALL OPEN ECONOMIES: CASE OF LATVIA"

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Abstract

Aim of this report is to analyse typology of technology transfer channels, assess key dimensions of technology transfer framework and mechanisms, introduce the concept of interaction modes in Latvia. The paper approaches local technology transfer policy, analyses available in market technology transfer models, describes efficiency of modes and identifies critical factors for efficient technology transfer system in Latvia.

Traditional approach assesses technology transfer as a knowledge transfer between research laboratories and industry and is influenced by four main components: (a) level of collectivisation or / and globalisation; (b) availability of new facts (knowledge); (c) personnel skills and abilities to adapt, use, improve and innovate and (d) availability of advanced machines and equipment.

The wider definition assumes that “technology transfer is an active interaction between two or more social entities, during which the sum of technological knowledge remains stable or increases through the transfer of one or more components of technology.”

Technology can be transferred through a range of channels and applying range of forms of interactions between the sources of technology and their environment locally and globally, e.g. B2B, B2C, B2R&D, R&D2R&D etc.

Today, Latvia is not yet a knowledge economy, but developing a knowledge economy has become the objective of the Latvian government, in a situation when country Latvia is more heavily reliant on labour intensive and low – tech industries, having little need for new knowledge.

Latvia in the same time is struggling with two related challenges. The first is to effectively create technology transfer channels for converting the country’s decreasing research capacity and human capital into an asset for economic growth, competitiveness, and rising standards of living. The second is enhancing competitiveness and productivity in low and medium-tech sectors.

Keywords: technology transfer, technology channels, knowledge transfer

Introduction

In recent years technology transfer has internationalised and its importance is reflected in different policy measures. Comprehensive mechanisms of technology transfer cover complex processes and numerous channels through which technology might be transferred. The value of access to new knowledge, fight for talents, getting societal value out of state public research, entrepreneurship behaviour and spirit of scientists, effective technology intermediate infrastructure are just few priorities of knowledge economy.

Besides traditional attitudes to research commercialisation and intellectual property (IP) management there continuously increasing value of knowledge workers, abilities and skills of technology absorption. In several small economies the policy towards creation of new type technology transfer system is getting more and more central place in national innovation policies. Here might be mentioned Finland, Sweden, Israel and Austria. The last one is constantly developing new regional RTD infrastructure with core element of technology or impulse centres that will act as catalysts and new technology providers in the entire region. This would mean adopting strategies that are suited to the respective regional and institutional conditions rather than addressing individual enterprises and research institutions.

This paper is aimed to assess Latvia's as a small transition economy's technology transfer measures and identify market imperfections as well as potential improvements.

Models of technology transfer

Technology is transferred to solve problems and create wealth.¹ Technology transfer could be understood as the movement of a specific set of capabilities from one entity (person, team, business, organization) to another. Lundquist and Thompson² have introduced the technology transfer to be: "movement of the ability to realize a technology from one person or group to another, as confirmed by demonstration of performance against agreed requirements". Technology transfer (TT) might be traditionally defined as "the process through which innovative technological know-how, expertise or knowledge developed by Research and Technological Development (RTD) institutions is transferred to and adopted by industry or society with the aim of industrial use, societal or environmental benefit or commercial exploitation"³.

The more wide definition is that technology transfer is "the active interaction between two or more social entities, during which the sum of technological knowledge remains stable or increases through the transfer of one or more components of technology".⁴

Transferring takes place between two parties: a "transferor" or technology provider who usually owns the intellectual property and is allowing making it available to others and a "receiver" or adopter who needs or wants the IP and is agreed to pay for it for its own use. Intermediaries or "facilitators" could make the transfer process easier.⁵

Technology transfer refers to any process by which one party gains access to a second party's information and successfully learns and absorbs it into his production function.⁶

TT mechanism is any specific form of interaction between two or more social entities during which technology is transferred:⁷

- internal transfer: delivery of internally developed systems or equipment within a company or organisation (division-to-division transfer);
- external transfer: movement of new knowledge into or out of organization, including acquisition of technologies from outside sources, licensing, and alliances at many levels, including collaborative development and industry consortia. This is the traditional way of technology transfer;
- mergers and acquisitions: purchase of both technologies and technical capabilities by acquiring whole company or business;

¹ Lundquist G. A Rich Vision of Technology Transfer Technology Value Management Journal of Technology Transfer, v.28, 2003, pp.265–284

² Lundquist G. and Thompson J. Technology Quality Management, Part 1, Technology Transfer Society Proceedings. 1999.

³ Vekinis G. Best practice for technological transfer. A best practice manual for successful transfer of technologies, know-how and knowledge to industry, commerce and society. Greece, June 2007, p.5.

⁴ Laamanen T. and Autio E. Technology transfer between research laboratories and Industry, Espo, 1993, p.16.

⁵ Vekinis G. p.5.

⁶ Maskus K. Encouraging international technology transfer. UNCTAD-ICTSD Project on IPRs and sustainable development. UNCTAD Issue Paper No.7, p.9

⁷ Tomi Laamanen & Erko Autio, p.17.

- dissemination: open access to technical papers and presentations sent directly to technical communities.

Technology Transfer Channel is the link between two or more social entities in which the various technology transfer mechanisms can be activated: B2R&D, B2B, B2C, R&D2R&D etc.⁸ Globalisation has also affected the technology flows taking place within such key TT channels:⁹

- *domestic and international trade* in goods and services is transferring technological information. Production equipment and related services can directly improve productivity;

- *Foreign direct investment (FDI)* transmits technological information and innovative solutions from multinational enterprises to their subsidiaries in recipient countries that are even newer or more productive compared to host firms;

- *Licensing* typically involves the purchase of production or distribution rights (protected by some intellectual property right (IPR)) and the technical information and know-how required to utilise those rights. It is important to differentiate intra-firm TT, where IPR and know-how stays under firm's control;

- *Joint ventures are formed by* contractual arrangements between two or more partners where international founders may provide technically superior production information through licensing, while local partners usually provide distribution networks, labour, unique management techniques or some other local advantages.

- *Imitation* is the most significant channel of TT, in which a rival firm obtains the technological or design secrets of another firm. Imitation or adoption may be achieved through product inspection, purchase and decomposition, trade fairs, reverse engineering and even simple trial and error.

- *Transfer of employees where* technical and managerial personnel with knowledge of technologies leave one firm and join or start a rival firm based on that knowledge. Such competition can be a significant form of information diffusion in industries and locations where crossfertilization of knowledge is important and employees are mobile.

- *Public data in patent applications* and test data allow studying available information about new technologies, learning the underlying technologies and developing competing processes and products.

- *mobility of personnel and temporary migration* to universities, laboratories, conferences and in-depth training centres located mainly in the developed economies allow to transfer much skills and technological know-how to students, scientists, and managerial and technical personnel. Many technologies cannot be effectively transferred without the complementary services and know-how of engineers and technicians that must be on-site for certain period of time.

Technology spillovers could be defined as information learned and absorbed in a way that the benefits do not fully accrue to the know-how owner. Technology B2B spillover societal benefits results in lowered costs, greater productivity, advantageous post-innovation and other business process elements for which the owner firm cannot charge full value.

The backward and forward linkages¹⁰ in a case of FDI may generate important spillovers. Through forward linkages the foreign subsidiary produces technological inputs that reduce the costs of its customer or raises the quality of its products. A backward linkage arises where the investors' operations require improve of the technologies and standards for technological inputs from its local suppliers.

Main TT Channels between R&D and industry

Traditionally publicly funded research organisations (PRO) operate in "open science" model where IPR are retained by PROs with unrestricted flow of new information (knowledge). However, the only moral obligations from the users are to quote the source and to share the improvements. This model still prevail in Latvia as in most countries of Europe.¹¹ The licensing model was introduced by USA in 1980 with adoption of Bayh-Dole Act encouraging PROs to establish a technology transfer function. World Bank report strongly suggested to Latvia to introduce such proactive way of knowledge commercialisation in 2002.¹² Like in Central Europe, also in Latvia almost nothing has been done to stimulate knowledge transfer by improving legal environment concerning ownership of public research results. The Open science and Licensing models operate as "linear" models,

⁸ Ibid. p.18

⁹ Maskus K. p.10-14.

¹⁰ Ibid. p.13

¹¹ Management of intellectual property in publicly-funded research organisations: towards European guidelines. Expert Group report, EU, DG Research, 2004, p.8

¹² Watkins A. and Agapitova N. "Creating a 21st Century National Innovation System for a 21st Century Latvian Economy", World Bank, 2004, 95 p.

reflecting straight process from invention to new product or technological improvement. The recent developments outline that more effective interactions between science and industry take place in non-linear way or so called “innovation model”.¹³

Technology transfer from PRO to industry is a complex non-linear process. It is not a relay race where the researcher hands over an invention to a patent attorney who files a patent that he then hands over to a salesman. Technology transfer is not a one-way road where the researcher communicates to the businessman. In fact, as you can see on figures 1 and 2, technology transfer is the result of a multi-dimensional relationship between science and industry where the actors communicate with each other.

The regular transfer of technology is influenced by the following pre-conditions¹⁴:

- The research organisation must hold relevant state-of-the-art competence, be capable to produce it, or be in a position to provide applied research services for the implementation and adaptation of technology developed elsewhere.
- The research organisation must be motivated to transfer its knowledge and to communicate with enterprises. Key motivators can be benefits such as financial rewards, better reputation, or access to competence held by an industrial organisation. It can also vary between individual academics according to personal preferences and may even vary from case to case according to the type of project.
- The research organisation must establish a transfer mechanism that is transparent to the potential user and capable of combining and integrating (research) competences according to the needs of client enterprises.

Academics usually prefer to spin-out their inventions rather to license even last is less costly and quicker route of commercialisation. Having limited motivation and unguaranteed royalties' income from IP generated academics prefer to keep control on their intellectual babies. As a result we see too much unsustainable and so called surrogate firms created on bases of created in universities new technologies.¹⁵

In a licensing channel PROs grants user rights to its IPR in the form of licence, which can be exclusive, with or without the right to sublicense, which enables the industrial partner to develop and commercialise covered products and processes and may regulate also design of derivatives in return for license fees and royalty income related to the commercial returns achieved by industrial partner.

The channel of collaborative, partnership or sponsored research is attractive for industry until it could acquire and own, often at reduced cost valuable new technologies, or at least, fully exploit their advantage. The disadvantage of this channel in Latvia is that government support “open science” model but potentially applicable new technologies are not developed up to the level and transferred form of ownership (unclear status of state ownership) from where industry could take over and commercialised results further. Here it is important to distinguish between three different knowledge transfer channels in non-linear “innovation model” for Latvia:

1. research consultancy services, usually provided to industry to solve particular practical technological issue without creating new IP. This could be a first step in establishing longer term partnership and knowing each other in practical work.
2. contract research where PROs provide research contribution to industry with aim to solve particular problem rarely developing new solutions or new ideas. Such projects are focused to improve existing technologies where PROs act as a quality research service and external expertise as well as equipment providers instead of providing frame for new millennium breakthrough.¹⁶
3. collaborative research (including sponsored one) where PROs provide significant new IP in a format of new novel solutions and technologies. In Latvia so far we see complete mass of all these channels in existing state aid programs therefore it is difficult to expect out measurable results and real collaboration.

Spin-off companies from PROs are relevant channel in cases where inventions are fare from proof-of-concept and their feasibility lack of readiness that industry would be interested to take a license. The advantage of spin-offs is continuous relations with original PRO and incubator near-by this PRO. If development become proofed new firms are acquired by another larger companies. In Latvia there is no such acquisition demand but local spinoffs have little trust on global scene.

¹³ Management of intellectual property ... p.10-11.

¹⁴ EC, DG Enterprise “Technology Transfer Institutions in Europe. An Overview” 2002, p.7-8.

¹⁵ Lambert review of business-university collaboration. Final Report. HM Treasury, London, 2003, p.60.

¹⁶ Management of intellectual property ... p.32.

The creation of a pre-incubation facility which can provide specific advice, services and access to pre-seed finance is crucial for sustainable spin-off firm development. One of models in USA is setting up proof of concept centres in a university that (1) develops innovative and marketable technology, (2) create external networks, and (3) collaborate with TTOs assisting in the commercialization process.¹⁷ Similar concept is technology bridging foundations in Germany and university holding companies Innovationsbron in Sweden that supports researchers that want to commercialise research results through pre-incubator and incubator services and the provision of seed capital.¹⁸

The competence centres is a recent R&D partnership model initiative in Europe (Sweden, Germany, Flanders, Austria, Estonia etc.) where the Swedish version of competence centres is based on two-year contractual agreements between the universities and the enterprises with a joint research program.¹⁹ In Austria a comparable *Kplus* competence centre program requires setting of independent legal entities providing enterprises with the long-term opportunity to make pre-competitive research together with different research institutions within the framework of jointly sponsored and designed research projects.²⁰

Latvia's technology transfer system

Overall situation in Latvia

Latvia is a small country and our economy is very closely tied to the global economy. Currently, Latvia has the distinction of being the fastest-growing economy in the European Union. For the past ten years, real GDP growth in Latvia has exceeded the average GDP growth rate in the EU countries. Ever since 2004, Latvia's GDP has increased by 10.4% on average annually and in 2007 Latvia's GDP increased by 10.3%. This year Latvia faces the same challenges as many other countries: a slowdown of economic development, an urgent need to reduce administrative expenses, and a government increasingly searching for measures to promote economic growth.

Developing a knowledge economy has become the objective of the Latvian government, in a situation when country Latvia is more heavily reliant on labour intensive and low – tech industries, having little need for new knowledge. Acquiring or developing knowledge is perceived as a panacea because it can help a country with limited natural resources generate growth, and for others, to diversify their sources of growth. Today, economic development is often viewed as a technological phenomenon; for a lagging economy, it is seen as the phenomenon of catching up with technological advancements. Still, the fact remains that the generation of knowledge is concentrated in relatively few innovation driven countries.²¹

Today, Latvia is not yet a knowledge economy. The key knowledge-intensive sectors—information-communications technology, electronics, materials science, wood chemistry processing, and biotechnology and pharmacology, remain marginal in the Latvian economy. High-technology sectors represent only 2% of the total workforce in Latvia, which is much lower than the average of 3.5% in existing and future EU member countries. The same conclusion emerges from foreign direct investment and export flows, which capture two important channels through which technology is diffused and enhanced in a transition economy like Latvia.

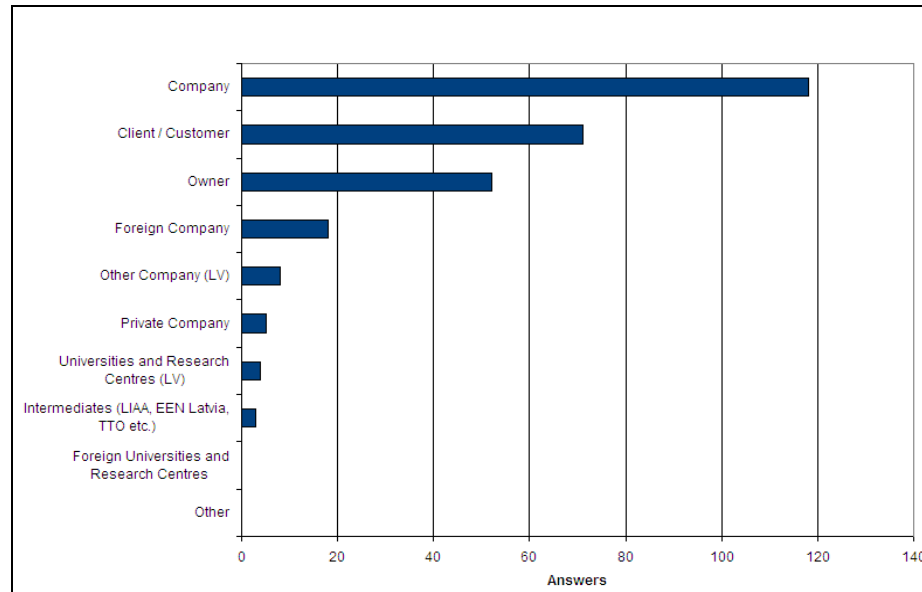
¹⁷ Gulbranson C. A., Audretsch D. B. Proof of concept centres: accelerating the commercialization of university innovation, *J Technol. Transfer.*, 2008, v.33, pp.249–258.

¹⁸ Sellenthin M.O. Technology transfer offices and university patenting in Sweden and Germany *J. Technol. Transf.*, 2009 (in press)

¹⁹ Mayer S., Blaas W. Technology Transfer: An Opportunity for Small Open Economies *Journal of Technology Transfer*, 27, 275–289, 2002

²⁰ *Ibid*

Figure 3. Company's innovation sources²²



Latvian industry isn't quite developed, there are no high growth innovative companies like "Microsoft", "Nokia" or "Skype" which have possibility to invest in researches and to create high technology laboratories themselves. Latvian enterprises are not concerned to invest in technology's development and adopting. The proposition demonstrates the statistics of European Union where Latvia's indexes lag behind ES average in the all fields. The traditional model of technology transfer (PROs – industry) in Latvia has low performance. This cross-country comparison also emphasizes the limited participation of the Latvian private sector in the knowledge economy. Not only have a few private firms been directly involved in the so-called knowledge intensive sectors but the level of R&D effort funded by the private sector remains one of the lowest in Europe, accounting for only 0.2% of GDP, which is approximately six times lower than the EU average.

Innovation policy in Latvia is formal priority as it has too little financial resources. The most part of enterprises operate far below the technological frontier. Only very few Latvian enterprises are product innovative and most of these firms innovate by investing in capital equipment rather than by either conducting applied research themselves or purchasing research services from Latvian or foreign research institutes.²³ The innovation culture is undeveloped and as a consequence, ability of imitation and adoption of external knowledge is low. According to figure 3, the most popular sources for technological development is company itself followed by linkages Business to Customer (B2C) and ideas coming from owners, and only then followed by TT industry to industry or business to business (B2B).

The state research programmes are established in priority areas of research to promote the development of these scientific disciplines and facilitate their contribution to the competitiveness of economy and advancement of society.

The main research policy funding trends over the last five years include:

- establishment of thematic research programmes in priority research areas that have the potential to make a significant contribution to the competitiveness of the national economy;
- introduction of institutional funding in 2005 to strengthen research institutions, which earlier received only project-based funding;
- in 2004 implementation of the National Programme "Support for Modernisation of Scientific Infrastructure in State Research Institutions" was started, attracting European Regional Development funds (ERDF). For the EU Structural Funds' 2007-2013 planning period it is foreseen that further support will be provided for the renovation of research institutions and the modernization of research equipment, as well as the enhancement of availability and the modernisation of ICT to promote increased human resources for research;
- introduction of a new measure "Support to the implementation of doctoral programmes and postdoctoral research" (2005), to facilitate the renewal of human resources in R&D. "Development of Tertiary (Higher)

²² Latvijas Tehnoloģiskais Centrs, "Latvijas MVU vajadzību analīze inovācijai", Rīga, LIAA, 2007, 101 p.

²³ Watkins, p.6.

Education” is a programme launched in 2009 to continue support for improving the quality of tertiary education studies and programmes, increase the proportion of students in masters and doctorate study programmes, and to raise the professional and research qualifications of academic personnel;

- emphasis on supporting the applications of research results (2005 and 2006). For example, via the newly set-up technology transfer offices in higher education establishments; development of scientific and research potential and capacity, attracting supplementary human resources to science and research, cooperation improvement among higher education institutions, research centres and enterprises, improving research and innovation policy and administration, and contributing to the awareness of society about the role of science and research via the EU Structural Funds’ measure “Development of Scientific and Research Potential”.

For 2008, 13.8MEUR out of 62.5MEUR allocated by the Ministry of Education and Science was spent on the nine state research programmes:

- information technologies;
- organic chemistry and biomedicine;
- materials science;
- forestry and wood sciences;
- Letonica (Latvian language, history and cultural studies);
- energy;
- environmental research;
- agro-biotechnology;
- medical science.

Country’s research potential is losing critical mass to train new industrial researchers and engineers. The potential to support business need to acquire intangible knowledge and to contribute with applicable research services so crucial for creative imitation is critical. The total capacity of R&D personnel in Latvia is equivalent to the total R&D personnel in one mid-sized US laboratory.²⁴

The first step to create technology transfer system in Latvia and development was State Aid Program “Technology Transfer Contact Points” (TTCP) which was implemented in 2005-2006. As a result 6 technology transfer contact points were established in Riga Technical University (two), University of Latvia, Ventspils University College, Rezekne University College, Latvia University of Agriculture -1. TTCP are structural units of a scientific institute or higher education institution to support and promote TT activities, and they are responsible for marketing and provision of information on research activities and experience of the organization. Consolidated outputs of the program are still on a way to reach measurable income and be sustainable:

- 40 seminars organized,
- 202 commercialization offers prepared,
- 19 cooperation agreements initiated,
- 55 local and 7 international patent applications prepared.

The second step of technology transfer system development for period 2007-2013 was planned launch of Technology Transfer Centres and further support to TTCPs. The main difference between these programs was market specification. If TTCPs are tended to local market, Technology transfer centres should be focused to international markets. Also was planned that Technology transfer centres will analyze and finance commercialization steps of unique technologies from special proof-of-concept fund, which is very important factor for successful commercialization and licence trade. Unfortunately, economic downturn had made corrections in plans. As result, program “Technology Transfer Centres” was cancelled and only eight contact points of technological transfer are operating since second step of TTCPs support program was launched in 2009.

Besides TTCPs the unique international technology transfer provider in Latvia is Enterprise Europe Network (EEN) Latvia. But it is not sufficient to cover growing industry needs and replace intended technology transfer centres. And the main reason is EEN Latvia can’t offer financing for new technology development and commercialization.

As a complementary aid program within second step was designed “IPR Policies of Universities”, but this policy measure don’t work effectively. The main reason for this is low PROs motivation in Latvia. According to low, all rights on IP, which are financed from public funds, belong to state. This unclear situation creates many difficulties in technology commercialization process, also scientists are not interested to disclose their inventions.

The funding sources for R&D and innovation are quite similar for Northern Ireland and Latvia. Low private R&D expenditure was identified as a key issue for knowledge transfer financing by both regions. The Northern Ireland

²⁴ Watkins p.7.

invested app. 250 MEUR for period 2003 to 2007. For years 2009-2013, it is expected to invest ~500 MEUR in R&D from EU structural funds. In terms of investment revenues, the expectations differ essentially as majority of investments goes to bricks and research. It is difficult to expect comparable outputs if knowledge transfer budget in Latvia represented only 300 - 400 ths. EUR in 2007 both for governance and operational tools.²⁵

Conclusions

Latvia in the same time is struggling with two related challenges. The first is to effectively create technology transfer channels for converting the country's decreasing research capacity and human capital into an asset for economic growth, competitiveness, and rising standards of living. The second is enhancing competitiveness and productivity in low and medium-tech sectors. There are too little changes since World Bank recommendations in 2003.²⁶

First, local firms must upgrade the technological development by absorbing knowledge produced outside Latvia. Unfortunately, current Latvian policies are only partly and weakly touching this challenge. And at the same time, Latvia will need to reform its national innovation system to get out societal value from its human capital and kept tradition of scientific excellence.²⁷

Latvian enterprises will simply be unable to compete without an efficient knowledge absorption and knowledge diffusion capability. Unfortunately, this capability currently does not exist in Latvia. Today's situation require strong increase of quality of technology transfer management as a capacity and as a profession; technology transfer managers (brokers) are often neither adequately qualified nor paid, even though they should play a central role in technology transfer to business.

A much broader focus is needed, with a stress on technology creation, including both R&D and design and engineering skills, technology acquisition, and technology use.²⁸ Government should come out with a clear policy statement regarding the ownership of intellectual property motivating PROs and researchers.

For development of Latvian national system of technology transfer is needed key strategy, valid for a broad range of different technologies. Main goals of such strategy is to find solutions for (1) improvement of the efficiency of existing technology transfer mechanisms (2) motivation and adoptability in enterprises towards innovation, (3) increasing industry awareness for technological needs and accessibility of research institutions and their products. The last target is (4) to enhance the quality of technology transfer. Recognizing the profession of technology transfer brokers and managers and introducing technology transfer-training schemes and study program could solve this problem.

²⁵ Knowledge Transfer Strategies for Regional Development and Competitiveness IRE Knowledge Transfer Working Group Final Report, 2008, IRE network, 64 p.P.24

²⁶ Watkins p.6

²⁷ Ibid p.29

²⁸ Watkins p.43

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