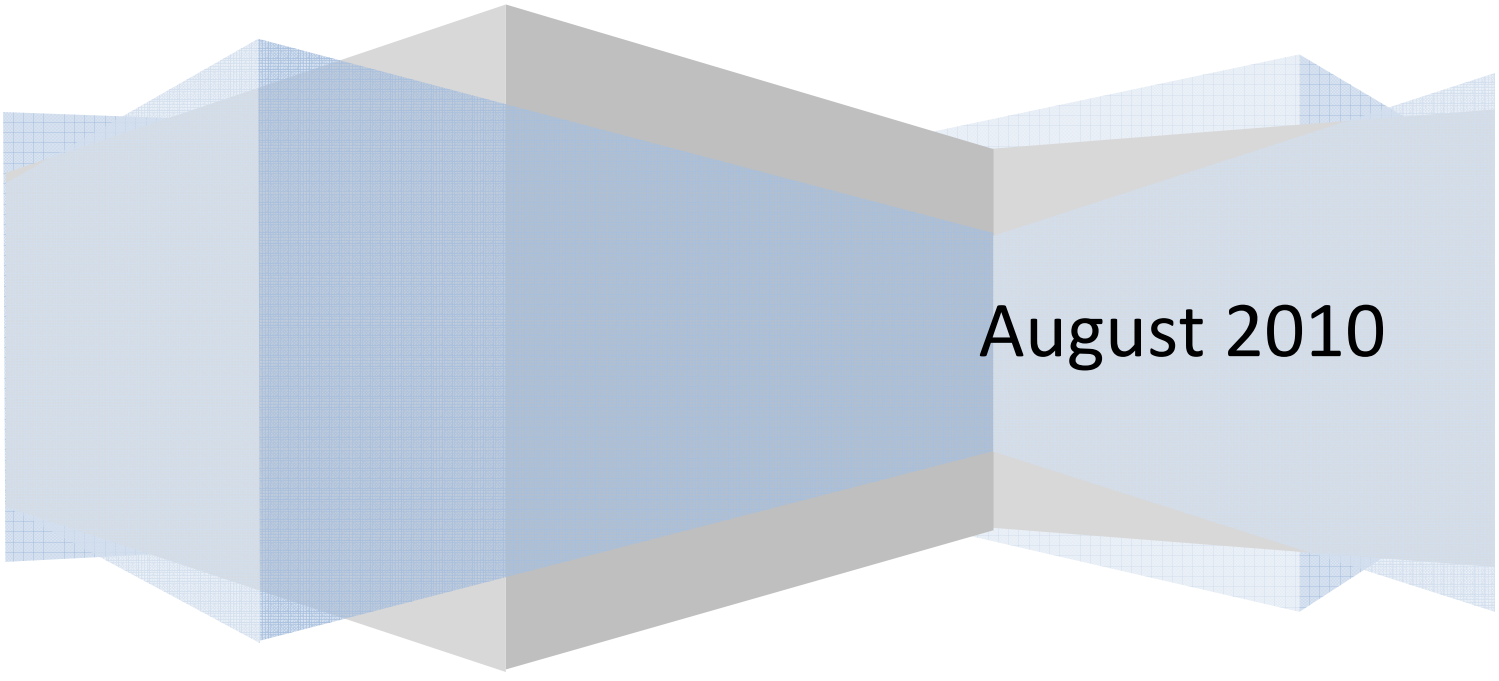
Aalborg University

Knowledge Transfer from Latvian Universities to Businesses

Master Thesis

MSc. in Innovation, Knowledge and Entrepreneurial Dynamics

Sanita Sampane



August 2010

Table of Contents

1. Summary

With an acknowledgement of the importance of knowledge-based economy and its promotion, countries have started to look for new tools and mechanisms to enhance creation of knowledge and to facilitate cooperation between universities, which have always been viewed as knowledge creation institutions, and other sectors e.g. businesses, policy makers and society in general. One of the tools that hold an enormous potential to contribute to reaching the knowledge-based economy goals is knowledge transfer. It can work between and among several knowledge producers and receivers e.g. between universities and policy makers, between universities and society, among different companies or even among several departments within one company. Nevertheless, the focus of this thesis is knowledge transfer between universities and businesses in a particular country – Latvia.

The thesis starts with an introduction where the author argues about the importance of knowledge transfer between universities and businesses within the current world. Further on, in order to set the ground rules for further analysis the methodology part explains and justifies the choice of the country, approaches and research techniques as well as sources of information used within the work. Additionally, the methodology part is where the research question for the work is formulated:

> *What is the established knowledge transfer process from HEIs to businesses and its broader environment in Latvia and how it can be improved in the future?*

Before moving on to analysis theoretical perspectives on the main attributes of the analyzed process e.g. knowledge, innovation and knowledge transfer are defined and their characteristics determined. This then is followed by an overview of current knowledge transfer literature based on which a theoretical model for further analysis is built; this is done by using *Knowledge Transformation Framework*, *5 Questions Knowledge Transfer Framework* and *4 Stages Knowledge Transfer Framework*. The developed framework is used for defining interview questions.

Within this thesis work knowledge transfer is defined as an opened system which means that emphasis of the analysis is not only put on the actual knowledge transfer process but also on the environment surrounding it – an overall economy in Latvia and its national system of innovation. Therefore chapter 5 of the thesis includes detailed description of current state of Latvian economy, and it elaborates on institutional and legal framework for innovation and knowledge transfer as well as innovation environment in Latvia. Based on this analysis problems that might directly or indirectly affect knowledge transfer are identified.

Another important aspect that influences knowledge transfer process is the background of the actors involved in the process – universities and businesses. Hence, chapter 6 explores science and research sector as well as business sector in Latvia in more detail. The main focus is put on the current affairs in these sectors, strategic trends, problems and challenges that might influence actors' participation in knowledge transfer.

Furthermore, in chapter 7, based on the information obtained during the interviews, an attempt to design the established knowledge transfer process in Latvia is made. Moreover, the chapter discusses the role of the knowledge transfer centres established within the largest universities in Latvia, explains the phases involved in the knowledge transfer process and elaborates on main challenges and facilitators with respect

to knowledge transfer in Latvia.

Last but not least, the conclusion summarizes the work done and conclusions drawn throughout the project. Additionally, it elaborates on possible limitations of this thesis as well as points out several directions for research in the field of knowledge transfer.

2. Introduction

In current business world and strategic policy planning 2 most used concepts could be innovation and knowledge. While knowledge has become the most strategically-significant resource of a business firm (Grant, 1996a: 375; Simonin, 1999: 595) ability to innovate is acknowledged to be the most important skill of a company or as Christopher Freeman wrote in his famous study of the economics of innovation (1982) "...not to innovate is to die".

Yet, with an ever increasing complexity of the world, with an ever increasing knowledge and opportunities in every area, keeping all the necessary knowledge and abilities to innovate within one organization becomes more and more difficult task. This is why cooperation and networking gains importance in the current business world. Besides, there has been a shift in the way companies think about their competitiveness – the importance of keeping all the knowledge and information to themselves has decreased as companies have become more aware that sharing some of the information and collaborating in creating new knowledge can bring even more benefits. Due to these reasons and due to an increasing emphasis on knowledge-based economy, knowledge transfer from higher education institutions (HEIs) to business increases its attractiveness for creating knowledge and ensuring innovative abilities.

In this thesis work the knowledge transfer process from HEIs to business has been analyzed within the context of one country – Latvia – to answer the defined research question:

> *What is the established knowledge transfer process from HEIs to businesses and its broader environment in Latvia and how it can be improved in the future?*

Knowledge transfer is a relatively new phenomenon in Latvia, besides the country faces deep economical recession and catching up with other European countries in many areas - innovation, research and science being only few of them. These are the reasons that make Latvia an exciting case for analysis in the field of knowledge transfer.

In order to answer the formulated research question a theoretical framework shaping the ideal knowledge transfer process was developed; the main source of information chosen for the analysis within this thesis work was interviews. Interview questions were formulated based on the developed theoretical framework; experts for the interviews were chosen from the knowledge centres established within the largest universities in Latvia which ensured their competence about the analyzed topic.

Based on the information gathered during interviews and through other sources – policy planning documents, legislation, statistical reports and others – the knowledge transfer from HEIs to businesses in Latvia and its broader environment was designed and analyzed pointing out the main problems and challenges it faces, facilitators that might help to improve the process as well as providing some suggestions for further development of the process.

3. Methodology

A part of understanding a specific research project is to comprehend the methodology and methods used for conducting the analysis and arriving at the specific conclusions, therefore the objective of this chapter is to give an overview of the methodology used in this thesis work and to explain the data sources and methods used to answer the research question:

> *What is the established knowledge transfer process from HEIs to businesses and its broader environment in Latvia and how it can be improved in the future?*

3.1. Choice of a Country for Analysis and Sources of Information

Although knowledge transfer as a process for prospering knowledge-based economy and contributing to countries' welfare has only been recognized lately, many countries have long record of intensive collaboration between HEIs and businesses; consequently the processes involved are quite developed and systems around it are set. This is not a case in Latvia where knowledge transfer is relatively new phenomenon. Establishing new processes and promoting them is always a challenging experience involving quite a few obstacles on a way, nevertheless this is also why development of something new is more educating and rewarding. But not only Latvia has to face developing knowledge transfer processes and advancing collaboration between science and business, it also has to face deep economical recession and catching up with other European countries in many areas - innovation, research and science being only few of them. All these reasons make Latvia an exciting case for analysis in the field of knowledge transfer. The author finds it extremely interesting to see how the knowledge transfer is being implemented in a real life taking into account the given circumstances, how the process is set up, what are the tools for enhancing the collaboration between HEIs and businesses and last but not least whether the government and other responsible institutions see the potential lying in the promotion of knowledge transfer. Of course, the influence of the fact that the author of this thesis work has a Latvian background is also undeniable. It provides her with a deeper understanding of the processes in society and economy, the overall environment and culture in the country but also adds a bit of subjectivity to the research.

Moving on to the sources of information, a few years ago – in 2005 - in order to stimulate knowledge transfer from HEIs to business and prosper commercialization of HEIs' scientific and technological developments *Ministry of Economics of Republic of Latvia* (*Latvijas Republikas Ekonomikas ministrija*) launched an incentive to establish innovation and knowledge transfer centres within the largest universities in Latvia. In 2007 there were already 5 knowledge transfer centres (KTC) and starting from 2008 another incentive with financial support from EU funds was launched to support establishment of 8 new knowledge and technology transfer offices (KTO) in HEIs. The reason why there are 2 different kinds of knowledge transfer institutions is mainly bureaucratic: KTO support incentive is financed by EU funds and therefore the KTOs should be established and managed as separate units. This had led to a situation where most of the HEIs in Latvia have established both institutions – KTCs and KTOs.

Anyhow, since the main responsibility of these centres and offices is to gather information on current scientific developments in HEIs, monitor and respond to the needs of businesses as well as to assist and promote the knowledge transfer between the two, these institutions currently have gathered the most

comprehensive knowledge and hands-on experience about the knowledge transfer process from HEIs to businesses. This is why the author has decided to approach these institutions to obtain the necessary information for the further analysis.

Currently there are 5 innovation and technology transfer centres in Latvia, and 4 of those are directly connected to HEIs – they are structural units of HEIs. Additionally, there are 7 knowledge transfer offices directly connected to HEIs. Since the main focus of the thesis work is knowledge transfer from HEIs to businesses the main criteria for selecting knowledge transfer centres and offices for interviews was their connection with HEIs. Consequently, the author decided to select 3 largest HEIs in Latvia and interview the representatives from KTCs and KTOs in these HEIs.

Latvia lacks a common university and HEI ranking therefore there are several rankings by different authors available. Over the last years the most recognizable ranking of universities and HEIs in Latvia was the one developed by Latvian daily newspaper *"Lauku Avīze"* in collaboration with *University of Latvia* (*Latvijas Universitāte*) and experts from various industries. The ranking is developed based on internationally known and approbated methodology that includes 10 indicators e.g. proportion of students and graduates; age structure of academic personnel, percentage of international students etc. In addition, the ranking is also based on data from a survey of Latvian inhabitants regarding popularity of universities, quality of education etc. For the last 3 years – ever since the ranking was established – the top 3 universities have not changed; they include *University of Latvia*, *Riga Technical University* (*Rīgas Tehniskā universitāte*) and *Riga Stradiņš University* (*Rīgas Stradiņa universitāte*). (based on *University of Latvia* website) Accordingly these 3 universities and KTCs and KTOs established within them were chosen for further interviews and analysis. Each of the universities includes the following KTCs and KTOs:

1) *University of Latvia* (UL):
   - *Innovation Centre* (*Inovāciju centrs*);
   - *Technology Transfer Office* (*Tehnoloģiju pārneses kontaktpunkts*);
2) *Riga Technical University* (RTU):
   - *Innovation and Technology Transfer Centre* (*Inovāciju un tehnoloģiju pārneses centrs*);
   - *Technology Transfer Office* (*Tehnoloģiju pārneses kontaktpunkts*);
3) *Riga Stradiņš University* (RSU):
   - *Innovation Centre for Construction of Medical Appliances* (*Medcīnas aparātbūves inovāciju centrs*);
   - *Technology Transfer Office* (*Tehnoloģiju pārneses kontaktpunkts*).

In case of UL and RTU *Technology Transfer Offices* are structural units of UL *Innovation Centre* and RTU *Innovation and Technology Transfer Centre*. Therefore to obtain the overview of KTCs and KTOs, their operations and knowledge transfer process in general, the interviews were conducted with the Heads of the centres. In case of RSU the Head of *Technology Transfer Office* was interviewed. This was due to the fact that RSU *Innovation Centre for Construction of Medical Appliances* is operating more like a business incubator than a knowledge transfer centre or office; all the functions related to knowledge transfer are carried out by RSU *Technology Transfer Office* (see interview transcripts in annex IV).

Furthermore, although the functions of KTCs and KTOs are directly connected with arranging, organizing, managing and promoting knowledge transfer processes they do not take part in the actual collaboration between scientists and businesses. Hence, in order to obtain information about the actual cooperation of

scientists and businesses an additional expert was interviewed. The expert Dr. Chem. Gunārs Bremanis currently is Chairman of The Board of Scientific Council and Leading Researcher at *State Stende Grain Crop Selection Institute* (*Valsts Stendes Graudaugu selekcijas institūts*); previously he had also worked for *Latvian Institute of Organic Synthesis* (*Latvijas Organizskās sintēzes institūts*) and has taken part in several knowledge transfer projects e.g. with the largest pharmaceutical company in Baltics – *Grindex* (see interview transcript in annex IV).

In addition, interview questions were developed according to the theoretical framework described in the section *4.5. Integrated Framework for Knowledge Transfer Analysis in Latvia* and are available in annex II (in Latvian) and annex III (in English).

Nevertheless, besides information gathered through the interviews additional sources of information were used. First, an overview of academic literature and articles regarding knowledge transfer was conducted in order to gain information for the development of the theoretical framework. Second, Latvian policy documents and reports on economy, innovation and knowledge transfer were used to give reader a broader picture of knowledge transfer environment in Latvia. In order to maintain objectivity the information from Latvian sources was verified and balanced with information from international institutions, reports and media e.g. PRO INNO Europe, Eurostat, BBC, Times and others.

3.2. Methodologies Used

Within this thesis work a combination of 2 methodological approaches is used – the systems approach and the actors approach. This section attempts to explain how these approaches are used within the work and how they interact to let the author conduct the necessary analysis and arrive at the conclusions.

As mentioned earlier, the main focus in this thesis is a knowledge transfer process and throughout the work it is viewed as a system, this means that generally for the analysis of knowledge transfer process the systems approach is used. Within the theory system is defined as follows: it is a set of components and the relations among them. Depending whether the system is analyzed within its context or as an isolated system, 2 types of systems can be identified – opened systems and closed systems. (Abnor *et al*, 1997: 111 and 112) Further on in this work both types of systems are used; first, within the theoretical framework knowledge transfer process – a closed system – is created in order to understand the main components in the system. Later on this theoretical closed system is put within the context – knowledge transfer process in Latvia – and then analyzed within the systems environment. The systems environment is what lies outside the "boundary" of a system (Ibid); in this case it includes institutional frameworks and overall environments of knowledge transfer, innovation and economy in Latvia.

There are several techniques how to conduct research by using the systems approach; it can be done with systems analysis, systems construction or systems theory. (Ibid: 136) Within this work systems analysis is used as a main technique; it means that a model of existing real system is build in order to describe, explain and understand it. Analysis in the sense of systems approach is the study of the relationships of the components to each other and to the totality in real systems. The analysis also includes the study of the totality as such, including its relationship to the environment of the real system (*the system synthesis*). (Abnor *et al*, 1997: 146)

Furthermore, according the systems approach systems analysis can be done in several steps; these steps include: 1) to describe; 2) to determine the relation; 3) to forecast; 4) to guide. (ibid: 150) Within the

analysis, where knowledge transfer process and its environment are described, the first 2 steps – to describe and to determine the relation – are covered. The forecasting step is covered in the part describing barriers and facilitators of the process where possible prognosis of knowledge transfer further development are described and recommendations for improvement are given; the guidance step is not fully covered within in this work but some elements can be found in the conclusion part.

Even though knowledge transfer throughout the project is seen as a system and analyzed based on the systems approach it is important to acknowledge that the actors approach is equally important for the analysis. The main characteristic of the actors approach is that it views reality as a social construction that consists of different levels of meaning. Human beings (the generating actors) and reality (what is generated) stand in a mutual dialectic relation to each other (we create reality at the same reality creates us). (Abnor *et al*, 1997: 79)

Within this thesis work the actors approach comes into play in 2 different ways. First, as the author of the thesis is Latvian and the country analyzed within this thesis work is Latvia, it already creates a specific perspective through which the knowledge transfer process as well as its environments is perceived in a rather subjective way. Of course, to limit the subjectivity the author applies critical objectivity to all the information, legitimate sources of information are used, arguments are grounded in and justified with facts but still the author – environment relations should be taken into account while reading the work.

Second, since information used for understanding the actual knowledge transfer process is gathered through the interviews with the experts in the field, the actors approach is used in this part of work too. Although all the experts are professionals still they see world and processes through their own perspective and this should be taken into account while conducting the analysis and critical thinking should be used while using information gathered. In order to limit personal perspectives and obtain objective understanding of knowledge transfer process in Latvia the author cross-checked information gathered from all the interviewees as well as verified data with other sources where possible.

4. Theoretical Perspective on Knowledge, Innovation and Knowledge Transfer

It is a commonly held understanding that theory differs from a practice. Despite that, at least in research it is essential to define terms used in research and build theoretical frameworks in order to proceed with practical research. Therefore this chapter provides theoretical background for the main topics used in this thesis work as well as it builds a theoretical framework for further analysis.

The first section talks about knowledge and its taxonomy explaining the main characteristics and types of knowledge mentioned in the knowledge management literature. Further on, a section on innovation defines innovation for the purpose of this thesis work, discusses different types and dimensions of innovation, describes its life cycle as well as elaborates on several models of innovation and their evolution over the time. This is followed by a section on knowledge transfer that includes the definition of knowledge transfer concept and elaborates on the main frameworks for knowledge transfer available in the current knowledge transfer literature. Additionally, this chapter includes a part on main preconditions, challenges and barriers as well as facilitators for knowledge transfer. Last but not least, the chapter is finalized by coming up with an integrated framework for knowledge transfer analysis in Latvia.

Even though, the author defines knowledge and innovation for the purpose of this thesis further on in this chapter the similarities between the 2 concepts must be admitted. For example, as innovation for the purpose of this thesis has been defined as a successful implementation of new ideas within a company or an organization it can also be seen as a successful application of knowledge. (Trott, 2008: 16) Or as Tidd *et al* (2005) puts it, innovation is about knowledge. It is about creating new possibilities through combining different knowledge sets. (Tidd *et al*, 2005: 15) Additionally, when talking about knowledge transfer some authors put emphasis only on technology transfer which indicates more narrow view than discussed in this thesis. Nevertheless, technology can also be seen as knowledge applied to products or production processes (Trott, 2008: 17) therefore it constitutes a part of a wider understating of knowledge transfer represented in this thesis.

4.1. Knowledge

It is widely recognized in the current business world that knowledge has become the most strategically-significant resource of a business firm. (Grant, 1996a: 375; Simonin, 1999: 595) Due to this fact, the scientific community has also put significant effort into improving knowledge definitions and taxonomies as well as elaborating on the characteristics of knowledge. Therefore, the main objective of this chapter is to reflect on available literature discussing academic views on knowledge, including its characteristics and classification. Although diverse perspectives on knowledge are discussed by different authors they all arrive at the same conclusion: knowledge is an elusive concept which is difficult to define.

Despite the recent trend to focus on knowledge as an important asset while also emphasising knowledge management, knowledge as a research subject has been deliberated/considered for many years. Over the last 3 decades different approaches to define and describe knowledge have been used. Some authors, like Roger, Winter, Nonaka *et al* and Zander *et al* stress characteristics of knowledge (see sub-section *4.1.1. Knowledge Taxonomy – Knowledge Characteristics*) while authors like Zeleny, Ackoff and Lundvall, put

more emphasis on describing different types of knowledge (see sub-section *4.1.2. Knowledge Taxonomy – Knowledge Types)*.

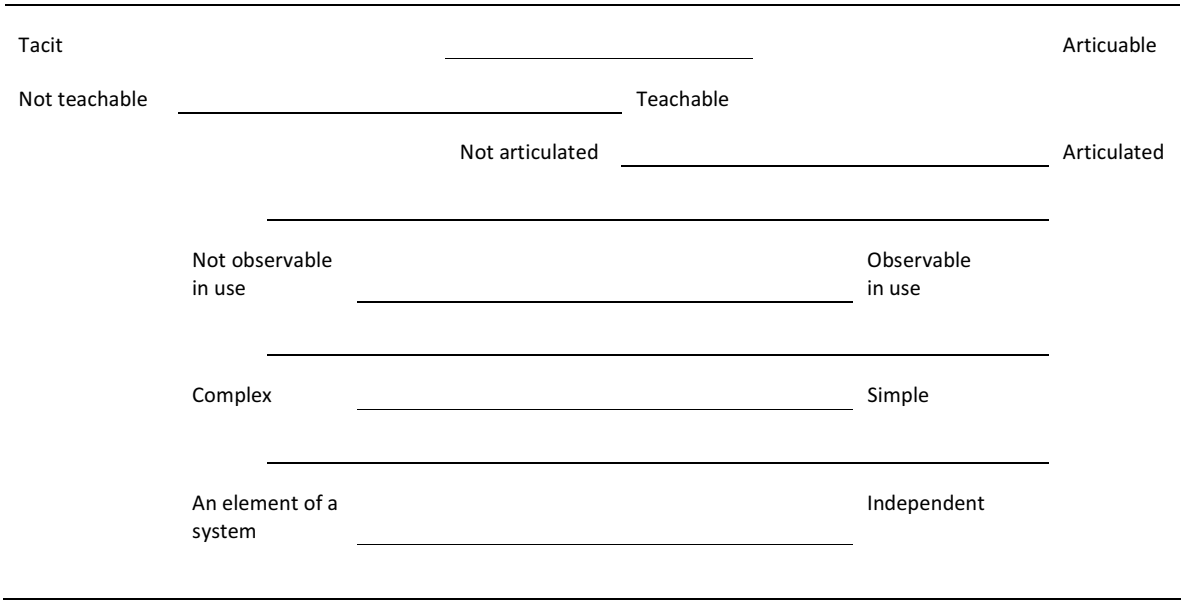
4.1.1. Knowledge Taxonomy – Knowledge Characteristics

Although almost everyone in the world is familiar with the concept of knowledge in one way or the other it is still very difficult to define or describe knowledge. Since knowledge is such a broad and comprehensive concept no common definition of knowledge is available in the academic literature; instead different characteristics are used, this section attempts to depict few of them.

One of the first and most influential authors in the knowledge literature is Sidney Winter who, in his article "Knowledge and Competence as Strategic Assets" (1987), proposes a knowledge taxonomy that consists of 6 taxonomic dimensions of knowledge assets (see ***Figure 1***). These dimensions are:

2) **Tacit/articuable** where tacit is a kind of knowledge that is embodied in individuals or embedded in companies or research groups while articuable knowledge is the one that can be articulated and codified.
4) **Not teachable/teachable** – sub-dimension of tacit/articuable knowledge where not teachable is knowledge that cannot be taught or transferred, while teachable knowledge is one that despite being tacit can be taught by apprenticeship. (Zander *et al*, 1995: 79)
5) **Not articulated/articulated** – sub-dimension of tacit/articuable knowledge where not articulated knowledge is knowledge that can in general be articulated but it has not been done yet. While articulated knowledge is the one about which records are kept. (ibid)
6) **Not observable in use/observable in use** where, of course, not observable knowledge refers to knowledge that cannot be observed in use while observable knowledge is gained through observation.
7) **Complex/simple** where, as the name suggests, complex knowledge refers to complicated knowledge and knowledge structures while simple knowledge represents simple and easily acquirable knowledge.
8) An element of a system/independent where, on the one hand, knowledge can be an element of a larger knowledge system or, on the other hand, it can be independent.

***Figure 1.*: Taxonomic Dimensions of Knowledge Assets**



Source: Winter, 1987: 175

Yet, Winter also explains how these characteristics relate to ability to transfer knowledge. In general, a position near the left end of any of the continua identified in the figure is an indicator that the knowledge may be difficult to transfer, whereas a position near the right end is indicative of ease of transfer. (Winter, 1987: 175)

Other authors who built their knowledge nomenclature based on previous works of Roger and Winter are Zander and Kogut. In their article "Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities: An Empirical Test" (1995) they develop five central constructs by which to characterize knowledge. These constructs are **codifiability**, **teachability**, **complexity**, **system dependence**, and **product observability**. (Zander *et al*, 1995: 79)

Within this taxonomy proposed by Zander *et al* **codifiability** captures the degree to which knowledge can be encoded, even if the individual operator does not have the facility to understand it, e.g., software controlling machinery. **Teachability**, on the contrary, captures the extent to which workers can be trained in schools or on the job; it reflects the training of individual skills. **Complexity** picks up the inherent variations in combining different kinds of competencies; knowledge, no matter the education of the worker, is simply more complex when it draws upon distinct and multiple kinds of competencies. **System dependence** captures the degree to which a capability is dependent on many different (groups of) experienced people for its production. Lastly, **product observability**, captures the degree to which capable competitors can copy the manufacturing capability, because they are able to manufacture the innovation once they have understood the functions of the product. (ibid)

Just as Winter, Zander *et al* states, there is a connection between the various characteristics of knowledge and its transferability and speed of transfer. First, the transfer of manufacturing capabilities is influenced by the degree to which they may be codified and taught. Second, accumulation of experience in an activity leads to the facility to communicate and understand the relevant knowledge; this facility, in turn, should

reduce the cost of acquiring new related capabilities and speed the time to transfer and imitation. Third, the more easily a capability can be communicated and understood, the shorter the times to transfer or imitation. (ibid: 79-80 and 87)

A bit broader but nonetheless important perspective regarding knowledge characteristics was proposed by Ikujiro Nonaka and Hirotaka Takeuchi. Although their division of knowledge into explicit and tacit knowledge can be found similar to Winter's tacit/articuable knowledge dimension and, as the authors have noted, they have built their work on Polanyi's writings, their definition on these 2 dimensions of knowledge is still the principal reference point in knowledge management. (Gourley, 2002: 1)

As mentioned before, Nonaka and Takeuchi separated knowledge into 2 dimensions: **tacit** and **explicit knowledge**. According to them, **explicit knowledge** can be expressed in words and numbers and easily communicated and shared in the form of hard data, scientific formulae, codified procedures, or universal procedures. (Nonaka et al, 1995: 8) **Tacit knowledge**, on the other hand, is highly personal and hard to formalize, making it difficult to communicate or to share with others. Furthermore, tacit knowledge is deeply rooted in an individual's action and experience as well as in ideas, values or emotions she/he embraces. (ibid)

Additionally, the authors argue that tacit knowledge can be further segmented into 2 dimensions. The first of these 2 dimensions is the technical dimension, which encompasses the kind of informal and hard-to-pin-down skills or crafts captured in the term "know-how". At the same time, tacit knowledge contains an important cognitive dimension. This dimension consists of schemata, mental models, beliefs and perceptions so ingrained that we take them for granted. It reflects our image of reality (what is) as well as our vision for the future (what ought to be). Although all these cognitive elements cannot be articulated in an easy way, these implicit models shape the way people perceive the world around them. (ibid)

Nonaka and Takeuchi, also emphasize the role of these dimensions and characteristics of knowledge when it comes to knowledge transfer and sharing. Explicit knowledge can easily be "processed" by a computer, transmitted electronically, or stored in databases while the subjective and intuitive nature of tacit knowledge makes it difficult to process or transmit the acquired knowledge in any systematic and logical manner. (ibid: 9)

As it can be seen from the previous, even though each of the authors offers some additional perspectives of knowledge, a lot of similarities can be found. The main conclusion, therefore, is that all these proposed nomenclatures and dimensions can coexist – using one kind of classification does not exclude using another one or adding some additional dimensions from the other authors depending on users'/researchers' needs or research preferences. Nevertheless, *within this thesis work the taxonomy proposed by Nonaka and Takeuchi will be primarily used to refer to characteristics of knowledge if necessary. Anyhow, the author is not aiming to strictly separate explicit knowledge from tacit knowledge as mostly both of them will be included when talking about knowledge and innovation transfer between HEIs and businesses*. The main 3 reasons for choosing this particular categorization is because: 1) it covers all knowledge and is broader than the other proposed taxonomies; 2) even if the nomenclature proposed by Nonaka *et al* is broader, it clearly defines the difference and border between explicit and tacit knowledge; 3) determining whether knowledge is explicit or tacit within this classification is easier than determining characteristics of knowledge based on any other proposed classification which would include more detailed analysis which, however, is not the objective of this study.

4.1.2. Knowledge Taxonomy – Knowledge Types

As previously mentioned, another stream of authors describes different types of knowledge. That is different from the stream of authors mentioned in the previous sub-section who describe knowledge characteristics. Not only do the perspectives taken from different authors differ; these authors also represent different academic fields listing information management, information systems and knowledge management among those fields that put the most emphasis on the subject.

For example, in 1987 Milan Zeleny, being a representative of the information systems management field, in his article "Management support systems: Towards integrated knowledge management" introduces a classification between data, information, knowledge, wisdom and enlightenment and proposes knowledge management strategies for each of classified knowledge types (see ***Table 1***)

***Table 1.*: Knowledge Taxonomy and Management Strategies**

	Metaphor	Management Strategy
Data	Know-nothing	Muddling through
Information	Know-how	Efficiency (measurement + search)
Knowledge	Know-what	Effectiveness (decision making)
Wisdom	Know-why	Explicability (judgement)
Enlightenment	Attaining the sense of truth, the sense of right and wrong, and having it socially accepted, respected and sanctioned	

Source: Zeleny, 1987: 60

The differences between different types of knowledge Zeleny explains with an example of baking bread. **Data** is considered the most basic element of knowledge; in the case of bread baking it would represent molecules of water, bacteria of yeast etc. **Information**, in turn, in the bread baking case would refer to the necessary ingredients e.g. flour, sugar, water etc. Having all the necessary ingredients still does not imply that knowledge of how to make bread exists as theoretically all these ingredients might as well be used to achieve a different result than bread. Therefore, as it can be seen from the example, having data or information does not indicate the end result which should or could be achieved. **Knowledge**, on the other hand, involves relations: recipes and their contextual interpretations, although it still does not imply that one actually should make bread and why. Here **wisdom** comes into play as it goes beyond knowledge allowing for comparisons (judgments) with regard to know-what and know-why. In addition, there is one more step beyond wisdom: **enlightenment,** which involves enriching the still value-free wisdom by the dimension of "truth". (Zeleny, 1987: 59-60)

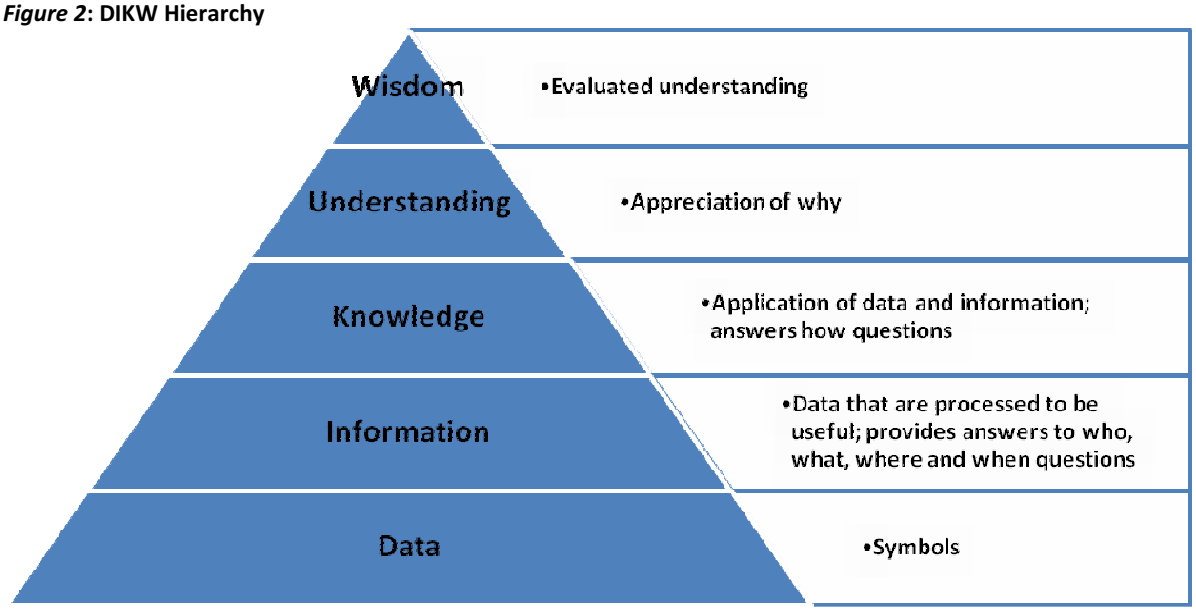
As admitted by the author, it is a long way from data to wisdom. (ibid: 60) although, on the contrary, each of the higher types in the hierarchy include and build-up on the categories that fall below it (Rowley, 2007:3) - information is based on data, knowledge is based on information while wisdom, in turn, is based on knowledge which, of course, means that enlightenment is based on wisdom.

Although all five of the above mentioned categories are separate, a broader distinction can be seen between data and information as one group and knowledge and wisdom as the other. Data and information as components can be generated *per se* i.e. without direct human interpretation while

knowledge and wisdom (being relations) cannot. They are human and context-dependent and cannot be contemplated without involving human comparison, decision making, and judgement. (Zeleny, 1987: 60) This explanation points out a division of knowledge into explicit and tacit knowledge described by several authors and discussed earlier in the section *4.1.1. Knowledge Taxonomy - Knowledge Characteristics*.

Similar knowledge taxonomy was introduced in 1989 by systems theorist and professor of organizational change Russel Ackoff. He proposed a data-information-knowledge-wisdom (DIKW) hierarchy including, as it can be concluded by the name of the hierarchy, four knowledge types: data, information, knowledge, wisdom and one additional dimension: understanding. (see ***Figure 2***)

***Figure 2*: DIKW Hierarchy**



Source: Rowley, 2007: 2

The definitions of each of the types of knowledge within the hierarchy provided by Ackoff in his article "From Data to Wisdom" are as follows:

1) **Data** are symbols which are obtained as products of observation. These symbols are relevant or useful if they are transformed into usable form.
2) **Information** is contained in descriptions e.g. like answers to questions who, what, when and how many. Information is inferred from data.
3) **Knowledge** is know-how, and is what makes possible the transformation of information into instructions.
4) **Understanding** refers to appreciation of why.
5) **Wisdom** is the ability to increase effectiveness. Wisdom adds value and therefore acquisition of wisdom requires personal judgement. (Ackoff, 1989: 3 – 9)

Although Ackoff defines understanding as part of the knowledge hierarchy, more recent commentators have disputed that understanding is a separate level. (Rowley, 2007: 4) Also in DIKW hierarchy, just as in Zeleny's hierarchy, each of the superior types in the hierarchy include and build-up on the categories that fall below it. (Rowley, 2007:3)

Further on, in 1994 Lundvall and Johnson introduced a different set of knowledge distinctions: know-what,

know-why, know-how and know-who (see ***Figure 3***)

***Figure 3*: Knowledge Taxonomy According to Lundvall and Johnson**

Source: Self-developed based on Lundvall *et al*, 2007: 210

In the classification proposed by Lundvall and Johanson **know-what** refers to knowledge about "facts". Knowledge within this dimension is close to what is usually referred to as information and, therefore, it can be further broken down into smaller categories. **Know-why** refers to knowledge about principles and laws of motion in nature, within the human mind and in society. This kind of knowledge has played a key role in technological development in various industries. As well, access to this kind of knowledge often allows advances to be made in technology more rapidly with a reduction in the frequency of errors in trial and error procedures. Furthermore, **know-how** refers to skills, such as the capability to do something. This kind of knowledge is typically the kind of knowledge that is developed and kept within the border of the individual firm or the single research team. **Know-who** involves information about who knows what and who knows to do what. This dimension also includes the social capability to co-operate and communicate with different kinds of people and experts. (Lundvall *et al*, 2007: 210 – 211)

Unlike in the situation with knowledge characteristics where all the taxonomies could more or less coexist, the discussed categorizations on knowledge types are not that compatible. In the next paragraphs the differences among the 3 of the earlier described nomenclatures will be explained as well as the main taxonomy for the use in this thesis will be chosen.

Firstly, Zeleny's and Ackoff's data dimensions are similar – they both refer to the lowest level of knowledge hierarchy consisting of symbols. Lundvall's *et al* classification, on the other hand, does not even include such a dimension. Second, even though Zeleny's metaphor for information dimension is "know-how" (which in Lundvall's *et al* categorization refers to tacit knowledge), the author himself describes it as more explicit. More similarities can be seen between Zeleny's and Ackoff's information dimensions and Lundvall's *et al* know-what dimension since all these dimensions, as described by the authors, represent facts and answers to questions who, what, where. Additionally, as Lundvall *et al* put it, they use "information" as part of knowledge rather than as something distinct from knowledge. They define information as knowledge that has been transformed into codes so that it can be saved in a computer and sent through electronic media. (Lundvall *et al*, 2007: 211)

In relation to knowledge, the first difference between Zeleny's and Ackoff's taxonomies and Lundvall's *et al* taxonomy is the fact that for Zeleny and Ackoff knowledge is only one dimension in the hierarchy, while for Lundvall *et al* knowledge is the whole that is further divided in different dimensions. Further to this, despite the fact that Zeleny has chosen metaphor "know-what" (which in Lundvall's *et al* classification refers to explicit knowledge - facts) to refer to his knowledge dimension it seems that Zeleny's and Ackoff's knowledge dimensions can be in some way similar to Lundvall's *et al* know-how dimension. Although it

must be noted that it seems that Zeleny's and Ackoff's knowledge is more explicit than Lundvall's *et al* know-how as they also refer to recipes and other formal guidance that answers the question "how" rather than emphasizing only the tacit part of the knowledge as in the case of Lundvall's *et al* know-how. Both Zeleny and Lundvall *et al* have a dimension with respect to know-why but there are significant differences between the two: 1) with his metaphor of "know-why" Zeleny refers to knowledge of understanding why something is being done – to personal judgement. Lundvall *et al* do not particularly emphasize such a dimension; 2) with know-why Lundvall *et al* refer to understanding about principles and laws of motion in nature, in the human mind and in society which in some way might be similar to Zeleny's and Ackoff's knowledge dimension since it refers to more formal understanding of how things work in the world.

One important dimension of knowledge that Lundvall *et al* have added to knowledge taxonomy is the know-who dimension which refers knowing who knows what and who knows to do what including the social capability to co-operate and communicate with different kinds of people and experts which is extremely important in the current business environment and in the case of knowledge and innovation transfer. Zeleny and Ackoff do not describe this type of knowledge.

As mentioned earlier, the nomenclatures described in this sub-chapter are quite different so only one should be chosen in order to proceed with research within this thesis work. Therefore, *for the purposes of this thesis Lundvall's et al taxonomy regarding knowledge types will be used.* This is due to several factors: 1) Lundvall's *et al* classification is more up to date and more correctly represents current situation in knowledge management; 2) as also stated by authors, these distinctions are closer to everyday language than other taxonomies; (Lundvall *et al*, 2007: 211) 3) it includes know-who dimension which is very important in the process of knowledge transfer. And again, *when referring to knowledge within this thesis work the author will refer to all 4 types of knowledge (know-what; know-why; know-how; know-who) unless it is necessary to put emphasis on one particular dimension of knowledge*.

4.2. Innovation

Nowadays innovation has become a buzz word. It is used in many different ways and contexts. This is especially true in connection to the global economical and financial crisis; innovation has been considered almost a panacea for recovery. As Paul Trott proposes in his book "Innovation Management and New Product Development" (2008), today the idea of innovation is so widely accepted that it has become a part of our culture – so much that it verges on becoming a cliché. But even though the term is now embedded in our language, to what extent is the concept truly understood and, even more, to what extent is this understanding shared. (Trott, 2008: 4) It is clear that probably there will never be one common understanding of innovation as people with different backgrounds (e.g. scientists, economists, and entrepreneurs) will see innovation in different ways. Additionally, although innovation is increasingly see as powerful way of securing competitive advantage and a more secure approach to defending strategic positions, success is by no means guaranteed. (Tidd *et al*, 2005: 37) Or in a wider perspective, even though innovation can be one of the main tools for the recovery of global economy it cannot be considered a panacea as well as it must understood that making innovation work in order for economy to benefit from it requires deep understanding of the process and hard work. Nevertheless, the main objective of this sub-section is to define and describe innovation from a business perspective and for the purposes of this thesis.

4.2.1. What Is Innovation?

In order to talk about innovation it is important to define what is understood by it. First of all, innovation is a difficult and complicated process to define. Besides that, over the time understanding of innovation together with its definitions has change substantially.

One of the first authors who defined innovation and who is still often cited in the literature as well as sometimes noted as a "godfather" of innovation studies (Tidd *et al*, 2005: 7) was Joseph Schumpeter. His definition of innovation is as follows:

> *"New combinations including new production methods, new products, new markets and marketing methods, new forms of business organisation and new legal and regulatory conditions." (Schumpeter, 1934)*

After Schumpeter many authors have made attempts to define innovation. Nevertheless, lately all the authors agree that innovation should be seen as a process instead of being seen as one isolated event. Additionally, there is a common understanding that innovation occurs only when idea or invention is put to a commercial and practical use.

Although there are several definitions that might be useful for this thesis the author has decided to use the one proposed by Trott in his book "Innovation Management and New Product Development" as a basis for further definition of innovation in this work. Trott's definition is based on the definition proposed by Myers and Marquis (1969) who define innovations as follows:

> *"Innovation is not a single action but a total process of interrelated sub processes. It is not just the conception of a new idea, nor the invention of a new device, nor the development of a new market. The process is all these things acting in an integrated fashion."* (Myers and Marquis, 1969 in Trott, 2008: 14)

Before coming up with his own definition of innovation Trott explains it as an equation:

> *"Innovation = theoretical conception + technical invention + commercial exploitation",*

and following that he defines innovation as:

> *"Innovation is the management of all the activities involved in the process of idea generation, technology development, manufacturing and marketing of a new (or improved) product or manufacturing process or equipment."* (Trott, 2008: 14 and 15)

Within this thesis innovation is discussed in context of knowledge transfer process from HEI to a business. This means that innovation as a full process is carried out in 2 different environments – in HEI and in a company or organization. Therefore, the sub processes involved in the whole innovation process are distributed between HEI and a business. For example, in some case innovation in terms of idea, theoretical conception and/or technical invention as well as part of marketing process (including the activities to present the innovation to a business) might come from a HEI and then commercial exploitation, after knowledge transfer has taken place, is carried out by a business. Or in other situation, an idea or theoretical conception might come from a business who expresses the need for HEI to further develop or improve the idea or conception. Then the further knowledge development process is done by the HEI and then

transferred back to the business or it is done in collaboration between the 2 parties involved. Taking these factors into account innovation within this work, based on the definition by Trott, is defined as follows:

> *"Innovation is the management of all the activities involved in the process of idea generation, technology development, manufacturing and marketing of a new (or improved) product or manufacturing process or equipment that are distributed between HEI and a business."*

4.2.2. Types, Characteristics, Dimensions and Life Cycle of Innovation

As already indicated by the definition of innovation in the previous sub-section, innovation can take several forms, have different characteristics as well as dimensions. They all should be taken into account while talking about innovation therefore a brief overview of different innovation types, characteristics and dimensions as well as innovation life cycle is given in this section.

Based on these forms different types of innovation can be defined. For example, Francis and Bessant (2005) suggest 4Ps of innovation:

1) **Product innovation** – changes in the things (products/services) which an organization or institution offers.
2) **Process innovation** – changes in the ways in which things are created and delivered.
3) **Position innovation** – changes in the context in which the products/services are introduced.
4) **Paradigm innovation** – changes in underlying mental models which frame what the organization or institution does. (Francis *et al*, 2005: 172 and Tidd *et al*, 2005: 10)

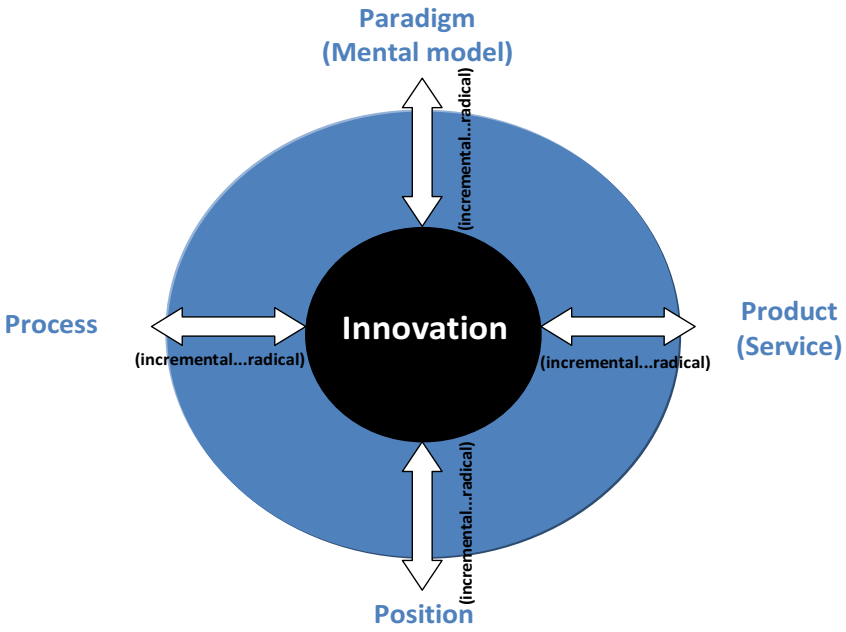
Nevertheless, these 4Ps are not tight categories: they have fuzzy boundaries. Nor are they alternatives: all 4 can be pursued at the same time. Additionally, there are linkages between them; using innovation capability for positioning, for example, will be highly likely followed by an introduction or improvement of products. (Francis *et al*, 2005: 172)

Besides different areas where innovation can take place there are also other characteristics of innovation that matter. For example, in his work on diffusion of innovations Rogers (1980) proposed 5 perceived attributes of innovation: **relative advantage** (or **profitability**), **compatibility**, **complexity**, **triability**, and **observability**. (Zander *et al*, 1995: 79) He defines them as follows: **relative advantage** is the degree to which an innovation is perceived as being better than the idea it supersedes. The degree of relative advantage is often being expressed as economic profitability, as conveying social prestige, or in other ways. (Rogers, 2003: 229) **Compatibility** refers to the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. (ibid: 240) Further on, **complexity** represents the degree to which an innovation is perceived as relatively difficult to understand and use. (ibid: 257) **Trialability**, however, is the degree to which an innovation may be experimented with on a limited basis, while **observability** is the degree to which the results of innovation are visible to others. (ibid: 258)

Furthermore, when it comes to actual implementation of innovations a higher degree of relative advantage (or profitability), compatibility, trialability and observability would represent higher ability to adapt the innovation while high degree of complexity, on the other hand, would indicate lower adaptability and transferability.

Additionally, a very important part of innovation is a degree of its novelty. For example, innovations can run from minor, incremental improvements right through radical changes which transform the way we think about and use them. Sometimes these changes are common to a particular sector or activity but sometimes they are so radical and far-reaching that they change the basis of society. Further on, each of 4Ps of innovation can take place along an axis running from incremental through to radical change. The area indicated by the circle in ***Figure 4*** is potential innovation space within which an organization or institution can operate. (Tidd *et al*, 2005: 12)

***Figure 4*: Innovation Space**



Source: Tidd *et al*, 2005: 12

Looking at the two dimensions of innovation – incremental and radical – someone might ask: which one of them is better? The answer to this question would be: both of them are important. Most likely in broader society innovations that involves discontinuous shift – something completely new or a response to dramatically changed conditions – are more obvious and more likely to be recognized as innovations. Still, as suggested by Ettlie, disruptive or new to the world innovations are only 6% to 10% of all projects labelled innovation. (Tidd *et al*, 2005: 13) Most of the time innovation takes place within a set of rules of the game which are clearly understood, and involves players trying to innovate by doing what they have been doing (product, process, position, etc.) but better. Some manage this more effectively than others but the rules of the game are accepted and do not change. (Francis *et al*, 2005 in Tidd *et al*, 2005: 18) Therefore, incremental innovation should be considered important drivers of change and progress. Of course, incremental innovations usually take place in periods of relative stability regarding given set of technological and market conditions. Then occasionally these periods are punctuated by discontinuities. This usually involves dramatic shifts in one or more basic conditions (technology, markets, social, regulatory, etc.), and this is when radical innovation can occur.

Still, incremental and radical innovations are not two separated and independent events. They are related and can be seen as a cycle or as Abernathy and Utterback's model suggests they happen in phases. They

describe 3 different phases - fluid phase, transitional phase and specific phase (see ***Table 2***).

***Table 2*: Stages in Innovation Life Cycle**

Innovation Characteristic	Fluid phase	Transitional phase	Specific phase
Competitive emphasis placed on…	Functional product performance	Product variation	Cost reduction
Innovation stimulated by…	Information on user needs, technical inputs	Opportunities created by expanding internal technical capacity	Pressure to reduce cost, improve quality, etc.
Predominant type of innovation	Frequent major changes in products	Major process innovations required by rising volume	Incremental product and process innovation
Product line	Diverse, often including custom designs	Includes at least one constant or dominant design	Mostly undifferentiated standard products
Production processes	Flexible and inefficient – aim is to experiment and make frequent changes	Becoming more rigid and defined	Efficient, often capital intensive and relatively rigid

Source: Abernathy and Utterback in Tidd *et al*, 2005: 23

During the **fluid phase**, which happens under discontinuous conditions, there is high uncertainty along 2 dimensions – the target dimension and the technical dimension. The main question to be answered within the target dimension is: what will the new configuration be and who will want it? While within the technical dimension the main question lies in how will new technological knowledge be harnesses to create and deliver the innovation. In order to find out the answers to these questions extensive experiments take place (usually accompanied by many failures). Players, including many new entrepreneurial businesses, learn and adapt quickly. (Tidd *et al*, 2005: 19)

Gradually these experiments begin to converge around so called dominant design – something which begins to set up the rules of the game. The period in which the dominant design emerges and emphasis shifts to imitation and development around it is termed the **transitional phase**. During this phase activities move from radical concept development to more focused efforts geared around product differentiation and to delivering it reliably, cheaply, with higher quality, extended functionality, etc. (ibid: 19 and 22)

Within the **specific phase**, as the concept matures, incremental innovation becomes more significant. This means that the industries which grow around these product or process areas tend to focus increasingly on rationalization, on scale economies and on process innovation to drive out cost and improve productivity. Innovation is increasingly about differentiation through customization to meet the particular needs of specific users. (ibid)

4.2.3. Models of Innovation

In order to understand the drivers of a process, the processes itself as well as actors taking place in the process wide range of models are used. Additionally, these models depict the current understanding of a particular topic or process. The same is true for innovation. Over the time understanding and appreciation of innovation process as well as its models has been evolving from simple linear models through to increasingly complex interactive models. Rothwell (1992) provides a useful historical perspective on this

(see ***Table 3***). (Tidd *et al*, 2005: 77)

***Table 3*: Stages in Innovation Life Cycle**

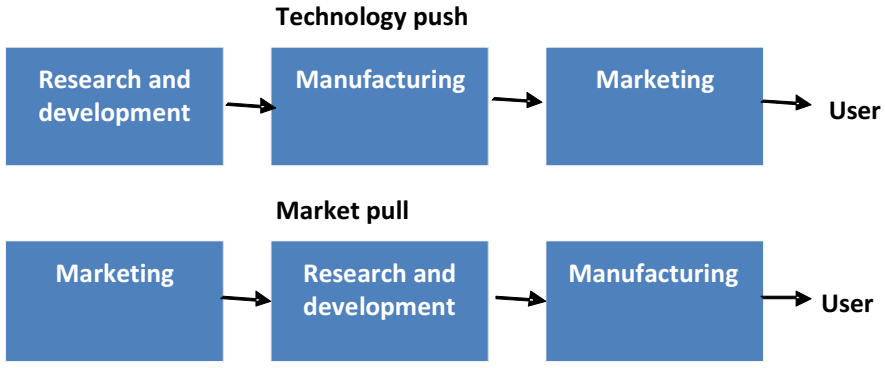
Generation	Date	Model	Key Features
First	1950/60s	Technology-push	Simple linear sequential process; emphasis on research and development (R&D); the market is a recipient of the fruits of R&D
Second	1970s	Market-pull	Simple linear sequential process; emphasis on marketing; the market is the source for directing R&D; R&D has a reactive role
Third	1980s	Coupling model	Emphasis on integrating R&D and marketing
Fourth	1980/90s	Interactive model	Combinations of push and pull
Fifth	1990s	Network model	Emphasis on knowledge accumulation and external linkages
	2000s	Open innovation	Chesbrough's (2003) emphasis on further externalization of the innovation process in terms of linkages with knowledge inputs and collaboration to exploit knowledge outputs

Source: Based on Rothwell (1992) in Trott (2008): 24 and Tidd *et al*, 2005: 23

As it can be seen from the ***Table 3***, the first and second generation (during 1950/60s and 1970s) of innovation models explained innovation as a simple linear process. The understanding that lies behind these models views innovation as a sequence of separable stages or activities. There are 2 basic variations of the linear models of innovation. First, and most crudely, there is the technology driven model, often referred to as technology push (see ***Figure 5***). In this model it is assumed that scientists come up with unexpected discoveries that are further applied by technologists to develop product ideas and engineers and designers in order to turn them into prototypes for testing. Afterwards it is left to manufacturing to discover ways to producing the products efficiently. Finally, marketing and sales promote the product to the potential customer. This model shows marketplace as a passive recipient of the fruits of R&D. (Trott, 2008: 22)

It was not until the 1970s that new studies offered a new perspective on drivers of innovation. These studies suggested that marketplace is an influential force in the innovation process which further on led to the development of the second linear innovation model – market pull (see ***Figure 5.***). In this model innovation is viewed as customer need-driven process, initiator for innovation is marketing that comes up with new ideas in a close collaboration with customers. These ideas, in turn, are conveyed to R&D for design and engineering and then to manufacturing for production. (ibid)

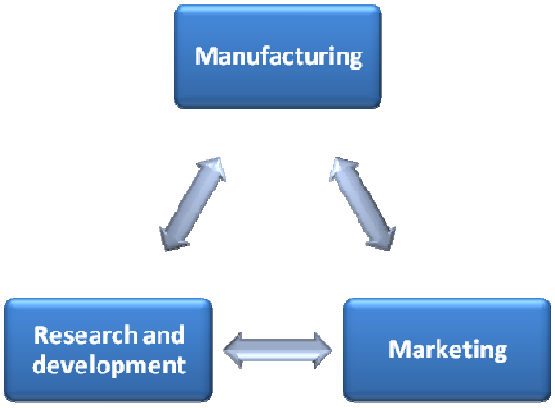
***Figure 5*: Linear Models of Innovation**



Source: Trott, 2008:23

One of the drawbacks for the linear models is the fact that they were only able to offer explanation of where the initial stimulus for innovation comes from, that is, where the trigger for the idea or need is initiated. The later understanding of innovation was based on a view that simultaneous coupling of the knowledge within all 3 functions is the force that will foster innovation. Furthermore, the point of commencement for innovation is not known in advance. This is where the third generation of innovation models aroused, and it was represented by simultaneous coupling models (see ***Figure 6***). (Trott, 2008: 23)

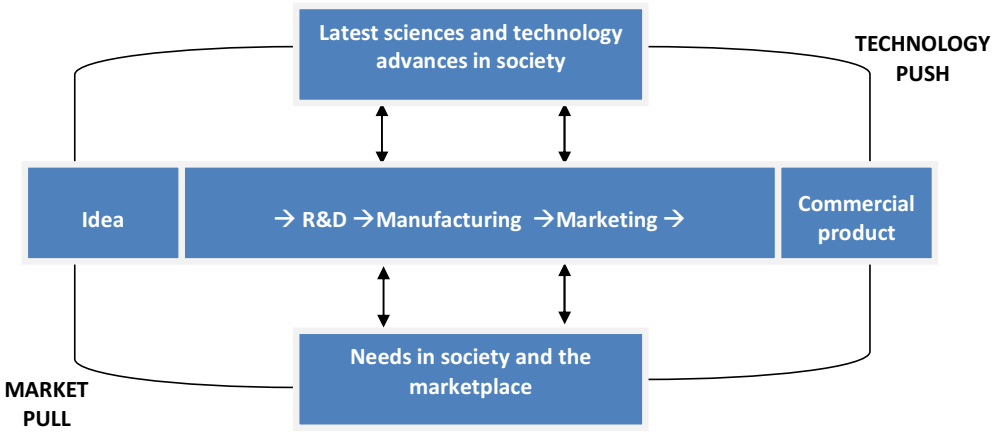
***Figure 6*: The Simultaneous Coupling Model**



Source: Trott, 2008:23

The fourth generation of innovation models is developing further the idea of collaboration as a fostering source of innovation and it is represented by the interactive model of innovation (see ***Figure 7***). It emphasises the importance of interaction of the marketplace, the science base and the organization's capabilities. Just like in the coupling model, in the interactive model there is no explicit starting point. (ibid)

***Figure 7*: Interactive Model of Innovation**



Source: Trott, 2008:23

As it can be seen from the ***Figure 7***, at the centre of the interactive model there are the organizational

functions of R&D, engineering and design, manufacturing and marketing and sales. While at first this may appear to be a linear model, the flow of communication is not necessarily linear. There provision for feedback. Also, linkages with science base and the marketplace occur between all functions, not just with R&D and marketing. Finally, the generation of ideas is shown to be dependent on inputs from 3 basic components: organization capabilities, the needs of the marketplace; the science and technology base. (Trott, 2008: 24)

Since the main objective of this thesis is to analyze the knowledge transfer process in Latvia none of the above innovation models is used directly in the theoretical framework developed. Nevertheless, this information is important to explain part of the knowledge transfer process.

4.3. Knowledge Transfer and Its Implementation

Like mentioned earlier, for businesses all over the world innovation is the central feature of competition (Zander *et al*, 1995: 79) which means that companies spend enormous amount of money on their research and development (R&D) to keep ahead of the competition. Besides that, companies explore other possibilities to gain new knowledge and enhance their innovation capabilities. But it is not only businesses for which the environment and requirements change. The same stands true for HEIs. From their primary missions like education and research HEIs have started to move towards what has been called the third mission. And with respect businesses that includes innovation, knowledge and technology transfer, commercialization of research results and orientation towards the needs of the business sector. (Adamsone – Fiskovica *et al*, 2009: 133) That is where the both parties meet to engage in a process called innovation and knowledge transfer.

The main objective of this sub-section is to review and elaborate on the available academic literature on knowledge transfer. This is done in order to provide answers to the following questions: what is knowledge transfer and what are frameworks for its implementation.

As mentioned in the previous sub-section on innovation, within this thesis work there is no strict separation between knowledge and innovation therefore further on the author will use the term “knowledge transfer” instead of the term “knowledge and innovation transfer”.

4.3.1. What Is Knowledge Transfer?

Knowledge transfer is not a new concept, and in it seems to be growing more important. Nonetheless, knowledge transfer as a field of research is still in its infancy. (Mitton *et al*, 2007: 759) This is especially true regarding knowledge transfer between HEIs and businesses. But even though this is the focus of this thesis, it must be stated that knowledge transfer can actually occur in many other environments e.g. between HEIs and government institutions, between HEIs and society, within organizations, within alliances etc. This is the main reason why different knowledge transfer definitions as well as different perspectives and views on knowledge transfer are represented in the existing knowledge transfer literature and research. Of course, each of the previously mentioned knowledge transfers has its distinguishing characteristics but still many similarities can be found among them. That is why in order to find the knowledge transfer definition that suits the specific needs of this thesis work the author has reviewed different knowledge transfer definitions and adjusted them to define knowledge transfer between HEIs and businesses.

One of the most quoted knowledge transfer definitions comes from Linda Argote and Paul Ingram, most of

their work in the field concentrates on knowledge transfer within an organization. The definition they propose is:

> *"Knowledge transfer in organizations is the process through which one unit (e.g., group, department, or division) is affected by the experience of another."* (Argote *et al*, 2000: 152)

Based on the definition developed my Argote *et al*, Majchrzak *et al* proposed more broader definition of knowledge transfer:

> *"Knowledge transfer is the process through which knowledge acquired in one situation is applied to another."* (Majchrzak *et al*, 2004: 174)

Additionally, besides arguing about the definitions of knowledge transfer, some authors argue that the term or concept itself should be different. According to Lavis *et al* and Mitton *et al*, "knowledge transfer" emerged in the 1990s as a process by which research messages were "pushed" by the producers of research to the users of research. More recently, "knowledge exchange" emerged as a result of growing evidence that the successful uptake of knowledge requires more than one-way communication, instead requiring genuine interaction among researchers, decision makers, and other stakeholders. (Lavis *et al*, 2003b: 168; Mitton *et al*, 2007: 730) Therefore they suggest using the term "knowledge transfer and exchange" instead of the term "knowledge transfer", and as the definition of knowledge transfer and exchange refer to the one proposed by Kiefer *at al*:

> *"Knowledge transfer and exchange is an interactive interchange of knowledge between research users and researcher producers* (Kiefer *et al*, 2005: I-15).

In order to come up with definition of knowledge transfer for the purposes of this thesis the author reviewed and analyzed previously mentioned definitions to adjust them to needs of the current work. The first definition by Argote *et al* does not really suit the situation as it refers to knowledge transfer within an organization and more indirect impact of knowledge transfer than the one between HEIs and businesses. But the important part from the Argote's *et al* and also Majchrzak's *et al* definitions are the fact that they refer to knowledge transfer as to a process; that is also the view that will be applied in this work. Although the author agrees with the perspective proposed by Kiefer *et al* regarding two-way knowledge exchange is true and can be seen in several cases of knowledge transfer within this thesis work the emphasis is on the knowledge transfer from HEIs to businesses.

Another important point that the author wants to include in the definition is the argument already raised by Darr and Kurtzberg (2000). They argue that knowledge transfer has occurred only when a knowledge producer shares knowledge that is used by a knowledge user. This differs from other point of views that equate knowledge transfer simply with sharing and that do not include the condition that knowledge transfer must involve use on the part of the knowledge user. (Darr *et al*, 2000: 29 and 30) This factor is important because within this thesis work the focus is on cases where knowledge transfer has actually occurred instead of focusing on the cases where knowledge is only shared by the knowledge producers.

Therefore the knowledge transfer definition within this thesis work is as follows:

> *Knowledge transfer is a process through which knowledge moves from knowledge producers (HEIs) to knowledge users (businesses) and where further this is being used and applied.*

4.3.2. Knowledge Transformation Framework

Knowledge transfer by definition involves interaction between at least two parties, and because these parties might come from different environments it may not be that easy to transfer knowledge directly from one party to another. Therefore, sometimes before knowledge transfer, knowledge has to be transformed in order for knowledge user to understand and successfully receive it. This is why in this sub-section knowledge transformation framework is introduced.

The knowledge transformation cycle that is going to be used in this thesis is developed by Carlile and Rebentisch (2003). It is based on a process model of knowledge transfer based on organizational learning and memory perspectives (Hargadon *et al*, 1997: 725; Huber, 1991: 90; Walsh *et al*, 1991: 64) that includes the stages of acquisition, storage, and retrieval (**acquisition-storage-retrieval model**). In this model, knowledge is acquired from external sources via organizational search routines, stored in organizational memory (e.g., in people's minds and organizational routines), and retrieved from organizational memory for use. (Carlile *et al*, 2003: 1181)

Although Carlile *et al* uses many elements of the acquisition-storage-retrieval model for the development of their knowledge transformation model; at the same time they also criticize the model for several drawbacks embedded in it. Their main argument for critics is the fact that the acquisition-storage-retrieval model does not address several of knowledge integration challenges – **novelty**, **dependence** and **specialization**. (ibid)

Novelty creates a problem in situations when the context changes (i.e. new requirements or novel conditions arise) between when knowledge is stored and when it is retrieved, the usefulness of the stored knowledge decreases, and it can even become harmful. Thus, the amount of novelty introduced between knowledge storage and retrieval is a core knowledge integration challenge. (ibid: 1181 and 1182)

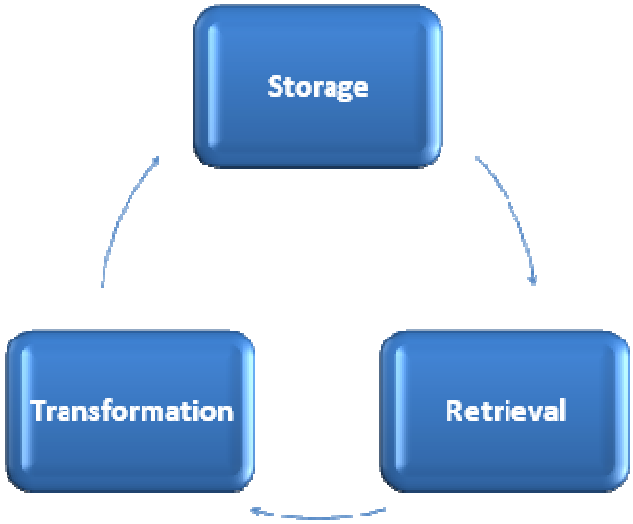
Like mentioned earlier, knowledge transfer usually occurs between 2 or more parties. Due to this reason it is more than being a case of simply transferring knowledge, it becomes a process of creating shared agreements across interdependent groups – creating **dependence**. And because dependence generates complexity and the need for mutual adaptation in knowledge integration, the amount of dependence between involved parties is also a core knowledge integration challenge. (ibid: 1182)

Additionally, all the parties involved in the process of knowledge transfer have their own background knowledge, understanding and experience – their own **specialization**. The amount and/or type of specialization or difference between involved parties are another core knowledge integration challenge. (Carlile *et al*, 2003: 1182)

In order to address these knowledge integration challenges the knowledge transformation cycle presented by Carlile *et al* expands beyond existing models to explain the integration of knowledge when novelty, dependence, and specialization are present (see ***Figure 8***). It has some similarities to the models developed in the organizational learning and memory perspectives. However, this model has two primary differences from those models. First, this model starts with the storage stage, emphasizing that stored knowledge often serves as a source of path dependency or constrains any retrieval effort. Second, transformation is emphasized over acquisition to highlight the more active effort required to address the path-dependent nature of knowledge when novelty is present. Authors also admit that although the cycle is presented with distinctive stages, in practice it is not always easy to uniquely define one stage in the absence of others or

define where one begins and another ends. Further complicating this situation is that, as different individuals, groups, or organizations collaborate, they may be at different stages in the cycle in relation to each other. (ibid: 1186 and 1187)

***Figure 8*: Storage-Retrieval-Transformation Knowledge Transformation Framework**



Source: Carlile *et al*, 2003:1187

Storage, for the purposes of this framework, is defined as the act of adding to the existing knowledge stocks in active use by an individual, group, or organization. Knowledge storage is therefore a process, whether intentional or unintentional, that leads to accumulated knowledge. Stored knowledge may range from written files to digital media, or knowledge embedded in tasks and artifacts to the experience individuals develop in a particular community of practice – that is stored knowledge that can be both explicit and/or tacit. (Carlile *et al*, 2003: 1187)

Retrieval involves identifying knowledge that is likely to result in the satisfaction of a need or solution to a problem. This involves two iterative efforts. The first effort is the search for knowledge producers/sources that may be useful, and the second is the assessment of those knowledge producers/sources and whether they are relevant to the task at hand, and thus worth acquiring. (ibid: 1189)

The **transformation** stage begins as relevant knowledge producers/sources have been identified. In cases where novelty is very low the simple transfer of knowledge can be a sufficient strategy for sharing knowledge between individuals, groups, or organizations. However, as novelty increases, the differences and dependencies between groups often generate negative consequences that must be jointly resolved; the specialized knowledge to be integrated must be transformed to deal with the consequences identified and generate a collective solution. The challenge of creating new knowledge is not merely to make tacit knowledge explicit between groups, but also to redefine, negotiate, and transform the knowledge used to accommodate the creation of a collective solution. (ibid: 1190)

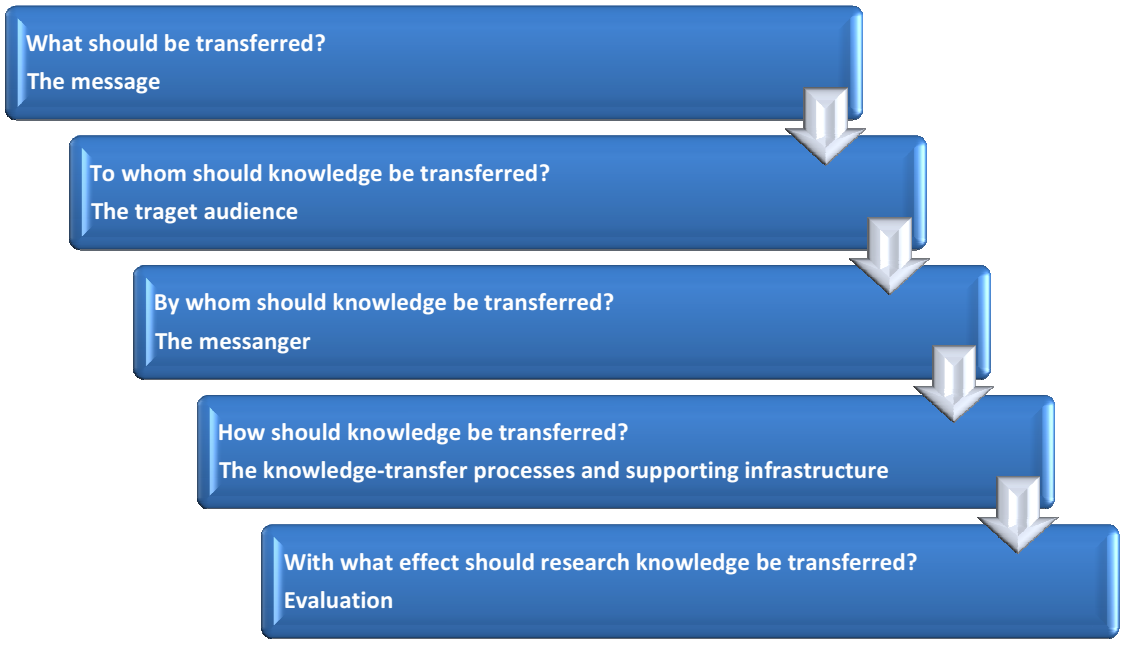
4.3.3. 5 Questions Knowledge Transfer Framework

Knowledge transfer cases can differ enormously based on partners involved, knowledge transferred, field or industry within which the transfer is taking place etc. Therefore it is understandable that developing

common frameworks for knowledge transfer implementation is a very difficult and challenging task or, as Mitton *et al* put it, it is not hard to find opinion pieces and anecdotal reports about how to use knowledge transfer, but there is limited reporting of knowledge transfer implementation. (Mitton *et al*, 2007: 759) Nevertheless, some attempts to develop knowledge transfer implementation frameworks or cycles have been made in academic literature. Due to the previously mentioned reasons some of them are very theoretical and broad but they still provide some guidelines in knowledge transfer process and are useful for further research.

Lavis *et al* proposes to use 5 questions approach that provides an organizing framework for a knowledge transfer. The 5 questions and graphical illustration of the framework is shown in ***Figure 9***. Before further elaboration on the framework it must be noted that the framework is developed and directly aimed at knowledge transfer from research organizations to decision makers in health and health care industry. Despite that, many elements of the framework are relevant and applicable for knowledge transfer between HEIs and businesses, so here the emphasis is put not on directly describing the framework but on enlightening the elements of the framework that can be used in a case of knowledge transfer between HEIs and businesses.

***Figure 9*: 5 Questions Knowledge Transfer Framework**



Source: Self-developed based on Lavis *et al*, 2003: 222

The message. Like the first question of the framework suggest, the first decision that knowledge producer has to make is: what exactly is his message or transferrable knowledge. The research literature strongly suggests that knowledge producers should transfer actionable messages, not simply a single research report or the results of a single study. Of course, the transferrable knowledge or actionable message strongly depends on a specific research, research field, knowledge user etc. For example, in social sciences actionable message might depend and be built upon several different research studies as individual studies can often lead to a conclusion very different from that of a systematic review of all available studies. In case of technology transfer, on the other hand, due to financing needs or others it might be necessary to define

an actionable message at very early stages of research. Nevertheless, in both cases knowledge producers should make an effort to transform their research into an actionable message. But even before transforming knowledge into actionable or take-home message knowledge producers have to evaluate if it is worth doing it as not all knowledge can or should be transferred and have an impact. (Lavis *et al*, 2003: 223)

Second, accountability mechanisms must be in place to ensure that when take-home messages can be generated, they are appropriate to the decision-making environments to which they are directed. This is especially crucial in case of knowledge transfer between HEIs and businesses as it is a well known fact that academic and business worlds and languages differ quite a lot – if in an academic world messages should be well argued, grounded and justified then business world looks for short, easy and quickly understandable messages. Even then, take-home messages should be seen as only a starting point for a discussion with knowledge users, given that knowledge transfer is a long and complicated process. (ibid: 224)

The target audience. The research literature makes clear that a message's target audiences must be clearly identified and the specifics of a knowledge transfer strategy must be fine-tuned to the types of products they produce or services they provide as well as types of environments/industries in which they work. Depending on that, multiple audience-specific messages might be needed. Additionally, learning about these environments/industries often requires a significant investment of time and financial resources. (Lavis *et al*, 2003: 224)

When deciding to whom the research knowledge should be transferred, the first step should be to ask who can act on the basis of the available knowledge; the second step should be to ask who can influence those who can act; and the third step should be to ask with which of these target audience(s) we can expect to have the most success and which messages pertain most directly to each of them. (ibid: 225)

The messenger. After the decisions about the message and the target audience(s) have been made, knowledge producers should move on to the next step – finding the right messenger. One of the main characteristics a messenger must possess is credibility because no matter whether the messenger is an individual, group, or organization, it is important to successful knowledge transfer interventions. Presumably credibility pertains to both the knowledge producer arena and the target audience, and the likelihood of credibility not mattering is very low so it should always be considered. (ibid)

Building credibility and acting as a messenger can be very time-consuming and skill-intensive processes, which makes it impossible to use a one-size-fits-all approach to decide who should act as the messenger. When knowledge producers have the skills and experience to act as the principal messenger, their credibility will likely make them the ideal choice. Having knowledge producers work with and through trusted intermediaries (i.e., knowledge brokers which in case of knowledge transfer between HEIs and businesses could be innovation and knowledge transfer centres etc.) may constitute a way around the time constraints faced by knowledge producers themselves and the limited interest in and skills applicable to knowledge transfer of some knowledge producers while at the same time enhancing the messenger's credibility. (ibid: 226)

The knowledge transfer process and supporting communication infrastructure. Although research literature on knowledge transfer does not explain or describe how exactly knowledge should be transferred it suggests that passive processes are ineffective and that interactive engagement may be most effective,

regardless of the audience. So the hallmark of knowledge transfer interventions is interaction. Interaction can occur at many stages in both the knowledge production process and the knowledge usage process. (ibid)

As proposed earlier, recently two-way "exchange" processes that give equal importance to what knowledge producers can learn from knowledge users and vice versa have started to emerge. It facilitates the ongoing use of knowledge transfer, not just one-off uses.

Additionally, supporting infrastructure like websites and newsletters can augment interactive efforts though not replace them. It is particularly useful if the material provides targeted information to clearly identified audiences and/or more general information in a searchable form when an intervention or event generates a demand for this information. (ibid: 227)

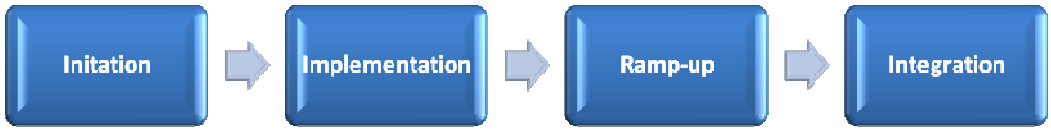
Evaluation. Since the 5 questions framework is designed towards knowledge transfer between research organizations and policy decision makers in the evaluation step they mostly discuss how to measure research impact on policy decisions and how much of the provided research information has actually been used in policy decision making. This, however, is not really relevant in case of knowledge transfer between HEIs and businesses. Despite that, they make one important point: performance measures for knowledge transfer should be appropriate to the target audience and to the objectives. (ibid) Therefore, in case of knowledge transfer from HEIs to businesses improved business performance of a company can be measured e.g. turnover, increase in sales, profits etc. In case of knowledge transfer from businesses to HEIs improved performance of HEIs in the specific field can be measured.

Additionally, it is widely discussed that the main objective of innovations and knowledge transfer should not only be possibility to earn more money or increase profits, there should also be benefits for society in general. In this case some measure evaluating social benefits should be introduced. Besides, knowledge transfer is important and is supported and promoted by governments for another reason – wider economical benefits can be created with the help of knowledge transfer e.g. new work places or increased exports so performance measurements for these dimensions should be implemented if necessary.

4.3.4. 4 Stages Knowledge Transfer Framework

Another knowledge transfer framework that the author of this thesis found useful for explaining the knowledge transfer between HEIs and businesses is 4 stages framework or model proposed by Gabriel Szulanski (1996). Just like other frameworks described in this section, 4 stages framework originally does not describe knowledge transfer between HEIs and businesses; it was proposed and designed to describe best practice transfer within a firm but still it is very useful to explain the process of knowledge transfer between HEIs and businesses. As the name suggests, it consists of 4 stages that are: initiation, implementation, ramp-up, and integration (see ***Figure 10***). (Szulanski, 1996: 28)

***Figure 10*: 4 Stages Knowledge Transfer Framework**



Source: Self-developed based on Szulanski, 1996: 28

Within 4 stages framework the **initiation stage** comprises all events that lead to the decision to transfer. A transfer begins when both a need and the knowledge to meet that need coexist. Szulanski talks about a need and knowledge to meet that need coexisting within an organization also mentioning that possibly that knowledge is undiscovered. (Szulanski, 1996: 28) Within the context of knowledge transfer between HEIs and businesses, the need and knowledge to meet that need coexists in different environments: the knowledge user has the need while knowledge producer possesses knowledge to meet that need which also might be undiscovered. Still, once the need and a potential solution to that need are identified, their fit - that is, the feasibility of the transfer - is explored. (ibid)

The **implementation stage** begins with the decision to proceed. During this stage, resources flow between the knowledge producer and the knowledge user (and maybe a third party). Transfer-specific social ties between the source and the recipient are established and the transferred knowledge is often adapted to suit the anticipated needs of the knowledge user or to help make the introduction of new knowledge less threatening to the knowledge user. (ibid: 28-29)

After the implementation stage knowledge transfer enters the **ramp-up stage**. It begins when the knowledge user starts using the transferred knowledge, that is, after the first day of use. During this stage, the knowledge user will be predominantly concerned with identifying and resolving unexpected problems that hamper its ability to match or exceed post- transfer performance expectations. The knowledge user is likely to use the new knowledge ineffectively at first, but gradually improves performance, ramping up toward a satisfactory level. (ibid: 29)

The last stage in the 4 stages framework is **the integration stage** that begins after the knowledge user achieves satisfactory results with the transferred knowledge. Use of the transferred knowledge gradually becomes routinized. (ibid)

4.4. Preconditions, Challenges and Facilitators for Successful Knowledge Transfer

How does a successful activity differ from a mediocre activity? One of the main reasons can be information obtained and preparation done before starting up the activity. Acquiring information about necessary preconditions for successful implementation, challenges and barriers that can rise during the activity as well as facilitators can prove to be worthwhile to insure the overall success of the planned activity. Knowledge transfer is no exception therefore this section describes main preconditions, challenges and barriers, and facilitators in the process of knowledge transfer.

4.4.1. Preconditions for Successful Knowledge Transfer

Already in the previous section some preconditions for a successful knowledge transfer were described. For example, 5 questions knowledge transfer framework emphasises the importance of clearly formulated message, precisely defined target audience and importance of interaction during the process of knowledge transfer. And as the proposed framework suggests, ensuring the existence of these preconditions can be seen more as a responsibility of knowledge producer rather than knowledge user. However, knowledge transfer is a process involving at least 2 parties that have equal responsibilities to fulfil several preconditions before the knowledge transfer process can take place and, more importantly, result in a success. In this sub-section preconditions for the perspective knowledge user are discussed and explained.

In the literature of knowledge transfer 2 main characteristics are highlighted with respect to knowledge user and its ability to successfully participate in the knowledge transfer process and to use the received knowledge: external access and internal capacity. Lack of these preconditions might challenge or even suspend the process of knowledge transfer. For example, an organization may want to obtain knowledge from other organizations but may not be able to access it. Or, even though the knowledge is available, the organization may not have the capacity to absorb and apply it for its own use. Because of their differential external access and internal capacity, organizations differ in their abilities to leverage and benefit from knowledge developed by other organizations or knowledge transfer. (Tsai, 2001: 996)

In his article Tsai talks about preconditions for knowledge transfer and knowledge user in the context of knowledge transfer within a firm. This context is slightly different from the context of knowledge transfer within this thesis and poses different challenges. As for this thesis, the author does not find it useful to examine importance of external access in more detail because, as it derives from the context of this work, it is assumed that external access is granted to the knowledge user as soon as knowledge producer and user engage in knowledge transfer.

Talking about knowledge user's internal capacity, many authors in the field emphasize characteristic called absorptive capacity as a crucial precondition on a side of knowledge user for knowledge transfer and, more importantly, for knowledge application and further usage. As Cohen and Levinthal (1990) argue in their paper, the ability of a knowledge user to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. They label this capability a knowledge user's absorptive capacity and suggest that it is largely a function of its level of prior related knowledge. (Cohen *et al*, 1990: 128) In the context of their paper Cohen *et al* talk about firms and their absorptive capacity; this is also applicable for this thesis although the author of this thesis refers to firms as to knowledge users.

Additionally, absorptive capacity tends to develop cumulatively and builds on prior related knowledge. Organizational units that possess relevant prior knowledge are likely to have a better understanding of new technology that can generate new ideas and develop new products. Organizational units with a high level of absorptive capacity are likely to harness new knowledge from other units to help their innovative activities. Organizational units must have the capacity to absorb inputs in order to generate outputs. Without such capacity, they cannot learn or transfer knowledge from one unit to another. (Tsai, 2001: 998)

So the question is: how knowledge user can develop or increase its absorptive capacity? As explained by Cohen *et al*, absorptive capacity can be generated in a variety of ways. First, some research shows that knowledge users that conduct their own R&D are better able to use externally available information. This

implies that absorptive capacity may be created as a byproduct of a firm's R&D investment (Cohen *et al*, 1990: 129) or, as Mowery *et al* (1996) put it, R&D investment is a necessary (although not necessarily sufficient) condition for the creation of absorptive capacity (Mowery *et al*, 1996: 81).

Second, other work suggests that absorptive capacity may also be developed as a byproduct of a knowledge user's manufacturing operations. Abernathy (1978) and Rosenberg (1982) have noted that through direct involvement in manufacturing, an organization is better able to recognize and exploit new information relevant to a particular product market. Production experience provides the firm with the background necessary both to recognize the value of and implement methods to reorganize or automate particular manufacturing processes. Knowledge users can also invest in absorptive capacity directly, as when they send personnel for advanced technical training. (Cohen *et al*, 1990: 129)

4.4.2. Challenges and Barriers for Successful Knowledge Transfer

Whenever an activity is taking place, especially if several parties are involved, some challenges and barriers can be expected. The barriers and challenges for knowledge transfer are well recognized as a result of dozens of studies and perhaps are the most frequently addressed topic area in the knowledge transfer literature. (Mitton *et al*, 2007: 735) So the main objective of this sub-section is to depict main challenges and barriers for knowledge transfer.

Different authors describe and categorize these challenges and barriers in different dimensions. For example, according to Szulanski (1996), four sets of factors are likely to influence the difficulty of knowledge transfer: characteristics of the knowledge transferred, of the source, of the recipient, and of the context in which the transfer takes place. (Szulanski, 1996: 30)

The main elements of the knowledge transferred that are likely to be problematic during the knowledge transfer process are causal ambiguity and unprovenness. With causal ambiguity the possible tacit nature and tacit elements of knowledge are understood. An existence of these tacit elements in the knowledge transferred make the transfer more complicated and creates knowledge transfer challenges. Unprovenness, on the other hand, refers to lack of a proven record of past usefulness of knowledge. Knowledge with a proven record of past usefulness is less difficult to transfer. Such a record hints of robustness and helps in the process of selecting knowledge for transfer. Without such a record, it is more difficult to induce potential recipients to engage in the transfer and to legitimize controversial integration efforts. (ibid: 30 and 31) Both of these parameters of knowledge transferred are specifically relevant in the context of this thesis work where knowledge is defined to include new technologies and innovations that are both characterized by high degrees of causal ambiguity and unprovenness.

On the side of the knowledge source or knowledge producer, as referred to in this thesis, the main barriers are lack of motivation and situations where the knowledge producer is not perceived as reliable. The lack of motivation can be caused by different factors, e.g., a knowledge producer may be reluctant to share crucial knowledge for fear of losing ownership, a position of privilege, superiority; it may resent not being adequately rewarded for sharing hard- won success; or it may be unwilling to devote time and resources to support the transfer. Talking about the reliability of the knowledge source or producer, it must be acknowledged that an expert and trustworthy source is more likely than others to influence the behavior of a knowledge user. When the source unit is not perceived as reliable, is not seen as trustworthy or knowledgeable, initiating a transfer from that source will be more difficult and its advice and example are likely to

be challenged and resisted. (ibid: 30)

Lack of motivation, lack of absorptive capacity and lack of retentive capacity are characteristics of the recipient or knowledge user that might prove to be problematic during the knowledge transfer process. Lack of motivation in this context is mostly caused by the reluctance of some knowledge users to accept knowledge from the outside - also known as the “not invented here” or NIH syndrome). As mentioned earlier, absorptive capacity refers to an ability of a knowledge user to recognize the value of new, external information, assimilate it, and apply it to commercial ends. (Cohen *et al*, 1990: 128) Without such capacity, learning or transfer of knowledge is not possible. (Tsai, 2001: 998) Additionally, a transfer of knowledge is effective only when the knowledge transferred is retained. The ability of a knowledge user to institutionalize the utilization of new knowledge reflects its 'retentive' capacity. In the absence of such ability, initial difficulties during the integration of received knowledge may become an excuse for discontinuing its use and, when feasible, reverting to the previous status quo. (Szulanski, 1996: 30)

Further on, characteristics of the context in which the transfer takes place come into play. They include barren organizational context and arduous relationship. Intraorganizational exchanges of knowledge are embedded in an organizational context, the characteristics of which may affect their gestation and evolution. An organizational context that facilitates the development of transfers is said to be fertile. Conversely, a context that hinders the gestation and evolution of transfers is said to be barren. Besides that, a transfer of knowledge, especially when the knowledge transferred has tacit components, may require numerous individual exchanges. The success of such exchanges depends to some extent on the ease of communication and on the “intimacy” of the over - all relationship between the knowledge producer and the knowledge user. An arduous (i.e., laborious and distant) relationship might create additional hardship in the transfer. (ibid: 31 and 32)

Different categorization of challenges and barriers for knowledge transfer was proposed by Mitton *et al* (2007). It is suggested that these factors can be classified on individual and organizational levels and pertain to relationships between researchers and decision makers, modes of communication, time and timing. (Mitton *et al*, 2007: 735) The main challanges on an indivudual level include lack of experience and capacity for assessing evidence, mutual mistrust and negative attitude toward change. Organizational level incorporates unsupportive culture, competing interests, researcher incentive system and frequent staff turnover as the main risks for future problems. Choice of messenger, information overload, traditional, academic language, research that is not relevant to practice-based issues and no actionable messages (information on what needs to be done and the implications) are listed as the main barriers related to communication. Last but not least, challanges related to time or timing include differences in knowledge producer' and knowledge users' time frames and limited time to make decisions. As well, the authors argue that lack of time and resources to participate in knowledge transfer for knowledge producers as well as knowledge users is an additional challenge. (ibid: 731-737)

Additionally, the fact that knowledge producers are not necessarily good commercialisers/marketers, low foreign investments coupled to technology investments, government barriers (regulations) to knowledge transfer (import and export), no or little incentives/deterrence for knowledge transfer, low public awareness/public pressure, existing asset base and existing technology and infrastructure base are mentioned as possible challenges and barriers for successful knowledge transfer. (Poulton, 2007: 79)

4.4.3. Facilitators for Successful Knowledge Transfer

Most of the authors describing challenges and barriers for successful knowledge transfer also elaborate on facilitators or suggest some solutions for overcoming emerged problems. Therefore the main objective of this sub-section is to elaborate on the main facilitators suggested in the knowledge transfer literature.

For example, referring back to 5 questions knowledge transfer framework, already Lavis *et al* (2003) suggest some elements that might help to make the knowledge transfer process more effective. Authors suggest that the opportunities for improvement (from the knowledge producer perspective) appear to lie in developing actionable messages for decision makers (what is transferred), developing knowledge-uptake skills among target audiences (to whom is it transferred) and knowledge-transfer skills within their own organizations (by whom is it transferred), and evaluating the impact of knowledge-transfer activities (with what effect).

First and foremost, within an actual process of knowledge transfer interaction is acknowledged as a crucial factor for successful knowledge transfer therefore several facilitators or possibilities for improvement are connected with it. For example, Mitton *et al* (2007) proposes several ways to improve communication between knowledge producer and knowledge user: 1) joint knowledge producer – knowledge user workshops; 2) inclusion of knowledge users in the research process as part of inter disciplinary research teams; 3) collaborative definition of research questions; 4) use of intermediaries that understand both roles known as "knowledge brokers". In addition, interpersonal contact between knowledge producers and knowledge users is an often cited fundamental ingredient in successful knowledge transfer initiatives. (Mitton *et al*, 2007: 731)

Further on, knowledge transfer facilitators, just as challenges and barriers, can be categorized on individual and organizational levels and pertain to relationships between researchers and decision makers, modes of communication. (Mitton *et al*, 2007: 735) According to this classification facilitators on each of the levels are as follows:

1) Individual level: ongoing collaboration, values research, networks, building of trust, clear roles and responsibilities;
2) Organizational level: provision of support and training (capacity building); sufficient resources (money, technology), authority to implement changes, readiness for change, collaborative research partnerships.
3) Related to communication: face-to-face exchanges, involvement of knowledge users in research planning and design, messages tailored to specific audience, relevance of research, knowledge brokers, opinion leader or champion (expert, credible sources). (Mitton *et al*, 2007: 737)

Broader perspective when talking about factors promoting knowledge transfer is taken by Wendy Poulton (2007). According to her, in order to assure successful knowledge transfer several factors can prove to be important or even crucial. First, knowledge (including technology and innovation) must be needs-driven and adaptable to local conditions. Second, the necessary environment for knowledge transfer must be provided. This include having people or a team that hold a full ownership for the specific knowledge transfer project, appropriate technology and infrastructure as well as skill base and local capacity in place. Additionally, full cost accounting must be implemented throughout the process of knowledge transfer. (Poulton, 2007: 80)

4.5. Integrated Framework for Knowledge Transfer Analysis in Latvia

The previously described frameworks describe and explain knowledge transfer process from different perspectives. Nevertheless, in order assure comprehensive analysis of knowledge transfer in Latvia the author of this thesis has made an attempt to develop an overall framework which would incorporate all previously described models. Therefore this sub-section describes the newly developed framework and explains how it is used for further analysis.

Based on the information about knowledge transfer obtained during the development of this thesis work the author constructed theoretical process of knowledge transfer that consists of the following cycles:

1) **Pre-cycle**: initiative for collaboration;
4) **The first cycle**: internal collaboration;
5) **The second cycle**: external collaboration;
6) **The third cycle**: knowledge transfer process.

Pre-cycle basically includes the activity of initiating the collaboration. In the case of knowledge transfer between HEIs and businesses the initiative for collaboration can come either from HEI or a business company. There are no specific models used within this cycle but indirectly author refers back to innovation models to analyse the source of initiative for knowledge transfer process.

As argued earlier, for the purposes of this thesis the author has decided to interview representatives from knowledge transfer centres established within the largest HEIs universities of Latvia. Due to this reason internal collaboration between scientists, researchers or research groups (or as referred to in this thesis – knowledge producers) and knowledge transfer centres must be taken into account to analyze the whole knowledge transfer process. These are the activities included in **the first cycle**. 2 previously described frameworks are included in this cycle. First, the storage-retrieval-transformation framework since knowledge producers add and store knowledge during the research process (storage), they retrieve it and transform it (retrieval and transformation) for the transfer to knowledge transfer centres. Although in the real life these stages may not be so distinct and obvious formally they do take place. Second, this cycle includes the first 3 stages of 5 questions knowledge transfer framework: the message, the target audience and the messenger. Since the cycle represents internal collaboration most of the stages are pre-defined i.e. the target audience is the knowledge transfer centre and the messenger is the knowledge producer itself. Anyhow, through the knowledge transformation knowledge producer still has to formulate a clear and usable message to the knowledge transfer centre. Additionally, knowledge transfer centres hold the main responsibility for the knowledge transfer activities within HEIs therefore they have to monitor existing and ongoing research and innovations in HEIs. This is why knowledge transfer centres' monitoring activities are also included in this cycle.

Of course, in case knowledge transfer is initiated by businesses collaboration cycle can also take place on a business side. In this situation a business company or organization goes through knowledge storage, retrieval and transformation phase in order to communicate its business need or problem to knowledge transfer centre(s). According to 5questions knowledge transfer framework here the message is a problem or need identified and formulated by the business, the target audience, again, is knowledge transfer centre(s) and the messenger is the business itself. In this case the first cycle also include monitoring activities by a knowledge transfer centre in order to keep up to date with need and problems business face.

The second cycle is very similar to the first cycle in terms of frameworks included in it. It also includes the storage-retrieval-transformation framework and the 5 questions knowledge transfer framework but additionally it also includes the first phase of the 4 stages knowledge transfer framework. Nevertheless, in this cycle the actual initiation of collaboration between HEI and businesses take place. In this situation the storage-retrieval-transformation framework is used to re-formulate messages from HEI to a business (in case HEI initiates the knowledge transfer) or from a business to HEI (in case a business initiates the knowledge transfer). According to 5 questions knowledge transfer framework, in both cases the messenger now is the knowledge transfer centre while the target audience still needs to be specifically identified based on a situation within in a business (in case HEI initiates the knowledge transfer) or a HEI (in case a business initiates the knowledge transfer).

Last but not least, **the third cycle** covers the actual knowledge transfer process. It includes the last 2 stages of 5 questions knowledge transfer framework (the process and evaluation) and the last 3 stages of 4 stages knowledge transfer framework (implementation, ramp-up and integration). The full illustration of the integrated framework for knowledge transfer analysis in Latvia can be found in annex I.

For further thesis work the developed framework is used in order to formulate interview questions. The formulated questions cover all the previously described cycles and the stages from the frameworks used in each cycle of the integrated framework. Due to the fact that interviews are conducted in Latvian the interview questions are formulated both in Latvian and in English. Interview questions in Latvian can be found in annex II while interview questions in English as well as their correspondence to the integrated framework can be found in annex III. Besides that, the interview questions also include questions on preconditions, barriers and facilitators for successful knowledge transfer (according to sub-section *4.4.1. Preconditions for Successful Knowledge Transfer*, *4.4.2. Challenges and Barriers for Successful Knowledge Transfer* and *4.4.3. Facilitators for Successful Knowledge Transfer*) and some questions addressing functions and organizational set-ups of knowledge transfer centres. Additionally, although only one list of interview questions is added to this thesis work the questions were adjusted to the each interviewee.

5. Economy, Innovation and Knowledge Transfer Environments in Latvia

Innovation and technology transfer is an important element within a country's economy. It spurs sustainable development, continuous improvements and knowledge acquisition. Besides, knowledge transfer can be considered one of the main drivers of overall economical growth and competitiveness. (Riga Technical University's Innovation and Technology Transfer Centre website: http://www.rtu.lv/content/view/128/646/lang,lv/) Therefore, even though the focus in this thesis is on knowledge transfer in Latvia it must be acknowledged that it cannot be fully separated from the broader context of innovation environment or country's economy in general. Due to this reason further on in this chapter, first, information about overall economical situation in Latvia is provided. This includes short description of the development of Latvian economy after the collapse of the Soviet Union and a discussion on current topics and problems Latvian economy has to face in the times of global economical and financial crisis.

Second, the section *5.2. Institutional and Legal Framework for Innovation and Knowledge Transfer in Latvia* elaborates on the main regulating documents, main institutions responsible in the field of innovation and knowledge transfer as well as measures taken by the government to promote both of these areas. Further on the section *5.3. Innovation Environment in Latvia* provides both quantitative and qualitative background information on innovation environment in Latvia and explains the main problems and challenges in the field.

5.1. Economy in Latvia

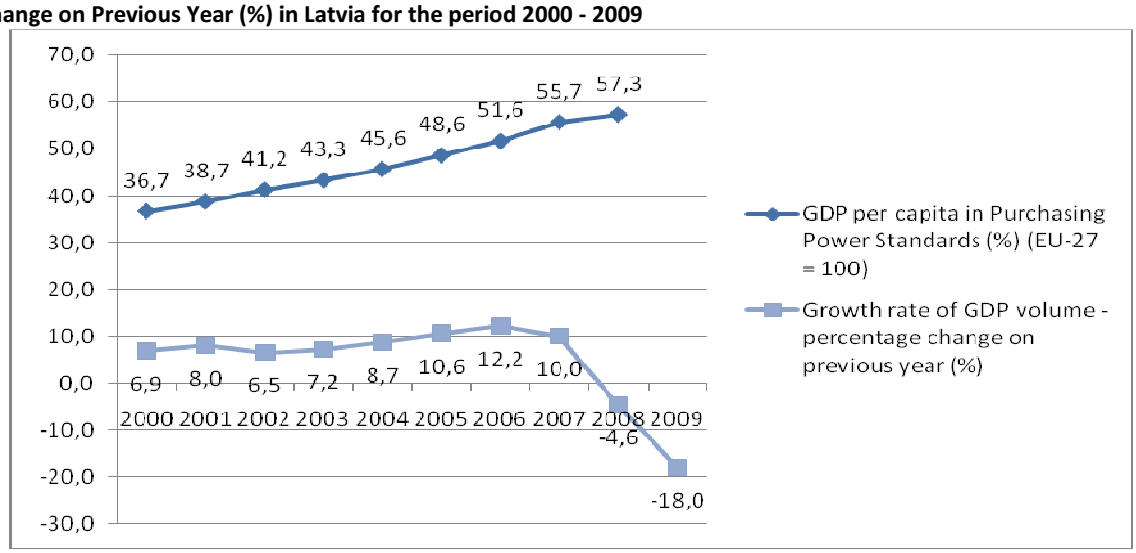
First and foremost, the Republic of Latvia is a country located in the Baltic region that, depending on the source of information, is indicated as a part of Northern or Eastern Europe. (Based on The World Factbook by Central Intelligence Agency (CIA)) Due to its strategic location by the Baltic sea Latvia has always had a complicated history. Over the course of time Latvia has only been independent and sovereign country 2 times: first, for a period lasting a little bit more than 20 years after World War I when it gained its independence in 1918 until it was occupied by Soviet Union in 1940; second, starting from 1991 when Latvia finally re-established its independence after the collapse of Soviet Union. (Based on The World Factbook by CIA)

Country's economy in a large degree is connected to its political affairs. Therefore, taking into account previously mentioned facts about Latvia's history, it is understandable that independent economy in Latvia has only been possible in its periods of independence. Of course, this thesis work does not attempt to cover whole history of Latvia's economy; its main objective is to give an overview of the recent economical history of Latvia and to emphasize current economical affairs and problems.

After re-establishing its independence in 1991 Latvia needed to rebuild its economy too. The centrally planned system of the Soviet period was replaced with a structure based on free-market principles. Latvia's currency, the lat, was introduced in 1993. Nevertheless, the process of rebuilding and restructuring the economy was never easy – the slow recovery of the economy was interrupted twice: first, in 1995 by a banking crisis and the bankruptcy of Latvia's largest bank at that time *Banka Baltija*; second, in 1998 by a severe crisis in the financial system of Russia.

Anyhow, after year 2000 Latvia's gross domestic product (GDP) grew by 6 – 8% a year for the 4 consecutive years but still the GDP per capita was only around 35% – 58% comparing to the EU average(see ***Figure 11***). (Based on The World Factbook by CIA and Eurostat)

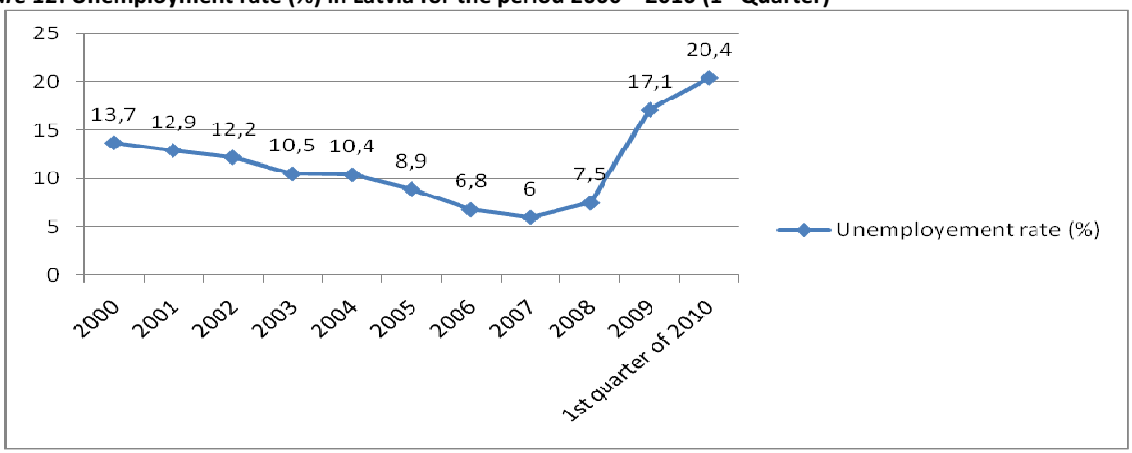
***Figure 11*: GDP per Capita in Purchasing Power Standards (%) and Growth Rate of GDP Volume – Percentage Change on Previous Year (%) in Latvia for the period 2000 - 2009**



Source: Eurostat

Furthermore, Latvia became a member of World Trade Organization; it joined the organization in 1999. On the 1st of May, 2004 Latvia also became a member of *European Union* (EU). After joining EU the growth of GDP continued but it was combined with an increasing inflation rate which reached the mark of 15.3 % in 2008. (Based on Eurostat) Despite the growing inflation rate the economy of Latvia was booming - until 2007 it was breaking economic records, from highest growth to fastest wage increases but it was not for long. Currently Latvia is still setting records, now it is for all the wrong reasons. The Latvian recession, which is now more than two years old, has seen a world-historical drop in GDP of almost 20% by 2009 (see ***Figure 11***); increasing unemployment, at almost 21% at the end of the first quarter of 2010 (see ***Figure 12***), is the highest in EU. (BBC News, "Latvia economy reels in recession", February 4, 2010)

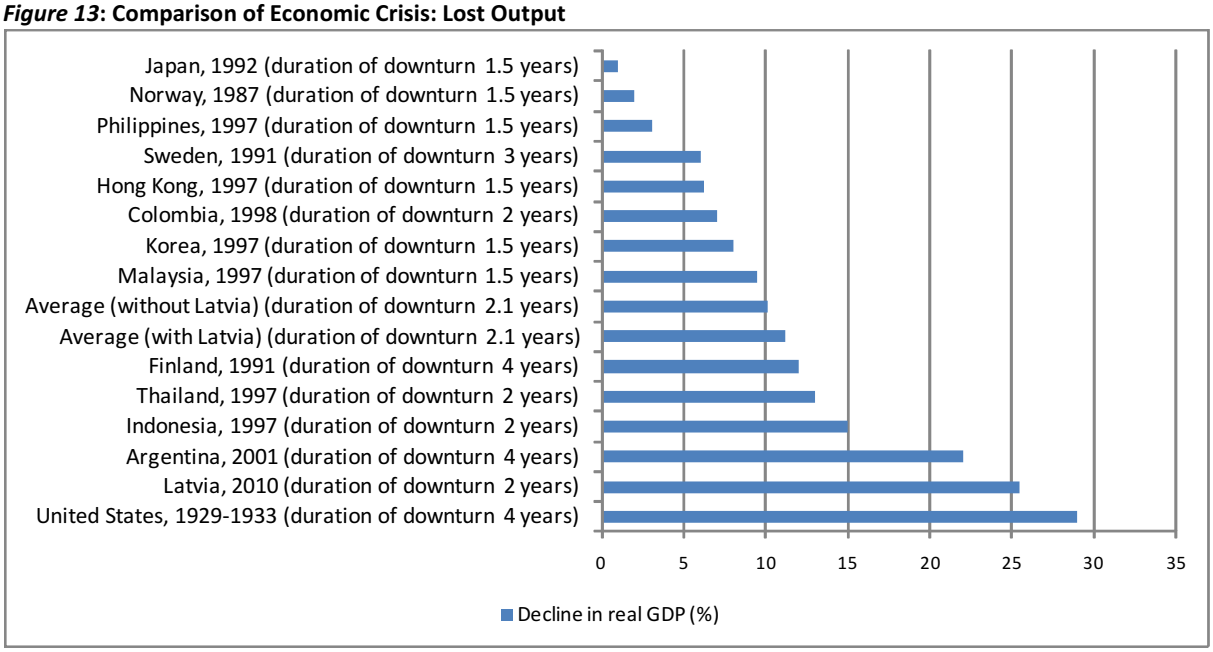
***Figure 12*: Unemployment rate (%) in Latvia for the period 2000 – 2010 (1st Quarter)**



Source: Eurostat and Central Statistical Bureau of Republic of Latvia (Latvijas Republikas Centrālā statistikas pārvalde)

As suggested by some authors, the current drop of economical output combined with International Monetary Fund's (IMF) projections of another 4% drop in 2010, and predictions that the total loss of output from peak to bottom will reach 30%, would make Latvia's loss more than that of the U.S. Great Depression downturn of 1929 – 1933 (see ***Figure 13***). (Weisbrot et al, 2010:3)

***Figure 13*: Comparison of Economic Crisis: Lost Output**



Source: Weisbrot *et al*, 2010:5

Even though looking back from today's perspective the crisis was inevitable, the Latvian government and many experts in Latvia and abroad did not foresee it or at least denied it coming. Many of those so-called 'experts' proclaimed Latvia was "different" and that it will catch up with the rest of Europe in some 15 years. These voices surely contributed to the confusion of both the government and ordinary people. It also indicates a serious failure of economics research capacity in the country. (Public Policy Website www.politika.lv, ""Nothing Special": The Economic Crisis in Latvia", December 16, 2008)

Anyhow, currently more or less all the experts agree that Latvia had an unsustainable, bubble-driven growth, with excessive borrowing, prior to the collapse. (Weisbrot *et al*, 2010:6) In 2004, when Latvia joined EU, two notable things happened. First, there was an extreme increase in long-term borrowing mostly supported by a widespread upsurge of optimistic expectations of never-ending economic growth. (Public Policy Website www.politika.lv, ""Nothing Special": The Economic Crisis in Latvia", December 16, 2008) Second, the real estate bubble, as in many countries, was a significant part of the story – including speculators "flipping" houses and, in Latvia, not even having to pay capital gains taxes on their profits. (Weisbrot *et al*, 2010:6) Additionally, it was a rather unfortunate coincidence that, at the same time, the United Kingdom (UK) and Ireland, which also experienced their own construction booms, opened up their labour markets for migrant workers from the new EU member states. As a result, an increase in demand for the construction of new housing coincided with the mass migration of unskilled labour to Ireland and the UK. This excess demand for housing combined with the shortage of labour to build houses resulted in a rapid growth in both real estate prices and wages in the construction sector. Growth in real estate prices made lots of people think it is a great idea to buy real estate now, before it gets even more expensive. The

ensuing rush to the real estate further increased demand for housing, construction workers, and inflated their wages even more. Given the competitive pressure from the construction and real estate sectors, other industries were forced to increase wages as well. This fed into increases in prices across the economy, as businesses had to compensate for the rising labour costs. Inflation, in turn, increased demand for yet higher wages, which would result in higher prices, and so on. All this could work while more people took more loans and the foreign-owned banks were willing to pump in money from abroad. Yet surely it had to end since no-one can borrow forever. The rest is history. Latvian economy got itself to a point where its wage and price level was too good to be true. (Public Policy Website www.politika.lv, ""Nothing Special": The Economic Crisis in Latvia", December 16, 2008) Furthermore, Latvia is the only Baltic nation that was forced to resort to international finance to avert bankruptcy. In December 2008 it was forced to sign a 7.5 billion euro emergency bailout deal with the EU, IMF, and other lenders. (Bloomberg Businessweek, "2009 worst year on record for Latvia, Estonia", March 11, 2010)

So what is the solution? Or at least what is the direction taken by the government of Latvia? Unlike other countries trying to boost economic growth by spending their way out of recession, Latvia has taken the opposite route and is effectively shrinking the economy. For the 2010 budget the Latvian parliament has passed tax increases and spending cuts of around 700 million euros. (BBC News "Latvia economy reels in recession", February 4, 2010) As some experts have noted it, the course taken by Latvia is a highly ambiguous experiment with deflation. This means that the nominal exchange rate is being kept fixed; and the adjustment in the real exchange rate takes place through pushing down prices and wages. (Weisbrot *et al*, 2010:6) This strategy has been chosen despite many warnings from economists that deflation proceeds through destroying jobs, that it means strict adherence to fiscal austerity, and that it would, in all likelihood, take quite a long time. (Public Policy Website www.politika.lv, "Chronicles of a 'Failed State'", June 16, 2009)

Nevertheless, the outrageous austerity measures and deflation is not the only possible solution for solving Latvia's economical problems. Many economists agree that the depth of the recession and the difficulty of recovery are attributable in large part to the decision to maintain the country's overvalued fixed exchange rate (Weisbrot *et al*, 2010:3) and that the government of Latvia is ignoring the one policy which would work, devaluation. (BBC News, "Latvia economy reels in recession", February 4, 2010) The overvalued exchange rate hurts Latvia's tradable goods industries by making the country's exports more expensive, and its imports artificially cheap. It also harms the investment climate generally, causes spikes in interest rates when investors fear that the peg will collapse, as well as capital flight. The end result is that the economy is trapped in a deep recession in which all of the major macroeconomic policy variables – the exchange rate, fiscal policy, and monetary policy – are either pro-cyclical or cannot be utilized to help stimulate the economy. This makes it very difficult to get out of the recession. (Weisbrot *et al*, 2010:3)

Undeniably, devaluation would have negative effects – it would have significant negative balance sheet effects, because about 89 % of Latvian residents' debt is in foreign currency (mostly euros). However, there is much that the government could do to mitigate the damage from devaluation. It could allow households who borrowed in foreign currency for their mortgages to redenominate these debts into local currency at the pre-devaluation fixed rate. In the housing sector, this redenomination could be limited to owner-occupied housing, and the amount of coverage could be limited to the price of the median home, or some additional fraction above that. Of course such a plan would imply losses for the banks holding these mortgages; however the government could subsidize these losses as necessary to share some of the burden. Nevertheless, if devaluation is done in a planned way, rather than holding the peg until it collapses

under a speculative attack, a better outcome is likely. (Weisbrot *et al*, 2010:4)

If devaluation is seen as a better option for the economic recovery in Latvia by many economists and experts, the question remains: why it has not been chosen as the main strategy by the government? First, the goal of adopting the euro has been one of the main arguments for making the sacrifices necessary to keep the peg. (ibid) Additionally, Latvia has found powerful allies to support its decision – Swedish government and European Commission (EC). Swedish government is mainly concerned about the exposure of its banks since large Swedish banks, such as Swedbank and SEB, control 50% of Latvia's lending market. EC, on the other hand, fears broad contagion effects to the whole of Central and Eastern Europe if Latvian currency is devalued. (Public Policy Website www.politika.lv, "Chronicles of a 'Failed State'", June 16, 2009 and Times Online, "Latvian crisis deepens as Europe debates aid", June 4, 2009)

Anyhow, as history has demonstrated, in the case of Latvia expert forecasts and prognosis do not always prove to be right. Therefore, only time will show if the strategy taken by the government of Latvia will lead the country closer to a recovery or deeper in the recession.

5.2. Institutional and Legal Framework for Innovation and Knowledge Transfer in Latvia

In sense, knowledge transfer process can be seen as a part of innovation process or at least they should be viewed as closely related processes aimed at developing new ideas, products or services. This means that knowledge transfer and innovation environments in a country should also be seen as related. Latvian case is a proof for that as in most cases promotion of knowledge transfer is done within activities aimed at promoting innovation. Besides, the institutional and legal frameworks are almost the same in both cases. Therefore, the main objective of this section is to elaborate on the institutional and legal framework for innovation and knowledge transfer in Latvia as well as to describe main activities and measures aimed at promoting both, innovation and knowledge transfer.

The main institution responsible for promotion of innovation, which also includes promotion of knowledge transfer, in Latvia is *Ministry of Economics*. The ministry has developed definitions of innovation and knowledge transfer in Latvia. Innovation within Latvian economy is defined as follows:

> *"Innovation is a process during which ideas, developments and technologies from scientific, technical, social, cultural or any other field are transformed into competitive products or services demanded in the market."* ("Program for Promotion of Entrepreneurial Competitiveness and Innovation 2007 – 2013", 2007 and "Law on Scientific Activity", 2005)

Knowledge transfer, on the other hand, is defined as:

> *…a transfer of a particular knowledge from one knowledge user to another or a transfer of knowledge created in one country to another country with a purpose of creating new products, processes or services.* ("Program for Promotion of Entrepreneurial Competitiveness and Innovation 2007 – 2013", 2007)

Besides defining what both of these concepts mean within the context of Latvian economy, *Ministry of Economics*, additionally to its other functions, is also responsible for developing policy within the field of innovation, for managing and coordinating its implementation and for ensuring the necessary international

corporation within the field. ("Statutes of Ministry of Economics", 2010) Additionally, since in most cases knowledge transfer involves participation of institutions from the fields of education, science and research, another responsible institution in the field of knowledge transfer is *Ministry of Education and Science of Republic of Latvia* (*Latvijas Republikas Izglītības un zinātnes ministrija*). Just like *Ministry of Economics, Ministry of Education and Science* is responsible for developing and implementing policy in the fields of education, science, sports and state language; these functions also includes some responsibilities with respect to knowledge transfer promotion (see ***Table 5***). (Ministry of Education and Science website www.izm.gov.lv)

Nevertheless, the main strategic planning documents within the field of innovation are developed by *Ministry of Economics*. This document is *"Program for Promoting Entrepreneurial Competitiveness and Innovation 2007 – 2013"* (*"Komercdarbības konkurētspējas un inovācijas veicināšanas programma 2007. – 2013.gadam"*) that has been approved by *Cabinet of Ministers of Republic of Latvia* (*Latvijas Republikas Ministru kabinets*) on June 28, 2007. This program is based on main policy directions defined by EU as well as by the government of Latvia and it states country's strategic priorities and measures for promoting innovation. For example, it complies with the main strategic objectives and priorities stated in Latvian *"National Development Plan"* (*Latvijas "Nacionālais attīstības plāns"*) approved by *Cabinet of Ministers* on July 4, 2006. The plan is a medium-term strategic planning document for 2007 – 2013 setting the main strategic objectives and priorities for the country to develop competitive knowledge based economy. (National Development Plan website www.nap.lv)

In order to achieve the objectives set in *"National Development Plan"* 5 main directions for further economic development in Latvia have been formulated in *"Program for Promoting Entrepreneurial Competitiveness and Innovation 2007 – 2013"*:

1) Ensuring macroeconomic stability;
2) Promotion of knowledge and innovation;
3) Investments for development of favourable and attractive work environment;
4) Promotion of employment;
5) Advancement of education and skills. ("Program for Promoting Entrepreneurial Competitiveness and Innovation 2007 – 2013", 2007:5)

As it can be concluded from the above stated priorities, the one specifically aimed at improving innovation and knowledge transfer environment in Latvia is the second priority: promotion of knowledge and innovation. The main objective of this priority is to promote an augmentation of capacity and efficiency of the national innovation system by developing beneficial regulating, financial and informative environment for innovative activities. This objective is further broken down into 3 main courses of action: 1) to promote knowledge transfer and commercialization; 2) to support implementation of innovative solutions in industries; 3) to ensure a demand for highly qualified experts and improve the knowledge infrastructure. (ibid: 17 and 18) Additionally, based on the objective and the main courses of action set in the program, more specific tasks for promotion of innovation and knowledge transfer are formulated:

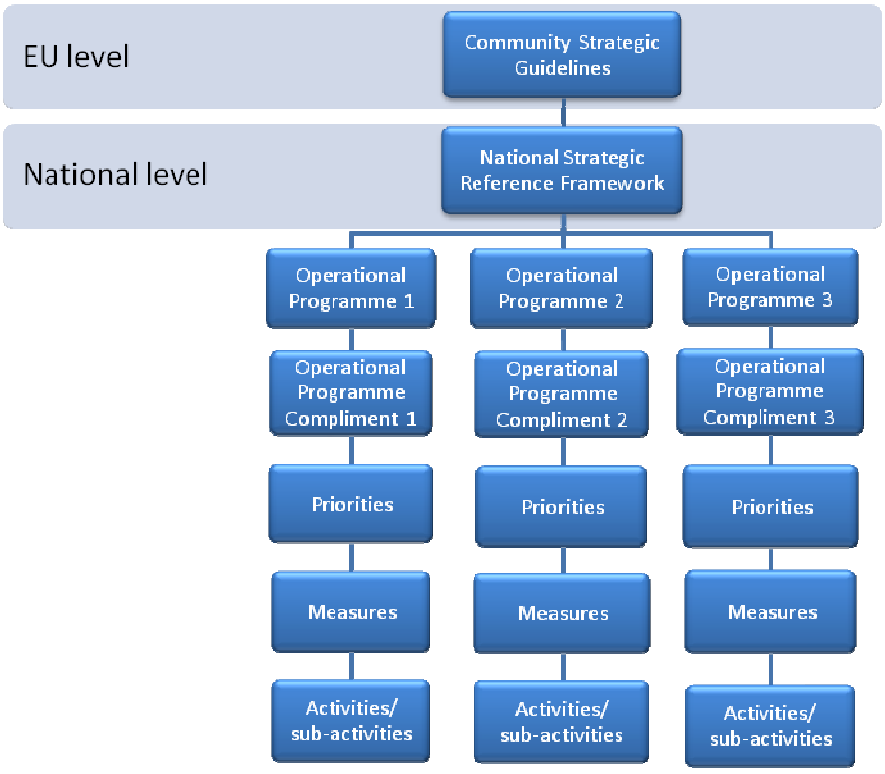
1) To spur knowledge and innovation by rising public investments and attracting more private investments in R&D;
2) To promote knowledge and technology transfer in manufacturing;
3) To increase innovation capacity by creating beneficial institutional environment for innovative

activities; to facilitate cooperation among science, education and business sectors;

4) To support development of new products and technologies; to improve entrepreneurs' understanding of intellectual property and its protection;
5) To stimulate the growth in the number of entrepreneurs who use e-commerce applications in their businesses. (ibid: 19)

Furthermore, since "*Program for Promoting Entrepreneurial Competitiveness and Innovation 2007 – 2013"* has been developed as a strategy for promoting entrepreneurship and innovation in Latvia it also includes activities and measures supported by EU funds. Nevertheless, these activities and measures are also described in a specific set of EU funds planning documents. This set of documents is developed in 3 levels: first, there is EU level strategy set out in *"Community Strategic Guidelines for Cohesion"*; second, there is national strategy set out in *"National Strategic Reference Framework"* (*"Valsts stratēģiskais ietvardokuments"*); third, there are 3 national operational programmes (OP). Each of the OPs addresses a specific area and is funded by a different EU fund: the first OP addresses challenges within the field of human resources and employment and it is funded by European Social Fund; the second OP addresses issues regarding entrepreneurship and innovations and it is funded by European Regional Development Fund (ERDF); while the third OP addresses problems within the field of infrastructure and services and it is funded by Cohesion Fund and ERDF. Moreover, within each of the OPs a set of priorities within the specific field are formulated, then a set of measures within each priority are defined in order to address the problems identified. Further on, the measures are divided into activities and sub-activities that are then implemented by the final beneficiaries. (see ***Figure 14***) (based on EU Funds website www.esfondi.lv)

***Figure 14*: Hierarchy of EU and Latvia's Cohesion Policy Planning Documents**



Source: EU Funds website www.esfondi.lv

Within the set of EU planning documents innovation and knowledge transfer issues are address in the second OP "Entrepreneurship and Innovations" with its first priority "Science and Innovations". This priority encloses 2 main measures: 1) "Science, Research and Development"; 2) "Innovations". The objective of the measure "Science, Research and Development" is to strengthen the capacity of scientific and research potential by promoting the implementation of practical research projects according to the priorities, by modernising scientific institutions, improving public awareness and interest in research and innovations. (Operational Programme "Entrepreneurship and Innovations", 2007: 48) While the objective of the measure " Innovations" is to promote entrepreneurship with higher value added by providing aid in development and producing new products and technologies, ensuring highly-qualified human resources in enterprises, as well as cooperation of the research and business sectors. (ibid: 54) Activities defined within each of the above mentioned measures as well as the amount of financial support within each activity are listed and described below in ***Table 4***.

***Table 4*: Innovation and Knowledge Transfer Promotion Activities Supported by EU funds**

No.	Activity (indicative)	Objective of the activity (indicative)	Amount of financial support within the activity (EUR) for the period 2007 - 20013
Measure "Science, Research and Development"			
1.	Support to science and research	To support practical research projects promoting the integration of research and production and the use of research results according to the research priorities nominated by the government (such as agrobiotechnology, informatics, biomedicine and pharmaceutics, energy sector, material science, forest science, medical science and environmental science), ensuring public access to the research results.	55 132 872
2.	Support to international cooperation projects in research and technologies (EUREKA, 7th FP, etc.).	To ensure the development of the capacity of research institutions, development of new cooperation projects and participation in technological platforms. Ensure the participation of state science institutions in international exhibitions, fairs, science congresses, thus promoting the recognition of Latvia science in the EU and the world.	7 000 000
3.	Development of the scientific and research infrastructure	To improve scientific and research equipment and to provide the relevant infrastructure in order to ensure a modern material and technical base for research activities at the leading national and regional research centres, develop information system, data basis and academic data transmission network of Latvia, provide science and research resources and their accessibility, thus, promoting the development of the intellectual potential of research and involvement of Latvian science in the unitary European science.	202 017 425

***Table 4*: Innovation and Knowledge Transfer Promotion Activities Supported by EU funds**

No.	Activity (indicative)	Objective of the activity (indicative)	Amount of financial support within the activity (EUR) for the period 2007 - 20013
Measure "Innovations"			
1.	Commercialisation of science and transfer of technologies	Enhancement of business competitiveness by establishing Competence Centres and Centres of Knowledge transfer and commercialisation. The Competence Centres will encourage cooperation of the research and industry sector in the implementation of projects of industrial research (applied research) and the development of new products and technologies. The centres of knowledge transfer and commercialisation will ensure a systematic framework for promoting commercialization of research as well as studying research competence (capacity) and purposeful development in universities and institutes.	78 108 000
2.	Development of new products and technologies	To promote the development of new or significantly improved products or technologies by providing aid, also to introduce successfully developed products, services and technologies in production and by awarding grants to enterprises for the development, patenting and transfer of new products and technologies and their introduction in production.	83979 774
3.	High value-added investments	To promote entrepreneurship with a high value added by encouraging local enterprises to invest in knowledge-based and/or technology-intensive projects and by attracting foreign investment to the industries with a high value added in order to foster transfer of the state-of-the-art technologies from abroad. This would ensure strengthening international competitiveness of the enterprises involved and the respective industry, increasing export volumes and the promotion of innovations and manufacturing of products with a high value added. The selection criteria will exclude the transfer of jobs from other Member States to Latvia with the help of this activity.	250 034 706

Source: Operational Programme "Entrepreneurship and Innovations", 2007:51–53 and 57-59

As mentioned earlier, as the main strategic document in the field of innovation "*Program for Promoting Entrepreneurial Competitiveness and Innovation 2007 – 2013"* also includes all the activities financed from EU funds. Therefore the above table represents part of the activities and financing devoted to innovation that is included in the program. Furthermore, the program also includes several innovation supporting

activities that are financed from the state budget. These activities are mostly aimed at educating; informing and increasing awareness in the society about innovation (see ***Table 5***).

***Table 5*: Innovation and Knowledge Transfer Promotion Activities Supported from Latvia's State Budget**

No.	Activity	Institution responsible for the support activity	Amount of financial support within the activity (EUR)* for the period 2007 - 20013
1.	To organize informative seminars and issue informative materials about innovation	Ministry of Economics; Investment and Development Agency of Latvia (Latvijas Investīciju un attīstības aģentūra)	503 697
2.	To identify, promote and implement best practice within the field of innovation in businesses	Ministry of Economics; Investment and Development Agency of Latvia	569 149
3.	To organize the contest "Innovation award"	Ministry of Economics; Investment and Development Agency of Latvia	110 984
4.	To support market oriented research projects	Ministry of Education and Science	11 850 000
5.	To support operation of innovation promotion centre in Latvia	Ministry of Economics; Ministry of Education and Science; Investment and Development Agency of Latvia; Latvian Technological Center (Latvijas Tehnoloģiskais centrs)	59 760 (current financial support) 961 861 (additional financial support needed)
6.	To support establishment and operation of innovation centres in HEIs and state scientific institutes	Ministry of Economics	1 700 000 (current financial support) 6 400 000 (additional financial support needed)

Source: "Program for Promoting Entrepreneurial Competitiveness and Innovation 2007 – 2013", 2007: Annex I, 12-15

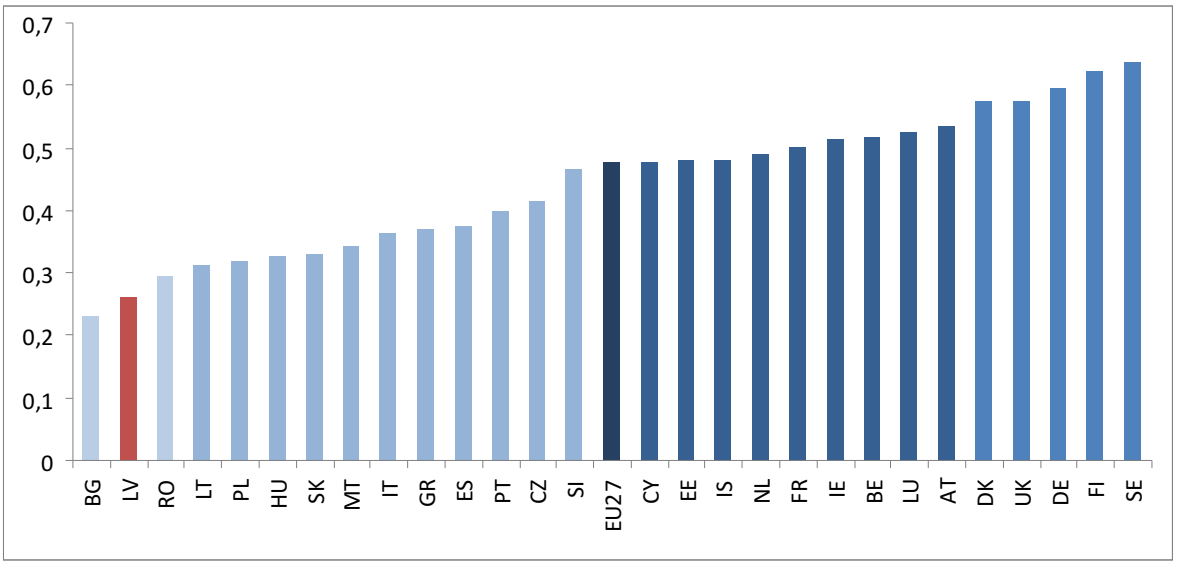
5.3. Innovation Environment in Latvia

When promoting and supporting some part of country's economy it is not only the inputs that matter; the outputs and results are even more important. They show whether the inputs and financial support have been utilized effectively and whether they have given any results. Therefore the objective of this section is to describe the overall innovation environment in Latvia based on statistical data to see whether the support and measures described in the previous section have reached their aim of improving the innovation environment in the country. Since there is no specific statistical data available on knowledge transfer this section only describes statistical data on innovation.

* Calculated based on the fixed exchange rate: EUR 0.702804 (source: The Bank of Latvia (Latvijas Banka) http://www.bank.lv/eng/main/all/)

The main source of the information about innovation performance in any EU country is European Innovation Scoreboard (EIS). It provides a comparative assessment of the innovation performance of EU27 Member States, under the EU Lisbon Strategy (see ***Figure 15***). Furthermore, the EIS 2009 includes innovation indicators and trend analyses for the EU27 Member States as well as for Croatia, Serbia, Turkey, Iceland, Norway and Switzerland. (European Innovation Scoreboard 2009, 2010:6)

***Figure 15*: Summary of Innovation Performance for EU27 Member States in 2009**



Source: European Innovation Scoreboard 2009, 2010:6 and Annex E

Based on their innovation performance across 29 indicators, EU27 Member States fall into the following four country groups:

1) Innovation leaders (e.g. Sweden, Finland, Germany);
2) Innovation followers (e.g. Austria, Luxembourg, Belgium);
3) Moderate innovators (e.g. Czech Republic, Portugal, Estonia);
4) Catching-up countries (e.g. Romani, Latvia, Bulgaria).

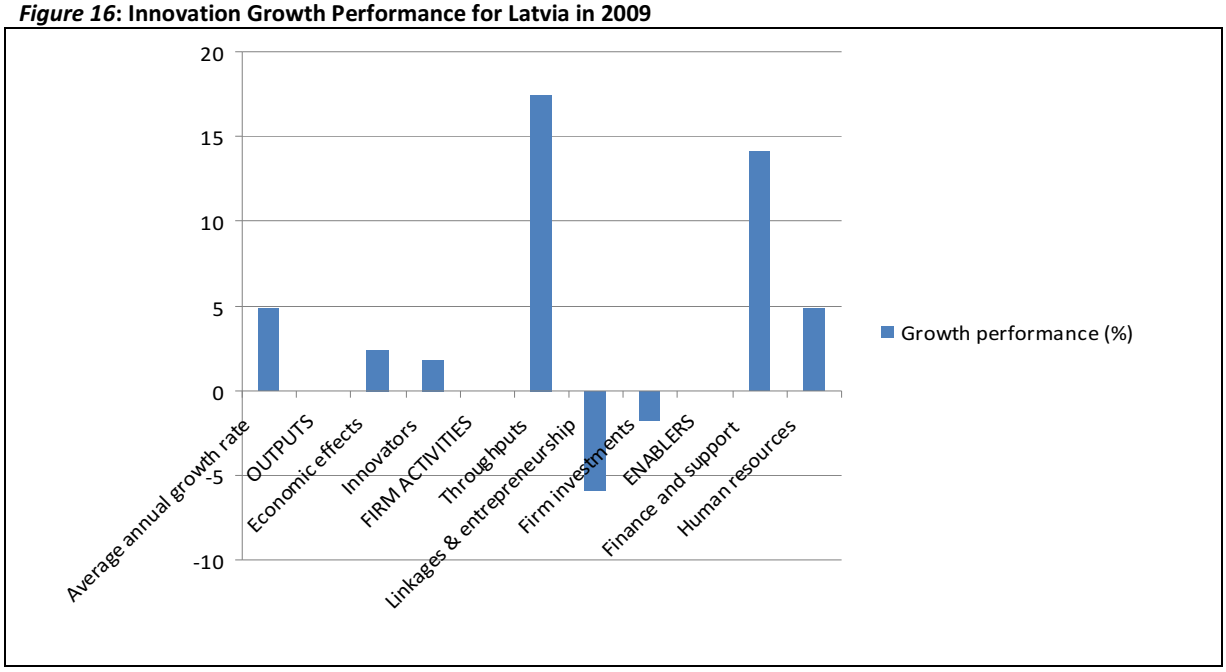
As it can be seen from the ***Figure 15***, Latvia, together with Romania and Bulgaria, belongs to the group of catching-up countries. Innovation performance for these countries is well below the EU27 average. Nevertheless, as it is stated in EIS 2009 report, the rate of the improvement is above that of the EU27. (EIS 2009, 2010:44)

Like mentioned earlier, the above displayed innovation performance indexes are calculated by evaluating 29 innovation indicators. Therefore, to explain innovation performance of a specific country, its relative strengths and weaknesses as well as its main drivers of innovation growth, a more detailed look at the innovation indicators should be taken. ***Figure 16*** shows more detailed country profile of innovation performance growth for Latvia based on 3 main categories: outputs, firm activities and enablers.

Relative strengths for innovation in Latvia, as it can be seen from the graph, are in human resources and finance and support, relative weaknesses are in linkages & entrepreneurship, throughputs and innovators. As for the main drivers of the improvements in innovation performance, finance and support as well as

throughputs should be mentioned. It is in particular a result from growth in more detailed indicators such as public R&D expenditures (18.9%), private credit (15.4%), European Patent Office patents (17.8%), community trademarks (35.9%) and community designs (21%). On the other hand, performance in linkages & entrepreneurship has worsened, in particular due to a decrease in the firm renewal rate (-17.2%). (EIS 2009, 2010:44)

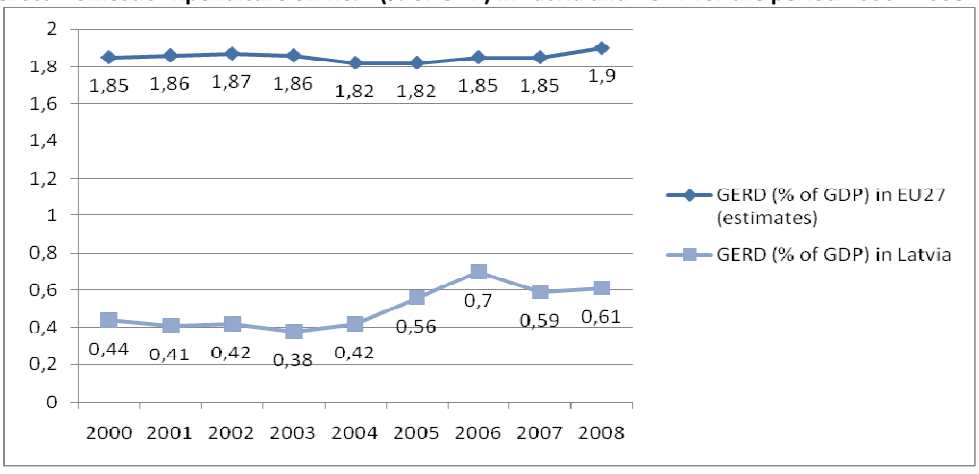
***Figure 16*: Innovation Growth Performance for Latvia in 2009**



Source: European Innovation Scoreboard 2009, 2010:44 and Annex B

Although EIS gives a comprehensive overview of innovative performance in all EU countries there are several other indicators used to evaluate country's innovation environment. For example, gross domestic expenditure on R&D (GERD), measured as a percentage of GDP, indicates expenditure on R&D performed on the national territory during a given period. Below displayed ***Figure 17*** indicates GERD in Latvia comparing to the EU27 average (estimated) over the period 2000 – 2008.

***Figure 17*: Gross Domestic Expenditure on R&D (% of GDP) in Latvia and EU27 for the period 2000 - 2008**



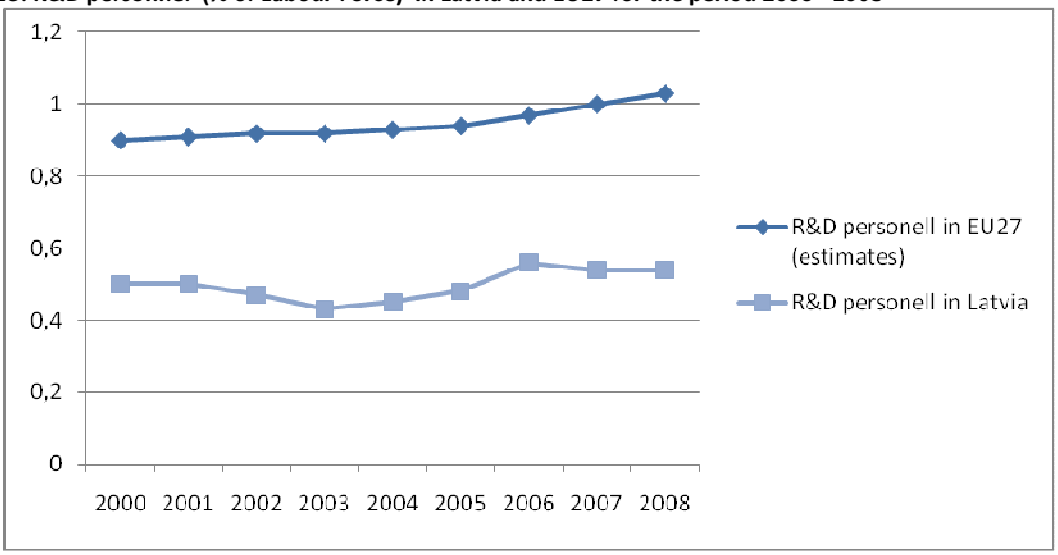
Source: Eurostat

By comparing GERD in EU27 and Latvia, it can be seen that Latvian GERD level is very low – sometimes even more than 4 times lower than the EU27 average. This can be one of the reasons why Latvian innovation performance is also very low.

Looking closer at the structure of GERD in Latvia, the statistical data shows that it is dominated by the GERD from the government sector (47.3% in 2008) followed by business enterprise sector (27%) and GERD from abroad (23.1%). Only over the last couple of years (2005 – 2008) some R&D is also financed from higher education sector and private non-profit sector although these amounts are still very small – respectively 2.5% and 0.3% in 2008. (based on Eurostat)

Another important indicator describing innovation performance in the country is R&D personnel as a percentage of the labour force and its structure. As showed in ***Figure 18***, in Latvia, in comparison to EU27, the percentage of R&D personnel in the labour force is approximately 2 times lower. Most of the R&D personnel is employed by higher education sector (0.31% in 2008) followed by and the government sector (0.13%) and the business enterprise sector (0.1%). No R&D personnel in Latvia are employed by the private non-profit sector.

***Figure 18*: R&D personnel (% of Labour Force) in Latvia and EU27 for the period 2000 - 2008**



Source: Eurostat

After this analysis of quite disappointing statistical data on Latvian innovation performance a question arises: what are the main factors keeping Latvia from reaching better innovative performance? Based on the analysis carried out by *Ministry of Finance of Republic of Latvia* (*Latvijas Republikas Finanšu ministrija*) as the main institution responsible for planning EU support measures and developing EU planning documents, several problems in the field of innovation have been identified:

1) Low number of innovative enterprises;
2) Low R&D funding (public and private);
3) Insufficient number of employees working in the R&D area;
4) Research is not business oriented; research is not stimulated by local demand;
5) Insufficient participation of enterprises in international technology transfer projects;
6) Low activity in the area of transfer of technologies. (Operational Programme "Entrepreneurship

and Innovations", 2007:21)

Additionally, in the *Operational Programme "Entrepreneurship and Innovations"* a SWOT analysis of innovations in Latvia is carried out. It lists specific sectors featuring highly-qualified human resources and scientific potential as a strength of the Latvian innovation system; the main weaknesses include all of the above listed problems. Opportunities to improve innovation performance in Latvia might lie in strengthening and promoting transboundary and international cooperation in the field of innovations as well as in development of a national innovation systems encouraging cooperation between scientists and entrepreneurs, facilitating technology transfer, R&D activities in the private sector thus both increasing the amount of available R&D funding and diversifying its structure. The main threat for innovations in Latvia is the exodus of educated professionals and scientists. (ibid: 34)

6. Main Actors in The Process of Knowledge Transfer from Higher Education Institutions to Businesses in Latvia

When some specific processes are selected for analysis they still cannot be detached and separated from their environments and overall backgrounds; the same stands true for knowledge transfer process from HEIs to businesses. The current state of HEI and business sectors has an undeniable effect on frequency, efficiency and quality of knowledge transfer between these sectors. Moreover, government policies defined for both of the fields affect strategic trends in the sectors and therefore they also have influence on the processes taking place between the sectors and that also includes knowledge transfer. These are the factors why knowledge transfer process between HEIs and businesses should be viewed and analyzed in close connection to their environments – HEI and business sectors in Latvia.

For the reasons mentioned above this chapter provides information on higher education, science and research as well as business sectors in Latvia. The chapter includes 2 sections each devoted to one of the sectors analyzed; these sections briefly cover history of both sectors, description of current affairs in the field, strategic trends and possible future directions, main problems encountered and government support activities addressed to promote each industry and to solve the identified problems. While discussing government support measures and policies the emphasis is put on incentives that in both of the sectors could enhance mutual collaboration and knowledge transfer.

6.1. Higher Education, Science and Research Sector in Latvia

The first universities in Latvia were established at the beginning of the 20th century (Adamsone – Fiskovica *et al*, 2009: 133); in 1920 there were 2 universities with total of 3900 students in Latvia. (Melnis *et al*, 2010: 10) Since then the number of universities and students have grown reaching 57 HEIs in 2010 including 31 universities (18 state universities and 13 private universities) and 26 colleges (18 state colleges and 8 private colleges) with total of 112 555 students in academic year 2008/2009. (ibid: 4 and 13)

In many countries HEIs hold the main responsibility for carrying out both educational and research functions; in Latvia, on the other hand, these functions historically have been separated. During the soviet period educational functions were the sole competency of HEIs and research functions were mainly performed by research institutes of *Latvian Academy of Sciences* (*Latvijas Zinātņu akadēmija*). It is only since the early 1990s that determined efforts have been undertaken to integrate the education and research functions. (Adamsone – Fiskovica *et al*, 2009: 134) The last changes with respect to scientific institutes took place in 2005 when, according to *"Concept Document on Legal Status of State Institutions in Higher Education and Science Sector"* (*"Koncepcija par augstākās izglītības un zinātnes nozares valsts institūciju juridisko statusu"*) approved by Cabinet of Ministers on June 21, 2004, a reorganization of state scientific institutes, at that time holding the legal status of state non-profit enterprises, was initiated. The reorganization process was completed in 2006 when 11 state scientific institutes, according to Latvian legislation, obtained the legal status of derivate public person, the rest were integrated into HEIs as their structural units or as public agencies under HEIs' supervision. ("Strategic Guidelines for Science and Technology Development 2009 – 2013", 2009: 5) Currently in Latvia there are 10 state scientific institutes (derivate public persons), 14 HEIs' scientific institutes and 2 private scientific institutes. (Melnis *et al*, 2010: 171) It must be stated that scientific activity is mainly concentrated in Riga and its region; yet lately a

development and growth of scientific capacity can be observed in other Latvian regions too e.g. Daugavpils, Ventspils and Jelgava. ("Strategic Guidelines for Science and Technology Development 2009 – 2013", 2009: 5)

Due to the historical circumstances Latvian HEIs still have a lot of work to do to improve their educational and research functions or, as named by several authors, their first and second missions. Still, as a member of EU and as a country who has stated knowledge-based economy as one of its future objectives, Latvian HEIs also have to put emphasis on implementing their third mission. What is the third mission? The concept of the third mission is not widely known in Latvia, even among the key stakeholders but still there is an emerging consensus that the mission of universities exceeds that of education and research. However, the third mission of HEIs is treated somewhat differently by exact and social scientists, with the distinction being made along the lines of the disciplinary particularities of 'hard' and 'soft' sciences featuring a certain bias towards either commercial or social aspects. Thus, exact scientists refer primarily to innovation, knowledge and technology transfer, commercialization of research results and orientation towards the needs of the business sector, while the representatives of social sciences use phrases such as 'education of the nation', 'general culture function' and 'influence on society and people's minds'. These notions imply a vision of the HEI as contributing to the enlightenment of the public and raising its educational and cultural level rather than giving merely economic returns from its activities. (Adamsone – Fiskovica *et al*, 2009: 133)

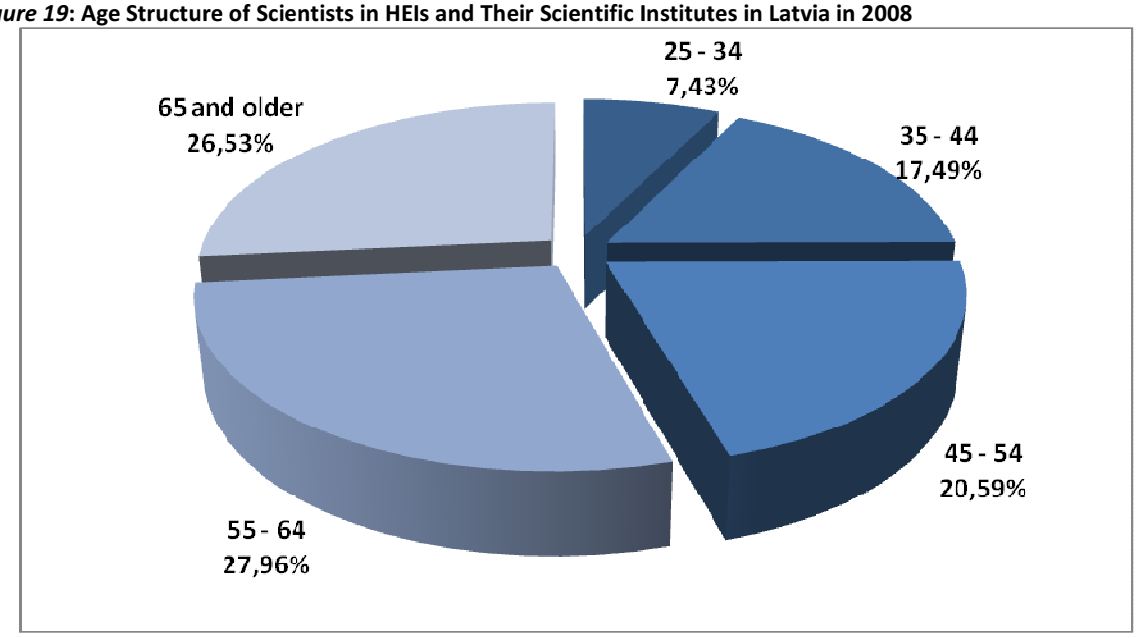
Furthermore, development of linkages between HEIs and the business sector is a relatively new phenomenon in Latvia, with far less experience accumulated compared to many developed countries and an even shorter national record of accomplishment than integrating education and research, both of which can be treated as a precondition for bringing forth the third mission. Nevertheless, efforts to establish and strengthen HEI–business cooperation have been quite active in recent years. (ibid: 135) At present, there are at least three major factors driving the development of these linkages: the lack of a qualified labour force, the recent shift in public policy, and the accompanying incentives of universities.

The lack of qualified labour force is caused by several reasons: first, the 'horizontal brain drain' of science and engineering staff during the transformation period in 1990s; second, the economic emigration of the labour force after joining EU; third, predominance of students in social sciences and humanities (ibid) (e.g. in academic year 2009/2010 54.1% of graduates were in the field of social sciences, business and law, 8.2% in engineering, manufacturing and construction; 5.2% in natural sciences, mathematics and information technologies). (Melnis et al, 2010: 103) Correspondingly the lack of qualified labour force results in lack of qualified personnel in science and research, decrease in number and aging of scientists as well as in inadequate number of PhD students. For example, in 2007 there were 3.8 scientists per 1000 inhabitants in Latvia while in EU-25 this number was 5.4 and in Finland – 16.2 ("Strategic Guidelines for Science and Technology Development 2009 – 2013", 2009: 13); besides, most of the scientists in HEIs and their scientific institutes in Latvia are in the age group from 55 to 64 years (27.96% in 2008) followed by scientists in the age group from 65 years and older (26.53% in 2008) (see ***Figure 19***). As for the PhD students in Latvia, the numbers are as follows: in academic year 2009/2010 all together 674 new PhD students were enrolled in Latvian universities adding up to a total of 2152 PhD students; in academic year 2008/2009 174 students received their PhD degrees. (Melnis *et al*, 2010: 162-163 and 172)

Besides the lack of qualified labour force, other reasons driving the insufficient interest in PhD studies and further career in academia are low salary level as well as unavailability of modern and up to date infrastructure in state scientific institutes. Furthermore, currently there are limited career possibilities in

many industries and specifically in business sector for people with PhD degrees. ("Strategic Guidelines for Science and Technology Development 2009 – 2013", 2009: 13)

***Figure 19*: Age Structure of Scientists in HEIs and Their Scientific Institutes in Latvia in 2008**



Source: Melnis *et al*, 2010: 162 and 163

Moreover, in recent years encouragement of HEIs–businesses cooperation has been prioritized by the government as one important step in building a knowledge-based economy, which was set as a strategic policy goal to ensure the competitiveness of the national economy, which had so far relied mainly on cheap labour and natural resources. (Adamsone – Fiskovica *et al*, 2009: 135) Like mentioned earlier, some of the policy documents listing promotion of collaboration between HEIs and businesses as a priority are *"National Development Plan"*, *"Program for Promotion of Entrepreneurial Competitiveness and Innovation 2007 – 2013"* as well as EU policy planning documents for the period from 2007 until 2013: *"National Strategic Reference Framework"* and OPs (see section *5.2. Institutional and Legal Framework for Innovation and Knowledge Transfer in Latvia)*.

Additionally, since *Ministry of Education and Science* is the responsible institution for education, science and research in Latvia, it has also developed several strategic documents setting out closer interaction between HEIs and businesses or at least creating a better environment to enhance this cooperation as the strategic objectives in these documents. The document most directly aimed at promoting cooperation between HEIs and businesses is *"Strategic Guidelines for Science and Technology Development 2009 – 2013"* (*"Zinātnes un tehnoloģijas attīstības pamatmnostādnes 2009. – 2013. gadam"*) that was approved by *Cabinet of Ministers* on September 16, 2009; the main objective of the guidelines is promote science and technology as a long-term foundation of civil society, economy and culture by ensuring implementation of knowledge-based economy and its sustainable growth. The main tasks to reach the set objective include:

1) To facilitate renewal and further development of intellectual potential and infrastructure of scientific activities in Latvia by establishing HEIs as an internationally competitive centres of R&D that collaborate with HEIs in other regions in Latvia; to support other state and private scientific institutions.

2) To ensure substantial increase in state investments into development of science and technology with financial support mechanisms that would attract and increase private investments in R&D over the time.
3) To advance international competitiveness of Latvian scientific activities by supporting international collaboration in the field of science and technology development.
4) To promote knowledge and technology transfer by establishing innovation friendly institutional environment, implementing support measures and enhancing public – private partnerships. ("Strategic Guidelines for Science and Technology Development 2009 – 2013", 2009: 19)

Other strategic documents and laws setting goals for HEIs and science sector are:

1) *"Strategic Guidelines for Education Development 2007 – 2013"* (*"Izglītības attīstības pamatnostādnes 2007. – 2013. gadam"*) approved by *Cabinet of Ministers* on September 27, 2006: this document puts emphasis on increasing competitiveness of higher education and role of science and research in HEIs.
2) *"Law on Scientific Activity"* (*"Zinātniskās darbības likums"*) that came into force on May 18, 2005: lays out the main rules for conducting scientific activity as well as states that state and private investments in R&D should reach 3% of GDP by 2010.
3) "Law on Higher Education Institutions" ("Augstskolu likums") that came into force on December 1, 1995: sets main regulations for HEIs and their operation.

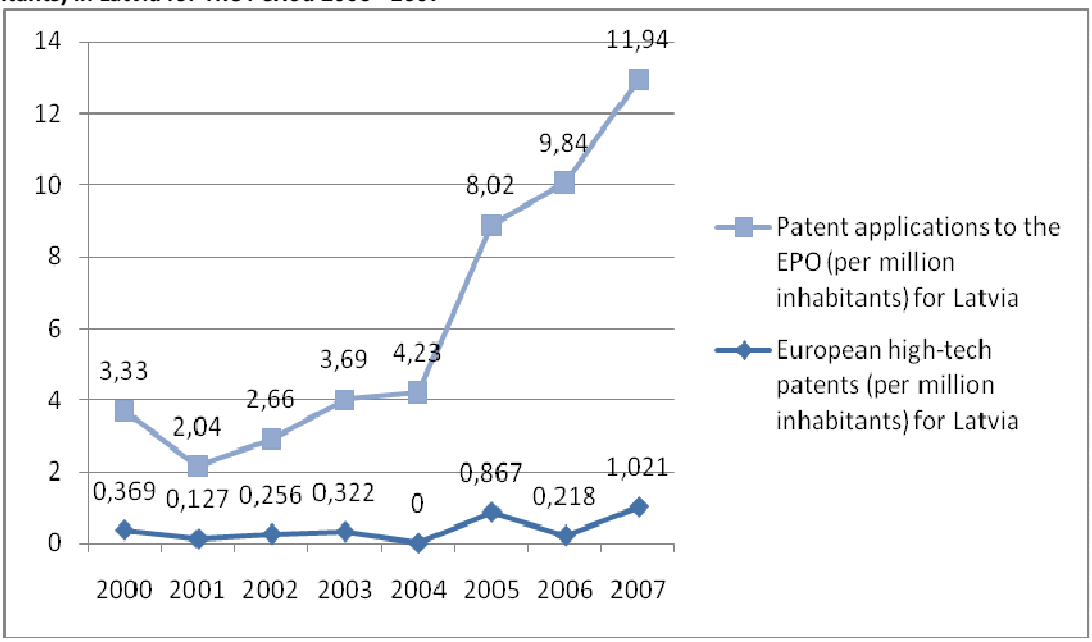
Talking about incentives of universities, they largely come in response to this policy orientation – universities have begun to take more focused actions to pursue industry linkages, spurred also by the need for additional sources of income and comprehension of the need to share their scientific and technological competence. Specific administrative units have been established at various universities to elaborate measures for partnerships with the business sector. Cooperation with business is also emerging as one of the selection criteria when researchers apply for research grants and that is another motivation factor for cooperation. (Adamsone – Fiskovica *et al*, 2009: 135)

Besides the above described problems and motivating factors for HEIs and business interaction there are several more problems Latvian education, science and research sector has to face. First, as already mentioned in the section *5.3. "Innovation Environment in Latvia*", public and private investments in science and research in Latvia are very low and insufficient. Second, science and research infrastructure is underdeveloped and the number of modern and fully equipped laboratories for carrying out technological projects is limited. The situation is even more dramatic in regions outside Riga and other large cities where modern scientific and research infrastructure is still to be developed. Third, limited knowledge and skills within the field of knowledge transfer and commercialization is another drawback – the current number of innovation and knowledge transfer centres and experts is inadequate to ensure effective knowledge transfer processes. There is an increasing demand for world class knowledge and technology brokers, auditors and knowledge and technology transfer consultants. Fourth, broader society and more specifically youth are not very well informed about the new developments and achievements in science and innovation; by providing more information about science, research and innovation to youth and broader society more people could be attracted to these fields in the future.

Last but not least, the poor situation in Latvian science, research and innovation sector is reflected in the low numbers of issued patents – the number of national patents is low (about 100 – 150 patents a year)

and they cannot be recognized as internationally significant and competitive patents therefore the statistics of European Patent Office (EPO) patent applications for Latvia is even lower e.g. although Latvian statistics is improving every year and reaching 11.94 patent applications in 2007 (see ***Figure 20***) it is still far from the numbers reached by the leading countries like Germany with 301.95 patent applications and Sweden with 287.03 patent applications. The situation is even worse with respect to high-tech patents - in the time period from 2000 until 2007 Latvian high-tech patents (per million inhabitants) increase 1 only in 2007 (see ***Figure 20***) while other developed countries reach a lot higher results: Denmark – 20.385; Germany – 19.994. (based on Eurostat) An important driver of this situation is the lack of financial resources available to scientists for patenting their inventions; therefore they either sell it to companies abroad as 'know-how' or they collaborate with these companies in the process of patenting and consequently the companies overtake the property rights to the new invention. ("Strategic Guidelines for Science and Technology Development 2009 – 2013", 2009: 16)

***Figure 20*: European High-tech Patents (per million inhabitants) and Patent Applications to The EPO (per million inhabitants) in Latvia for The Period 2000 - 2007**



Source: Eurostat

Nevertheless, Latvia has always considered itself and has been recognized as a country with a high academic and scientific potential, and since the government has started to note the importance of education, science, research and knowledge in general as an important source for an overall welfare of the country, there is a high possibility that over some period of time Latvia's science and research will catch up with the developed EU countries. Of course this process will not be fast but with concentrated efforts to address the identified problems and to implement the set measures the development of Latvian scientific and research potential is inevitable.

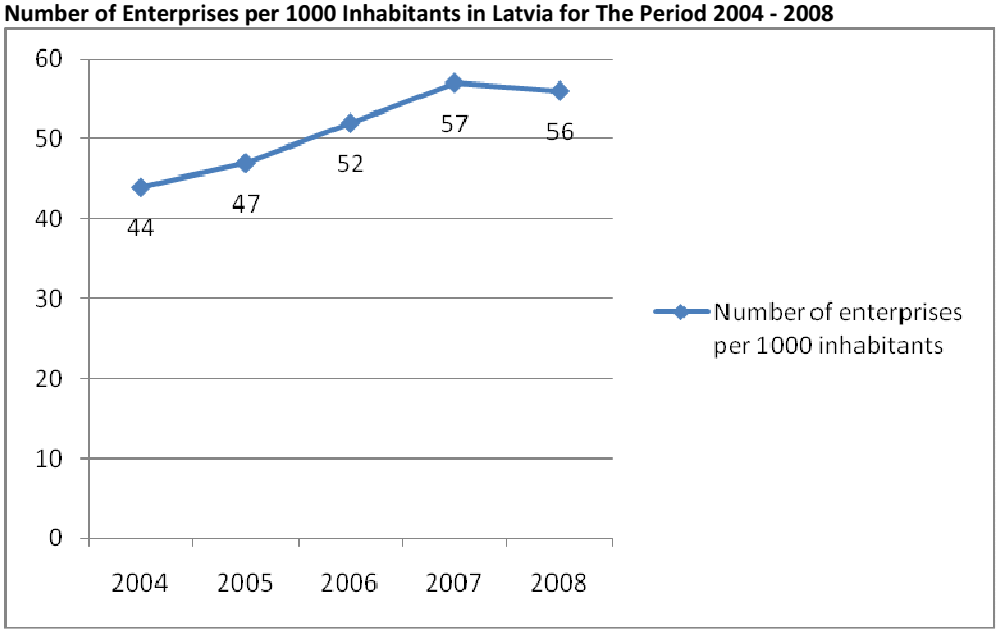
6.2. Business Sector in Latvia

As all the areas in Latvia, business sector does not have a long record of operation. Business sector in Latvia, in the understanding of market economy, started to develop after Latvia gained back its

independence – approximately 20 years ago. The mission to establish well functioning economy and catch up with the rest of the world was not an easy task. Yet, slowly but surely over the years Latvia has managed to improve its performance in business sector and has started to catch up with other EU countries. The objective of this section is to give a short overview of business sector in Latvia, its main problems and possible future developments.

For quite a while Latvia was struggling with respect to the number of enterprises operating in the country – the number of enterprises was low and even with different support measures for new entrepreneurs in place the numbers did not increase. Lately though the situation has started to improve letting Latvia reach the average numbers of EU e.g. in 2008 there were 125 908 enterprises in Latvia reaching 56 enterprises per 1000 inhabitants (see ***Figure 21***). (*Central Statistical Bureau of Republic of Latvia*)

***Figure 21*: Number of Enterprises per 1000 Inhabitants in Latvia for The Period 2004 - 2008**

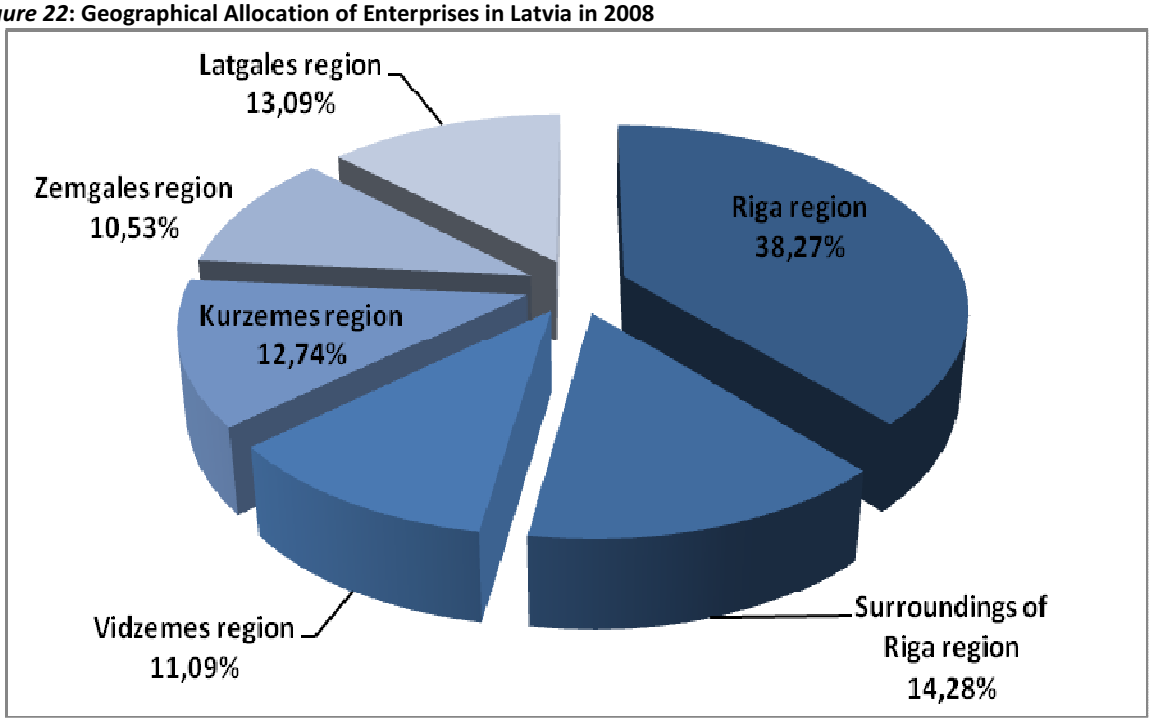


Source: Central Statistical Bureau of Republic of Latvia

Anyhow, since the statistical data is available only for 2008, which also is a year when Latvia was hit by the economical crisis and faced substantial downturn in business sector, the situation might have worsen since then as many enterprises have gone bankrupt. Nevertheless, this data gives an overview of the recent situation and further on latest information on business environment in Latvia is provided.

Further on, the structure of business sector in Latvia is quite similar to that in every EU country – more than 99% of all the enterprises are small or medium size enterprises. In 2008 out of all enterprises there were 87.91% micro enterprises; 9.81% small enterprises; 1.97% medium size enterprise and only 0.31% large enterprises. (*Central Statistical Bureau of Republic of Latvia*) Nevertheless, despite the increasing number of enterprises their geographical distribution is still a major problem in Latvia – most of the enterprises are located in Riga and its surroundings, with far less being located in other major cities and even less in rural areas of Latvia. As it can be seen in ***Figure 22***, in 2008 38.27% of enterprises were located in the region of Riga, 14.28% were located in surroundings of Riga region, 12.74% in Kurzeme region, 13.09% in Latgales region, 11.09% in Vidzeme region and 10.53 in Zemgales region.

***Figure 22*: Geographical Allocation of Enterprises in Latvia in 2008**

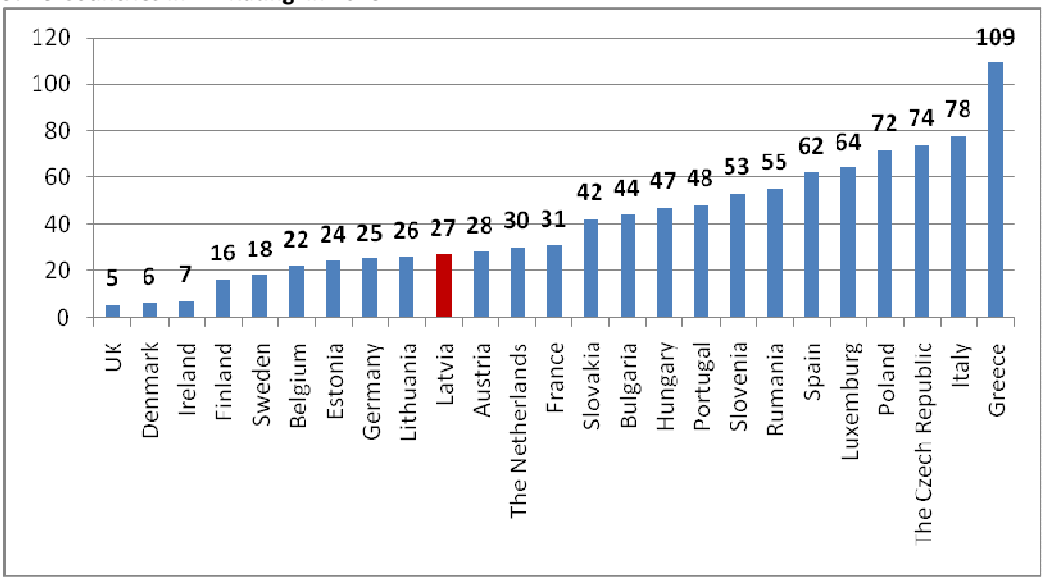


Source: Central Statistical Bureau of Republic of Latvia

The responsible institution for governing, managing and supporting entrepreneurship and business sector in Latvia is *Ministry of Economics*. For monitoring and evaluating business environment in Latvia several tools are used; the most popular being the international study of the *World Bank* "Doing Business" (DB). It is an international, comparative rating of business environment, which measures administrative procedures regulating entrepreneurship and their application in various countries of the world each year. The DB quantitatively measures and compares conditions and procedures regulating countries – both those who promote the activity of entrepreneurship, and those who restrict. Annual rating of business environment and the added thematic report have been developed already for six years. The DB measures the regulation within 10 business areas that cover all stages of entrepreneurship life cycle: starting up entrepreneurship, harmonization of construction, employment, registration of property, credit registers, protection of investors, fulfilment of contractual obligations and termination of the entrepreneurship. The DB is not only a qualitative, descriptive evaluation of business environment, but also a quantitative totality of indicators that measures the regulation of entrepreneurship within 183 various countries of the world. (www.doingbusiness.org)

This year Latvia within the DB index holds the 27th position in the world (see ***Figure 23***); it has risen by 2 positions – from the 29th comparing to the previous year. In comparison to other EU countries Latvia is at the end of the first 10 EU member states – 10th place – leaving behind Austria, the Netherlands and France, but falling quite behind world leaders – UK, Denmark and Ireland. Looking at the context of Baltic States this year in DB index they hold the following positions: Estonia – 24th position, but Lithuania – 26th position. (ibid)

***Figure 23*: EU Countries in DB Rating in 2010**



Source: www.doingbusiness.org

Looking in more detail into the evaluated business areas, Latvia is more successful in areas like enforcing contracts (15th place), trading across borders (22nd place) and paying taxes (45th place). Although it must be noted that the most significant decrease from the previous year is also in these spheres: enforcing contracts (-13 positions), trading across borders (-5 positions) and paying taxes (-8 positions) along with the most drastic decrease in starting business (-16 positions). Less successful Latvia is in the fields of employment (128th place), closing business (88th place) and dealing with business construction permits (78th place). An increase in the ranking can be observed in registering property (+21 positions) and closing business (+1 position). (www.doingbusiness.org)

Another tool for monitoring business environment in Latvia is a study *"Impact of Administrative Procedures upon Business Environment in Latvia" ("Administratīvo procedūru ietekmes uz uzņēmējdarbības vidi pētījums"*), which is conducted every year and helps to find out the opinion of entrepreneurs upon factors preventing their activity and elaborate list of measures that need to be performed in order to improve the current business environment. In accordance with the research results within the inquiry for 2009, 76% of entrepreneurs identified tax rates as a major obstacle. More than a half of entrepreneurs as obstacles see tax administration (55%), frequency of changes in the laws and regulations regarding taxes (52%) as barriers for their businesses. Almost half of entrepreneurs admit that problematic accessibility of finance resources impede entrepreneurship (49%). (Action Plan to Improve the Business Environment for 2010, 2010: 4)

The results from and problems identified within both of the reports DB ranking and in the study *"Impact of Administrative Procedures upon Business Environment in Latvia"* are further addressed in *"Action Plan to Improve the Business Environment"* (*"Uzņēmējdarbības vides uzlabošanas pasākumu plāns"*) which is one of the policy documents designed to improve business environment in Latvia. The plan includes improvement measures in 6 categories: 1) starting up entrepreneurship; 2) tax administration; 3) registration of real estate; 4) customs declaration; 5) electronic government; 6) construction process. (ibid: 12 – 37)

Additionally, there are several other policy documents in Latvia developed in order to improve the business environment and promote entrepreneurship. Since *Ministry of Economics* is the responsible institution for both fields - innovation and entrepreneurship - few of the documents aimed at promoting entrepreneurship are the same as mentioned earlier in connection with enhancing innovations and knowledge transfer. These documents are *"National Development Plan"*, *"Program for Promotion of Entrepreneurial Competitiveness and Innovation 2007 – 2013"* as well as EU policy planning documents for the period from 2007 until 2013: *"National Strategic Reference Framework"* and OPs (see section *5.2. Institutional and Legal Framework for Innovation and Knowledge Transfer in Latvia)*.

In OP *"Entrepreneurship and Innovations"* some problems in the Latvian business sector are identified, they include:

1) Low business activity, small number of enterprises in general as well as in industries with high added value and relatively low intensity of labour and natural resources consumption; insufficient number of enterprises able to survive;
2) The market does not ensure proper availability of financial resources and various financial instruments;
3) The current state aid measure are fragmented and do not provide a complex solution for increasing competitiveness;
4) Weak cooperation between the private sector and public sector (there is a need to encourage public – private partnerships);
5) Shortage of highly-qualified workforce meeting the labour market requirements;
6) Unbalanced business activity in regions. (Operational Programme "Entrepreneurship and Innovations", 2007: 15 – 17)

In order to address these identified problems and needs a set of measures for improvement are defined with the OP; 2 priorities are aimed at promoting entrepreneurship: 1) "Access to Finance"; 2) "Promotion of Entrepreneurship". The priority "Access to Finances" includes one measure with an objective to enhance access to financial capital for new enterprises, small and medium size enterprises as well as large enterprises by offering guarantees, high-risk financial instruments, as well as will developing financial market. (ibid: 61) Within the priority "Promotion of Entrepreneurship", on the other hand, 2 measures are planned; the measure "Business Support Activities" facilitates increase of business activity and access to international trade markets while the measure "Business infrastructure and Improvements to Equipment" enhances business development in regions, fosters cooperation between enterprises and industry associations (cluster development), as well as facilitates development of high value added entrepreneurship. (ibid: 69)

While OP "Entrepreneurship and Innovations" is developed for implementing EU support measures, *"Program for Promotion of Entrepreneurial Competitiveness and Innovation 2007 – 2013"* is an overall policy document including both local and EU support measures. In addition to the EU support measures described above the program includes come additional measure to improve an overall entrepreneurial environment in Latvia and to address these problems:

1) Complex administrative environment;
2) Inflexible tax system;
3) Weak information flow to entrepreneurs about local and EU support tools and measures available.

("Program for Promoting Entrepreneurial Competitiveness and Innovation 2007 – 2013", 2007: 11 and 12)

Looking from the perspective of this thesis work, the main question is: what is the business sector attitude and actions towards knowledge transfer? There are no specific statistical data indicating the number of enterprises engaging in knowledge transfer with HEIs but one indicator that can be used is the number of innovative enterprises. There several general preconditions characterising an innovative enterprise:

1) At least every 3 years an enterprise introduces a new competitive product or technology to improve its competitiveness;
2) The new products have been developed within the knowledge available in the company or in the collaboration with HEIs or individual researchers in Latvia or abroad.
3) The amount of financial resources allocated for the development of new products or services is at least 2% of a turnover. (Booklet "Innovation", 2006: 5)

Furthermore, in addition to the above mention preconditions there are also more formal criteria indicating an innovative enterprise. In Latvia an enterprise is considered to be innovative if it fulfils 2 out of 3 of the following criteria:

1) At least 25% of sales acquired through selling products or services that are less than 5 years old.
2) Profits gained from the products and services that are less than 5 years old are at least 10% of total profits gained.
3) Increase of annual sales of new products is at least 5%. (Booklet "Innovation", 2006: 5)

So, the statistics for enterprises complying with the above stated preconditions and criteria are showed below in ***Table 6***. As it can be seen from the table, the number of innovative enterprises and therefore also percentage of innovative enterprises has risen in manufacturing industry: from 363 innovative enterprises or 14.7 % of innovative enterprises from the total number of enterprises in the period 2006 – 2006 to 658 and 27.1% in the period 2006 – 2008. In service industry, on the other hand, the numbers have decreased: from 476 enterprises and 17.8% in the period 2004 – 2006 to 458 innovative enterprises and 14% from the total number of enterprises in the period 2006 – 2008. Anyhow, these numbers are still quite low and consequently a conclusion can be drawn that businesses are not very motivated to engage in innovative activities such as knowledge transfer from HEIs or others.

***Table 6*: Enterprises Active in The Field of Innovation and Percentage of Enterprises Active in The Field of Innovation from All Active Enterprises in Latvia for periods 2004 – 2006 and 2006 - 2008**

Industry	Enterprises Active in The Field of Innovation in Latvia		Percentage of Enterprises Active in The Field of Innovation from All Active Enterprises in Latvia	
	2004 – 2006	2006 - 2008	2004 – 2006	2006 - 2008
Manufacturing	363	658	14.7%	27.1%
Services	476	458	17.8%	14%

Source: "Program for Promoting Entrepreneurial Competitiveness and Innovation 2007 – 2013", 2007: Annex I, 12-15

Nevertheless, there are several facts that might indicate the change of this trend in the direction towards increase of innovative and collaboration activities within the business field in Latvia. First, the government and the responsible institutions hold a common understanding that Latvian enterprises will only be able to maintain the rate of economic development and create new well-paid jobs only if they become competitive

at the international level, involve in the innovation process, accrue knowledge and use new technologies, as well as capture a high value-added niche in European or global markets. (Operational Programme "Entrepreneurship and Innovations", 2007: 14 and 15) Second, besides stating such strategic future visions these institutions have also developed policy documents and defined measures to promote these activities. Third, in the environment when Latvia is economical crisis and downturn more and more entrepreneurs and society in general come to an understanding that old ways of doing business will not ensure further development or even survival of enterprises and that new and different ways for survival in the current international business environment should be found.

7. Knowledge Transfer Process from Higher Education Institutions to Businesses in Latvia

After reviewing the surrounding environments of knowledge transfer in Latvia as well as the sectors involved in this process – HEIs and businesses, this chapter contains the actual analysis of knowledge transfer process in Latvia. The analysis is based on the information obtained during the conducted interviews as well as it contains information acquired from other sources – the knowledge transfer centres' web pages, policy planning documents, informative materials etc.

Furthermore, the chapter is structured according to the theoretical framework developed for this thesis and based on which the interview questions were formulated. Therefore the first section of the chapter covers information on knowledge transfer centres analyzed and their operations. S*ection 7.2. Initiative* deals with initiation of collaboration and covers the first 2 cycles of the theoretical framework: internal collaboration (between HEI and the knowledge transfer centre) and external collaboration (between HEI and businesses). Further on, the third section covers and analyzes the actual knowledge transfer process while section *7.4. Barriers and Facilitators* elaborates on the main obstacles and drivers for knowledge transfer process in Latvia.

7.1. Knowledge Transfer Centres

As already mentioned earlier, in 2005 *Ministry of Economics* launched a support program and devoted financial aid in order to establish technology transfer centres within HEIs in order to promote commercialization of HEIs' scientific developments and research results. (Ministry of Economics: http://www.em.gov.lv/em/2nd/?cat=30281) These centres were also established in the HEIs selected for the analysis within this thesis work: *University of Latvia* (UL), *Riga Technical University* (RTU) and *Riga Stradiņš University* (RSU). This means that over the years these centres have acquired substantial knowledge and experience with knowledge transfer projects and processes and therefore they were chosen as the main sources of information for the thesis. The main objective of this section is give an overview of each of the centres, their functions and personnel as well as to elaborate on other elements connected with their operation.

7.1.1. University's of Latvia Innovation Centre

Since UL *Innovation Centre* (IC) is UL's structural unit it is important to give a short overview on the universities background and current affairs. UL was established in 1919 – soon after Latvia gained its independence for the first time – therefore UL soon became a symbol of brighter future that will be built by educated Latvian society. Currently UL is the largest university in Latvia providing education to 20 500 students within 13 different faculties and 154 study programs and having 2243 employees (in academic year 2009/2010) (see ***Table 7***). These faculties and study programs cover the following fields: biology; economics and management; history and philosophy; medicine; theology; computing; education, psychology and art; humanities; physics and mathematics; chemistry; geography and earth sciences; law; social sciences. Regarding performance indicators in research, in 2008 there were 756 PhD students in UL of which 80 received their degrees in academic year 2008/2009; in 2008 UL held 23 patents and licences (see ***Table 7***). (University of Latvia website: http://www.lu.lv/)

***Table 7*: UL Performance Indicators for 2008 and Academic Year 2009/2010**

Number of Students (2009/2010)	Number of Employees (2009/2010)	PhD Students (2008)	PhD Degrees Received (2008/2009)	Patents and Licences (2008)
20 500	2243	756	80	23

Source: Melnis *et al*, 2010: 54, 116 and 170

Referring back UL IC, it was developed in 2006 and the overall objective of the centre is to promote involvement of UL as an innovation partner in building knowledge-based economy in Latvia, ensuring collaboration opportunities between UL researchers and businesses for both wider use of UL's knowledge, competences and technologies as well as for commercialization of research results. All of the centre's activities can be divided into 4 strategic stages:

1) Development and maintenance of innovation friendly environment;
2) Marketing;
3) Identification and promotion of innovative ideas;
4) Commercialization of ideas. (UL Innovation Centre website: http://www.lu.lv/par/strukt/departamenti/apd/ic/)

Moreover, UL IC's services are mostly targeted at 2 target groups: scientists and businesses; for each of the target groups the centre provides different services (see ***Figure 24***).

***Figure 24*: IC's Target Groups and Activities**

Target group: Businesses

- Information on collaboration opportunities with LU
- Information on services provided by LU laboratories
- Information on LU scientists' developments
- Consulting services on new product development
- Consulting services on intellectual proprty rights
- Organizing events with researchers for generation of new ideas and solutions

Target group: Scientists

- Consulting services on intellectual property rights
- Consulting services on commercialization of research results or ideas
- Informing investors about research results and ideas that could be commercialized
- Information on attracting financial resourses for commercialization of research results or ideas
- Development of Commercialization proposals
- Financial suuport for participation in exhibitions
- Financial support for verification, registration and maintenance of intellectual property rights
- Provision of *Proof of concept* financing
- Organizing of meetings with businesses and investors

Source: UL Innovation Centre website: http://www.lu.lv/par/strukt/departamenti/apd/ic/

As it can be seen from the table above, to businesses UL IC provides information on: 1) collaboration opportunities with scientists in order to receive consulting services or to order some specific research projects; 2) services provided by UL's laboratories in order to carry out various expertises and analysis; 3) scientific developments and research results. Additionally, IC can be approached by businesses in order to obtain consultations regarding new product development and registration and use of intellectual property rights; besides, the centre organizes meetings with scientists to encourage generation of new ideas and solutions. (UL Innovation Centre website: http://www.lu.lv/par/strukt/departamenti/apd/ic/)

To assist scientists with their needs IC ensures consulting services regarding intellectual property rights and commercialization on research results and ideas. Moreover, the centre informs businesses about ideas, research results and scientific developments that can be commercialized and helps scientists to prepare commercialization proposals. Scientists can also approach IC regarding financial matters since the centre helps with information about possibilities to attract financial resources for commercialization of ideas or research results, it provides support for taking part in exhibitions, for verification, registration and maintenance of intellectual property rights as well as it provides *Proof of concept* financing. *Proof of concept* fund is a collaboration incentive of UL and risk capital investment company's *Imprimatur Capital* to promote commercialization process of UL intellectual property. Last but not least, IC organizes meetings where scientists can meet their potential business partners and investors (see ***Figure 24***). (ibid)

Currently to execute all the above mentioned functions and provide the services there are 4 employees in IC: Head of the Centre, Project Leader, Project Leader's Assistant and Project Administrator. Their educational backgrounds include economy, law, biology and chemistry as well as microbiology (interview materials: annex IV: 100); and their duties within the centre are segregated as follows:

1) Head of the Centre: development and implementation of innovation strategy for UL; initiation of technology transfer projects and coordination of the process of intellectual property rights commercialization;
2) Project Leader: coordination of European Regional Development Fund (ERDF) project „Development of Technology Transfer Office at University of Latvia"; development and maintenance of intellectual property policy for UL academic staff; consultations on intellectual property protection;
3) Project Leader's Assistant: administration of ERDF project „Development of Technology Transfer Office at University of Latvia"; collection of information on innovative activities in UL; improvement and maintenance of data base on scientific competencies of UL academic staff; organization of informative events;
4) Project Administrator: management of project of Biotechnology Science Park of University of Latvia; involvment of university personnel and biotech branch enterprises in the activities of the park; initiation, promotion and coordination of the development projects of the park. (UL Innovation Centre website: http://www.lu.lv/par/strukt/departamenti/apd/ic/)

7.1.2. Riga Technical University's Innovation and Technology Transfer Centre

RTU, within which RTU *Innovation and Technology Transfer Centre* (ITTC) operates, was established in 1892; over the time its name has been changed but nevertheless its mission has always been to provide high quality engineering and technical education. Currently there are 8 faculties within RTU providing education in fields like architecture and urban planning, civil engineering, computer sciences and information

technologies, electronics and communication, power and electrical engineering, engineering economics and management, materials sciences and applied chemistry, transport and mechanical engineering. (Riga Technical University website: http://www.rtu.lv/en/content/view/878/1357/lang,en/) In academic year 2009/2010 there were 15 715 students and 2797 employees in RTU. In research there were 429 PhD students in 2008 and in academic year 2008/2009 36 of them received their degrees, additionally, in 2008 RTU held 103 patents and licences (see ***Table 8***).

***Table 8*: RTU Performance Indicators for 2008 and Academic Year 2009/2010**

Number of Students (2009/2010)	Number of Employees (2009/2010)	PhD Students (2008)	PhD Degrees Received (2008/2009)	Patents and Licences (2008)
15 715	2797	429	36	103

Source: Melnis *et al*, 2010: 54, 116 and 170

Talking about ITTC, it was established in 2007 within the previously mentioned initiative from *Ministry of Economics*. The main objective of the centre is to facilitate development and growth of RTU in fields of innovation and technology transfer as well as to increase recognition and competitiveness of the university's intellectual potential and to promote establishment of environment that is beneficial and opened to innovations and new technologies. (RTU Innovation and Technology Transfer Centre website: http://www.rtu.lv/content/view/128/646/lang,lv/)

Moreover, ITTC has several areas of operation that include:

1) Ensuring technology transfer processes;
2) Acknowledging and evaluating intellectual potential;
3) Maintaining scientific competences and research data base;
4) Searching for collaboration partners;
5) Organizing events to promote science and other marketing activities;
6) Ensuring and promoting communication regarding science;
7) Organizing of conferences and seminars;
8) Development of local and international collaboration networks;
9) Consulting. (ibid)

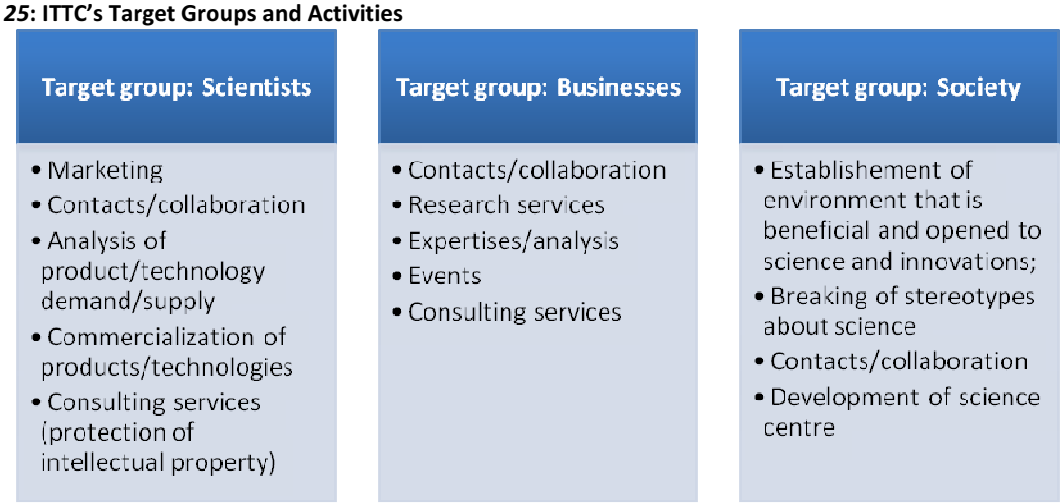
The above described ITTC's activities are aimed at several target groups: scientists, businesses or society in general (see ***Figure 25***). For example, in order to assist scientists the centre provides help with marketing activities; these activities include: 1) any kind of printed advertising and promotion materials – booklets, catalogues, books, publications in both printed and electronic media in Latvia and abroad; 2) organizing different events – conferences, seminars, contact exchanges and exhibitions. Additionally, ITTC helps scientists to find new contact and promote collaboration with businesses, scientists and society. Other functions aimed at scientists include gathering and evaluating information on product and technology supply and/or demand; commercialization of new products and technologies as well as providing consulting services with respect to protection of intellectual property rights. (Information material on ITTC and interview materials: annex IV: 104 and 105)

Furthermore, with respect to businesses ITTC assists with finding contacts and collaboration partners within the university and helps businesses receive necessary services – research projects, expertises, analysis etc. As for the scientists, the centre provides consulting services to businesses with respect to knowledge

transfer and possible cooperation projects and organizes contact exchanges and meetings with scientists to promote mutual interaction. (ibid)

Last but not least, as it can be seen in ***Figure 25***, another ITTC's target group is society in general. Regarding society the main objective of the centre is to break existing stereotypes about science and establish environment that is beneficial and opened to science and innovation. This is mainly done through organizing science promotion events e.g. Scientists' Night and RTU Science Fair; by establishing contacts and cooperation between scientists and society as well as by developing Science Centre. (ibid)

***Figure 25*: ITTC's Target Groups and Activities**



Source: Information material on ITTC and interview materials: annex IV: 105

With respect to future there are several goals ITTC wants to reach:

1) ITTC as a recognized institution within RTU, in Latvia and internationally;
2) RTU (through ITTC) is a leader in promotion of science and innovation;
3) ITTC data base in Scientific Department's information system containing information on RTU scientific and innovative potential: proposals, products, technologies, equipment, patents and experts;
4) Several cases of best practice in knowledge transfer between HEI and businesses;
5) RTU Science Centre. (Information material on ITTC)

Nevertheless, in order to implement all of the above mentioned functions and the future vision of ITTC currently there are 5 employees: Head of ITTC, ITTC Project Manager, Head of RTU Technology Transfer Office (TTO) and 2 other employees. Their educational backgrounds include: journalism, communications and public relations; engineering and economics; engineering; sociology; management sciences. Duties among the employees are not strictly segregated but still each of them has his/her own specialization; this is also important to ensure that employees constantly can improve their knowledge in their fields of specialization. As admitted by the Head of ITTC, it is planned to formalize segregation of duties in the nearest future. (Interview materials: annex IV: 105 and 106)

7.1.3. Riga Stradiņš University's Technology Transfer Office

RSU has grown out of the Riga Medical Institute that was established in 1950, nowadays the university

offers medicine and health care studies and dynamic social science studies steeped in historic traditions, but incorporating the latest world trends. Within the field of medicine and health RSU's programs cover medicine, pharmacy, rehabilitation, public health and dentistry while in the field of social sciences the university provides education in European studies, law and communications. Comparing to other universities selected for analysis RSU is the smallest one: in academic year 2009/2010 it had 4662 students, 891 employees, in 2008 there were 182 PhD students of whom 20 received their degrees in academic year 2008/2009 as well as it held 16 patents and licences (see ***Table 9***). (Riga Stradiņš University website: http://www.rsu.lv/)

***Table 9*: RSU Performance Indicators for 2008 and Academic Year 2009/2010**

Number of Students (2009/2010)	Number of Employees (2009/2010)	PhD Students (2008)	PhD Degrees Received (2008/2009)	Patents and Licences (2008)
4662	891	182	20	16

Source: Melnis *et al*, 2010: 54, 116 and 170

Situation regarding RSU innovation and technology transfer centres are a bit different than in UL and RTU. In 2007 with state aid provided my *Ministry of Economics*, just like in case of UL and RTU, *Innovation Centre for Construction of Medical Appliances* (*Medicīnas aparātbūves inovāciju centrs*) (MAIC) was established within RSU; its main objective was to support and promote development of knowledge based enterprises with the field of construction of medical appliances and other related fields as well as to facilitate commercialization of research results. Currently the centre has transformed into a business incubator rather than a knowledge transfer agent between HEI and businesses that is the main focus of this analysis. (Innovation Centre for Construction of Medical Appliances website: http://www.rsu.lv/medicinas-aparatbuves-inovaciju-centrs and interview materials: annex IV: 111)

Nevertheless, the role of knowledge transfer agent within RSU has been taken by *Technology Transfer Office* (TTO) that was established in September, 2008. The office was established within the EU funds' support framework for innovation for the period 2007 - 2013 (Operational Program "Entrepreneurship and Innovations"; priority "Science and Innovations"; measure "Innovations"; activity "Commercialisation of Science and Transfer of Technologies"; sub-activity "Technology Transfer Offices"). The objective of TTO is to support RSU scientists in launching, or commercialising, the results of their research work, to assist in the protection of intellectual and industrial property – preparation of patent applications, registration of trademarks and designs, registration of copyrights in the name of RSU, and in the provision of custom research services and research-related services. (RSU Technology Transfer Office website: http://tpk.rsu.lv/index.php/about-tto) This the reason why TTO instead of MAIC was chosen a source of information for this thesis work.

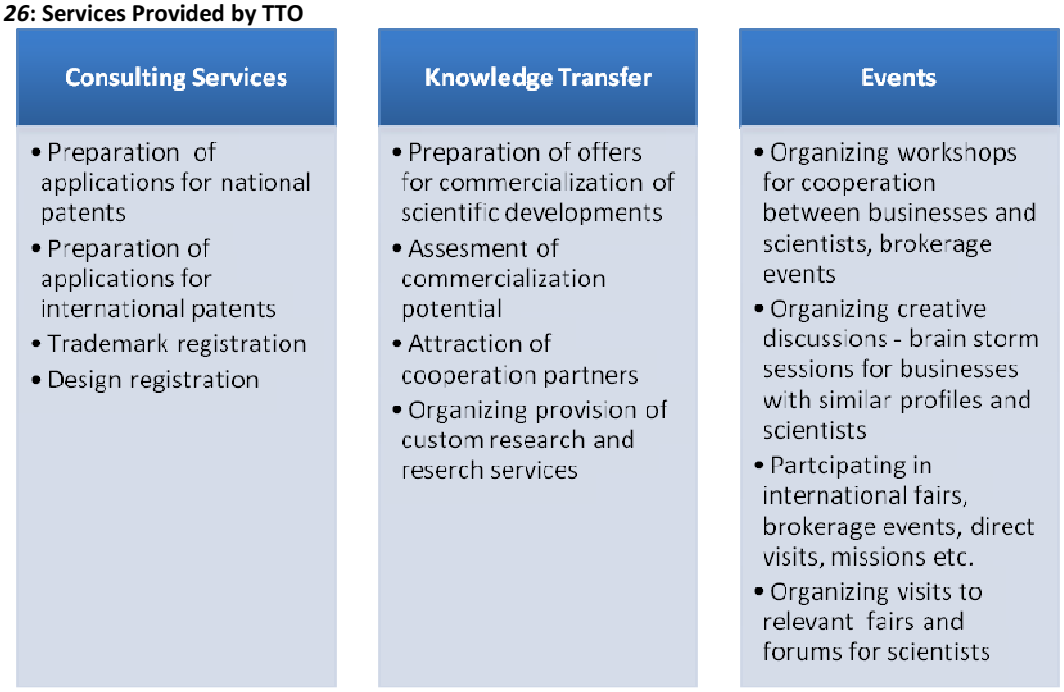
The main tasks of the office include the following:

1) Creating and maintaining database on the scientific competences at RSU;
2) Contributing to commercialisation of RSU research work, preparation of offers;
3) Protecting and developing RSU intellectual and industrial property;
4) Organizing cooperation between RSU scientists and businesses, including brokerage events. (ibid)

The main target groups of TTO are RSU scientists and businesses, and each of these target groups are provided with services in 3 main areas: consulting services, assistance in knowledge transfer processes and

organizing of events (see ***Figure 26*** for more information). For example, within the field of consulting TTO helps with preparation of applications for national and international patents as well as assists with registration of trademarks and designs. In the field of knowledge transfer, on the other hand, the office performs assessments of commercialization potential, attracts cooperation partners etc. Organizing workshops for cooperation between businesses and scientists as well as creative discussions are part services provided within event organization.

***Figure 26*: Services Provided by TTO**



Source: RTU Technology Transfer Office website: http://tpk.rsu.lv/index.php/services

Currently there are 2 full time employees in TTO - The Head of the Office and her Assistant. The Head of the Office has educational background in business management and innovation management combined with work experience in innovation centres and innovation supporting institutions. Additionally, there are 2 part time (they are paid based on hours worked) employees in TTO – experts that deal with specific issues when necessary. One of the experts has experience in technology transfer and matchmaking while other deals with intellectual property rights protection (in medicine), licensing and agreements. The functions are divided among the employees based on their specialities. (Interview materials: annex IV: 112)

7.1.4. Technology Transfer Offices

Previous analysis of the knowledge transfer centres and offices indicated that there 2 kinds of knowledge transfer agents within universities are possible. The main reason for that is purely bureaucratical, and this section tries to briefly explain reasons behind it.

As explained earlier, the first incentives for establishing knowledge transfer centres in Latvia were passed in 2005 by *Ministry of Economics*, and soon after that the first knowledge transfer centres were established within the largest universities in Latvia. These centres also included the above described LU IC, RTU ITTC and RSU MAIC.

Later on, within the Latvian framework for implementation of EU funds for the planning period of 2007 – 2013 support for knowledge transfer from HEIs to businesses was provided. In operational program "Entrepreneurship and Innovations" a priority "Science and Innovations" were set which included a measure "Innovations"; further on, one of the activities within this measure was "Commercialisation of Science and Transfer of Technologies" which then again included sub-activity "Technology Transfer Offices". Therefore in order to receive the financial support within this sub-activity HEIs had to establish new structural units carrying out knowledge transfer activities; within RSU technology transfer office was developed as a separate structural unit from MAIC while in UL and RTU technology transfer offices were established as structural units of IC and ITTC respectively.

Within Latvian legislation developed for implementation of the sub-activity knowledge transfer office is defined as a structural unit of HEI or scientific institute which supports and promotes knowledge and technology transfer activities and is responsible for establishing and maintaining external contacts with business sector by providing information on the organization's research activities and competences. ("Regulations on Sub-activity 2.1.2.1.2. "Technology Transfer Offices" from Operational Program's "Entrepreneurship and Innovations" Compliment") Moreover, the legislation provides regulations on what functions can be undertaken by the technology transfer centres, these functions are:

1) Development and maintenance of data base containing information on institution's competences;
2) Preparation of commercialization proposals for scientific developments and research results;
3) Registration and maintenance of industrial property rights;
4) Organizing of cooperation seminars for scientists and businesses, conferences and brokerage events;
5) Participation in international fairs, exhibitions, brokerage events, direct visits, missions and other events to promote commercialization of research results and scientific developments;
6) Provision of publicly available information on competences of scientific institution and knowledge and technology transfer;
7) Organizing of informative events to promote the technology transfer centre's activities. (ibid)

While situation is more or less clear regarding functions of RSU TTO – it includes all the functions determined in the legislation, the question remains: how UL IC and RTU ITTC deals with incorporating functions of technology transfer centres in their daily work. As the author found out in the interviews, in both cases technology transfer centres are treated as projects carried out by the centres. Additionally, the functions of both institutions are mainly separated due to administrative reasons e.g. accounting and reporting for the technology transfer offices should be kept separate from the rest of the activities. Nevertheless, the employees of UL IC and RTU ITTC carry out functions for both the centres and the technology transfer centres; this mainly due to the shortage of human resources. (Interview materials: annex IV: 100 and 104)

7.1.5. Challenges and Problems Identified

After analyzing knowledge transfer centres and offices established with HEIs chosen for analysis a few challenges and problems have been identified by both the author of the thesis as well as the interviewees. Therefore this sub-section attempts to summarize the main challenges and problems identified regarding knowledge transfer centres and their operation.

First, as described in the previous section, quite complicated administrative structures have been created within UL IC and RTU ITTC due to the establishment of the technology transfer offices in order to receive support from EU funds. Of course, participating in any project to receive EU funding involves obeying several rules and regulations as well as regular reporting to responsible institutions which adds an additional administrative burden to the institution receiving the support. Nevertheless, it seems that in this situation the responsible institutions could have thought about other ways of supporting the defined functions of technology transfer offices without requiring HEIs to establish new structural units and creating more complex administrative structures within the centres that have been already established.

Furthermore, as noted by the Head of RTU ITTC, there are some additional problems connected with implementation of the technology transfer projects:

1) Sometimes the limitations and requirements for the project are too strict and do not allow freedom to plan the necessary activities.
2) The economical situation in the country has changed but the achievable goals within the project have not been revised.
3) There is a lack of positive collaboration with the responsible institutions - *Investment and Development Agency of Latvia* and Ministry of *Economics*.
4) Within the technology transfer office project there are no financial resources available for covering the maintenance costs of the offices. (Interview materials: annex IV: 104)

Second, shortage of knowledge transfer personnel can be observed in all of the knowledge transfer centres and offices e.g. in RTU there are 565 people employed in scientific personnel and only 5 people employed by ITTC – roughly and theoretically speaking each of the ITTC employees has to provide services to 100 scientists. Of course, not all of the scientific staff is scientists and not all of the scientists will get involved in knowledge transfer activities or will approach ITTC for any services; nevertheless, these numbers are good indication of possible shortage of knowledge transfer staff especially if amount of knowledge transfer activities will increase over the time. The same observation is true for both UL IC and RSU TTO.

Additionally, of all of the people working for the analyzed centres and offices, only one – the Head of RSU TTO – has formal educational background in innovation management and relevant previous experience in the field before being employed by RSU TTO. Of course, the rest of the people with their educational backgrounds in engineering, economics etc. can and do bring benefits to the operation of the centres and offices; besides, since knowledge transfer is a new field in Latvia and they have been working with the field for a while they have acquired significant practical knowledge and experience in the field; but still this statistical data indicates shortage of people with relevant educational and practical background in innovation and knowledge transfer in Latvia.

One of the solutions in this situation for knowledge transfer centres could be using their position of being closely related to the universities to consult relevant faculties and responsible employees for relevant study programs about the current needs in the field and knowledge and skills required within it.

Last but not least, a problem that knowledge transfer centres and offices have started to think about and will face in the future is their sources of financing. Currently large part of their budgets are received with the financing received within the technology transfer offices project from EU funds but this incentive will only last until 2013. This means that these institutions have to start thinking about finding additional sources of financing. (Interview materials: annex IV: 112)

One of the options is to receive funding through knowledge transfer activities e.g. as in the case of UL, when UL IC receives 10% of the agreement amount if it has brought scientist together with business. Nevertheless, in the current situation that is a very sensitive tool for receiving financing due to several reasons. First, knowledge transfer activities in general and through knowledge transfer centres or offices is a new initiative therefore time is necessary until scientists get used to this system and the institutions become trustworthy partners. In order to do that providing services for no additional costs is a good motivation factor for scientists to collaborate with knowledge transfer offices. Second, as admitted by the interviewees, many scientists have established informal relationships with businesses therefore if knowledge transfer centres and offices start collecting money for their services scientists might decide that benefits gained from the collaboration with the centres are worth less than the loss of additional 10% of money. (Interview materials: annex IV: 101)

Another option, as planned by RTU ITTC, is to introduce providing information from its competences and equipment data base as paid service. But also in this case there are several factors that should be considered before this idea is implemented. First, the data base should be promoted to business in order for it to establish reputation of a useful tool for business so they would be ready to pay for the services. Second, while RTU ITTC plans to keep the data base only for internal use, UL IC and RSU TTO plans to make their data bases publicly available therefore in cases when competences of universities overlap RTU might lose possible collaboration partners to other universities. (Interview materials: annex IV: 109)

Although the author of thesis discusses several arguments against each of the ways for finding additional resources for financing operation of knowledge transfer centres and offices it should not be taken as denial of these sources of income. All of them might work and be useful if effectively combined and if identified obstacles regarding each of them are carefully addressed. Nevertheless, some additional sources might be required to fully finance operations of knowledge transfer centres and offices.

7.2. Initiative

The main focus of the analysis discussed within this section is initiation of collaboration between HEIs and businesses; it describes who usually initiates knowledge transfer activities, how internal collaboration between HEIs and the knowledge transfer centres is carried out as well as how matchmaking process between scientists and businesses is performed. Basically, this section covers all the phases taking place before the actual knowledge transfer process begins.

7.2.1. The First Cycle: Internal Collaboration

In order to be trustworthy and respected collaboration partner for both the universities and businesses knowledge transfer centres and offices have to monitor the recent scientific developments and research results in HEIs and update themselves regarding the current problems businesses face. Therefore some tools and mechanisms should be implemented to serve this purpose, these tools and mechanisms usually depend on the institution.

There are no specific regular monitoring initiatives implemented in UL IC, the most common way for the centre to obtain the information on the latest scientific developments and research results is through direct communication with scientists. In some other cases IC acquires current updates when scientists approach the centre to receive some consulting services e.g. regarding some specific problems during knowledge

transfer process or regarding protection of intellectual property rights. (Interview materials: annex IV: 101)

At RTU ITTC, on the other hand, some monitoring tools have been established and are operating on regular basis. The most important of these tools is *"Innovation and New Technologies Conference"* (*"Inovāciju un jauno tehnoloģiju konference"*) that is held twice a year and during which scientists from RTU can introduce businesses and broader society with their projects and scientific developments. These conferences are organized as poster sessions (lasting 2 hours) where scientists establish a stand and a poster explaining the main idea, application of their invention as well as possible industries where the invention could be used so entrepreneurs can acquire information about the project and develop further contacts if interested. Additionally, there 2 motivating factors for scientists to participate in these conferences: 1) they are used as a report mechanism for scientists to receive financing; 2) ITTC helps scientists to prepare necessary materials for the conferences that way limiting scientists' effort and time spent to prepare for these events. Nevertheless, there are other ways RTU ITTC obtains information on latest research results within RTU: through personal contacts and previously gained experience from collaboration; in other events e.g. exhibitions; and by gathering publicity information. (Interview materials: annex IV: 106)

Since RSU TTO is quite new structural unit in RSU, it needs not only to monitor the information on recent scientific developments and research results but, first of all, it needs to gather information on overall competencies and equipment in the university. Hence, last year TTO acknowledged RSU competences including information on where and what kind of information can be found in each of the RSU's structural units, and what services they provide. (Interview materials: annex IV: 112)

Another important tool for gathering information on available competences and scientific developments at the universities is data bases developed at each of the knowledge transfer centres and offices. In all of the knowledge transfer institutions these data bases contain information on scientists' competences, services they can provide, their scientific developments and research results as well as university's equipments that can be used for carrying out expertises and analysis required by business. Yet, in none of these institutions formal procedures for updating these data bases are developed.

Talking about monitoring the needs and problems of business, more or less similar tools are used as for obtaining information from the universities – it is done during the conferences, seminars, direct meetings and exhibitions.

Taking into account that knowledge transfer centres and offices as knowledge transfer agents in the process of knowledge transfer are a quite new thing in Latvia, these centres are still in the process of gaining trust from both universities and businesses. This change also challenges established routines and practices mainly within universities and during knowledge transfer processes. Due to these reasons it is understandable that it takes a while to pursue scientists to collaborate with knowledge transfer centres and offices and that not all of the knowledge transfer cases are currently channelled through these institutions.

This is also noted by the interviewees, and they explain additional reasons behind it: first, there is no strict policy that requires scientists to involve the knowledge transfer centres or offices in their cooperation with businesses; second, as mentioned above, many scientists have previously established relationships with businesses (through previous collaboration or other contacts) therefore they find it easier to cooperate directly without involving the third party; third, as stated earlier, there is shortage of human resources in the knowledge transfer centres and offices hence it is difficult for them to participate in all the projects. Nevertheless, the knowledge transfer centres and offices are involved in the largest projects as well as they

are being more often approached regarding legal issues and handling agreements, protections of intellectual property rights and patenting. (Interview materials: annex IV: 101, 107 and 112)

Yet, on what terms are the relationship between scientists and the knowledge transfer centres/offices established in cases when the centres and offices take part in the knowledge transfer process? In all cases no formal relationships in form of agreements exist; this is based on a fact that all knowledge transfer institutions are structural units of the universities so the scientists of the particular university and the employees of the knowledge transfer institutions have the same employer and work for the same cause. In some cases (e.g. in RTU) scientists and employees of the knowledge transfer centre are also formally connected with the collective agreement within the organization. (Interview materials annex IV: 101 and 107)

7.2.2. The Second Cycle: External Collaboration

In a way initiation of knowledge transfer process between HEIs and businesses can be explained by the linear models of innovation: technology push and market pull (see also sub-section *4.2.3. Models of Innovation* and *Figure 5 "Linear Models of Innovation"*). For example, in the technology push model it is assumed that scientists come up with unexpected discoveries (at HEIs) that are further applied by technologists to develop product ideas and engineers and designers in order to turn them into prototypes for testing (at companies). Afterwards it is left to manufacturing to discover ways to producing the products efficiently. Finally, marketing and sales promote the product to the potential customer. (Trott, 2008: 22) Or as in the market pull model where innovation is viewed as customer need-driven process, initiator for innovation is marketing that comes up with new ideas in a close collaboration with customers. These ideas, in turn, are conveyed to R&D for design and engineering and then to manufacturing for production. (ibid) Yet, in the knowledge transfer case the market pull model can have more than one initiator - besides marketing, it can also be company's manufacturing units and even management if some manufacturing or any other processes need to be improved; R&D in this case would be scientists at HEIs. Anyhow, even though the linear models have quite a few drawbacks when it comes to explaining current drivers of innovation, they clearly explain initiation of knowledge transfer within this thesis – the incentive can come either from HEIs or businesses. (Interview materials: annex IV: 100)

According to the information received during the interviews, in 2 cases (RTU ITTC and RSU TTO) knowledge transfer is more often initiated by businesses while in case of UL IC it is the university (or more specifically the knowledge transfer centre) that approaches businesses and tries to initiate knowledge transfer. (Interview materials: annex IV: 100, 106 and 112)

In case businesses initiate collaboration there 2 scenarios are possible: 1) a company has specific requirements or a problem – they need to improve something, develop or introduce new technologies or enter new markets; 2) a company has a new idea and they want a scientist/-s to develop it. Within the first scenario when the requirements from business side are clear the knowledge transfer centres/offices can start looking for collaboration partners within the university. Nevertheless, there are situations when several solutions can be provided to the existing business problem. Then these solutions are discussed with the company and, based on their decision, a collaboration partner is selected, or solution to the problem is developed by exploring all possible solutions in a joint project. The second scenario involving new idea development is rarer and more complicated; sometimes in these situations the knowledge transfer institutions need to assist the company to formulate the idea more precisely, to specify requirements or

further development directions to scientists. Since these cases usually include a high level of novelty and uncertainty companies do not want to share information necessary for further developments, and this also makes these cases more difficult and complex. (Interview materials: annex IV: 106 and 113)

When the requirements from the business side have been specified the next step is finding a scientist or a group of scientists that could help the company. If a company needs consulting services or some specific help from the university, requirements are quite specific therefore there is a limited choice of scientists that can provide the help. They usually are known to the knowledge transfer institutions due to previous collaboration or contacts. Another way to find the necessary specialists for the projects is through the scientific competences and research data bases. Besides formal criteria like scientist's background, competences, skills etc. some informal factors are also taken into account when choosing the collaboration partners for businesses e.g. scientist's motivation and willingness to get involved in knowledge transfer projects, communication skills etc. Although these seem like minor factors within knowledge generation and transfer they can prove to be key success factors in the actual cooperation process. Moreover, when choosing experts from the universities, their workload, ability and time to engage in a new project are also taken into account; and it is a well know fact that the most well known experts in the field are usually the busiest ones therefore some solutions to balance their expertise and availability are necessary. (Interview materials: annex IV: 102, 108 and 113)

Other initiation strategies can include selecting specific companies, analysing their specific situation and problems they might face and then approaching them with possible solutions or competences offered by the universities they might find udeful. This strategy is used by UL IC. One of the reasons why UL IC is not that often approached by businesses and has to look for other strategies for initiation of knowledge transfer is the fact that UL is a wide profile university and it is not know for some specific competences like is in case of RTU (technical competences) or RSU (medical competences). (Interview materials: annex IV: 100)

Of course another way of initiation knowledge transfer, as mentioned earlier, can involve scientists approaching businesses in order to commercialize their ideas, scientific developments or research results. As explained, by interviewees, these cases are quite rare. An explanation for this situation can be imbedded in the research system in Latvia – due to the aging of Latvian scientists the scientific society is still dominated by the older generation scientists who have spent most of their academic careers in the research system established within the Soviet Union; this means that they prefer researching topics of their own interest without putting much emphasis on their commercialization potential. This tendency has started to change lately but still some scientists are struggling with adjusting to the new science and research system. (Interview materials: annex IV: 106)

Nevertheless, in situations when scientists initiate knowledge transfer process and the knowledge transfer centres/offices are involved, the main tasks of the knowledge transfer institutions, first of all, include evaluation the potential of the specific idea, development or research result. Then they assist with preparing knowledge transfer proposals and "translating" the transferrable message as well as with handling various administrative tasks. (Interview materials: annex IV: 101, 107 and 113)

After the preparation of knowledge transfer proposal the possible collaboration partners are searched within the business sector. The main criteria for selecting a company for knowledge transfer involve the necessary industry (due to Latvia's small market there are limited number of industries and companies

operating within each of them), opinions of experts on the company and its operations as well as company's reputation. In order to bring the scientist/-s together with the selected company/-ies several mechanisms are used: as mentioned earlier, the conferences; specific seminars between scientist/-s and a company; contact exchange meetings when scientist/-s with the project idea and several companies that might be interested in collaboration participate; exhibitions; media; contacting specific individuals (but those are very rare cases); different events. When it comes to approaching companies to establish contacts and to introduce them with the new idea the knowledge transfer institutions try to approach departments who are directly dealing with the issue on hand, other than that in small and medium enterprises usually management is approached while in large enterprises R&D department is contacted. (Interview materials: annex IV: 101, 108 and 113)

7.2.3. Challenges and Problems Identified

From the above analysis of internal and external collaboration among HEIs, businesses and the knowledge transfer institutions several challenges and problems can be identified.

First, since one of the main functions of the knowledge transfer centres and offices is gathering information on scientific developments and research results in the universities in order to further promote this information to businesses, it is almost essential to have procedures, mechanisms and tools in place in order to monitor these activities. Unfortunately, in UL IC and RSU TTO incentives for monitoring the latest scientific achievements have not been implemented. Nevertheless, a good example regarding this problem is set by RTU ITTC and its regular conferences. First of all, it is a good initiative for monitoring innovations within RTU and, second of all, good motivation mechanisms for scientists to participate have been incorporated in this system: 1) conferences as a report mechanism for scientists to receive financial support; 2) assistance from RTU ITTC to prepare for the conferences which limits scientists' efforts and time spent for non-science activities.

Closely related to innovation monitoring mechanisms and equally important are procedures for updating the scientific competences and equipment data bases established within each of the knowledge transfer institutions. Even though currently none of the centres or offices have developed formal procedures for updating these data bases, it should be recommended in the future. These procedures should be closely related to the implemented mechanisms for monitoring the recent scientific developments and research results as these mechanisms would be the source of the information entered into the data bases; additionally, these procedures should determine who enters and updates the information in the data bases (scientists or the knowledge transfer institutions), how this information is verified and approved as well as how often some monitoring checks should take place.

Moreover, although establishing new knowledge transfer routines with the knowledge transfer centres and offices as a permanent partner within this process will take some time, some effort should be put in to fasten development of these routines. Of course, it is not necessary to involve the knowledge transfer centres and offices in all knowledge transfer projects especially if they are small and connected only with providing some consulting services. Hence, informing the centres and offices about all knowledge transfer cases might prove to be beneficial since: 1) all the data about knowledge transfer activities would be recorded and kept in one place; 2) established contacts could be used for other collaboration projects; 3) provided services could be used as references in order to initiate new knowledge transfer projects.

When it comes to external collaboration and commercialization of scientific developments or research results the knowledge transfer institutions are the main players in evaluating the potential of the transferrable knowledge therefore they should be very responsible and careful while doing that. Yet, they acknowledge that this is one of the most difficult tasks in the knowledge transfer process since scientific developments are so different and there no general or specific methodologies developed for use in these cases. (Interview materials: annex IV: 114) This indicates an undeveloped area within the filed of innovation evaluation and knowledge transfer not only in Latvia but also internationally and broad variety of research possibilities for the future.

In knowledge transfer theory many authors in the field emphasize characteristic called absorptive capacity as a crucial precondition on a side of knowledge user for knowledge transfer and, more importantly, for knowledge application and further usage. (Cohen *et al*, 1990: 128) This means that selection of possible collaboration partners within the business sector is one of the key factors for successful knowledge transfer. Despite that, none of the analyzed knowledge transfer institutions carry out detailed analysis of companies and their absorptive capacity before engaging in knowledge transfer process. Of course, in a market as small as Latvian, an informal information flows exist regarding current affairs in most of the industries and in the largest enterprises but still more deeper analysis of possible collaboration partners in the pre-initiation phase of knowledge transfer might prove to be worthwhile for a successful result of the cooperation.

7.3. Knowledge Transfer Process

Due to the fact that knowledge transfer projects differ significantly based on the knowledge transferred – the field or industry it belongs to, its complexity, amount of knowledge transferred etc. – it is very difficult to describe one general knowledge transfer process. Therefore this section theoretically incorporates all the phases of the process starting from initiation of collaboration to draw a theoretical knowledge process; it also elaborates on other important elements of the process e.g. agreements and financing, as well as discusses roles taken the actors (HEIs, businesses, knowledge transfer institutions) involved.

7.3.1. Knowledge Transfer Process

As admitted by all the knowledge transfer institutions there is no specific knowledge transfer process developed, and it is understandable as knowledge transfer projects can vary significantly. Nevertheless, as we learned from the previous section several ways to initiate knowledge transfer process are possible; this also influences the further development of the knowledge transfer process. ***Table 10*** describes all the steps in the knowledge transfer process that is carried out with participation from the knowledge transfer centres/offices if business initiates the knowledge transfer; the table also describes main roles of the actors involved in the process as well as activities within each step.

***Table 10*: Knowledge Transfer Process if Business Initiates Knowledge Transfer**

Steps	Actors Involved	Activities
Business initiates knowledge transfer		
Step 1: Initiation of knowledge transfer process	Businesses	• Approaching knowledge transfer centre/office with an idea or a problem
Step 2: Formulation of an idea/problem	Businesses Knowledge transfer centre/office	• Idea/problem formulation (if necessary) • Requirement specification for scientists

***Table 10*: Knowledge Transfer Process if Business Initiates Knowledge Transfer**

Steps	Actors Involved	Activities
	(if necessary)	(if necessary)
Step 3: Search for the collaboration partner	Knowledge transfer centre/office	• Search for the most appropriate candidates for knowledge transfer project • Checking their availability
Step 4: Meeting, discussions (if collaboration partner is found and available)	Businesses HEI Knowledge transfer centre/office	• Organizing of a meeting for a company and selected scientist/-s • Discussions and negations about knowledge transfer project
Step 5: Signing of an agreement (if partners agree to collaborate)	Businesses HEI Knowledge transfer centre/office	• Negations on terms of agreement • Signing of the agreement
Step 6: Knowledge transfer	Businesses HEI Knowledge transfer centre/office	• Actual knowledge transfer process • Monitoring of the process (knowledge transfer centre/office) • Legal and administrative tasks (knowledge transfer centre/office)

Source: Self developed based on interview materials: annex IV: 108

To sum it up, if a company initiates knowledge transfer it approaches the knowledge transfer institution in a specific university or several universities; if necessary the knowledge transfer centres/offices can help the company to formulate the idea, problem or more specific requirements for scientists. Then, based on the business needs of the company, collaboration partners from HEI are selected based on their competences, availability and willingness to participate in the project. In the next step a meeting is organize in order to discuss the possible project and negotiate its terms, the company, HEI and the knowledge transfer centre/office take part in this meeting. If parties agree to engage in knowledge transfer an agreement is signed and the actual knowledge transfer process started. (Interview materials: annex IV: 108)

The process is slightly different if HEI initiates the knowledge transfer (see ***Table 11***). In this case, first, knowledge transfer institutions evaluates the potential of the possible knowledge transfer project; if there is a potential knowledge transfer proposal is prepared. During the next step possible knowledge transfer partners within the business sector are searched. There are several ways how scientists can be brought together with business, it can happen in conferences, seminars or through direct contacts. After this step process is as same as in the case when business initiates the collaboration, it involves discussions and negotiations, signing of an agreement and the actual knowledge transfer process. (Interview materials: annex IV: 108)

***Table 11*: Knowledge Transfer Process if HEI Initiates Knowledge Transfer**

Steps	Actors Involved	Activities
Business initiates knowledge transfer		
Step 1: Initiation of knowledge transfer process	HEI	• Approaching knowledge transfer centre/office with an idea or scientific development
Step 2: Evaluation of	HEI	• Evaluation of knowledge transfer

***Table 11*: Knowledge Transfer Process if HEI Initiates Knowledge Transfer**

Steps	Actors Involved	Activities
knowledge transfer idea and preparation of a proposal	Knowledge transfer centre/office	potential (knowledge transfer centre/office) • Formulating the knowledge transfer message • Preparation of a knowledge transfer proposal • Handling other administrative tasks (knowledge transfer centre/office)
Step 3: Search for the collaboration partner (if the idea is approved)	Knowledge transfer centre/office	• Search for the most appropriate candidates for knowledge transfer project • Checking their suitability
Step 5: Bringing together HEI and businesses	Knowledge transfer centre/office	• Conferences • Seminars • Direct contacts • Other events
Step 6: Meeting, discussions (if collaboration partner is found and available)	HEI Businesses Knowledge transfer centre/office	• Organizing of a meeting for HEI and selected business/-es • Discussions and negations about knowledge transfer project
Step 7: Signing of an agreement (if partners agree to collaborate)	HEI Businesses Knowledge transfer centre/office	• Negations on terms of agreement • Signing of the agreement
Step 6: Knowledge transfer	HEI Businesses Knowledge transfer centre/office	• Actual knowledge transfer process • Monitoring of the process (knowledge transfer centre/office) • Legal and administrative tasks (knowledge transfer centre/office)

Source: Self developed based on interview materials: annex IV: 108

Talking about the actual knowledge transfer process, there are several ways how it can go. In some cases scientists only participate as experts so limited work is done at the university, in other cases scientists might work on the project at the university using its premises equipment and while in other cases the premises and equipment of the company are used. (Interview materials: annex IV: 108)

The knowledge transfer institutions' participation in the actual knowledge transfer process is limited, they usually monitor the process to receive feedback from both parties involved and to ensure that all the agreed results are reached; additionally they take care of any legal or administrative issues if they occur. (Interview materials: annex IV: 101 and 113)

Further on, all knowledge transfer relationships are formalized by signing an agreement. In all the cases companies sign an agreement directly with the university involved in the knowledge transfer process. The agreement covers all the activities that should be performed, results to be achieved, finances, intellectual property rights etc. Sometimes, if a project is large and time consuming, it can be set up in phases and then agreements for separate phases are signed. (Interview materials: annex IV: 108 and 113)

Sources of financing knowledge transfer process can differ – sometimes businesses cover all the expenses, sometimes additional sources of financing are found e.g. EU funds, state aid; then financing is done according to the requirements of the specific program or those of the provider of the funds. (Interview materials: annex IV: 102, 108 and 113)

The knowledge transfer process is considered to be finished when the agreement for the whole project or a project phase expires. Only in one case (RTU ITTC) evaluation of the lessons learned from the project implemented are carried out after the project closure. The knowledge transfer centre asks for the feedback to the participants of the project as well as informally discusses lessons learned during internal meetings. The lack of these evaluation mechanisms can be identified as one of the areas of improvement in the work other knowledge transfer centres/offices (UL IC and RSU TTO) as these mechanisms can provide a lot of useful information in order to improve future knowledge transfer processes and operation of the institutions in general. (Interview materials: annex IV: 102, 109 and 113)

7.4. Barriers and Facilitators

All the way through this thesis work the knowledge transfer process has not been viewed as a separate process, it has been analyzed within its broader environment that includes an overall Latvian economy and innovation environment. Besides, influences from the backgrounds of the main actors taking part in the process – HEIs and businesses – have also been taking into account. This is also why barriers and facilitators of the process should be identified in several levels: overall economical influence, impact from innovation and knowledge transfer environment, affect from the current state in the science and research as well as business sectors, and, last but not least, barriers and facilitators within the process itself. This section summarizes barriers and facilitators affecting knowledge transfer process in Latvia identified by the author and the interviewees in all the levels mentioned earlier.

As discussed earlier, currently Latvian economy is experiencing massive downfall caused by an overall financial and economical crisis in the world. Nevertheless, as surprising as it might sound, all of the experts list the crisis as one of the main facilitators for the development of knowledge transfer process in Latvia. First of all, the government has cut back support for science and research hence scientists and universities have to look for opportunities to find additional resources, they have to become more active in collaboration with businesses and therefore develop technologies that can be commercialized and used by the companies. Second of all, businesses are also in a need to find solutions to optimize their operations as well as to develop new technologies and products. This makes both of the parties more motivated and eager to engage in knowledge transfer process. (Interview materials: annex IV: 103, 110 and 114)

Further on, knowledge transfer environment in Latvia is closely related to innovation environment, this is mainly due to the same institutional framework and incorporated support measures – knowledge transfer is supported within the support programs for innovation. So, the problems innovation sector in Latvia faces and that are described earlier in this work will in some way also affect knowledge transfer process (for more information see sections *5.2. "Institutional and legal Framework for Innovation and Knowledge Transfer in Latvia"* and *5.3. "Innovation Environment in Latvia"*). Yet, there are some additional barriers identified that are related to the established innovation and knowledge transfer environments in Latvia.

First, as noticed by the author of the thesis, there are 2 responsible institutions for knowledge transfer activities in Latvia: 1) *Ministry of Economics* due its responsibility for economy and innovations in Latvia; 2)

Ministry of Education and Science due to its responsibility for education, science and research in the country. Promotion of knowledge transfer has been set as a priority in the agendas of both ministries; additionally, there are several support measures aimed at facilitating knowledge transfer being implemented by both of the institutions. In general, this system is understandable and the support measures are more than necessary. Nevertheless, it might prove to be more productive if ministries would collaborate on dealings with knowledge transfer since shared knowledge on the topic might give better understanding on the priorities in the field of knowledge transfer and coordinated support measures might give more effective results.

Additionally, the analysis of the government support aid for innovation, science and research as well as business sector showed that there are quite a few activities aimed at motivating universities to engage in knowledge transfer processes but there are almost no support mechanisms aimed at motivating businesses to engage in the same process. Since the government has set enhancing collaboration between universities and business as an important element for reaching the goal of knowledge-based economy they also should realize that there are 2 parties involved in the process and both of them should be motivated to take part in this process.

Moreover, as noted by the Head of UL IC Matīss Neimanis, there is a huge fragmentation in the field of innovation and business in Latvia that slows down the process of promoting knowledge transfer. First, there are several non-governmental institutions and governmental institutions being responsible for innovations in Latvia and, of course, they all are fighting for more power and responsibilities in the industry which makes it difficult to understand with whom to collaborate and how to do that. Second, there is also fragmentation in business industries e.g. there are several industry associations, information flow within them is slow, besides, the same people work for several of these associations, and that again is not a helping factor to reach out for more collaboration partners in different industries. (Interview materials: annex IV: 103)

Although universities in Latvia are independent from each other and so are the knowledge centres and offices established within them they all are trying to reach the same objective – promote knowledge transfer and increase amount of knowledge transferred and commercialized. Besides, each of the universities has its own specialization therefore there are very few situations when they actually could become competitors. Due to this reason it might be worthwhile to coordinate their efforts to work for their overall objective. For example, if a company needs a specific set of competences from a university and they approach one of the universities that, unfortunately, lacks the competence; it might be useful to advice them on which university to approach in order to solve their problem and to safe their time. Hence a source of shared information e.g. data base containing information on competences, science developments and research results from all the universities and a common administrative unit that could be approached by businesses could be useful. This would also help to promote competences of Latvian scientists internationally as in Latvia they are spread in different universities. (Interview materials: annex IV: 102)

Even though the above mentioned initiative is just an idea for now some knowledge transfer centres has started to understand that providing coordinated solutions to businesses might prove to be more efficient. For example, in RSU there is an initiative to establish collaboration network among TTO and MAIC and the business incubators to organize common contact exchanges since this would allow to provide more complex solutions to businesses. The also list this collaboration network and information shared within it as one of the facilitators for their work. (Interview materials: annex IV: 114)

Talking about the actors involved in the process – HEIs and business – all of the interviewees admit that the main barrier is the lack of financing on both sides. On the other hand, they note that huge facilitator for the research and science industry has been support programs and measures available from EU. This money have helped to establish modern infrastructure and purchase up to date equipment for scientists, the knowledge transfer offices have also been established with the financial support from EU, as well as participation in different EU programs have allowed scientists to collaborate with their colleagues abroad and pursue their research. (Interview materials: annex IV: 117)

More or less all the problems, challenges and barriers within the actual process of knowledge transfer have been identified and described in the previous sections of this chapter. Hence, there is no reason to repeat them here but it is worth summarizing the ones highlighted by the experts as the main ones. Mainly it is the challenge to change established routines in the universities and scientific community regarding collaboration with business and the way it should and could be done. The fact that makes this challenge even harder is the lack of knowledge and experience on the side of the knowledge transfer institutions since this field is quite new in Latvia. Moreover, not only ways knowledge transfer is done should be changed it is also the ways scientists are used to do their research that needs to be adjusted to the new market needs – research should be more market oriented and useable. And this, again, brings things back to enhancing collaboration between HEIs and business, but this time not only for knowledge transfer but constantly in order to inform scientists about the current market needs and businesses on the latest scientific developments in the field. (Interview materials: annex IV: 103, 109,110 and 114)

8. Conclusion

The main ambition of this thesis work, as suggested by the research question, was to determine what the established knowledge transfer process from HEIs to businesses in Latvia is, what its broader environment is and how it can be improved in the future. All of the work and analysis was built around this ambition.

Before moving on to analysis, the main components of the analyzed process e.g. knowledge, innovation and knowledge transfer were defined and their characteristics determined. Further on, based on current literature in the field of knowledge transfer a theoretical model for further analysis was built using *Knowledge Transformation Framework*, *5 Questions Knowledge Transfer Framework* and *4 Stages Knowledge Transfer Framework* which was then used for defining interview questions. As the main sources of information were chosen knowledge transfer centres established within the largest universities in Latvia who over the last couple of the years have been the organizations most closely related to knowledge transfer process from HEIs to businesses in Latvia; additional expert was interviewed in order to obtain more detailed information about the actual execution of the knowledge transfer process.

Already in the methodological part the author defines knowledge transfer as an opened system which means that emphasis of the analysis is not put only on the actual knowledge transfer process but also on the environment surrounding it – national system of innovation as well as overall economy in Latvia. Therefore the thesis included detailed description of current state of Latvian economy; even though Latvian economy is facing a major downturn and deep economical crises further analysis showed that it actually works as a facilitator for knowledge transfer process in Latvia since businesses need to look for innovative solutions both in their operations and product portfolios while scientists need to find additional sources to finance their research.

Moreover, the analysis of national innovation system in Latvia showed that it is closely related to knowledge transfer system developed in Latvia; both systems share similar institutional and legal frameworks and all the knowledge support activities are implemented through established innovation support programs in Latvia. Hence, deeper analysis of innovation environment in Latvia within this thesis proved to be worthwhile as many identified problems and challenges within the field of innovation has a direct or indirect impact on knowledge transfer environment e.g. insufficient number of employees working in the R&D area; low R&D funding both public and private; low number of innovative enterprises. Most of the problems identified are addressed within policy planning documents aimed at promoting innovation in Latvia and described in this work therefore some improvements should be expected in the future.

Nevertheless, during the analysis of Latvian innovation environment, the author as well as experts interviewed identified some additional challenges that directly affect knowledge transfer in Latvia. First, based on their specialization, there are 2 institutions responsible for knowledge transfer activities in Latvia: *Ministry of Economics* and *Ministry of Education and Science*. Both of these institutions are implementing several support measures for promotion of knowledge transfer. Yet, none of the policy planning documents or any other sources provides information on how they coordinate their efforts, so there is a possibility that lack of this kind of coordination exist. Hence, it might prove to more productive if ministries would collaborate on dealings with knowledge transfer since shared knowledge on the topic might give better understanding on the priorities in the field of knowledge transfer and coordinated support measures might

give more effective results.

Additionally, as pointed out by one of the experts, there is a huge fragmentation in the fields of innovation and business in Latvia that slows down the process of promoting knowledge transfer. In the innovation sector there are several non-governmental and governmental institutions that are in the constant rivalry for more power while in the business sector is dominated by several industry associations in which information flow is very slow and the same people work for different associations. If some effort is put into making these sectors more homogenous with clearly defined responsibilities among different organizations and associations it might help to spur knowledge transfer activities since finding collaboration partners would be much easier and less time consuming. (Interview materials: annex IV: 103)

Since the focus of this thesis was on knowledge transfer from HEIs to businesses the author had a strong belief that exploration of science and research as well as business sectors in Latvia will bring an additional perspective on the overall analysis of knowledge transfer process. Main problems faced by the businesses in Latvia among others included low business activity and weak cooperation between public and private sectors which again is some way explains the low level of knowledge transfer in Latvia. The analysis of the HEIs' sector, on the other hand disclosed the main drivers of knowledge transfer: 1) lack of qualified labour force; 2) shift in public policy; 3) accompanying incentives of universities.

Likewise, the sector analysis helped to identify another area of improvement: currently quite a few activities aimed at motivating universities to engage in knowledge transfer processes have been defined and are being implemented, but there are almost no support mechanisms aimed at motivating businesses to engage in the same process. Since the government has set enhancing collaboration between universities and business as an important element for reaching the goal of knowledge-based economy they also should realize that there are 2 parties involved in the process and both of them should be motivated to take part in this process.

Last but not least, the analysis of the actual knowledge transfer process between HEIs and businesses was conducted based on the information gathered during the interviews. Based on the established theoretical framework, this analysis covered several areas: 1) knowledge transfer centres and their operations; 2) initiation of knowledge transfer process; 3) the actual knowledge transfer process including agreements, financing mechanisms etc.; 4) barriers and facilitators in the process. Within this stage of thesis work the author developed theoretical knowledge transfer models as well as identified the main problems and challenges within each area analysed.

Talking about the knowledge transfer centres and offices, there are several obstacles and challenges these institutions face or will face in the future. First, in order to receive financial aid from EU funds for various knowledge transfer activities one of the rules set by the local EU funds managing institutions in Latvia was to establish knowledge transfer offices. In some cases (RSU TTO) this requirement worked well while in some previously established knowledge transfer centres (UL IC and RTU ITTC) it has led to establishment of quite complicated administrative structures since these knowledge transfer offices were developed as structural units of the centres. Of course, regarding this project the requirements cannot be changed but it would be advisable for the future that all responsible institutions would think about ways how to support some activities without creating complications and increasing administrative burden for the receivers of the support.

Moreover, the knowledge transfer institutions in Latvia, first of all, face shortage of personnel in general.

But second of all, there is also a shortage of people who have educational or professional background within the fields of innovation or knowledge transfer. Here the knowledge transfer institutions could use their close proximity to the universities to inform them about the required knowledge and skills in the labour market.

Another future challenge these institutions will face is: how to earn money for their operations. Now most of their funds are received as part of EU or state support but new solutions will be needed when these sources run out. Some of the options include charging companies a fee if the centres/offices involve in the knowledge transfer process or making provision of information from their competences data bases a paid service. Yet, careful analysis of each of these solutions as well as consideration of some additional sources is necessary.

From a strategic perspective a future possibility for all the knowledge transfer centres would be creating a common data base containing information on competences, science developments and research results from all the universities and a common administrative unit that could be approached by businesses. It would make it easier and less time consuming for businesses to find a collaboration partner since now competence are spread among several universities; besides, it could help to promote competences of Latvian scientists internationally. (Interview materials: annex IV: 102)

Turning to the actual knowledge transfer process it also provides some space for improvements. These improvements are mostly connected with mechanisms, tools and procedures the knowledge transfer centres could implement in order to increase the overall quality of the knowledge transfer process. First, regular innovation and scientific development monitoring mechanisms and procedures should be developed in UL IC and RSU TTO since they currently lack coordinated efforts to obtain this information. A good example is set by RTU ITTC with its twice a year conferences for scientists. Second, clear procedures and responsibilities for updating the scientific competences and research equipment data bases within each of the institutions should be developed. Third, currently the knowledge transfer centres are not involved or even informed about all collaboration and knowledge transfer cases between HEIs and businesses. Of course, even if the current system changes, due to the shortage of human resources the centres will not be able to take part in all projects in the future but at least they should be informed so all the information about these activities would be kept in one place.

Furthermore, a wide set of different evaluation mechanisms should be implemented within the daily routines of the knowledge transfer institutions. First, since the centres/offices are the key players in evaluating a potential of scientific ideas and developments, they should work on establishing some tools or guidelines to execute this activity carefully. Second, a little attention is put on assessing such an important component in the knowledge transfer process as absorptive capacity of knowledge receiver so this asks for another set of mechanisms and tools. Last but not least, only one centre (RTU ITTC) asks for feedback from collaboration partners and evaluates lessons learned once the knowledge transfer process is finished. All the centres should think about implementing this incentive since it can provide a lot useful information for further improvements.

Although this work elaborates on quite a few areas connected to knowledge transfer in Latvia it does not attempt to ensure the reader that it gives a flawless reflection of knowledge transfer process between HEIs and businesses in Latvia. It mostly indicates tentative linkages that might affect the process but still deeper evaluation of these linkages are possible in order to establish if they truly affect the process and to what

extent. Additionally, it must be acknowledge that this thesis might provide to some extent subjective overview of the process due to the authors Latvian background. On the other hand, this fact can also provide more detailed explanations and understanding of the knowledge transfer process and the overall environment than non-related observer would and could do. Another drawback can be the fact that only Latvia is analyzed within this work, putting Latvia in comparison with some other countries and knowledge transfer processes established there would provide another perspective to this analysis.

Summarizing the lessons learned while working on this thesis work, it is worth mentioning that there are plenty of opportunities for further research and academic work within the field of knowledge transfer, especially with respect to knowledge transfer between HEIs and businesses. For example, there are no models explaining knowledge transfer between HEIs to businesses; all the models used for building the theoretical framework for this thesis were adjusted since they originally were designed to describe knowledge transfer from HEIs to policy decision makers (*5 Questions Knowledge Transfer Framework*) or for transfer of best practices within an organization (*4 Stages Knowledge Transfer Framework*).

To conclude, even though throughout the thesis work a lot problems, challenges and barriers regarding knowledge transfer and its environment in Latvia have been observed it must be acknowledged that HEIs and businesses with the help from the knowledge transfer institutions have done an impressive work to promote knowledge transfer in Latvia. Besides, all the experts admit that situation in the field of knowledge transfer is getting better and better since all the involved partners have realized the benefits of the process.

Reference List

Arbnor, I. and B. Bjerke (1997). "Methodology for Creating Business Knowledge", 2nd edition, Sage Publications Inc.

Ackoff, R. L. (1989). "From Data to Wisdom", *Journal of Applies Systems Analysis*, Vol. 16, pp. 3-9.

Adamsone-Fiskovica, A., J. Kristapsons, E. Tjunina and I. Ulnicane-Ozolina (2009). "Moving beyond teaching and research: economic and social tasks of universities in Latvia", *Science and Public Policy*, 36(2), pp. 133-137.

Argote, L. and P. Ingram (2000). "Knowledge transfer: A basis for competitive advantage in firms", *Organizational Behaviour Human Decision Process*, 82 (1), pp. 150-169.

BBC News, "Latvia economy reels in recession", February 4, 2010.
http://news.bbc.co.uk/2/hi/8496925.stm (viewed: May 20, 2010)

Buklets "Inovācija" [Booklet "Innovation"] developed by Ministry of Economics in 2006

Central Intelligence Agency, *The World Factbook*:
https://www.cia.gov/library/publications/the-world-factbook/geos/lg.html

Cohen, W. M. and D. A. Levinthal (1990). "Absorptive Capacity: A New Perspective on Learning and Innovation", *Administrative Science Quarterly*, Vol. 35, No. 1, *Special Issue: Technology, Organizations, and Innovation*, pp. 128-152.

Darbības programma "Uzņēmējdarbība un inovācijas" [Operational Programme "Entrepreneurship and Innovations"] developed by Ministry of Finance and approved by Cabinet of Ministers on 02/11/2009

Darr, E. D. and T. R. Kurtzberg (2000). „An Investigation of Partner Similarity Dimensions on Knowledge Transfer", *Organizational Behavior and Human Decision Processes*, Vol. 82, No. 1, pp. 28 -44.

Doing Business, The World Bank Group:
http://www.doingbusiness.org/ExploreEconomies/?economyid=108 (viewed June 25, 2010)

"Ekonomikas ministrijas nolikums" [Statutes of Ministry of Economics] approved by Cabinet of Ministers on 23/03/2010

Feeman, C. (1982). "Economics of Industrial Innovation", 2nd edition, Frances Pinter, London.

Information material on RTU Innovation and Technology Transfer Centre [Inovāciju un tehnoloģiju pārneses centrs] developed by RTU Innovation and Technology Centre.

"Izglītības attīstības pamatnostādnes 2007. – 2013. gadam" ["Strategic Guidelines for Education Development 2007 – 2013"] developed by Ministry of Education and science and approved by Cabinet of Ministers on 27/09/2006.

"European Innovation Scoreboard (EIS) 2009" (2010), PRO INNO Europe, European Union.
http://www.proinno-europe.eu/page/european-innovation-scoreboard-2009

Francis, D. and Bessant, J. (2005). "Targeting innovation and implications for capability development", *Technovation*, 25(3), pp. 171-183.

Grant, R. M. (1996a)."'Prospering in dynamically-competitive environments: Organizational capability as knowledge integration", *Organization Science*, 7(4), pp. 375-387.

Gourley S. (2002). "Tacit knowledge, tacit knowing or behaving?"
http://myweb.tiscali.co.uk/sngourlay/PDFs/Gourlay%202002%20tacit%20knowledge.pdf

Kiefer, L., J. Frank, E. Di Ruggerio, M. Dobbins, D. Manuel, P. Gully and D. Mowat (2005). "Fostering Evidence-Based Decision-Making in Canada: Examining the Need for a Canadian Population and Public Health Evidence Centre and Research Network", *Canadian Journal of Public Health*, Vol. 96, No. 3, pp. I-1-I-19.

"Komercdarbības konkurētspējas un inovācijas veicināšanas programma 2007. – 2013. gadam" ["Program for Promotion of Entrepreneurial Competitiveness and Innovation 2007 – 2013"] developed by Ministry of Economics and approved by Cabinet of Ministers on 28/06/2007

Latvijas Banka [The Bank of Latvia]:
http://www.bank.lv/eng/main/all/ (viewed June 25, 2010)

Latvijas Republikas Centrālā statistikas pārvalde [Central Statistical Bureau of Republic of Latvia]:
http://www.csb.gov.lv/ (viewed June 25, 2010)

Latvijas Republikas Izglītības un zinātnes ministrija [Ministry of Education and Science of Republic of Latvia]:
http://izm.izm.gov.lv (viewed June 25, 2010)

Latvijas universitāte [University of Latvia] website, "Latvijas augstskolu reitingā LU pirmajā vietā trešo gadu", May 20, 2010
http://www.lu.lv/zinas/t/2886/ (viewed July 22, 2010)

Latvijas universitātes Inovāciju centrs [University's of Latvia Innovation Centre]:
http://www.lu.lv/par/strukt/departamenti/apd/ic/ (viewed July 22, 2010)

Lavis, J., D. Robertson, J. M. Woodside, C. B. McLeod, J. Abelson and The Knowledge Transfer Study Group (2003). "How Can Research Organizations More Effectively Transfer Research Knowledge to Decision Makers?", *The Milbank Quarterly*, Vol. 81, No. 2, pp. 221-248.

Lavis, J., S. Ross, C. McLeod and A. Gildiner (2003b). "Measuring the Impact of Health Research", *Journal of Health Services Research and Policy,* 8, pp. 165-170.

Lundvall, B.-A°. and P. Nielsen (2007). "Knowledge management and innovation performance", *International Journal of Manpower*, Vol. 28, No. 3/4, pp. 207-223.

Majchrzak, A., L. P. Cooper, and O. E. Neece (2004). "Knowledge Reuse for Innovation", *Management Science*, Vol. 50, No. 2, pp. 174-188.

Medicīnas aparātbūbes inovāciju centrs [Innovation Centre for Construction of Medical Appliances]:
http://www.rsu.lv/medicinas-aparatbuves-inovaciju-centrs (viewed July 22, 2010)

Melnis, A. and V. Abizāre (2010). ”Pārskats par Latvijas augstāko izglītību 2009. gadā. Skaitļi, fakti, tendences” [Report on Higher Education in Latvia in 2009. Figures, Facts and Trends] developed by Ministry of Ministry of Education and Science.

Mitton, C., C. E. Adair, E. McKenzie, S. B. Patten and B. W. Perry (2007). „Knowledge Transfer and Exchange: Review and Synthesis of the Literature”, *The Milbank Quarterly*, Vol. 85, No. 4, pp. 729-768

Mowery, D. C., J. E. Oxley and B. S. Silverman (1996). “Strategic Alliances and Interfirm Knowledge Transfer”, *Strategic Management Journal*, Vol. 17, *Special Issue: Knowledge and the Firm*, pp. 77-91.

“Nacionālais attīstības plāns” [National Development Plan] developed by Ministry of Regional Development and Local Government and approved by Cabinet of Ministers on 04/07/2006

Nacionālais attīstības plāns [National Development Plan] website:
www.nap.lv (viewed June 25, 2010)

Nonaka, I. and H. Takeuchi (1995). “The Knowledge – Creating Company. How Japanese Companies Create The Dynamics of Innovation”, Oxford University Press, Inc., New York.

Ministru kabineta noteikumi Nr. 129 ”Noteikumi par darbības programmas "Uzņēmējdarbība un inovācijas" papildinājuma 2.1.2.1.2.apakšaktivitāti "Tehnoloģiju pārneses kontaktpunkti" [Regulations of Cabinet of Ministers No. 129 “Regulations on Sub-activity 2.1.2.1.2. “Technology Transfer Offices” from Operational Program’s “Entrepreneurship and Innovations” Compliment”] approved by Cabinet of Ministers on 26/02/2008

Poulton, W. (2007). “Elements of Effective Transfer and Stimulating Entrepreneurship”, in *Integrating Science & Technology into Development Policies: An International Perspective*, OECD, pp. 79-83.

Public Policy Website www.politika.lv, “”Nothing Special”: The Economic Crisis in Latvia”, December 16, 2008.
http://www.politika.lv/en/topics/quality_in_politics/nothing_special_the_economic_crisis_in_latvia/ (viewed May 20, 2010)

Public Policy Website www.politika.lv, “Chronicles of a ‘Failed State’”, June 16, 2009
http://www.politika.lv/en/topics/quality_in_politics/Chronicles_of_a_Failed_State/ (viewed May 20, 2010).

Rīgas Stradiņa universitāte [Riga Stradiņš University]:
http://www.rsu.lv/ (viewed July 22, 2010)

Rīgas Stradiņa Universitātes Tehnoloģiju pārneses kontaktpunkts [Riga Stradiņš University’s Technology Transfer Office]:
http://tpk.rsu.lv/index.php/about-tto (viewed July 22, 2010)

Rīgas Tehniskā universitāte [Riga Technical University]:
http://www.rtu.lv/en/content/view/878/1357/lang,en/ (viewed July 22, 2010)

Rīgas Tehniskās universitātes Innovāciju un tehnoloģiju pārneses centrs [Riga Technical University’s Innovation and Technology Transfer Centre]:

http://www.rtu.lv/content/view/128/646/lang,lv/ (viewed July 22, 2010)

Rogers, E. M. (2003). "Diffusion of Innovations", 5th edition, Free Press, New York.

Rowley, J. (2007). "The wisdom hierarchy: representations of the DIKW hierarchy", *Journal of Information Science OnlineFirst*, pp. 1-18.
http://antonietta.philo.unibo.it/IUcorso2007-08/mdidattici/rowleydikw.pdf

Simonin, B. L. (1999). "Ambiguity and the Process of Knowledge Transfer in Strategic Alliances", *Strategic Management Journal*, Vol. 20, No. 7, pp. 595-623.

Statistical Office of the European Union Eurostat:
http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home (viewed June 25, 2010)

Szulanski, G. (1996). "Exploring Internal Stickiness: Impediments to the Transfer of Best Practice Within the Firm", *Strategic Management Journal*, Vol. 17, *Special Issue: Knowledge and the Firm*, pp. 27-43

Tidd, J., J. Bessant and K. Pavitt (2005). "Managing Innovation. Integrating Technological, Market and Organizational Change", 3rd edition, John Wiley & Sons, Ltd, Hoboken.

Times Online, "Latvian crisis deepens as Europe debates aid", June 4, 2009.
http://business.timesonline.co.uk/tol/business/economics/article6430946.ece (viewed May 21, 2010)

Trott, P. (2008). "Innovation Management and New Product Development", 4th edition, Pearson Education Limited, Harlow.

Tsai, W. (2001). "Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance", *The Academy of Management Journal*, Vol. 44, No. 5, pp. 996-1004.

"Uzņēmējdarbības vides uzlabošanas pasākumu plāns" [Action Plan to Improve the Business Environment for 2010] developed by Ministry of Economics and approved by Cabinet of Ministers on 24/03/2010

Zander, U. and B. Kogut (1995). „Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities: An Empirical Test", *Organization Science*, Vol. 6, No. 1, *Focused Issue: European Perspective on Organization Theory*, pp. 76-92

Zeleny,M. (1987). "Management support systems: Towards integrated knowledge management", *Human Systems Management*, 7(1), pp. 59–70.

"Zinātnes un tehnoloģiju attīstības pamatnostādnes 2009. – 2013. gadam" ["Strategic Guidelines for Science and Technology Development 2009 – 2013"] developed by Ministry of Ministry of Education and Science and approved by Cabinet of Ministers on 16/09/2009

"Zinātniskās darbības likums" ["Law on Scientific Activity"], approved by Cabinet of Ministers on 14/04/2005

Weisbrot, M. and R. Ray (2010). "Latvia's Recession: The Cost of Adjustment With An "Internal Devaluation", Center for Economic and Policy Research, pp. 1-19.

Winter, S. G. (1987). “Knowledge and Competence as Strategic Assets”, in Klein, D. A. (Ed.), *The Strategic Management of Intellectual Capital*, Butterworth-Heinemann, Woburn.

Annexes

Annex I: Integrated Framework for Knowledge Transfer Analysis in Latvia

Annex II: Interview Questions (in Latvian)

Nr.p.k.	Jautājums
	Zināšanu pārneses centri (ZPC)[†]
1.	Kā atšķiras centru un kontaktpunktu funkcijas? Vai nav funkciju pārklāšanās?
2.	Kā ZPC panāk, ka gan AII, gan uzņēmumi sadarbojas (ZPC uzticamība)?
3.	Kādas zināšanas un pieredze ir ZPC darbiniekiem, lai sadarbotos gan ar AII, gan uzņēmumiem?
	Iniciatīva
4.	Kas parasti ierosina sadarbību (AII, uzņēmums, citi gadījumi)?
5.	Ja AII ierosina sadarbību, kurā stadijā parasti tiek meklēta sadarbība?
	Pirmais cikls: iekšējā sadarbība
6.	Kā ZPC tiek informēta par AII esošajām inovācijām?
7.	Vai ir veidi, kā ZPC regulāri uzrauga, kādas ir uzņēmumu problēmas un vajadzības?
8.	Vai ir veidi, kā ZPC regulāri uzrauga inovācijas AAI vai tā paļaujas uz saņemto informāciju no AII?
9.	Vai obligāti visam zināšanu pārneses (ZP) jānotiek caur ZPC?
10.	Ja AII sadarbojas tieši (bez ZPC dalības) ar uzņēmumu, vai ZPC par to tiek informēta? Vai tā tiek piesaistīta kā konsultants?
11.	Kā notiek iekšējā sadarbība starp AII un ZPC? Vai tiek slēgts līgums? Kāds ir process?
12.	Kā ZPC sadarbojas ar uzņēmumiem? Vai tiek slēgts līgums arī pirms zināšanu pārneses procesa?
	Iniciatīva: sadarbību ierosina augstākās izglītības iestāde (AII)
	Otrais cikls: ārējā sadarbība
13.	Kā tiek sagatavots sadarbības priekšlikums uzņēmumam/-iem? To dara ZPC vai AII vai abi kopā?
14.	Vai informēšana ir vienreizējā vai arī uzņēmumi tiek regulāri informēti par inovācijām AII?
15.	Kā tiek izvēlēti iespējamie sadarbības partneri (kritēriji, spējas ieviest inovāciju)?
16.	Ar ko uzņēmumos tiek dibināti kontakti (R&D departaments, vadība)?
17.	Kas ir iesaistīts tālākajā sadarbības procesā? ZPC, AII vai abi kopā?
	Iniciatīva: sadarbību ierosina uzņēmums
	Otrais cikls: ārējā sadarbība
18.	Vai uzņēmumi nāk ar skaidriem sadarbības piedāvājumiem un prasībām vai arī ZPC jāiesaistās piedāvājumu sagatavošanā un prasību izstrādē?
19.	Kā tiek atlasīti sadarbības partneri no AII puses (kritēriji)?
20.	Kā notiek tālākā sadarbība ar uzņēmumu? Vai tas notiek caur ZPC vai arī uzņēmums sadarbojas tieši ar AII (līgums)?
	Trešais cikls: ZP process
21.	Kā notiek pats ZP process (līgums, finansējums)?
22.	Kā tiek veikta sadarbība – dokumentālā formā, tieša sadarbība?
23.	Vai uzņēmuma darbībā ZP procesa ietvaros tiek iesaistīti AII darbinieki?
24.	Cik ilgi notiek sadarbība? Kad ZP process tiek uzskatīts par pabeigtu?

[†] Zināšanu pārneses centri: LU Inovāciju centrs, RTU Inovāciju un tehnoloģiju pārneses centrs, RSU Tehnoloģiju pārneses kontaktpunkts

Nr.p.k.	Jautājums
25.	Vai arī pēc ZP procesa pabeigšanas notiek sadarbība?
26.	Kāda informācija tiek publicēta internetā?
27.	Kāda informācija ir ietverta ZPC datu bāzē? Vai datu bāza ir publiski pieejama?
28.	Vai pēc ZP procesa pabeigšanas tiek veikts formāls/neformāls procesa/sadarbības novērtējums?
29.	Vai tiek pārrunātas procesa stiprās/vājās puses (ar sadarbības partneriem, iekšēji ZPC)?
30.	Vai uzņēmumiem vai AII ir konkrētas sasniedzamās prasības ZP procesa ietvaros?
	Barjeras un stimulējošie faktori
31.	Kādas ir galvenās problēmas un barjeras ZPC darbībā, ZP procesā?
32.	Kādi ir stimulējošie faktori ZPC darbībā, ZP procesā?

Annex III: Interview Questions According to the Theoretical Framework (in English)

No.	Question	Knowledge Transformation and Transfer Frameworks and Their Stages		
		Knowledge Transformation Framework	**5 Questions Knowledge Transfer Framework**	**4 Stages Knowledge Transfer Framework**
Knowledge transfer centre (KTC)[‡]				
1.	What is the difference between Centres' and Offices' functions? Do not they overlap?	-	-	-
2.	How does KTC ensure collaboration with both HEI and businesses (KTC creditability)?	-	-	-
3.	What is the current (and necessary) background for KTC's employees in order to achieve successful collaboration with both HEIs and businesses?	-	-	-
Initiative				
4.	Who usually initiates collaboration (HEI, businesses and/or other cases)?	Retrieval	-	Initiation
5.	If HEI initiate collaboration in which phase of research does HEI usually look for collaboration with businesses?	-	-	Initiation
The first cycle: internal collaboration				
6.	How is KTC being informed about ongoing innovations in HEI?	Retrieval/Transformation	The message	-
7.	How is KTC being informed about current needs and problems businesses face?	Retrieval/Transformation	The message	-
8.	Does KTC monitor ongoing innovations in HEI or does it rely on information received from HEI?	-	The message	-

[‡] Knowledge transfer centres: UL Innovation Centre, RTU Innovation and Technology Transfer Centre, RSU Technology Transfer Office

No.	Question	Knowledge Transformation and Transfer Frameworks and Their Stages		
		Knowledge Transformation Framework	5 Questions Knowledge Transfer Framework	4 Stages Knowledge Transfer Framework
9.	Does KTC take part in all knowledge transfer (KT) activities between HEI and businesses?	-	The target audience/ The messenger	-
10.	If HEI collaborates directly with a company (without participation of KTC) is KTC informed about these activities? Is KTC involved as a consulting body?	-	The target audience/ The messenger	-
11.	How do HEIs and KTC collaborate? Is there an agreement? What is the process?	-	Process	-
12.	How do businesses and KTC collaborate? Is there an agreement before an actual knowledge transfer process takes place?			
Initiative: HEI initiates collaboration				
The second cycle: external collaboration				
13.	How is a proposal for collaboration with a company prepared? Is that a responsibility of HEI, KTC or both?	Retrieval/Transformation	The message	Initiation
14.	Are businesses informed on one case bases or are they informed regularly about ongoing innovations in HEI?	Retrieval/Transformation	The message	Initiation
15.	How are the possible partners selected? Criteria for selection, evaluation of capabilities to implement the innovation?	-	The target audience	Initiation
16.	Who is approached in a company in order to initiate collaboration (management, R&D department)?	-	The target audience	Initiation
17.	Who is involved in future collaboration? KTC, HEI or both?	-	The messenger	Initiation

No.	Question	Knowledge Transformation and Transfer Frameworks and Their Stages		
		Knowledge Transformation Framework	5 Questions Knowledge Transfer Framework	4 Stages Knowledge Transfer Framework
Initiative: a business initiates collaboration				
The second cycle: external collaboration				
18.	Do businesses initiate collaborate with clearly defined proposals and requirements or does KTC need to assist them with formulating the proposal and requirements?	Retrieval/Transformation	The message	Initiation
19.	How are the possible partners within HEI selected? Criteria for selection?	-	The target audience	Initiation
20.	How do businesses collaborate with HEI? Does it happen through KTC or is it a direct collaboration with HEI?	-	The messenger	Initiation
The third cycle: KT process				
21.	What is the actual KT process (agreements, financing etc.)?	-	The knowledge-transfer process	Implementation
22.	How does actual collaboration between HEI and a company happen (through exchange of documents, interaction)?	-	The knowledge-transfer process	Implementation
23.	Are HEI's employees involved in a company's activities (regarding KT) during the KT process?	-	The knowledge-transfer process	Implementation
24.	For how long does HEI collaborate with a company? When is KT process considered finished?	-	The knowledge-transfer process	Ramp-up
25.	Does collaboration continue after the actual KT process has been finalized?	-	The knowledge-transfer process	Integration
26.	What information is published in KTC's webpage/internet?	-	The supporting communication infrastructure	-
27.	What information does the KTC's data base	-	The supporting	-

No.	Question	Knowledge Transformation and Transfer Frameworks and Their Stages		
		Knowledge Transformation Framework	5 Questions Knowledge Transfer Framework	4 Stages Knowledge Transfer Framework
	contain? Is it publicly available?		communication infrastructure	
28.	Is formal or informal evaluation of KT process or collaboration conducted after finalizing the KT process?	-	Evaluation	-
29.	Are pros and cons of the KT process discussed after finalization of the KT (with partners, within KTC)?	-	Evaluation	-
30.	Do HEI or businesses specify concrete objectives that have to be achieved within the KT process?	-	Evaluation	-
Barriers and facilitators				
31.	What are the main barriers in KTC work or in KT process?	-	-	-
32.	What are the main facilitators in KTC work or in KT process?	-	-	-

Annex IV: Interview Transcripts (in English)

Interviewee:	Matīss Neimanis
Position held:	Head of the Centre
Institution represented:	University's of Latvia Innovation Centre
Interview date:	29/04/2010
Interviewer:	Sanita Šampane

Sanita Šampane (SS): *explaining the theme of the thesis, introducing to the main objective and structure of the interview, emphasizing that the focus of the interview is on the actual knowledge transfer (KT) process between HEIS and businesses.*

Knowledge Transfer Centre

SS: What is the difference between Centres' and Offices' functions? Do not they overlap?
Matīss Neimanis (MN): there are only administrative reasons for 2 separate institutions – Innovation Centre (IC) and Technology Transfer Office (TTO); it is because TTO is a project financed from EU funds.

The functions do not overlap and are only separated due to the same administrative reasons. These functions include: 1) obtaining information on the university's scientific and research activities; 2) marketing; 3) providing help to people from University of Latvia (UL) who have new ideas.

SS: How does IC ensure collaboration with both HEI and businesses?
MN: Just like in theory, 2 basic approaches are used: 1) Market Push if UL approaches businesses; 2) Market Pull if businesses seek the help of the university.

SS: What is the current (and necessary) background for IC's employees in order to achieve successful collaboration with both HEIs and businesses?
MN: Currently there 4 people working in IC with the following educational backgrounds: 1) economy; 2) law – therefore this person is responsible for issues regarding intellectual property rights; 3) biology (biology, chemistry); 4) microbiology.

All the employees work closely together and their duties are segregated on project bases.

Initiative

SS: Who usually initiates collaboration (HEI, businesses and/or other cases)?
MN: In most cases university approaches businesses. Sometimes businesses seek for specific help in different phases of their projects but mostly IC analysis a company sees what they can offer and approaches the company.

One drawback for UL is the fact that it covers so many different industries (e.g. law, biology, chemistry, physics etc.) that it is not known for some specific field they operate in.

The first cycle: internal collaboration

SS: How is IC being informed about ongoing innovations in HEI?

MN: There are no specific mechanisms therefore usually IC goes and searches for the necessary information. Sometimes IC obtains information about some scientific developments when scientists approach them with specific questions (50% of cases) and regarding property rights (50% of cases). Other than that IC goes to laboratories and talks to scientists.

In some other cases information can be obtained through the competences and research services data base. It contains information on competences and equipment available in UL, it is publicly available and currently IC works to simplify the data base.

SS: Does IC take part in all KT activities between HEI and businesses?
MN: In UL case most of the collaboration is direct – scientists cooperate directly with businesses. This is due to the fact that some scientists have already established informal relations with some businesses since they have worked together before. In these cases IT is sometimes approached to deal with legal issues and agreements.

SS: How do HEIs and IC collaborate? Is there an agreement? What is the process?
MN: Scientists and IC are within one organization therefore additional agreements are not necessary.

The only formal requirement is that in case IC finds a collaboration partner to scientists then IC should be paid 10% of the agreed price.

Initiative: HEI initiates collaboration
The second cycle: external collaboration

SS: How is a proposal for collaboration with a company prepared? Is that a responsibility of HEI, IC or both?
MN: IC helps to prepare proposals. Basically, IC helps in every case unless an idea is too unrealistic.

SS: Are businesses informed on one case bases or are they informed regularly about ongoing innovations in HEI?
MN: Usually businesses are informed in the exchange events when HEI can meet possible partners from businesses and vice versa.

SS: How are the possible partners selected? What are criteria for selection? Is there an evaluation of capabilities to implement the innovation?
MN: IC goes through businesses that could be interested in collaboration in each specific field and selects the most appropriate ones to approach.

SS: Who is approached in a company in order to initiate collaboration (management, R&D department)?
MN: It depends on a company – sometimes it is R&D while other times it might be management or both. Depends who can is more connected to the area where collaboration is possible.

SS: Who is involved in future collaboration, IC, HEI or both?
MN: IC takes part if necessary; usually it involves taking care of administrative duties or legal aspects.

Initiative: a business initiates collaboration
The second cycle: external collaboration

SS: Do businesses initiate collaborate with clearly defined proposals and requirements or does KTC need to assist them with formulating the proposal and requirements?
MN: Businesses usually look for a specific solution to their problem then IC suggests other possible solutions. Idea generation as such sometimes is difficult as businesses do not want to share their information.

SS: How are the possible partners within HEI selected - criteria for selection?
MN: Mainly scientists are selected based on the field required, also based on some personal factors – their motivation, willingness to collaborate, also on their workload. Of course, there is also the fact that experts in the field are usually very busy so a balance between expertise and workload should be found.

The third cycle: Knowledge transfer process

SS: What is the actual KT process (agreements, financing etc.)?
MN: IC usually takes care or agreements and administrative duties in order to let work directly on the project.

If a company has initiated the KT and they need a solution to a problem they usually finance the project. In case of market oriented research (support program) part of the money comes from EU while other part from businesses.

SS: For how long does HEI collaborate with a company? When is KT process considered finished?
MN: Until the solution to the specific problem is found. Of course, rules on property rights and usability for both sides are included in the agreement.

SS: Is formal or informal evaluation of KT process or collaboration conducted after finalizing the KT process?
MN: Currently most of the projects are still in progress therefore no evaluations have been conducted so far.

Barriers and facilitators

SS: What are the main barriers in IC work or in KT process?
MN: First, businesses do not have financial resources to finance KT projects.

Second, there is no common data base for science and research in Latvia e.g. if enterprise needs a specific solution, it approaches UL that cannot help in the situation. Nevertheless, there is a possibility that RTU could help. Unfortunately, there is no shared information that could be used in this situation.

The solution to this situation could be a united data base containing information on science and research from all the universities and a common administrative unit that could be approached by businesses. This would also help internationally as in Latvia competences are spread in different universities.

Additionally, there is a fragmentation in the field of innovation in Latvia – there are several non-governmental institutions and governmental institutions being responsible for innovations in Latvia and everyone wants to be the main responsible institution. There is also fragmentation in business industries e.g. there are several industry associations, information flow within them is slow, besides, many of people work for several of these associations.

Moreover, scientists in Latvia have competences but unfortunately there are no businesses in Latvia that can use them. Innovations mostly are not market oriented due to the fact that there is no communication between HEIs and businesses. To use their competences and earn money scientists establish their own businesses and lack motivation to collaborate with other businesses.

In order to promote Latvian scientists internationally IC lacks competence although many large enterprises in the world are informed and collaborate with Latvian scientists.

There are also intrapersonal problems – the scientists have to find a balance between working for academia and business, there is also jealousy from other colleagues possible.

Last but not least, most of the equipment in universities is state owned (bought with money from EU funds) therefore there are limitations for its use for research e.g. not to violate rules of ensuring competitiveness a public bid should be carried out in all cases and ideas should be offered to several enterprises.

All together these problems cause a huge drawback to innovation field in Latvia.

SS: What are the main facilitators in IC work or in KT process?
MN: As surprising as it might sound, one of the main facilitators is the economical crisis. The state decreased the support for scientists therefore they needed to find other sources of funding. Some, of course, lost their motivation but some have started to collaborate with businesses. There are also some scientists who have started their own businesses and abandoned their scientific activity which is unfortunate.

Of course, financing for science and research is necessary but lately due to the many possibilities scientists were not able to use all of it and became quite lazy.

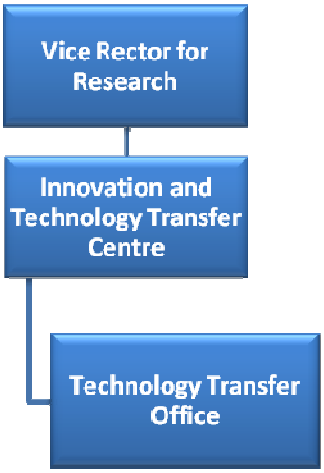
Interviewee:	Laila Eliņa
Position held:	Head of the Centre
Institution represented:	Riga Technical University's Innovation and Technology Transfer Centre
Interview date:	29/04/2010
Interviewer:	Sanita Šampane

Sanita Šampane (SS): *explaining the theme of the thesis, introducing to the main objective and structure of the interview, emphasizing that the focus of the interview is on the actual knowledge transfer (KT) process between HEIS and businesses.*

Knowledge Transfer Centre

SS: Could you please shortly describe the centre and its functions?
Laila Eliņa (LE): Riga Technical University's (RTU) Innovation and Technology Transfer Centre (ITTC) was established in 2007. A specific KT process has not been developed yet; the operation of ITTC is based on different activities and projects.

SS: What is the difference between Centres' and Offices' functions? Do not they overlap?
LE: The organizational structure of the ITTC is as follows: the ITTC is under the supervision of Vice Rector for Research while the Technology Transfer Office (TTO) is a project carried out by ITTC; the project will last until 2013.



The functions of ITTC and TTO are not strictly separated. The main reason for that is a shortage of human resources; this is why employees carry out different duties for both ITTC and TTO.

The main functions of ITTC are: to insure participation and assist in taking part in different conferences, seminars, exhibitions as well as marketing (preparation of different marketing materials such as booklets etc.)

Additionally, there are several problems arising because TTO is a project financed by EU funds:

1) Sometimes the limitations and requirements for the project are too strict and do not allow freedom to plan the necessary activities.
2) The criteria for the project and economical situation have changed.
3) There is a lack of positive collaboration with *Investment and Development Agency of Latvia* and *Ministry of Economics,* the responsible institutions for this project.
4) There are no funds/support available for maintenance costs.
5) The financial planning is difficult due to:
   - Planning periods for procurements (they have to be planned for a year);
   - Inflexibility to change plans – ITTC cannot follow the latest trends and adjust plans accordingly (e.g. construction plans).

Nevertheless, *Ministry of Economics* has understood the difficulties caused by the current economical situation and has agreed to include other activities in the TTO project.

SS: How does ITTC ensure collaboration with both HEI and businesses (ITTC creditability)?
LE: ITTC has 3 main target groups: scientists, businesses and broader society. With respect to each target group there are several objectives to achieve or activities to assist with (see below):

Target group: Scientists (carried out by ITTC and TTO)	Target group: Businesses (carried out by ITTC and TTO)	Target group: Broader Society (carried out by ITTC)
•Patents •Choise of projects	•Cooperation between scientists and businesses	•To bring science closer to the society •To break stereotypes about science

In general, ITTC holds the main responsibility for the first target group – science as well as it is responsible for maintaining the scientific competence and research data base. This data base contains information about inner competences and scientific and reserch infrastructure in RTU. ITTC is also responsible for informing wider society about scientific achievements in RTU e.g. there is an event called *„The Night of Science"* (*„Zinātnes nakts"*) being organized every year within the framework of the *7th Framework Program*. Each year a different theme is chosen and the event is opened to everyone – schools, families, pensionairs etc.; during the event there are also lectures being held. In the future ITTC plans to develop short stories about the event on TV.

TTO, on the other hand, holds the main responsibility for the second target group – businesses. It includes collboration between science and businesses (contracts), contacts with businesses, this is mainly due to that fact that these activities are financed from EU funds as a part of the TTO project.

Furthermore, the creditability of ITTC is ensured through participation in different exhibitions. Each year ITTC takes part in at least 4 local exhibitions (for different industries), 4 international exhibitions or conferences (also for scientists).

Collaboration is also achieved through other functions of ITTC: consulting and development of new products and technologies both locally and internationally, pursuing of new ideas and collaboration, development of prototypes, testing and use of RTU infrastructure, participation in international projects and patenting.

SS: What is the current (and necessary) background for ITTC's employees in order to achieve successful collaboration with both HEIs and businesses?
LE: Currently besides the Head of ITTC there are 4 employees altogether in ITTC and TTO. Their duties have not been formalized yet but there is an intention to do so in the nearest future.

The structure and internal regulations in RTU are quite rigid and therefore difficult to change in order to e.g. establish a patenting unit or even to establish alumni association. Although the future vision of ITTC is to have a KT agent in each faculty.

The backgrounds of the people employed by ITTC are very different: 1) journalism, communications and public relations; 2) engineering and economics; 3) engineering; 4) sociology; 5) management sciences.

Even though the functions of each employee are not formalized each of the employees has its own specific duties, their own contacts and daily affairs to deal with. The segregation of duties is also import in order to ensure that employees can deepen their knowledge in a specific field. Nevertheless, the main task of ITTC that should be implemented by all the employees is to be a messenger among science, business and society.

Initiative

SS: Who usually initiates collaboration (HEI, businesses and/or other cases)?
LE: In most cases businesses initiate the collaboration. There might be several scenarios: 1) a company has a new idea and they want a scientist to develop it (but these are complicated cases); 2) a company has specific requirements or a problem – they need to improve something, develop or introduce new technologies or enter new markets. The cases when scientists have an idea and initiate collaboration are rarer. When a scientist initiates collaboration ITTC helps with developing necessary document packages.

Regarding scientists' ideas there used to be problems since some of the scientists from the older generation "research just with a purpose of research", their ideas or research results cannot be commercialized or are not beneficial to the society. But the situation is getting better since the new generation of scientists understand the current situation and they try to take part in international projects.

SS: If HEI initiates collaboration, in which phase of research does HEI usually look for collaboration with businesses?
LE: Theoretically all collaboration cases should go through ITTC but unfortunately not always ITTC is informed – it is not that easy to change developed routines and ways of doing things. If ITTC participates it mostly consults scientists regarding agreements. Besides, scientists start to trust ITTC more and more as they know that it is a trustworthy partner.

ITTC also helps with patenting. Regarding patents there is a formal procedures but it is not very strict therefore patents can be issued to the scientist or to the university. The benefit of involving ITTC in the process is the fact that all the information is kept in one place.

The first cycle: internal collaboration

SS: How is ITTC being informed about ongoing innovations in HEI?
LE: there are several ways ITTC obtains information about current innovations and scientific developments: 1) conferences; 2) through personal contacts, information, from previous experience; 3) other events e.g. exhibitions; 4) by gathering publicity information.

Conferences are a good way for obtaining the information since it is used as a report mechanism for scientists to receive financing. Therefore scientists are motivated to participate in these conferences.

ITTC helps scientists to prepare for the conferences so the scientists do not have to spend their time carrying administrative and technical tasks. It also helps scientists to formulate the

message they want to bring to entrepreneurs as well as to improve their stands and presentations.

SS: How is ITTC being informed about current needs and problems businesses face?
LE: The conferences are also a good way to identify business needs. These conferences are organized as poster sessions (lasting 2 hours) where scientists establish a stand and a poster explaining the main idea, application of their invention as well as possible industries where the invention could be used so the entrepreneurs can see and develop further contacts. Besides, these conferences are getting more popular.

SS: Does ITTC take part in all KT activities between HEI and businesses?
LE: It does not happen in all cases. ITTC takes part in the most important projects. Additionally, an initiative and motivation from scientists to collaborate with ITTC is important since there are around 500 scientists in RTU while there are only 5 employees in ITTC. Currently a certain circle of scientists has developed who use the help of ITTC. Furthermore, it is also important that help is used by those who are interested in that instead of everyone being forced to use ITTC services. The same is true for patenting since not every scientist can patent his/her invention or scientific development, there is a special commission of independent experts who make decisions in case of patenting.

SS: How do HEIs and ITTC collaborate? Is there an agreement? What is the process?
How do businesses and ITTC collaborate? Is there an agreement before an actual KT process takes place?
LE: Since ITTC is a structural unit of RTU there is a collective agreement for all the employees therefore no additional agreements are signed in the collaboration process between scientists and ITTC. Trust is also an important factor in this cooperation.

Of course, when it comes to collaboration with companies a confidentiality agreement is signed in every case.

Initiative: HEI initiates collaboration
The second cycle: external collaboration

SS: How is a proposal for collaboration with a company prepared? Is that a responsibility of HEI, ITTC or both?
LE: ITTC does not always assist scientists in the collaboration, it is done only when there is a potential in the project. Of course, limited help is offered to everyone but an actual KT process is initiated only when there is a potential in the project.

SS: Are businesses informed on one case bases or are they informed regularly about ongoing innovations in HEI?
LE: There are several ways of bringing HEI together with businesses: 1) as mentioned earlier, the conferences; 2) specific seminars between scientist/-s and a company; 3) contact exchange meetings when there is scientist/-s with the project idea and several companies that might be interested in collaboration; 4) exhibitions; 5) media; 6) contacting specific individuals (but those are very rare cases); 7) different events.

SS: How are the possible partners selected? What are criteria for selection? Is there an evaluation of capabilities to implement the innovation?

LE: If HEI is looking for a company to collaborate with then usually the main criteria involve the necessary industry (due to Latvia's small market there are limited numbers of industries); opinions of experts; company's sustainability; company's reputation.

SS: Who is approached in a company in order to initiate collaboration (management, R&D department)?
LE: Contacts usually are established in a direct contact or during organized meetings. If small or medium size enterprises are approached then usually management is contacted. If a large enterprise is targeted then usually R&D Department is approached.

SS: Who is involved in future collaboration, ITTC, HEI or both?
LE: If scientist provides consulting services then ITTC is not involved. Usually during the KT process ITTC keeps in touch with both HEI and a company to supervise the process.

Initiative: a business initiates collaboration
The second cycle: external collaboration

SS: How are the possible partners within HEI selected, criteria for selection?
LE: If a company needs a consulting services or a help from a scientist then usually the requirements are quite specific therefore there is a limited choice of scientists that can help. They usually are known to ITTC due to previous collaboration or contacts.
Another way to find the necessary specialists for the projects is through the scientific competence and research data base that contains information on available competencies and equipment in RTU. It is developed in collaboration with RTU Information Technology Department and regarding scientists the following information is available in it: scientist's profile, his/her competencies, in which areas the scientist can provide consulting services, developed products and their developent stage.

SS: How do businesses collaborate with HEI? Does it happen through ITTC or is it a direct collaboration with HEI?
LE: If KT process takes place then a company signs an agreement with RTU (as with an enterprise) through ITTC.

The third cycle: Knowledge transfer process

SS: What is the actual KT process (agreements, financing etc.)?
LE: The actual process depends on a situation or a phase when the KT is initiated.

The process can go as follows: 1) a company initiates the KT process → 2) HEI finds experts/scientists who can help the company → the availability of experts/scientists is checked → if experts/scientists are available a meeting with the experts/scientists, the company and ITTC is organized → discussions → an agreement about collaboration is signed.

The agreement usually covers the activities that should be performed, results to be achieved, finances, intellectual property rights etc. Sometimes the projects can set up in phases and then agreements for separate phases can be signed. ITTC contacts both sides throughout the project to monitor the progress.

SS: Are HEI's employees involved in a company's activities (regarding KT) during the KT process?
LE: It depends on a project. Sometimes RTU scientists take part in KT projects as independent experts. There are cases when, besides RTU scientists, RTU premises and equipment are used.

SS: For how long does HEI collaborate with a company? When is KT process considered to be finished?

LE: The KT process is considered to be finished when the agreement for the whole project or a project phase expires. The process is usually financed by the company but it also depends on the way of collaboration as sometimes there are barter cases e.g. the company uses RTU equipment for free in exchange for RTU to use the company's equipment for free.

SS: What information does the ITTC's data base contain? Is it publicly available?
LE: The data base contains information about research equipment available in RTU, what can it be used for; its load etc. It also contains information necessary for ITTC's daily work as well as information about the developed products.

The data base is only used internally. Publicly available are only contacts and basic information. It is planned that in the future obtaining information from the data base for external use could be a paid service.

SS: Is formal or informal evaluation of KT process or collaboration conducted after finalizing the KT process? Are pros and cons of the KT process discussed after finalization of the KT (with partners, within ITTC)?
LE: Yes, it is being done after projects as well as after conferences and seminars. The lessons learned are shared internally during meetings.

Barriers and facilitators

SS: What are the main barriers in ITTC work or in KT process?
LE: First, there are some negative aspects regarding the collaboration with *Investment and Development Agency of Latvia* and *Ministry of Economics* within the TTO support project. Rather than that there is a good cooperation with responsible institutions and other KT centres in Latvia, formal and informal information and knowledge is shared.

Second, the lack of financing – ITTC receives 60% of its budget from RTU and other part of financing within the TTO project from EU funds and through other projects.

Third, RTU is a big organization with well established traditions that are hard to change. Moreover, it is hard for ITTC to win over people's trust due to the fact that scientists have had bad experience with enterprises and collaboration with them.

Fourth, a fact that the KT system is new and there is no previous experience. KT centres from abroad do not like to share their knowledge and experience.

SS: What are the main facilitators in ITTC work or in KT process?
LE: The economical crisis – it raises the interest from businesses as well as scientists realize that they have to look for opportunities to find additional resources, they have to be more

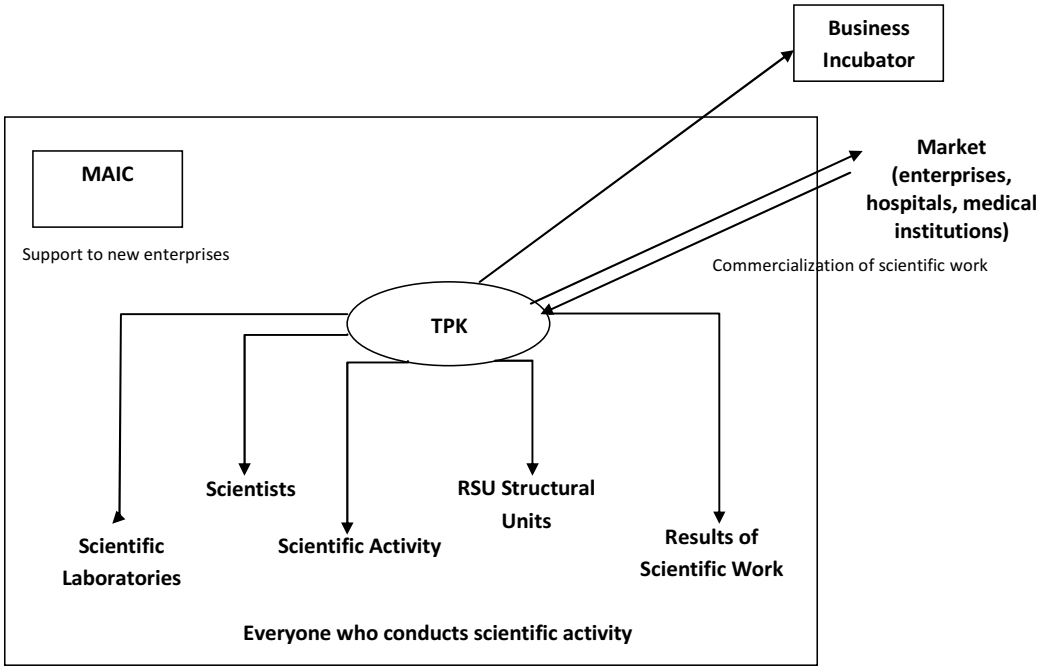
active and develop technologies that can be used by businesses and can be commercialized. Furthermore, the attitude in all the sectors change – businesses are getting used to the fact that help can be acquired in an organized manner while scientists start to trust and collaborate more.

Interviewee:	Linda Gabrusenoka
Position held:	Head of the Office
Institution represented:	Riga Stradiņš University's Technology Transfer Office
Interview date:	30/04/2010
Interviewer:	Sanita Šampane

Sanita Šampane (SS): *explaining the theme of the thesis, introducing to the main objective and structure of the interview, emphasizing that the focus of the interview is on the actual knowledge transfer (KT) process between HEIS and businesses.*

Knowledge Transfer Centre

SS: What is the difference between Centres' and Offices' functions? Do not they overlap?
Linda Gabrusenoka (LG): the innovation centre in case of Riga Stradiņš University (RSU) is Innovation Centre for Construction of Medical Appliances (Medicīnas aparātbūves inovāciju centrs) (MAIC). It was established in 2007 with the state support program for development of technology transfer centres within HEIs in Latvia. RSU Technology Transfer Office (TTO) was established in 2008 within the new support initiative from EU funds and it started to operate on the 1st of September, 2008. MAIC and TTO within RSU operate as showed in the scheme below.



MAIC currently works as a business incubator for the biggest microelectronics enterprises although it plans to renew construction of medical appliances. At the moment there 4 enterprises in MAIC: 1) a company who has built a new ultra red apparatus; 2) IT enterprise that works on a program for ergonomic work with personal computers; 4) Eco-cosmetics company; 4) an enterprise producing magnetic elements for clothing.

MAIC and the business incubator are independent institutions although they are supported within the same support program and have the same functions. MAIC is closely related to RSU and the term that new enterprises can stay in the incubators is longer (5 years), MAIC is

supported from “Innovation support program” launched by *Ministry of Economics* (state aid).
TTO, on the other hand is supported from ERAF within the support measure “Technology Transfer Offices”.

The main challenge for TTO at the moment is to find a way to support itself after closing the EU funds support measure; the office has to find ways to create revenue. *Ministry of Economics* as a responsible institution already sees it might be difficult and is trying to find additional financial resources. MAIC and the business incubator face the same problem.

SS: What is the current (and necessary) background for KTC’s employees in order to achieve successful collaboration with both HEIs and businesses?
LG: currently there are 2 full time employees in TTO - The Head of the Office and her Assistant. The Head of the Office has educational background in business management and innovation management combined with work experience in innovation centres and innovation supporting institutions.

Additionally, there are 2 part time (they are paid based on hours worked) employees in TTO – experts that deal with specific issues when necessary. One of the experts has experience in technology transfer and matchmaking while other deals with intellectual property rights protection (in medicine), licensing and agreements.

The functions are divided among the employees based on their specialities.

Initiative

SS: Who usually initiates collaboration (HEI, businesses and/or other cases)?
LG: At the moment more collaboration is initiated by enterprises e.g. different measures in laboratories and further developments or solutions.

In other cases collaboration can be initiated based on previous experience and collaboration. There have also been cases when TTO approached businesses e.g. after exhibitions.

The first cycle: internal collaboration

SS: How is TTO being informed about ongoing innovations in HEI?
LG: Last year TTO acknowledge competences in RSU – where and what kind of information can be found in each structural unit, what services they provide. All this information is now entered into RSU Scientific Competences Data Base which is publicly available. The next step is marketing of RSU competences.

TTO is responsible for monitoring the data base therefore it reminds scientists to update it. TTO also uses the data base in their daily work and update it if necessary.

SS: Does TTO take part in all KT activities between HEI and businesses?
LG: It is difficult if TTO is informed about all the cases of KT since RSU and TTO has separate infrastructures and it is not required to always collaborate with businesses through TTO.

Initiative: HEI initiates collaboration
The second cycle: external collaboration

SS: How is a proposal for collaboration with a company prepared? Is that a responsibility of HEI, TTO or both?
LG: TTO helps if necessary mostly with administrative duties as well as with "translating" the information from HEI to businesses and vice versa.

Often scientists come willing to patent their scientific developments then the responsibility of TTO is to see whether or not the innovation has a potential.

SS: Who is approached in a company in order to initiate collaboration (management, R&D department)?
LG: Within enterprises the people actually working with the problem in question are approached, in small enterprises also management can be approached.

SS: Who is involved in future collaboration, TTO, HEI or both?
LG: TTO's involvement in an actual KT process is limited; mostly it is just controlling and monitoring the process to see if there are no problems and if the necessary results are achieved.

Initiative: a business initiates collaboration
The second cycle: external collaboration

SS: Do businesses initiate collaborate with clearly defined proposals and requirements or does KTC need to assist them with formulating the proposal and requirements?
LG: Usually companies have clear and defined requirements. TTO helps only if enterprises come only with ideas that need to be further developed.

SS: How are the possible partners within HEI selected - criteria for selection?
LG: Through the data base or by approaching structural units that might can help with the specific problem.

The third cycle: Knowledge transfer process

SS: What is the actual KT process (agreements, financing etc.)?
LG: TTO usually takes care of agreements. If a company has money they pay for services provided by scientists. If project deals with product development then a company pays if they can and other sources of financing are searched – EU funds, public resources etc.

SS: For how long does HEI collaborate with a company? When is KT process considered finished?
LG: It depends on a case. If the KT process is long it can be divided in several phases. The project usually ends when all the requirements agreed upon are fulfilled; if not – it should be explained why.

SS: Is formal or informal evaluation of KT process or collaboration conducted after finalizing the KT process?
LG: Not at the moment since there are very few projects. But there is a plan to implement such an initiative.

Barriers and facilitators

SS: What are the main barriers in TTO work or in KT process?
LG: First, it is the lack of financial resources for both enterprises and scientists. It also applies to protecting intellectual property rights since it is an expensive thing, especially internationally.

Significant amount of resources are necessary for marketing. Now TTO has noted that and plans to provide more time and money to marketing activities.

Another barrier is a fact that there is no methodology to evaluate the results of scientific and research activities.

SS: What are the main facilitators in TTO work or in KT process?
LG: There is an initiative to establish collaboration network among TTO and MAIC and the business incubators to organize common contact exchanges since this would allow to provide more complex solutions to businesses.

Additionally, the crisis is also a facilitator since businesses have to find solutions on how to keep operating, how to develop new products. Scientists become more active since all structural units of RSU have to find additional sources of financing and TTO can help in all these situations.

Interviewee:	Dr. Chem. Gunārs Bremanis
Position held:	Chairman of The Board of Scientific Council and Leading Researcher
Institution represented:	*State Stende Grain Crop Selection Institute* (*Valsts Stendes Graudaugu selekcijas institūts*)
Interview date:	14/05/2010
Interviewer:	Sanita Šampane

Sanita Šampane (SS): *explaining the theme of the thesis, introducing to the main objective and structure of the interview, emphasizing that the focus of the interview is on the actual knowledge transfer (KT) process between HEIS and businesses.*

Situation in Latvia

Gunārs Bremanis (GB): Due to the soviet times Latvia has fallen back and now needs to catch up with the rest of Europe. Some things are improved, some are left as they are – in the catching up process there is not enough time to do everything.

The current drawbacks in the field of innovation include:

1) No effect for investments;
2) Lack of competition for financial resources – in Latvia the responsible persons are not entirely independent therefore the financial support not always goes to projects with highest returns.

Research Institutes in Latvia

The institute – selection station – is a non-profit enterprise; this means that all its profits should be invested in its development.

Since *"Law on Commerce"* (*"Komerclikums"*) came into force there was no longer niche for non-profit enterprises therefore there were 2 possibilities: 1) to be a state agency (financed from the state budget); 2) to be an enterprise (no financial resources from the state budget available). This move left all the science "outside the law" therefore the regulations were changed again and now research institutes became derived public persons.

Now there 2 kinds of research institutes – the ones incorporated within universities and independent ones.

***State Stende Grain Crop Selection Institute* (*Valsts Stendes Graudaugu selekcijas institūts*)**

The financial resources for the institute are as follows:

1) State budget – base budget calculated and received based on number of projects, patents etc.);
2) Direct earnings;
3) Private orders:
   - Companies want to approbate western crop sorts (within 3 years period);
   - Companies want to approbate pesticides – Latvian legislation determines that pesticides should be approbated before they can be sold in Latvia;

4) Projects – financed by EU but still within a project a part of money should be supplied by the institute.

***Latvian Institute of Organic Synthesis* (*Latvijas Organizskās sintēzes institūts*)**

The Institute of Organic Synthesis was taking part in medical research. They invented a medicine "Mildronāts". I synthesized all surrounding structures, all derivatives are more specific. Then the crisis started and all the experiments ended.

The institute's Experimental Unit collaborated with *Grindex*'s Drug Department. In order to introduce one new medicine it is necessary to synthesize several thousands of compounds. First it is done in culture mediums, then tested on animals, then clinical tests are carried out and still after that the medicine should be regularly tested for another 3 years. Some indications can only be observed after 10 years.

In Latvia the average number of synthesis per medicine is lower than in Europe since less financial resources are available and synthesis should be planned more carefully. Now synthesis can be done with specific equipment therefore it is easier and less resources consuming.

Latvian innovations

Many innovations are developed by individuals e.g.

1) Mowing machine designed for rough environments;
2) Cream "Evija" that is now being produced for broader society;
3) "Tarafūns" - anti cancer medicine (Author: Hillers; Synthesized by: Žuka);
4) "Leokadīns"- anti cancer medicine, improves immune system. It helps to live longer but does not heal therefore it was denied.
5) Anti-flue medicine (Author: Juris Polis) "Remantadīns" and "Antigripīns" – they might be the first anti-virus medicines.

The Selection Institute has also selected new crop sorts; this is important due to Latvian specifics – environment, weather. "Fredis", "Ufo" and "Austris" are the latest sorts. It takes a long time to select new sorts (around 10 years) + independent testing; besides, the scientists have to prove that the new sort is better than the previous one.

Many innovations are possible in the field of environmental protection. The negative side of the market system is the fact that businesses do not think about the environment. There has to be a sustainable circulation in the environment – what people take from environment should be given back to environment. By not doing it people change environment in the negative way. So there are plenty room for innovations to address the questions what to do to protect and improve the environment and how to do it.

Additionally, enterprises should think what to do with the things they produce until the very end of their life cycle. The government has implemented the environment tax but the taxes should be imposed based on product utilization e.g. some plastics can be burned. Recycling should be introduced but that needs government reforms, development of a system and infrastructure, implementation of stimuli etc.

The main requirement for the change is sustainable thinking in society and state government. It should be acceptable that things can be done slower but in more sustainable way e.g. organic fertilization.

Furthermore, organizational and political innovations are necessary in Latvia.

Knowledge transfer projects

The project was carried out in collaboration with *Grindex,* the largest pharmaceutical company in the Baltics. In the process of producing the medicine "Mildronāts" chemical waste occurs which is then burned (it is a costly process). The aim of the project was to check how this chemical waste affects crops – it was tested on technical rape and no big effect was necessary.

At the end it turned out that the effect was minimal; it was more on industrial crop field than on the experimental field. The effect on micro organisms was also tested – it was rather positive than negative. As a result *Grindex* can save a lot of money for burning the chemical waste and instead give it to farmers. To motivate farmers *Grindex* might even consider bringing the waste to farmers because that would still be cheaper than burning them.

I had the idea from my previous work and I had to interest *Grindex* in this idea. The project was carried out within the support program for market oriented research therefore the aid was provided by the state and *Grindex*, in the third year also by the institute.

Within the project progress reports had to be prepared twice a year – one at the end of March (due in the 1st of April) with description of activities carried out; the other one at the end of the year with research results.

Another project was carried out within *The Institute of Organic Synthesis*; the financial support was provided my *Ministry of Education and Science* through an idea contest. Within the project one of the synthesized chemical was tested on rye. Moisture usually spoils the harvest of rye therefore it was expected that this chemical could help maintain rye quality in wet conditions. It was observed that in ideal conditions there is no effect, in real conditions the observations were as follows:

1) In the 1st year weather conditions were dry so no important effects were observed, the harvest increased;
2) In the 2nd year weather conditions were wet and the quality of rye had increased, no effect on harvest was observed.

These effects should be tested for 3 years but due to the lack of resources the experiments were stopped.

Facilitators and Barriers

One of the main facilitators is support available from EU for research.

The main problems are lack of financial resources, technical possibilities and in some cases legislation. There is also lack of PhDs. The system is not well developed; bureaucracy is another barrier.