RIGA TECHNICAL UNIVERSITY

Mikus Dubickis

TECHNOLOGY TRANSFER MANAGEMENT SOLUTIONS FOR THE COMPANY'S GROWTH

Summary of the Doctoral Thesis

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RIGA TECHNICAL UNIVERSITY

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DOCTORAL THESIS PROPOSED TO RIGA TECHNICAL UNIVERSITY FOR THE PROMOTION TO THE SCIENTIFIC DEGREE OF DOCTOR OF SCIENCE

To be granted the scientific degree of Doctor of Science (Ph. D.), the present Doctoral Thesis has been submitted for the defence at the open meeting of RTU Promotion Council on December 28, 2021 at 10:00 online.

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DECLARATION OF ACADEMIC INTEGRITY

I hereby declare that the Doctoral Thesis submitted for the review to Riga Technical University for the promotion to the scientific degree of Doctor of Science (Ph. D.) is my own. I confirm that this Doctoral Thesis had not been submitted to any other university for the promotion to a scientific degree.

Mikus Dubickis …….(Signature)

Datums: ……

The Doctoral Thesis has been written in Latvian. It consists of an Introduction, 3 parts, Conclusions and Proposals, 35 appendices, 21 figures; the total number of pages is 156. The bibliography contains 304 titles.

Contents

Introduction

A variety of societal and economic terms such as *information society, data economy, digital economy, sharing economy, knowledge economy, knowledge-based economy, learning economy, and innovation economy are used to describe the changes taking place in the modern world and* characterise the current era. At the same time, it is debated whether the economic situation of the world, regions, and countries is improving. Although there are different views depending on the viewpoint and the indicators used, it can be assumed that the situation is rather improving – the quality of life for residents is increasing. To a certain extent, societal development can be attributed to both scientific and technological development and the increasing competition in business. At the same time, this development requires companies to constantly think about introducing innovations. In historical retrospect, it is acknowledged that there is an overriding sign of uniformity between an entrepreneur and an innovator, as expressed by Austrian economist Joseph Schumpeter more than a hundred years ago. Schumpeter is also associated with the beginnings of the term *innovation economy*. This concept explains that innovation is the primary driver of economic growth and is used as an assumption of the Doctoral Thesis, justifying the relevance of the research.

The term *innovation* is becoming more habitual in the information space, though sometimes its usage is debatable, as it can be used to seemingly increase the value of the object described. Depending on the context in which this term is used, there are many explanations and various semantics, sometimes resulting in a misunderstanding between the parties involved both socially and during scientific discussions. In this Thesis, *innovation* is considered both as a set of activities or innovation processes and a result of innovative activity – introduced innovations. One of the ways to implement the innovation process is by using only the resources available at the disposal of an enterprise – this is referred to as *closed innovation*. In contrast, the process of using resources outside an enterprise is called *open innovation* (Chesbrough, 2003). The second case goes about using a wider knowledge base and cooperating with others, which is not a common practice for various reasons. These include, for example, fear that the knowledge of the enterprise will be revealed to others or just a lack of knowledge about using external sources of knowledge and technology. Still, it is open innovation or, more specifically, one of the types of open innovation – acquisition of new knowledge and technology that in recent decades has been highlighted as an innovative and valuable approach to innovation and

enterprise growth and, thus, **the object of research of the Doctoral Thesis is the process of technology transfer (acquisition of new knowledge and technology)**.

At the same time, in view that technology transfer is a term used in literature relatively much less commonly, the Thesis analyses the concepts of both innovation and technology transfer and reveals their interrelation.

Technology transfer from a business management perspective is a much less studied field when compared to studies conducted in education management (from the perspective of higher education institutions). However, acquiring new knowledge and technology is recognised as one of the most important activities for developing the organisation's expertise and market expansion (by introducing new products and/or acquiring new markets). Accordingly, the competitiveness of businesses is strengthened, and, at the same time, other stakeholders in innovation and the business ecosystem, including public administration, higher education institutions, and society, have a positive impact. However, despite the benefits of technology transfer and innovation, their potential has not been exploited sufficiently in Latvia. The share of investment in R&D is one of the lowest in the EU. Although the Joint Technology Transfer Centre, which operates as an organisational unit of the Investment and Development Agency of Latvia, was established to facilitate technology transfer in Latvia in recent years, it is more dedicated to higher education and research institutions. The activities available to enterprises in this support programme (e.g., the so-called *innovation vouchers*) are not so binding and are used relatively rarely. Therefore, technology transfer management solutions are essential for developing innovation potential and entrepreneurship in Latvia as a whole. Accordingly, the Thesis explicitly addresses the dimension of the acquisition of new knowledge and technology. In other words, **the research subject is the factors related to innovation and acquisition of new knowledge and technology to facilitate business growth**.

The Doctoral Thesis aims to explore the links between the factors contributing to innovation and technology transfer to develop technology transfer management solutions to promote business growth.

To achieve the aim set in the Thesis, the following **objectives** have been identified:

1) to describe the importance of innovation and technology transfer in the context of an economy and business management;
2) to analyse innovation and technology transfer concepts and their interrelation and review technology transfer performance studies in business management;

3) to summarise, group, and evaluate factors involved in the process of innovation and technology transfer;
4) to obtain empirical data, analyse them, and develop management solutions based on the research results to facilitate business growth.

There is a **hypothesis** put forward in the Thesis: **acquisition of new knowledge and technology positively correlates to the introduction of product, process, marketing, and organisational innovation and business growth (turnover, productivity, profits, and customer satisfaction)**.

The conceptual part of the Thesis uses the following **data acquisition methods**: literature review on existing technology transfer performance studies, interviews, and reference reports on factors affecting innovation and technology transfer. The conceptual framework of the research, which has been established on the basis of guidelines on the development and components of the logical model, has been used to structure aggregated factors and formulate hypotheses. The factors summarised in the second part of the Thesis for their inclusion in the empirical research have been evaluated by using the following criteria:

1) relevance of factors to the purposes of the empirical research and the pool of respondents – managers or representatives of an enterprise familiar with its activities as a whole;
2) relevance of the factors for the unit to be analysed – for the enterprise activity as a whole;
3) collection of as objective data as possible;
4) frequency of business practices or other circumstances examined for meaningful analysis of quantitative data;
5) achieving the intended response.

The empirical part of the Thesis uses the quantitative method for collecting data – survey. Both factual scales and perception scales are used to measure the factors or, in other words – variables included in the questionnaire. They are either directly adapted from literature or are specially designed for some of the variables, provided that the solutions already available in the literature do not correspond to the specific nature of this research and/or could have been too complicated to use. Before the data acquisition, the formulated questionnaire was approbated. A pilot survey[1] was carried out to verify its validity for empirical research in actual circumstances – to refine the questionnaire and developed hypotheses.

[1] During the pilot survey, the time needed to complete the questionnaire has been assessed and its complexity in general, as well as the clarity of each question.

To identify the correlation between various factors and technology transfer performance, as well as the correlation between the performance of innovation and technology transfer and business growth, a survey of enterprises that are hypothetically engaged in the acquisition of new knowledge and technology has been performed. The general group is composed of enterprises that had any form of cooperation formalised in writing (contractual) with the higher education and research institution – Riga Technical University – between 2014 and 2017 and which continue operating (the enterprises have not ceased their activities and have not commenced insolvency proceedings), as well as their contact details are publicly or otherwise available. Overall, this group includes 193 enterprises.

The survey was performed in July – August 2018 (inclusive) in the electronic environment by using the *Google Forms* platform. Electronic polling is recommended in cases where the questionnaire is more sophisticated – a transition to further questions has to be made, depending on the response provided. To ensure the response, representatives of the enterprises were contacted before sending the questionnaire and were requested to participate in the research. As a motivation for participating in it and rewards for the time spent, it was proposed to provide an opportunity for getting familiar with the research results.

Both in similar technology transfer studies (see, for instance, Love and Roper, 1999; Henchion et al., n.d.) and other business management studies (for example, Ozoliņa-Ozola, 2017), the response usually reaches up to 20 %. The same was also expected in this research. However, overall, replies from 65 enterprises representing around 34 % of the general group have been received, thus exceeding the predicted response by 14 percentage points. Nearly all or 63 respondents who participated in the study completed the questionnaire online, while two agreed to answer the questions by phone. The oral replies were entered electronically in the same online form that was sent to the other respondents. MS Excel software was used to process the resulting data, and *SPSS* was used for the data analysis.

The research period overall covers the period from 2014 to 2021. The research design of the Doctoral Thesis is schematically shown in Fig. 1.

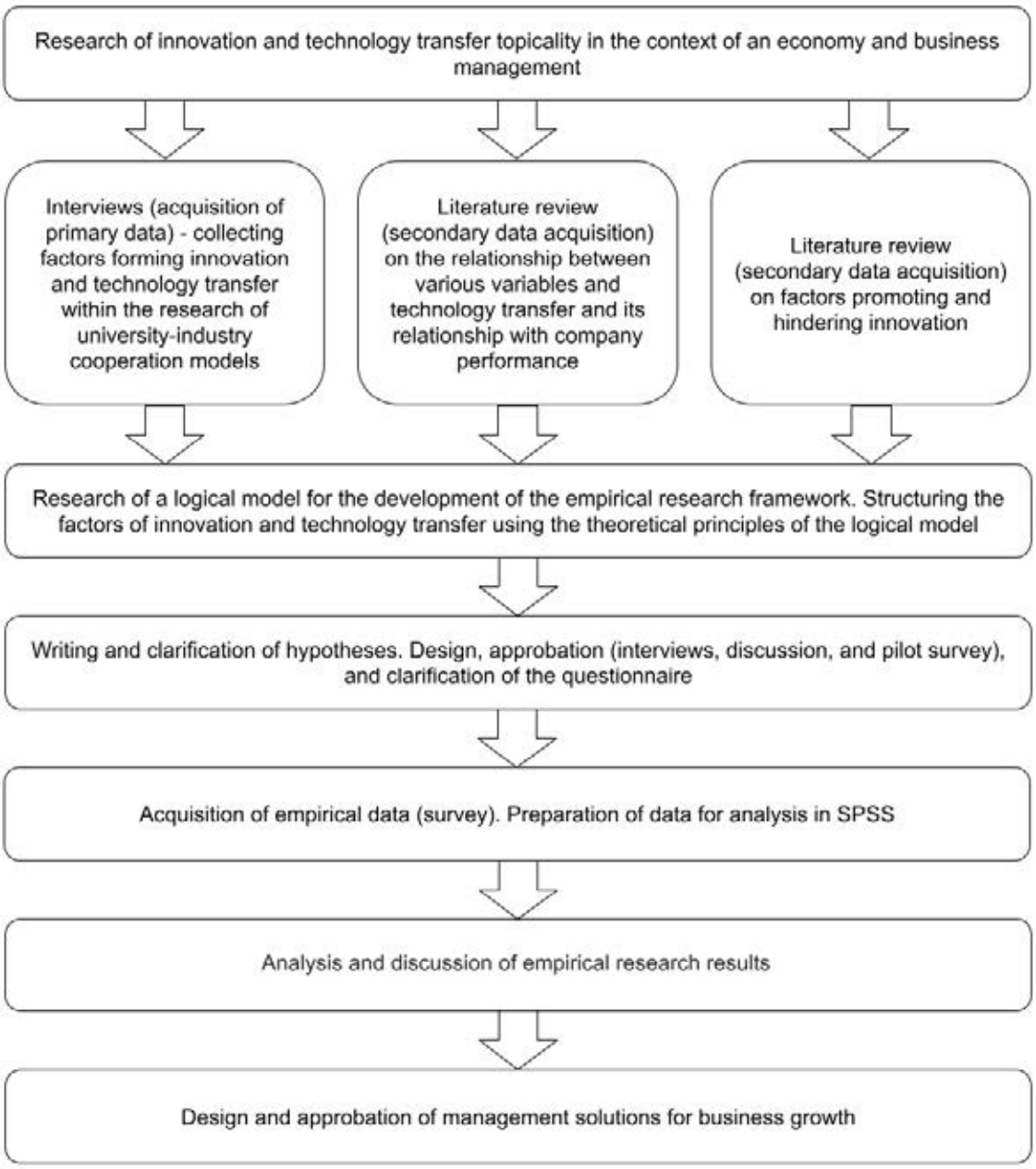

Fig. 1. The research design of the Doctoral Thesis.

The following scientific novelties have been developed and demonstrated in the Doctoral Thesis:

1. Terminology has been summarised, clarified, and developed, including defining the relationship between the terms of innovation and technology transfer[2].

[2] The author of the Doctoral Thesis is currently developing descriptions of the concepts of innovation and technology transfer for the Latvian National Encyclopedia (enciklopedija.lv).

2. For the first time in Latvia, the factors and their relationship with technology transfer performance, as well as technology transfer relationship with the enterprise performance, have been summarised.
3. Factors affecting innovation and technology transfer conceptually have been summarised and classified (the conceptual framework of the innovation and technology transfer process has been developed and verified based on the logic model guidelines).
4. A business growth model in the context of innovation and technology transfer has been developed.
5. Business management solutions have been developed – flowcharts enabling the enterprise management to assess the current situation in the context of innovation and technology transfer and introduce changes for the business growth.
6. Approbation of the developed models and solutions and integrating the research results in the study process have been performed.

The findings obtained as a result of the Doctoral Thesis complement the knowledge base on the management of innovation and technology transfer, including the *Absorptive Capacity* model, since the findings emphasise the importance of performing internal research and development. The formulations and results of the Doctoral Thesis have been used for the development and implementation of the following study courses: "Innovation Economy", "Innovation Process Management", "Innovation and Technology Transfer", "Management System analysis", "Fundamentals of Business Administration", "Enterprise Management", and "Business Management."

The business management solutions developed in the Thesis – flowcharts – have a high spectrum of practical application, namely, seven flowcharts have been created:

1) flowchart for the enterprise profit growth;
2) flowchart for the customer satisfaction growth;
3) flowchart for the turnover growth;
4) flowchart for the productivity growth;
5) flowchart for the introduction of process innovations;
6) flowchart for the introduction of organisational innovations;
7) business growth promotion flowchart with the integration of the solutions as mentioned above.

The issues raised in the management solutions (flowcharts) are based on the results of the empirical research (relationships found and the hypothetical effects of factors). At the same

time, the results obtained and the solutions developed respectively do not exclude the relationship of other factors not covered by the research with the resulting indicators (dependent variables). Thus, the solutions designed are not comprehensive and should be used as one of the tools for planning business growth and development.

Theses to be defended:

1. In Latvia, innovation can be considered a driving force of the economy. The introduction of innovations will be successful if new knowledge and technologies are acquired from external sources. Growth in a company will be observed even if the introduced innovations will be new only in the respective company. At the same time, to achieve a higher level of novelty, new knowledge and technologies must be acquired from companies in other industries abroad.
2. When planning a company's growth in the context of innovation implementation, it is important to carry out internal research and development work. To achieve the innovation goals and the desired economic growth in Latvia, both public and private sector investments in research and development are insufficient, therefore it is necessary to significantly increase them.
3. Participation in networked organizations is important to the introduction of innovations, and companies operating in such organizations have an advantage regardless of the degree of involvement.
4. The negative impact of the barriers to innovation described conceptually in the literature on the company's operations has been overestimated – there is no empirical justification for them.

The Doctoral Thesis has **limitations** listed hereinafter in the text. The Doctoral Thesis is based on the assumption that innovation is a driver of growth. At the same time, it is not considered that the concept of an innovation economy could be universal. It does not apply to all countries around the world, since, for example, as Olcay and Bulu (2016) point out: “The rapid technological development and the increasing globalisation have made traditional industries moving to low-cost countries.” This could indicate that production, not innovation, is the driver of the economy in the respective countries. Consequently, the assumption made in the Thesis in the international context should be studied empirically further on and thus is considered as one of the limitations of this research. It is recommended in further studies to summarise, classify, and empirically test the characteristic features of contemporary economies to identify the prevailing concept by countries and regions to predict its impact on the parties involved in specific contexts.

Empirical data for the needs of the Doctoral Thesis have been obtained from the enterprises that are still operating. Therefore, the obtained results are limited in the context of the general *survival bias*, i.e., there is a possibility that observation of significant factors identified in this research in practice would not guarantee the stability and growth of the enterprise. At the same time, it can be partially explained by the fact that no empirical basis has been found in the Thesis to consider hypothetical obstacles as factors delaying innovation and technology transfer. In addition, it has to be noted that, when analysing the obtained results of the empirical research, one of the hypothetical obstacles – resistance to changes on the part of employees is established as a positive correlation with resultative indicators. Therefore, based on the theories of changes, this aspect is interpreted as the introduction of changes as such, assuming that resistance to changes, by default, is observed when changes are being introduced.

The results of the correlation of the factors obtained from the empirical research demonstrate that respondents, when replying to the question on more rational use of resources in the issue of performance indicators, could have provided a reply not about expenses per one unit of the produced/provided service but about the costs in general. Therefore, this indicator is excluded from further interpretation of the results.

With the account of the nature of the empirical research (quantitative research), it does not explain the results obtained, including, for example, the reasons why following the product innovation no relationship with the increase in the enterprise performance has been established. The relationship has not also been found, for example, between the turnover growth and introduction of innovation and other output indicators. This could, however, be explained in the same way as in the case of product innovation by the time required for the hypothetical effects of innovation to be actually demonstrated in the performance indicators of the enterprise. Therefore, further studies should provide both an analysis of the reasons for the correlations identified in the course of profound research and the choice of another research design for the duration of the research. The positive effects of innovation in practice can only be seen in several years.

The empirical data were obtained in summer 2018 in the economic growth circumstances. Therefore, the interpretation of the obtained results was not affected by the fluctuations that occurred during the *Covid-19* pandemic. At the same time, changes in the economic situation in 2020 could have affected the performance of the enterprises used for the approbation of the management solutions developed in the research.

The research results of the author of the Doctoral Thesis were presented at the following academic and scientific conferences:

- "Science, Technology and Society (STS)" special issue of special seminar organized by the Society of Open Innovation: Technology, Market, and Complexity (SOItmC), August 23, 2021. Participation with presentation: "Factors Influencing Technology Transfer in Companies at Emerging Economies", South Korea (Online).
- "SOItmC & Oklahoma State University 2020" organized by the Society of Open Innovation: Technology, Market, and Complexity (SOItmC), July 11–14, 2020. Participation with presentation: "On Factors Influencing Technology Transfer in Companies at Emerging Economies," South Korea (Online).
- Academic Conference "Integration of study methodological and scientific work in the study process" organized by the Faculty of Engineering Economics and Management, Riga Technical University, April 27, 2018. Participation with presentation: "Learning Outcomes Oriented Transfer of Know-how," Riga, Latvia.
- "The 21st World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2017)" organized by the International Institute of Informatics and Systemics, July 8-11, 2017. Participation with presentation: "Contemporary Study Process for Enhancement of Employability in the Dynamic Environment," Orlando, United States of America.
- "III INTERNATIONAL SCIENTIFIC CONGRESS INNOVATIONS 2017" organized by the Scientific-Technical Union of Mechanical Engineering "Industry-4.0", June 19–22, 2017. Participation with presentation: "Technology transfer drivers and barriers: case of discrete manufacturing company," Varna, Bulgaria.
- "SOItmC & Riga Technical University 2017" organized by the Society of Open Innovation: Technology, Market, and Complexity (SOItmC), June 15–18, 2017. Participation with presentation: "Identification of Innovativeness Level in New Product and Technology Development Projects: Case of Latvia," Riga, Latvia.
- "Scientific Conference on Economics and Entrepreneurship" organized by the Faculty of Engineering Economics and Management, Riga Technical University, September 29, 2016. Participation with presentation: "Technology push vs market pull driven new product development," Riga, Latvia.
- "Society of Open Innovation: Technology, Market, and Complexity (SOItmC) & Consortium of Supply Chain & Operations Management (CSCOM) 2016" organized by the Society of Open Innovation: Technology, Market & Complexity, May 31, 2016.

Participation with presentation: “Transfer of Know-how Based on Learning Outcomes for Development of Open Innovation,” San Jose, United States of America.

- 56th International Riga Technical University Conference “Scientific Conference on Economics and Entrepreneurship,” October 14–16, 2015. Participation with presentation: “Development of Innovation Driven Culture at Higher Education Institution: ISPEHE Project Results,” Riga, Latvia.
- International Scientific Conference “Innovation and Smart Entrepreneurship” organized by the Ventspils University College, September 17–18, 2015. Participation with presentation: “Theories of Innovation and Technology Transfer,” Ventspils, Latvia.
- 16th EBES Conference – Istanbul organized by the Bahcesehir University, May 29, 2015. Participation with presentation: “Tacit vs Explicit Knowledge Dichotomy: State-of-the-Art Review for Technology Transfer Purposes,” Istanbul, Turkey.
- International scientific conference “Economics and Management – 2015, ICEM-2015” organized by the Kaunas University of Technology, May 7, 2015. Participation with presentation: “Perspectives on innovation and technology transfer: a systematic review,” Kaunas, Lithuania.
- The 56th RTU Student Science and Technology Conference organized by the Riga Technical University, April 22, 2015. Participation with presentation: “Systematic Approaches to a Literature Review in Management Science,” Riga, Latvia.
- RTTEMA X International Conference of Young Scientists organized by the Riga Teacher Training and Educational Management Academy, November 28, 2014. Participation with presentation: “Historical Development of Innovation and Technology Transfer”, Riga, Latvia.
- RTTEMA X International Conference of Young Scientists organized by the Riga Teacher Training and Educational Management Academy, November 28, 2014. Participation with presentation: “Values in Technology Transfer,” Riga, Latvia.
- RTU 55th International Scientific Conference “Scientific Conference on Economics and Entrepreneurship” organized by the Riga Technical University, October 15, 2014. Participation with presentation: “Factors Influencing Technology Transfer,” Riga, Latvia.

Theses of the following conferences and articles were published in scientific journals:

- Dubickis, M., Gaile-Sarkane, E. Factors Influencing Technology Transfer in Companies at Emerging Economies. *Science, Technology and Society*, 2021. Available: doi:10.1177/09717218211005615 (Scopus).
- Dubickis, M., Gaile-Sarkane, E. Transfer of Know-How Based on Learning Outcomes for Development of Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 2017, Vol. 3, e-ISSN 2199-8531. Available: doi:10.1186/s40852-017-0053-4. (Scopus, SpringerLink, EBSCOhost).
- Dubickis, M., Gaile-Sarkane, E. Identification of Innovativeness Level in New Product and Technology Development Projects: Case of Latvia. *SOItmC & RTU 2017 Conference Proceedings*, 2017, pp. 253–256.
- Dubickis, M., Gaile-Sarkane, E. Technology Transfer Drivers and Barriers: Case of Discrete Manufacturing Company. *International Scientific Journal "Innovations,"* 2017, Iss. 3, pp. 111–114. ISSN 1314-8907. e-ISSN 2534-8469.
- Lapiņa, I., Ščeulovs, D., Gaile-Sarkane, E., Dubickis, M., Ņikitina, T. Contemporary Study Process for Enhancement of Employability in the Dynamic Environment. *Proceedings of the 21st World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2017).* Vol. 2, 2017. Winter Garden, Florida: International Institute of Informatics and Systemics, 2017, pp. 49–55. ISBN 978-1-941763-60-5. (Scopus).
- Dubickis, M., Gaile-Sarkane, E. Tacit vs Explicit Knowledge Dichotomy: State-of-the-Art Review for Technology Transfer Purposes. *Financial Environment and Business Development*, 2017, Vol. 4: Proceedings of the 16th Eurasia Business and Economics Society Conference, pp. 423–433. ISSN 2364-5067. Available: doi:10.1007/978-3-319-39919-5_31 (Web of Science, SpringerLink).
- Dubickis, M., Gaile-Sarkane, E. Transfer of Know-how Based on Learning Outcomes for Development of Open Innovation. *Programme of SOItmC & CSCOM 2016 Conference*, 2016. Daegu: Society of Open Innovation, Technology, Market & Complexity, pp. 178–178.
- Dubickis, M., Gaile-Sarkane, E. Perspectives on Innovation and Technology Transfer. *Procedia – Social and Behavioral Sciences*, 2015, Vol. 213, pp. 965–970. ISSN 1877-0428. Available: doi:10.1016/j.sbspro.2015.11.512 (ScienceDirect, Web of Science).
- Dubickis, M., Ščeulovs, D., Lapiņa, I. Development of Innovation Driven Culture at Higher Education Institution: ISPEHE Project Results. *56th International Riga Technical University Conference "Scientific Conference on Economics and Entrepreneurship" [CD-ROM] :*

SCEE '2015 : Proceedings, 2015. Riga: RTU Press, 2015, pp. 116–117. ISBN 978-9934-8275-3-2. ISSN 2256-0866.

- Dubickis, M., Gaile-Sarkane, E. Tacit vs Explicit Knowledge Dichotomy: State-of-the-art Review for Technology Transfer Purposes. *16th EBES Conference – Istanbul: Program and Abstract Book*, 2015. Istanbul: Filmon Ofset, 2015, p. 135. ISBN 978-605-84468-1-6.
- Dubickis, M., Gaile-Sarkane, E. Impact of Human Capital on Development of Innovation Ecosystem in Latvia. *Economic Science for Rural Development: Proceedings of the International Scientific Conference*, 2013. Jelgava: 2013, pp. 37–42.ISBN 978-9934-8304-6-4. ISSN 1691-3078. (Web of Science, EBSCOhost).

The results provided in the Doctoral Thesis were developed and/or used in the following scientific and applied projects:

- Research project "Research of alternative models for the study process and industry cooperation promotion activities" – analysis of foreign and Latvian experience and data collection for the action programme "Growth and Employment" 1.1.1.3 "Innovation grants for students", implemented by the Association of Latvian Universities and Riga Technical University (2017), researcher.
- "Impact of the EU policy on changes in the higher education and science systems in Norway and Latvia," implemented by FEEM, RTU (2016–2017), researcher.
- National research programme's 5.2.1. "Transformation of the national economy, smart growth, governance and legal framework for sustainable development of the country and society – a new approach to building a sustainable knowledge society," the project "Innovation and business development in Latvia in line with the Smart Specialisation Strategy" (2014–2017), acting scientific assistant.
- Scientific transfer project (action research) in cooperation with Bucher Municipal SIA (2016), results are published in the scientific journal indexed in the SCOPUS scientific database.
- Erasmus+ project "Innovative Strategic Partnership for European Higher Education", implemented by FEEM, RTU (2014–2016), researcher.
- Leonardo Da Vinci Innovation transfer project No. LLP-LdV-ToI-12-CY-1671210 "YOUNG LEADERS: Developing and enhancing leadership skills for young managers in times of crisis: an innovative training package for European young professionals," implemented by FEEM, RTU (2012-2014), technical specialist/acting researcher.

- INTERREG 4C programme financed project “Working4talent – Regional policy development in employment and education for attracting new talent in innovation industries”, implemented by the City Development Department of Riga City Council (2012–2014), innovation expert.

Volume and content of the Thesis. The Doctoral Thesis is an independently developed scientific research in Latvian, consisting of an explanation of the terms and abbreviations used, an introduction, statement of contents in three parts, conclusions and proposals, a list of references used, and 34 annexes.

1. The Importance of Innovation and Technology Transfer Research

Global economic growth is observed in general. However, forecasts for the coming years point to potential stagnation (World Bank Group, 2017). In the opinion of management, the most significant concern for organizations' growth prospects is the threat of uncertainty of economic development (PWC, 2017). Such concerns were confirmed by the *Covid-19* pandemic, which began at the end of 2019 in China and started encompassing the entire world in early 2020, leaving a significant impact on businesses in different areas and national economies in general. The literature devoted to growth and development of the economy emphasises the importance of innovation – it is a widespread view that innovation is the primary driver of the economy (see, e.g., Ram et al., 2010; Pece et al., 2015; Maradana et al., 2017; European Central Bank, 2017; Mckinney, 2017). Based on this assumption, **the concept of an innovation economy** emerged, the origins of which are related to Schumpeter (1943).

Looking at the European Union (EU) situation, a positive link between innovation and the economy is shown by current data collected for the development of the EU Innovation Index (See Fig. 2).

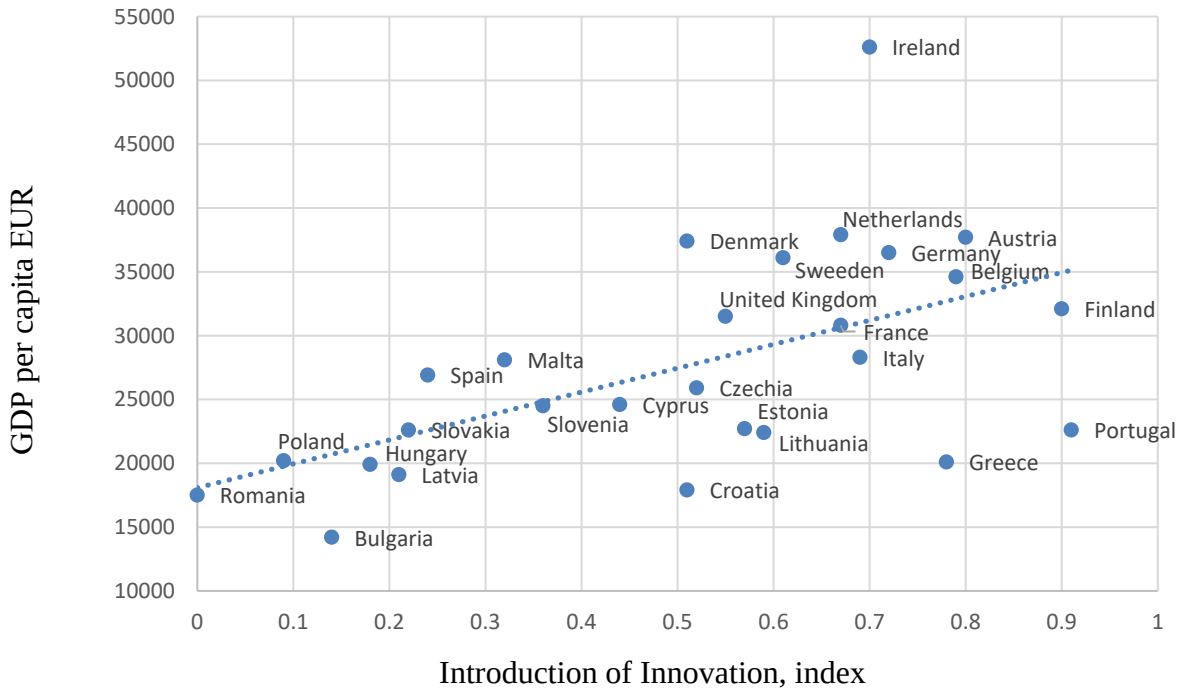

Fig. 2. Correlation of the *Introduction of Innovation* index with the GDP per capita (developed by the author using the European Commission data, 2019).

Based on the Science, Technological Development and Innovation Guidelines for 2014–2020, it is considered that the convergence of the Latvian economy with the developed EU countries and the increase in the well-being of the population can be achieved by increasing the competitiveness of the Latvian economy based on **innovation** (IZM, 2013). However, as shown in Fig. 2, Latvia has one of the lowest rates compared to other countries of the European Union.

The introduction of innovation is related to performing research and development (see, e.g., Mansfield, 1984; Mairesse and Mohnen, 2004; Love and Mansury, 2007; Audretsch and Belitski, 2020). At the same time, as Valdis Dombrovskis acknowledges, investments in research and development in Latvia are among the lowest in the EU (Leta, 2019). When looking at current statistics (Eurostat, 2019), the situation could be evaluated even more critically – Latvia is in the penultimate place between the regions under consideration. Whereas, when looking directly at business investments – they represent 0.14 % of GDP in Latvia, which is the lowest rate among the countries considered (**the difference from the EU average is ten times**).

A developed country is considered to be the innovative one – such assumption lays the basis of the analytical report by Mārtiņš Kaprāns and Ivars Austers (2017) on topical issues in the development of Latvian society, national economy, and science. This work is also based on the assumption that innovation is a driver of growth[3]. At the same time, it must be acknowledged that the term *innovation* is interpreted in a very diverse way – the Latvian state information resources primarily understand it as a process. In contrast, an analysis of world literature shows that **innovation** is being examined and analysed as **a process of creativity and change, competence or capacity, result, business function, the driving force** or **strategic choice** for growth, **system,** and **research direction**.

The definitions of the concept of innovation indicate that it is usually about something new. However, when looking more broadly, questions arise: what is new and new to whom? Types of innovation (Garcia and Caantone, 2002), supplemented by potential sources of knowledge by Altshuller (2007 cited in Nazidizaji et al., 2014), are shown in Table 1.

[3] At the same time, it should be noted that the concept of an innovation economy does not apply to all countries around the world – its characteristics and impacts on the parties involved are subject to further investigation.

Table 1

Types of innovation, adapted from Garcia and Calantone (2002) and Altshuller (2007 cited in Nazidizaji et al., 2014)

Aspect	Alternatives
What is new?	Technology; product line; product functions; product benefits; improvements/changes; quality; ways of usage; consumption habits; needs of customers; product design; process; service; customers; competition; training; experience; knowledge; skills; quality
New to whom?	World; industry; scientific community; market (local); enterprise; customers
Required knowledge	Personal knowledge; knowledge from different fields of the respective industry; knowledge from other industries; knowledge from different areas of science; everything known

OECD/Eurostat (2005) and the Central Statistical Bureau of Latvia (2015) recognise innovation as such when it is a novelty (or has significant improvements) for the enterprise concerned. This is one of the aspects that is empirically verifiable to make meaningful decisions at enterprises to plan their growth. In addition, there is a thesis that different sources of knowledge and technology may be needed to achieve different levels of innovation or novelty. In particular, innovation can occur either by using only the resources at the enterprise's disposal or by acquiring them from the external environment.

The historical development of innovation research and thought (Kotsemir and Meissner, 2013) shows that since the 1990s, innovation models that involve cooperation with external stakeholders have been dominating. The importance of cooperation and networking for the development of innovation in scientific literature has been highlighted by, e.g., Rothwell (1992), Von Hippel (2005), Chesbrough and Bogers (2014), Nieminen and Lehtoranta (2015). Whereas the importance of readiness to accept new ideas and change has been noted by, e.g., Weiner (2009) and Combe (2014). **The Doctoral Thesis is dedicated to studying the development of innovation through external sources of knowledge and technology**.

Often, from the perspective of higher education and research institutions (HERI), the transfer of knowledge and technology to others or the acquisition from the external environment and use is denoted as transfer of knowledge and/or technology. **Technology transfer** is a less common term than innovation, including in business management literature. However, the analysis of concepts in the Thesis shows its importance for innovation. Technology transfer is essentially an innovation process involving cooperation with external parties. The relationship between innovation and technology transfer terms is shown in Fig. 3.

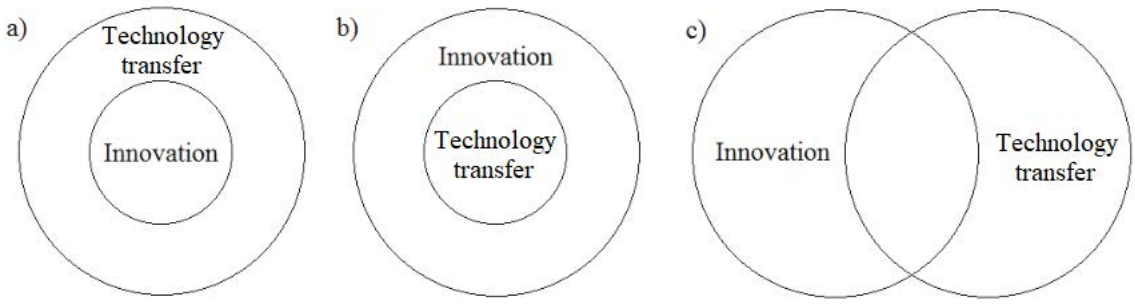

Fig. 3. Relationship between innovation and technology transfer terms (Dubickis and Gaile-Sarkane, 2015).

From a business management viewpoint, technology transfer is defined as a process of change in which an enterprise either acquires and introduces new knowledge and technology from outside or commercialises the knowledge and technology generated by the enterprise. This Thesis mainly deals with the acquisition of new knowledge and technology. The National Development Plan for 2014–2020 (Cross-Sectoral Coordination Centre, 2012) highlights that the joint work of science and business continues to create innovative and creative products and services that are competitive in the global market. At the same time, it is recognised that cooperation between scientists and entrepreneurs is still a chain link that is insufficiently developed in Latvia (Riekstiņa, 2017). Since 2016, Investment and Development Agency of Latvia has expanded its functions to promote innovation and technology transfer more purposefully (Urpena, 2016). Consequently, because of both theory and practice development, the **technology transfer process** has been put forward as the **research object** of the Doctoral Thesis.

Nieminen and Lehtoranta (2015) have found that the still existing statistical measurement frameworks are usually based on a relatively simple input-process-output-impact model, which generally does not explain the relationship between the indicators at the level of the whole frame. To get an idea about the current situation with the *state-of-the-art* technology transfer performance studies, the Doctoral Thesis, by using a systematic approach to literature analysis (Khan et al., 2003; Grant and Booth, 2009; Booth et al., 2012; Briner and Denyer, 2012), has summarised publications (see Tables 2 and 3), where technology transfer performance has been studied empirically (by using quantitative methods), namely links between factors that make up innovation and technology transfers. In total, 180 entries have been identified during the search, 17 of which are included in the report and are to be classified in the following three groups:

1) **factors affecting technology transfer performance have been studied** (Davidson, 1983; Lin et al., 2004; Lin et al., 2009; Sazali et al., 2011; Abidin et al., 2013; Iyengar et al., 2015);
2) **the impact of technology transfer on company performance has been studied** (Guan et al., 2006; Ma and Wang, 2006; Filatotchev et al., 2009; Bilgin et al., 2012; Al-Abed et al., 2014; Appiah-Adu et al., 2016; Bolatan et al., 2016);
3) simultaneously, **both factors influencing technology transfer performance and the impact of technology transfer on company performance have been studied** (Jabar and Soosay, 2010; Li, 2010; Grimpe and Hussinger, 2013; Nguyen and Aoyama, 2014).

The research results on the relationship between different aspects and technology transfer performance are provided in Table 2. Whereas an overview of the technology transfer relationship with the enterprise performance is provided in Table 3.

Table 2

Research on the relationship of different factors with technology transfer performance (made by the author)

Source	Theoretical substantiation / research frame	Data collection	Technology flow	Main results
1	2	3	4	5
Iyengar et al. (2015)	*Organisational Learning* / made by the authors of the publication	Questionnaire of 783 real estate agency franchises. Perception research.	Technology acquisition from the franchiser	The use of information technologies is an important learning mechanism that positively impacts the efficiency of knowledge transfer.
Abidin et al. (2013)	Social Capital (Barney, 1991) / made by the authors of the publication	Questionnaire of 19 manufacturing enterprises operating in one of the Malaysian technological parks. Perception research.	No information	A positive relationship has been found between the two dimensions of social capital (structural and relationship dimensions) and technology transfer performance. The relationship between cognitive social capital and technology transfer performance has not been established.
Grimpe and Hussinger (2013)	*Knowledge spillover theory of Entrepreneurship* (Audretsch et al., 2005; Acs et al., 2009), S*cientific and technical human capital approach* (Bozeman and Corley, 2004; Ponomariov and Boardman, 2010) / *Theory of supermodularity* (Milgrom and Roberts, 1995)	Questionnaire of 2000 German manufacturing enterprises within the framework of the Manheim innovation panel. Perception research.	Technology acquisition from HERI	The size of the company has a significant positive relationship with the use of knowledge and technology transfer mechanisms. The intensity of investment in research and development has a positive relationship with the use of knowledge and technology transfer mechanisms. The age of the company has a negative relationship with the use of formal knowledge and technology transfer mechanisms: older companies use formal knowledge and technology transfer mechanisms less frequently. The level of education of workers has a positive relationship with the use of knowledge and technology transfer mechanisms: companies with no employees with higher education are much less likely to use such mechanisms. Companies belonging to a group of companies are less likely to use knowledge and technology transfer mechanisms.
Li (2010)	No information / made by the author of the publication	Data on medium and large manufacturing enterprises in China, obtained by the China National Statistics Bureau during the period of 1991 to 2007.	Technology acquisition	No causal relationship between innovation performance and technology transfer has been established.
Jabar and Soosay (2010)	*Resource-based View, Organisational Learning, Transaction Cost Economics* / made by the authors of the publication	Data from the questionnaire, where valid forms from 335 respondents (manufacturing enterprises) have been received. Perception research.	Technology acquisition	It has not been concluded that the availability of resources has a positive impact on technology transfer performance. The ability to learn and use technology has a positive impact on technology transfer performance. Selfish behaviour has a negative relationship with technology transfer performance.

Table 2 (continuation)

1	2	3	4	5
Lin et al. (2009)	*Organisational learning), Social capital* / O*pportunity–willingness–capability* (Adler and Kwon, 2002)	Data on 110 enterprises of the Research and Development Consortium financed by the Industrial Technologies Research Institute supported by the Taiwan government. Perception research.	Technology acquisition from other Research and Development Consortium participants	It has been partly confirmed that there is a positive relationship between mutual trust among consortium members (relationship dimension) and technology transfer performance. It has been partly confirmed that there is a positive relationship between mutual trust among consortium members (relationship dimension) and technology transfer performance. It has been partly confirmed that there is a positive relationship between agreed objectives and norms (cognitive dimension) and technology transfer performance. There is a positive link between the commitment to learning and technology transfer performance. There is a positive relationship between absorptive capacity and technology transfer performance.
Lin et al. (2004)	*Absorptive capacity*, *Organisational culture* / made by the authors of the publication	Data from the questionnaire, where 110 Taiwan electronics and chemistry manufacturing enterprises participated.	Technology acquisition	The ability to learn and use technology affect the performance of technology transfer. The use of different technology transfer mechanisms (formal and informal) does not affect the performance of technology transfer. Interaction mechanisms (intra-organisation and inter-organisation) affect the performance of technology transfer. Investment in R & D has an impact on technology transfer performance.
Davidson (1983)	*Learning curve* (Teece, 1977) / made by the author of the publication	Data on 57 USA-based multinational companies with a clear intention of operating on foreign markets. Factual research.	Technology transfer (entering foreign markets)	A significant relationship between organisational structure and technology transfer performance has been identified.
Sazali et al. (2011)	No information / made by the authors of the publication	Data on 128 joint ventures with a minimum of 20 % of foreign capital in Malaysia. Perception research.	Technology acquisition from a foreign Multinational company (MNC)	The country of registration of the MNC has been found to have an impact on the relationship between technology transfer and corporate performance, but the country of registration of the MNC has not been shown to have an impact on the relationship between technology transfer and the performance of human resources of companies.
Nguyen and Aoyama (2014)	*Organisational learning*) (Huber, 1991; Buckler, 1998; Sadler-Smith et al., 2001) / made by the authors of the publication	Data on 223 manufacturing subsidiaries of Japanese enterprises in Vietnam. Perception research.	Technology acquisition from a parent enterprise	The impact of the organisation culture on the relationship between technology transfer performance and enterprise performance has been identified.

Table 3

Research on the relationship between technology transfer and business performance (made by the author)

Source	Theoretical substantiation / research frame	Data collection	Technology flow	Main results
1	2	3	4	5
Appiah-Adu et al. (2016)	No information / *source-position-performance* framework (Day and Wensley, 1988)	Data on 83 enterprises in Ghana from the Ghana Top 100 rating, summarised by Ghana Investment Promotion Centre. Perception research.	Technology transfer to suppliers	It has been concluded that the transfer of technology to both local owners and foreign ownership companies constitutes capability for businesses. The impact of technology transfer on the performance of the company has not been identified.
Bolatan et al. (2016)	No information / made by the authors	Data on 200 manufacturing enterprises with achievements in technology transfer. Perception research.	No information	The relationship between technology transfer performance and comprehensive quality management has been identified. The relationship between technology transfer performance and quality performance has not been established.
Grimpe and Hussinger (2013)	*Knowledge spillover theory of Entrepreneurship* (Audretsch et al., 2005; Acs et al., 2009), S*cientific and technical human capital approach*) (Bozeman and Corley, 2004; Ponomariov and Boardman, 2010) / *Theory of supermodularity* (Milgrom and Roberts, 1995)	Questionnaire of 2000 German manufacturing enterprises within the framework of Manheim innovation panel. Perception research.	Technology acquisition from HERI	The use of formal and non-formal knowledge and technology transfer mechanisms is complementary: the simultaneous use of both mechanisms leads to higher innovation performance.
Bilgin et al. (2012)	Long-term economic growth model (Solow, 1956) / made by the authors	Data on 1609 manufacturing enterprises in China from the World Bank enterprise questionnaire survey during the period from 2000 to 2002. Factual research.	Technology acquisition	A positive relationship between technology transfer and company performance has been identified.
Li (2010)	No information / *Dynamic econometric theory*	Data on medium to large manufacturing enterprises in China obtained by the China National Statistical Bureau during the period from 1991 to 2007.	Technology acquisition	No impact of technology transfer on innovation performance has been identified.

Table 3 (continuation)

1	2	3	4	5
Filatotchev et al. (2009)	*International Business* (Chen and Chen, 1998), *Resource-based view* (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984), and *Knowledge-based view* / made by the authors	Data on 711 high-tech SMEs from the *Zhongguancun* science park in China. Perception research.	Technology acquisition	There has been a positive relationship between global networks and exports as such, global networks and export performance, return presence and export performance, international knowledge transfer and export performance, such as international knowledge transfer and export performance. Complementarity between the presence of return and the intensity of R&D work on exports has been identified.
Guan et al. (2006)	No information / made by the authors	Data on 2334 Chinese manufacturing enterprises, summarised by Beijing Aeronautics and Astronautics University and Hongkong City University.	Both technology acquisition and technology transfer are studied	There has been a positive and negative relationship between technology transfer and innovation performance. A positive relationship has been established between the transfer of designs, manuals, and software to others locally (China) and the performance of innovation. A negative relationship has been found between the acquisition of designs, manuals, and software from others locally and innovation performance, the absorption of equipment from abroad and the performance of innovation, the absorption of equipment from others locally, and the performance of innovation. The relationship between the remaining technology transfer variables and the performance of innovation has not been established, while the research has produced different results, taking into account the breakdown of companies by technology intensity and by size.
Ma and Wang (2006)	No information / made by the authors	Data from the database of Chinese enterprises, summarised by the National Science and Technology Department and Beijing Aeronautics and Astronautics University in 1996.	Both technology acquisition and technology transfer are studied	Some aspects of technology transfer have been identified as having a positive relationship with the organization's economic performance.
Al-Abed et al. (2014)	*Resource-based view, knowledge-based view* / made by the authors	Data from 514 managers and engineers of 9 oil and gas enterprises in Yemen. Perception research.	Technology acquisition	A positive relationship has been established between technology transfer performance and competitive advantage.
Nguyen and Aoyama (2014)	*Organisational learning* (Huber, 1991; Buckler, 1998; Sadler-Smith et al., 2001) / made by the authors	Data on 223 manufacturing subsidiaries of Japanese enterprises in Vietnam. Perception research.	Technology acquisition from a parent enterprise	Technology transfer performance has a positive relationship with enterprise performance.
Jabar and Soosay (2010)	*Resource-based view, Organisational learning* and *Transaction Cost Economics* / made by the authors	Data from the questionnaire, where valid forms from 335 respondents (manufacturing enterprises) have been received. Perception research.	Technology acquisition	Technology transfer has a positive impact on the performance and innovation capacity of the enterprise.

The review of the empirical research presented in Tables 2 and 3 shows a diversity of understanding among researchers in different aspects, both theoretical substantiation and the examination of the relations of the research framework, as well as technology flows, data sources and the type of research according to the approach to measuring variables (perception or factual research). In general, it has been observed that the results of the studies included in the review are difficult to interpret, compare and repeat. Therefore, it is concluded that these studies do not give a clear picture of the different relationships in the context of technology transfer, thereby creating a knowledge gap on this issue. In addition, the literature reviews show that existing studies have been mainly carried out in Asian countries, thereby highlighting the need to replenish the knowledge base with technology transfer research in Europe.

Proceeding from the topicality of the theme and the findings of the technology transfer studies carried out so far, the author will systemise the factors affecting innovation and technology transfer in this Thesis. Accordingly, **the empirical part of the Doctoral Thesis aims to identify the relationship between the various factors affecting innovation and technology transfer performance, as well as the impact of innovation and technology transfer performance on the performance of the enterprise**. The relationships identifiable schematically in the empirical research are shown in Fig. 4.

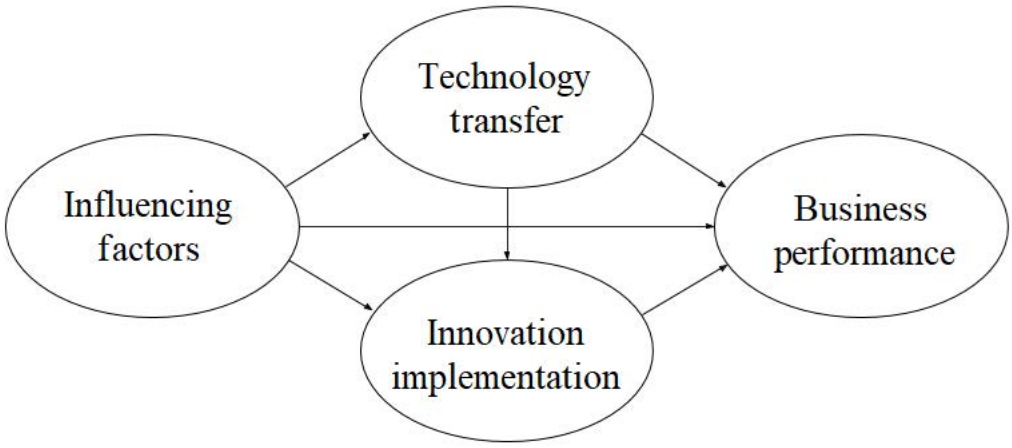

Fig. 4. Relationships identifiable in the empirical part (made by the author).

A sample of respondents for the collection of quantitative data should be planned both from enterprises engaged in technology transfer and from those not involved in it to achieve the aims of the empirical part. Whereas the unit of analysis is respectively the operation of an

enterprise as a whole. The following sequential objectives are to be performed for the implementation of the empirical research:

1. Creation of a conceptual framework for the innovation and technology transfer research.
2. Summarising and grouping of factors contributing to innovation and technology transfer using the conceptual framework.
3. Assessment of factors contributing to innovation and technology transfer for their inclusion in the empirical research.
4. Putting forward hypotheses, questionnaire development and measurement of variables.
5. Approbation of the questionnaire, clarifying of variables and hypotheses.
6. Pilot survey, clarifying questionnaires and hypotheses.
7. Defining sample and obtaining data.
8. Data processing and analysis.

2. The Logical Model of the Innovation and Technology Transfer Process

The *input-output* frame or *black-box* model is widely used to describe the interaction and dependency of certain system factors in the literature. Today, this approach, in an extended way, is called a logical model (see, for example, W. K. Kellogg Foundation, 2004; 2017). It promotes the thinking of the system (Anderson et al., 2011), links activities and outcomes consistently (Milstein and Chapel, n.d.), and provides a mechanism and a conceptual basis for identifying and measuring the impact of the system (Julian, 1997). By summarising some examples using the logical model, a part of the diversity of possible components in this concept is shown in Table 4.

Table 4

Application of the logical model components (made by the author)

Group	Component	Source					
		Milstein and Chapel (n.d.)	Hackett and Dilts (2004)	Corporate Citizenship (2018)	W. K. Kellogg Foundation (2004)	W. K Kellogg Foundation (2017)	Quality Improvement and Innovation Partnership (2009)
Context	Antecedents		x				
	Context	x				x	
Input	Purpose (commitment)	x					x
	Input (cesources)	x	x	x	x	x	
	Constraints (barriers)	x			x		
	Activities	x	x		x	x	x
Results	Output	x	x	x	x	x	x
	Short-term outcome	x	x		x	x	x
	Medium-term outcome	x	x			x	
	Long-term outcome	x	x			x	x
	Impact			x	x		
Stakeholders				x		x	x

Considering the created review of the logical model components, 11 components may be distinguished and grouped in three sets of components of the logical model – context, input, and results, which, essentially, is a broader term and includes output, outcome, and impact. In addition, *stakeholders* are also considered in several sources as a separate aspect.

Context or, in other words, different types of **circumstances** (such as demographic, economic, historical, and other situation shaping features) that hypothetically influence or may influence the respective process. Unlike input, context factors are more likely to be identified than planned at a certain level (see more generally, e.g., Milstein and Chapel, n. d.; W. K Kellogg Foundation, 2017). The business incubation logic model developed by Hackett and Dilts (2004) also includes the causes of the respective process (antecedents), which essentially describes the context.

Input is considered to be the various types of resources (human resources, time, financial resources, raw materials, commitment, etc.) and activities, the planning, and implementation of which can help to achieve the expected results (see more, e.g., W. K. Kellogg Foundation, 2017; Corporate Citizenship, 2018). At the same time, resources or activities that may delay or delay achieving the expected results – constraints or barriers (see, e.g., Milstein and Chapel, n.d.) are also sometimes considered.

Output – usually relatively fast-measurable interim results (the number of resources used and activities carried out, duration, etc.). **Impact** (added value or effect on an indicator and/or stakeholders), which can only be identified after a particular time – for example, in the context of this Thesis, there is a possibility that the impact of innovation on the enterprise growth can only be observed after several years. In addition to output and impact, short-term, medium-term, and long-term **outcome** indicators are also distinguished, which, by nature, are relatively dependent on the respective process, which is being analysed (see more, e.g., Milstein and Chapel, n.d.; Hackett and Dilts, 2004; W. K. Kellogg Foundation, 2017). All components of this type are considered to be r**esults**.

The **stakeholders** mean any person or group thereof who has or may have direct or indirect involvement and/or interest in an initiative, programme, or its results and who affects or is affected by the respective process (see more, e.g., McAdam et al., 2012; W. K. Kellogg Foundation, 2017; Corporate Citizenship, 2018).

Factors forming the innovation and technology transfer processes have been summarised using secondary and primary sources of information. They have been grouped by using a logical

model structure consisting of **context, input**[4], **output, outcome**[5], impact aspects, and **stakeholders** of the process. The possibility of each factor being included in the empirical research has been assessed with account of the following principles:

1) the relevance of factors to the objectives of the empirical research and the pool of respondents – heads of companies or representatives familiar with the company's overall performance;
2) the relevance of the factors for the unit to be analysed – for the enterprise operation as a whole;
3) acquisition of as objective data as possible;
4) the frequency of practices implemented by enterprises or other circumstances examined for a meaningful analysis of quantitative data;
5) achieving the intended responsiveness.

Several clarifications needed to carry out the empirical research were made in drafting the questionnaire, following which the questionnaire was checked in discussions with academic and business environment representatives and clarified in line with the proposals made. During the approbation process, several variables were excluded from the questionnaire. Following the approval of the questionnaire, to verify in actual circumstances its validity for empirical research, a pilot survey was carried out involving 12 business environment representatives. **The timing and complexity of completing the questionnaire as a whole** and the clarity of each question were assessed during the pilot survey to achieve the intended responsiveness. Based on the factors contributing to the innovation and technology transfer process examined in the previous part of the Thesis, the approbation of the questionnaire, the pilot survey, and the focus group discussion, the following performance indicators were identified for testing the correlation of different variables[6] of the put forward hypotheses:

1) acquisition of new knowledge and technology;
2) product innovation;
3) process innovation;
4) marketing innovation;

[4] Including different levels of commitment, actions or activities and barriers or delaying input factors are addressed as input factors.

[5] In literature, outcome indicators tend to be distinguished in short-term, medium-term and long-term indicators, but in this Thesis they are all aggregated in a single group.

[6] The relationship, or correlation, means that when one variable changes, the other changes as well. As the value of both variables grows, it is called a positive correlation, but if the value of one variable increases and the other decreases, then it is called negative correlation (see more, e.g., Rivera, 2020).

5) organisational innovation;
6) product innovation level;
7) process innovation level;
8) marketing innovation level;
9) organisational innovation level;
10) sale of intellectual property rights created by the enterprise;
11) establishment of new enterprises in which shares are held (Spinoff);
12) establishment of new enterprises in which shares are not held (Spinout);
13) turnover increase;
14) productivity increase;
15) more rational usage of resources;
16) profit increase;
17) customer satisfaction increase.

This research uses widely used scales or their modifications to measure variables, taking into account the specifics of the research. Some variables have been specifically created if the available solutions are not appropriate for the research specifics and/or could have been too complicated for respondents. With the account of the specifics and extent of the research, factual scales have been used to measure variables wherever possible, but, as can be seen, part of them are perception scales (see Table 5).

Table 5

Scales used to measure variables and their sources (made by the author)

Group of aspects	Variable	Source
1	2	3
Context	Enterprise location (factual address)	Respondents indicate the statistical region according to the Cabinet of Ministers (2010)
	Enterprise age	Respondents indicate the year of establishment
	Technology intensity level (manufacturing enterprises)	Respondents indicate the main type of activity by NACE classification; data coded using Eurostat (2016)
	Knowledge intensity level (service enterprises)	
	Geographical market	Adapted from the European Innovation Survey (CIS Task Force, 2017)
	Being a part of a group of companies	
	Location of the parent company	
	Size of the enterprise by number of employees	
	Competition intensity	A statement is formulated to be answered affirmatively or negatively: 1) yes 2) no
	Status of the franchiser	
Input	Receiving tax incentives	
	Availability of the intellectual property rights policy	
	Commitment to the acquisition of new knowledge and technology	Adapted Likert scale from the European Innovation Survey (CIS Task Force, 2017): 1) there was no such commitment 2) low importance 3) medium importance 4) high importance 5) very high importance
	Commitment to introduce innovations	
	Commitment to establish new enterprise(-s)	
	Commitment to increase net turnover	
	Commitment to increase profit before tax	
	Commitment to increase the satisfaction of customers	
	Commitment to using resources more rationally	
	Commitment to increase productivity	
	Participation in a networked organisation (industry association, strategic alliance, cluster, or another formation)	Adapted from Frey et al. (2006)
	Degree of interaction in a networked organisation	
	Qualification of employees at the enterprise	Established Likert scale: 1) inappropriate 2) rather inappropriate 3) rather appropriate 4) appropriate
	Clarity of objectives of the organisation	Established statement to be answered using the Likert scale: 1) do not agree 2) rather do not agree 3) rather agree 4) agree
	The ability of the company employees to cooperate with others	

Table 5 (continuation)

1	2	3
Input	Whether the company employees are motivated to cooperate with other companies and organisations	Established statement to be answered using the Likert scale: 1) never 2) rare 3) sometimes 4) often 5) always
	Whether the company employees are trained to upgrade their qualifications	
	Whether the company employees have information available on success stories	
	Availability of vacancies at the enterprise (lack of qualified employees)	
	The enterprise fears that the knowledge at its disposal will be disclosed to others	
	The company employees resist the process of changes at the company	
	The company has difficulties in establishing initial contacts for the cooperation implementation	
	Internal R&D work	Adapted from the European Innovation Survey (CIS Task Force, 2017)
	Regularity of internal R&D work	
	Acquisition of external R&D services	
	Type of internal R&D work	OECD classification and explanatory notes for research works (2015) is used
	Type of acquired R&D services	
	Acquisition of new knowledge and technology	A statement is formulated to be answered affirmatively or negatively: 1) yes 2) no
	Source of acquisition of new knowledge and technology	Possible sources of new knowledge and technology are listed (the respondent notes all relevant ones): 1) from other companies of the group (if there are any) in Latvia 2) from other companies of the group (if there are any) abroad 3) from other respective industry companies in Latvia 4) from other respective industry companies abroad 5) from another industry companies in Latvia 6) from another industry companies abroad 7) from HERI in Latvia 8) from HERI abroad 9) other sources (named by the respondent) New variables for distinguishing local and foreign sources are created for data coding.
	Source of financing of the acquisition of new knowledge and technology	Possible sources of financing are listed (the respondent notes all relevant ones): 1) own financing 2) from other companies of the group (if there are any) 3) public 4) creditors 5) external support through non-financial instruments 6) other sources (named by the respondent)
	Source of financing of internal R&D	
	Source of financing of external R&D services	
Output	Product innovation	Adapted from the European Innovation Survey (CIS Task Force, 2017)
	Process innovation	
	Marketing innovation	
	Organisational innovation	
	Patent filing	

Table 5 (continuation)

1	2	3
Output	Application for the European functional model	Adapted from the European Innovation Survey (CIS Task Force, 2017)
	Design sample registration	
	Trade mark registration	
	Requesting the status of a commercial secret	
	Requesting copyright	
	Development of technologies for which no formal mechanisms have been used to protect property (licences, patents, design samples, etc.)	
	Sale of intellectual property rights created (if any)	
	Product innovation level	Established Likert scale: 1) new to the company 2) new to the company market 3) new to the world
	Process innovation level	Established Likert scale: 1) new to the company 2) new to the company industry 3) new to the world
	Marketing innovation level	
	Organisational innovation level	
	Establishment of new enterprise(s) in which shares are held	A statement is formulated to be answered affirmatively or negatively: 1) yes 2) no
	Establishment of new enterprise(s) in which shares are not held	
Outcome	Changes in net turnover	Established Likert scale to identify the direction of the performance changes: 1) significantly decreased 2) slightly decreased 3) not changed 4) slightly increased 5) significantly increased
	Changes in productivity	
	Changes in rational use of resources	
Impact	Changes in profit before taxes	
	Changes in customer satisfaction	

3. Results of Empirical Research

With the account of the objectives of the empirical part of the Doctoral Thesis (see page 25), the questionnaire survey for the data acquisition was conducted at 193 enterprises, which were hypothetically engaged in acquiring new knowledge and technology[7] in an electronic environment using the *Google Forms* platform. The data collection took place between July and August 2018 (inclusive). Representatives of the enterprises were called and invited to participate in the research, and interested respondents were offered to be presented with the results of the research. A 20 % response was expected in the research. However, overall answers were obtained from 65 companies, representing around 34 % of the general group. Nearly all or 63 respondents participating in the research completed the questionnaire online, while two agreed to answer the questions by phone. *MS Excel* software was used to process the resulting data and *SPSS* to analyse them.

49 % of all respondents have noted that their enterprise **acquired new knowledge and technology** during 2015–2017, thereby demonstrating the relevance of the audience selected for the empirical research to its objectives. The proportion of respondents regarding the sources of acquisition of new knowledge and technology from different viewpoints is shown in Fig. 5.

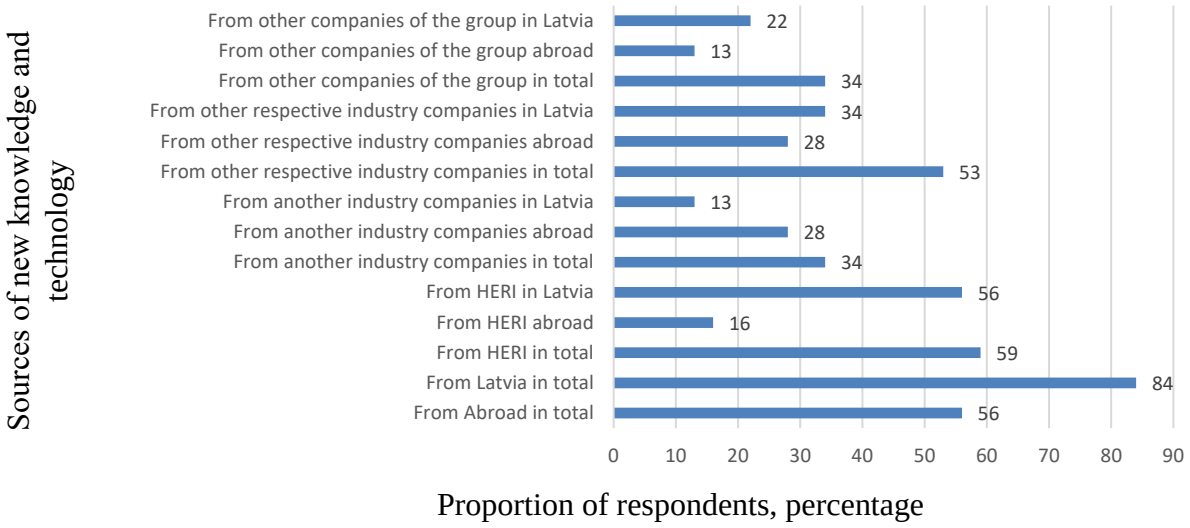

Fig. 5. Proportion of respondents concerning the use of sources of acquisition of new knowledge and technology (percentage of respondents who have acquired new knowledge and technology) (made by the author based on data from the array of enterprise data).

[7] Enterprises having any form of cooperation executed in writing with Riga Technical University during the period 2014–2017, still operating, as well as their contact details are publicly or otherwise available.

The proportion of innovation introducing respondents by type of innovation is shown in Fig. 6.

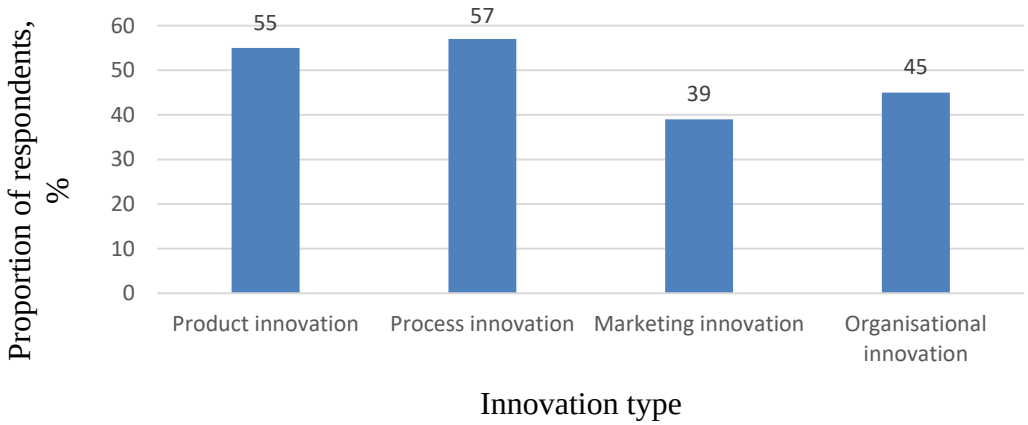

Fig. 6. Proportion of innovation introducing respondents, percentage (made by the author based on data from the array of enterprise data).

The innovation indicators are relatively high, pointing to the innovativeness of the sample (enterprises having any type of cooperation) chosen for the empirical research. By comparison, the latest innovation survey of CSP (2020) has found that only 13.3 % of Latvian companies have introduced process innovation and 9.9 % – the product innovation. The proportion of companies surveyed according to the level of innovation introduced is provided in Table 6.

Table 6

Breakdown by the level of innovation introduced at surveyed companies (made by the author based on data from the array of enterprise data)

Innovation level	**Product innovation**	**Innovation level**	**Process innovation**	**Marketing innovation**	**Organisational innovation**
Innovation at the respective enterprise	28 %	Innovation at the respective enterprise	41 %	44 %	52 %
Innovation at the respective enterprise market	61 %	Innovation in the respective enterprise industry	51 %	52 %	45 %
Innovation in the world	11 %	Innovation in the world	8 %	4 %	3 %

The proportion of other innovation output indicators among respondents is shown in Fig. 7.

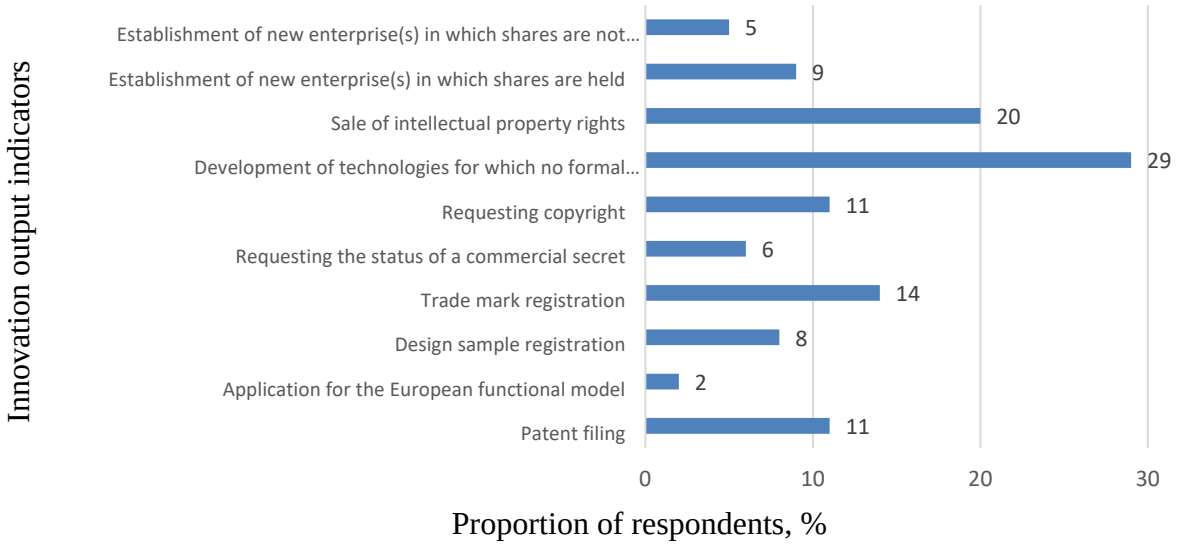

Fig. 7. Proportion of other innovation output indicators among respondents, % (made by the author based on data from the array of enterprise data).

The proportion of enterprise performance (outcome and impact) indicators among respondents is shown in Table 7.

Table 7

Proportion of business performance changes of the survey respondents in 2017 compared to 2016 (made by the author based on data from the array of enterprise data)

Situation	**Outcome**			**Impact**	
	Net turnover	Productivity	Rational use of resources	Net profit	Customer satisfaction
Significantly decreased	3 %	2 %	0 %	6 %	0 %
Slightly decreased	11 %	3 %	13 %	20 %	5 %
Not changed	20 %	28 %	31 %	23 %	39 %
Slightly increased	51 %	56 %	51 %	39 %	47 %
Significantly increased	15 %	11 %	5 %	12 %	9 %

In general, the correlation of all statistically significant independent variables identified in the research with performance indicators is provided in Table 8.

Table 8

Statistically significant correlations between independent variables with performance indicators (made by the author)

Independent variable	Statistically significant correlations with performance variables													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Enterprise age					0.280*									
Technology intensity level (manufacturing enterprises)												-0.575**		
Enterprise operation in the entire Latvian market		0.303*												
Enterprise operation on foreign markets	0.268*	0.500**	0.339**		0.254*									
Being part of a group			0.408**											
The number of employees			0.262*		0.426**						0.274*		0.284*	
Competition intensity		0.376**	0.261*		0.305*									
Participation in a networked organisation					0.281*									
Commitment to introduce innovations			0.286*											
Commitment to establish new companies										0.366**				
Commitment to increase customer satisfaction														0.321**
Enterprise has vacancies (lack of qualified employees)		0.245*												
Resistance of the employees to the processes of change[8]				,246*							0.281*	0.252*		
Availability of the intellectual property rights policy		0.250*	0.294*						0.293*					
Clarity of the organisation objectives			0.248*											
Motivating the enterprise employees to cooperate with other enterprises and organisations				,260*										
Frequency of training for qualification upgrade of the enterprise employees					0.252*									
Internal R&D	0.307*		0.429**						0.303*					

[8] This factor in the study is interpreted as introducing changes as such, given that, according to change management theories, resistance to change is a natural response.

Table 8 (continuation)

Independent variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Acquisition of new knowledge and technology		,265*	,297*					,437*	,277*		,286*	,311*	,273*	,253*
Acquisition of new knowledge and technology from other companies of the group in Latvia						-,424*								
Acquisition of new knowledge and technology from other companies of the group abroad		-,357*												
Acquisition of new knowledge and technology from other companies of the group in total					,373*									
Acquisition of new knowledge and technology from other industry companies abroad						,432*	,491*							
Acquisition of new knowledge and technology from HERI in Latvia				-,434*										
Acquisition of new knowledge and technology from HERI in total				-,371*										
Acquisition of new knowledge and technology from Latvia				-,458**										
Acquisition of new knowledge and technology from abroad						,472*	,548**							
Financing of other companies of the group for the acquisition of new knowledge and technology			-,394*											
Creditor financing for the acquisition of new knowledge and technology						,457*								
Process innovation													,372**	,279*
Organisational innovation														,280*
Establishment of a new company(-ies) with retained shares													,261*	
Net turnover changes													,671**	
Productivity changes													,468**	

1 – Acquisition of new knowledge and technology; 2 – product innovation; 3 – process innovation; 4 – marketing innovation; 5 – organisational innovation; 6 – product innovation level; 7 – process innovation level; 8 – marketing innovation level; 9 – sale of intellectual property rights created by the enterprise; 10 – establishment of new companies with retained shares; 11 – net turnover; 12 – productivity; 13 – profit increase; 14 – customer satisfaction.

By looking at and interpreting the results of the empirical research holistically (see Table 8), the author regards internal R&D work as a key factor for the enterprise growth model in the context of innovation and technology transfer. R&D work contributes to the acquisition of new knowledge and technology, leading to innovation and thereby ensuring an increase in the performance of the enterprise (the enterprise growth process). The following context factors influence the enterprise growth process: the breadth of the enterprise market, the intensity of competition, the enterprise size by the number of employees, the enterprise being part of a group, the age of the enterprise, and the following input factors: the commitment to introduce the necessary changes, the clarity of the organisation's objectives among employees, motivating employees for cooperation, training to upgrade the qualification of employees, the participation in the networked organisation, the existence of a policy on intellectual property rights, sources for acquisition of new knowledge and technology and sources of funding the acquisition process. The context factors affecting the enterprise growth process are more likely to be identified and less affected than input factors that are directly dependent on the enterprise management or controlled but can also be managed in a specific way. Schematically, the enterprise growth process and the context and input factors affecting it are shown in Fig. 8.

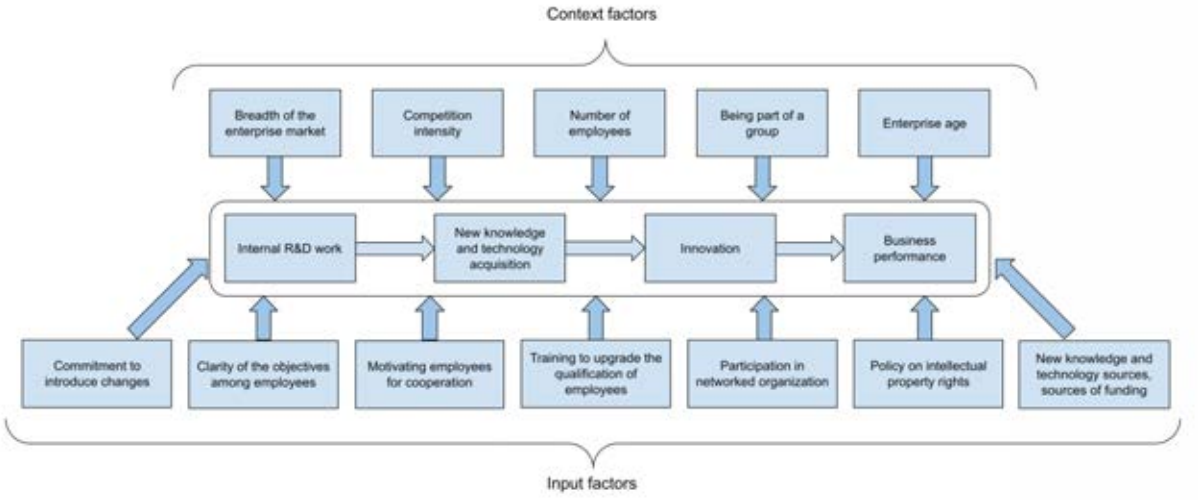

Fig. 8. The enterprise growth process in the context of innovation and technology transfer (made by the author).

The developed model explains that to increase the performance of the enterprise, one needs to be aware of the need for introducing changes and plan their introduction, as well as to ensure that the organisation's objectives are clarified among employees. Changes to be

introduced may include, for example, a new set of benefits or products on the market (product innovation) or new technologies/methods:

1) in the process of manufacturing a product or providing a service (process innovation);
2) in promoting a product to the market, selecting sales channels and pricing strategies or, in other words – enterprise marketing (marketing innovation);
3) in enterprise management (organisational innovation).

It is important to note that innovations to be introduced should not necessarily be of a high level – it is sufficient for the growth of the enterprise performance when these are novel for the enterprise concerned to introduce them. The introduction of innovations is affected positively by the acquisition of new knowledge and technology, which is affected positively by internal R&D work. Within the limits of the factors considered by the Thesis, the driving forces or stimuli for the enterprise growth are incentives for encouraging employees to cooperate, training to upgrade the qualification of employees, participation in a networked organisation, the developed policy of intellectual property rights, the intensity of competition and the breadth of the enterprise market. The enterprise growth process is also related to the enterprise size by the number of employees, the enterprise being a part of a group, the age of the enterprise, the source of acquisition of new knowledge and technology, and the source of its financing.

In general, it can be concluded from the **results of the empirical research** that they **confirm the assumption of innovation as a driver of growth**. The introduction of innovation is facilitated by acquiring new knowledge and technology from outside. At the same time, higher levels of innovation are driven by acquiring new knowledge and technology from abroad and, more specifically, from enterprises of other industries abroad. In turn, the acquisition of new knowledge and technology requires internal R&D work.

4. Management Solutions for the Enterprise Growth and Introduction of Innovation

Management solutions – flowcharts for the enterprise growth and introduction of innovation have been developed based on the results of the empirical research and their holistic interpretation, including by taking into account the mutual correlations of performance indicators defined in the research and the criticism and proposals expressed by the stakeholders in the approbation process[9]. The use of the enterprise growth model components in management solutions, taking into account the approbation results, is provided in Table 9.

Table 9

Usage of components of the enterprise growth model in management solutions (made by the author)

Component of the enterprise growth model	Integration in management solutions
Internal research and development	Included in the flowcharts with the account of the correlations identified in the research
Acquisition of new knowledge and technology	
Introduction of innovation	Two types of innovation have been included in the flowcharts, where the research has identified a correlation with the growth rates of the enterprise performance – process and organisational innovation
Increase of the enterprise performance	The two performance indicators covered by this research are included in the flowcharts – profit growth and customer satisfaction growth
Size of the enterprise market	Defined as an enterprise characteristic
Competition intensity	
Size of the enterprise by number of employees	
Inclusion of the enterprise in a group of companies	
Age of the enterprise	
Intellectual property rights policy	
Commitment to introduce the required changes	The commitment levels are defined as an enterprise characteristic, for which a correlation with the corresponding performance indicators has been established in the Thesis – the objective to introduce innovation, the objective of establishing new enterprise(s), and the objective of increasing customer satisfaction
Clarity of objectives of the organisation	Included in the flowcharts with the account of the correlations identified in the research
Training to upgrade the qualification of employees	
Participation in a network organisation	
The motivation of employees for cooperation	Not included, with the account of the correlations identified in the research
Source of new knowledge and technology and the financing source for their acquisition	Not included

[9] The earliest drafts of flowcharts were approved (discussed and specified) during expert interviews and a specially organised workshop at the Cyprus University of Technology in May 2019, as well as at the general meeting of entrepreneurs of Aloja Region – a workshop organised by the local business support centre in September 2019.

As a result of the research for promoting enterprise performance growth, a process model of six interrelated steps has been proposed to promote enterprise profits, customer satisfaction, turnover, productivity, and the introduction of process and organisational innovation. The issues discussed in the solutions characterise the effects of the correlation and hypothetical factors identified in the research. At the same time, they do not exclude the correlation between other factors not examined in the research with the performance indicators defined. During the approbation of the solutions developed, it was found that in some cases the issues to be addressed in the flowcharts were repeated (e.g., acquisition of new knowledge and technology, as it has a positive correlation with several performance indicators). Therefore, a single complex flowchart was also created to cover all issues addressed in the separate flowcharts (see Fig. 9).

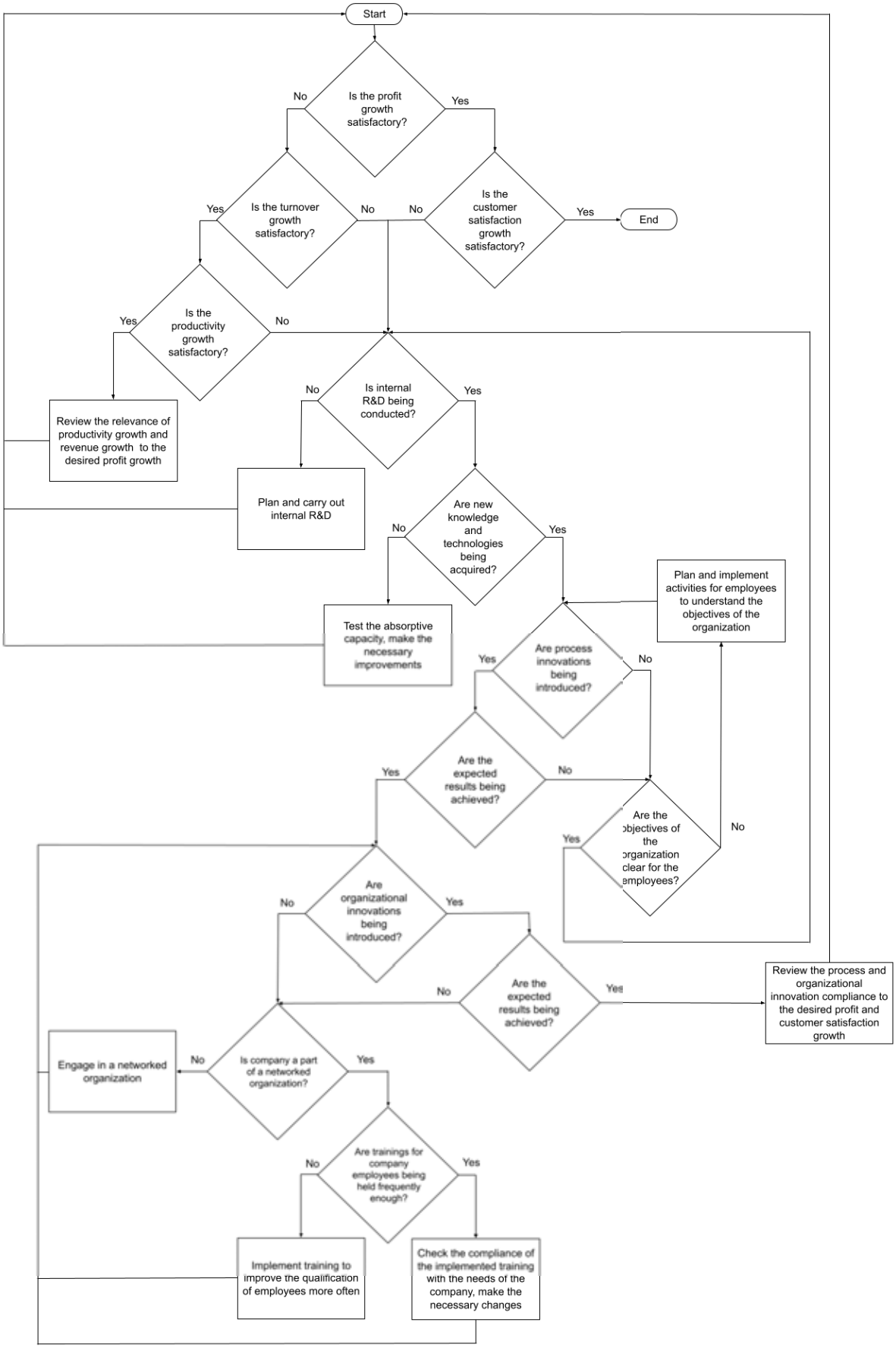

Fig. 9. The complex enterprise growth promotion flowchart (made by the author).

Additional approbation of the enterprise growth promotion flowchart, where all issues are addressed, was conducted at two enterprises. At the same time, since it might not be easy to apply this flowchart in practice, business managers can use flowcharts where each of the six steps is set out separately. Flowcharts can be used both as a whole set and separately, depending on the needs of the enterprise. In addition, it should be noted that the solutions developed do not constitute a universal and comprehensive instrument – they should be used as part of management practices, taking into account the situation at the enterprise and changes in both the internal and external environments. It is assumed on the default that enterprises have access to finance and other necessary resources to introduce the solutions developed in the Thesis. Specific possible actions are provided[10] to use the designed flowcharts in practice and solve the issues involved.

The first step is to identify whether the enterprise profit growth is satisfactory to apply the enterprise growth flowcharts in practice. In this case, it is simply achievable by comparing the financial indicator concerned with the planned one. In the empirical part of the research, it has been found that profit growth is more common in enterprises with a larger number of employees. Therefore, the management solutions developed could be more topical for companies with fewer employees. In addition, it should be noted that, based on the correlations identified in the research, the increase in profits is attributable to the acquisition of new knowledge and technology, process innovation, and establishment of new enterprises (while retaining their shares). These factors are examined more comprehensively for each aspect in the separately created flowcharts (to promote profit growth, increase customer satisfaction, increase turnover, increase productivity, introduce process innovation, and introduce organisational innovation). If the profit growth is satisfactory, **the next step is to determine the level of customer satisfaction**. A variety of approaches can be used, including a formulated question in a questionnaire or interview, where a respondent (using the Likert scale) is asked to assess satisfaction with a product or its specific feature(s). Another approach would be using the methodology of the recommendation index Net Promoter Score (NPS) to test the loyalty of existing customers (see, e.g., Satmetrix, 2017).

If the increase in customer satisfaction is satisfactory, the process in the context of this flowchart is considered to be ended[11]. Whereas, if the profit growth is insufficient, **the next**

[10] At the same time, these flowcharts do not exclude the use of other solutions – business managers should continuously verify the efficiency and effectiveness of the practices recommended in the solutions in the particular context.

[11] Nevertheless, the enterprise management may also use other flowcharts developed in this Thesis, as they may contain topical management solutions characteristic for the enterprise.

step is to identify whether the turnover growth is satisfactory. When it comes to turnover, like identifying profit growth, it is achievable by comparing the financial indicator concerned with the expected figure. If the increase in turnover is satisfactory, **the next step is to ensure that the increase in productivity** (the volume of units produced / services provided per employee for a given period) **is satisfactory** by simply comparing the financial indicator concerned to the expected level. If the productivity growth is also acceptable, the enterprise needs to review the relevance of the turnover growth and the productivity growth to the desired increase in profits and return to the start of the process.

Whereas, if it is found that the increase in customer satisfaction, the increase in turnover, or the increase in productivity are not satisfactory, **the next step is to make sure that internal research and development work is performed at the enterprise**. If such are not performed or are performed insufficiently, they must be planned and executed. For example, the Kano methodology can be used to study customer needs and satisfaction (see Shahin et al., 2013), which makes it possible to categorise the product characteristics in a complex manner to meet customers' essential needs as a priority. Internal R&D for the turnover growth or market expansion is planned, for example, by using the Ansoff (1957) matrix. The changes to be introduced for increasing the turnover may, as appropriate, relate to the implementation of the enlargement strategies chosen as a result of the research. With regards to the enterprise expansion, it should be noted that, based on the correlation identified in the research, the increase in profits is attributable to the establishment of new enterprises (while retaining their shares). Whereas, to increase productivity, R&D can be started with more advanced measurements of productivity, which, among other things, could already increase productivity by itself by referring to the Hawthorne effect (see, e.g., the Business Manual, n.d.). In addition, research and development for increasing productivity or turnover growth or customer satisfaction could be related to identifying the knowledge and technology needed to introduce the respective changes beyond the enterprise (technology watch).

If internal research and development work is performed at the enterprise, **the next question is whether new knowledge and technology are being acquired**. Understandably, the acquisition of new knowledge and technology is closely related to the performed R&D work results. If the acquisition does not occur, it is first recommended to check the absorptive capacity. A few proven instruments are available to complete the task, such as Camison and Fores (2010), Flatten et al. (2011), Jimenez-Castillo and Sanchez-Perez (2013), or Chauvet (2014). Potential sources of new knowledge and technology to be used after absorptive capacity

improvements are listed in the summary of Fig. 5. At the same time, it should be taken into account that achieving higher levels of innovation will promote the acquisition of new knowledge and technology from enterprises of other industries abroad and the sources of new knowledge and technology from abroad in general. As well as taking into account the fact that activities of the enterprise on foreign markets play a role in acquiring new knowledge and technology (a positive correlation), and thus it is expected that the acquisition for companies operating exclusively in Latvia could be more complicated. The enterprise is recommended to attract new and qualified employees to address this issue.

In the event the necessary new knowledge and technology are acquired by the enterprise, **the next step is to make sure that innovation is in the process of introduction** (new technologies and/or methods acquired from the external environment are introduced in the process of manufacturing and supplying the product or providing the service). If the acquired knowledge and technology are not presented, it is necessary to introduce them, and if they are introduced, **check whether the expected results are achieved**. If the desired results are not fulfilled, it is required to **check whether the employees understand the objectives of the organisation**. If the objectives are clear, return to the issue of performing internal research and development. If not – understanding should be promoted among employees. **But if the expected results are reached, the case of whether organisational innovations are being introduced** (new technologies and/or methods for enterprise management) **should be continued**. If **organisational innovations are introduced, the question should be answered whether the expected outcome is achieved**. If so, it is necessary to review the relevance of the process and organisational innovations introduced to the desired growth in profits and customer satisfaction. However, in cases **where organisational innovation is not implemented, or the expected results are not achieved, the issue of whether the enterprise operates in a networked organisation should be continued**.

Suppose an enterprise does not operate in a networked organisation that is working to achieve common objectives. In that case, it should be involved in such an organisation. At the same time, if it is already in place, **it should be continued on whether the employees of the company are trained frequently enough to upgrade their qualifications**. It is recommended that qualitative and/or quantitative data collection and analysis methods be used to identify this aspect, depending on the size of the enterprise by the number of employees and organisational structure. Still, in any case, it is advisable to organise the collection of data from employees of all levels and areas (see more Brown, 2002). Accordingly, training should occur more

frequently when it is established that it is not sufficiently implemented. Whereas, if it is identified that the qualification upgrade is frequent enough, it is recommended to use the know-how transfer framework in the action research developed by Dubickis and Gaile-Sarkane (2017) to check the compliance of the implemented training.

In addition, it should be noted that this research has identified positive correlations between the commitment to introduce innovation and the introduction of the innovation process, the commitment to establish new enterprises and the establishment of new enterprises with retained shares, and the commitment to increase customer satisfaction and its growth. Consequently, the enterprise managers are recommended to ensure that the commitment to implement the planned and necessary changes is high. It is recommended to adapt the approach developed and validated by Fishbein and Ajzen (2011) to determine a complex level of commitment. Having established that the level of commitment is insufficient, action must be taken to increase the commitment based on the results obtained. At the same time, before collecting more information at the enterprise, it is recommended to check whether the respective commitment is defined as objective.

The complex flowchart for the enterprise growth promotion created within the framework of the Doctoral Thesis (see Fig. 9) has been approbated in practice at two enterprises that hypothetically engage in internal research and development, as well as the acquisition of new knowledge and technology and the introduction of innovation. In general, when assessing the application of the integrated enterprise growth flowchart, it is concluded that the approbation confirms the expedience of its usage, since it allows enterprises to identify urgent issues that need to be addressed to ensure business growth.

Conclusions and Proposals

The Doctoral Thesis has a hypothesis put forward that acquisition of new knowledge and technology has a positive correlation with the introduction of innovation and enterprise growth, which has been confirmed: acquisition of new knowledge and technology has a positive correlation with both product and process innovations and other innovation output indicators, as well as the enterprise performance indicators – net turnover, productivity, profit, and customer satisfaction. In developing the Doctoral Thesis, the following conclusions have been generally drawn:

1. The research results confirm the importance of research and development for innovation as highlighted in scientific literature and policy planning documents. At the same time, Latvia has one of Europe's lowest investments in R&D (the Latvian enterprise sector has even the most insufficient investment in R&D in Europe), thus explaining why the set national innovation targets have not been achieved.

2. In assessing the goal of achieving the share of innovative enterprises currently set in Latvia's policy planning documents, it has been observed that the methodology for determining the share of innovative enterprises does not include, for example, enterprises with fewer than ten employees in the survey, thereby not covering the majority of Latvian enterprises. Such an approach does not, by its very nature, illustrate the actual share of innovative enterprises.

3. In the information resources of Latvian State institutions, innovation is mainly defined as a process. However, the analysis of the world innovation literature in the Thesis shows that the concept of innovation is much broader – it also considers, as a result, capacity or competence, business function, economic driver, and strategic choice for growth. At the same time, when it comes to innovation, documents and discussions do not always refer to the viewpoint used, thereby creating confusion and misunderstanding between the stakeholders.

4. The literature review provided in the Thesis shows that existing technology transfer performance studies do not give a clear picture of the correlations between different factors, primarily due to the diversity of the variables used in the research. Thus, an identifiable knowledge gap indicates the need for empirical research to identify factors that influence the technology transfer process and address the importance of technology transfer for increasing enterprise performance.

5. The factors associated with the process of innovation and technology transfer are to be classified by using logic model guidelines. This set of factors demonstrates the complexity and

importance of the innovation and technology transfer process, both in business management and in the economy as a whole, but their assessment shows that not all factors can be considered within the framework of one empirical research.

6. The results of the empirical research demonstrate that being a part of a group of companies is important in the process of innovation and acquisition of new knowledge and technology since the acquisition of new knowledge and technology from companies abroad and the financing from the enterprise group for the acquisition of new knowledge and technology have been identified as having a statistically significant correlation with the corresponding product innovation (negative correlation) and the introduction of process innovation (positive correlation). The results could be explained by the fact that the management of enterprises belonging to a group of companies does not define their own objectives and activities, including introducing innovation.

7. As a result of the research, it can be concluded that the expansion of the market in which an enterprise operates is important in the process of innovation and technology transfer since it has a positive correlation with both the acquisition of new knowledge and technology and the introduction of product, process, and organisational innovations. At the same time, given the correlation identified, the question is whether the expansion of the market determines the introduction of innovation or whether the introduction of innovation determines the size of the market.

8. The Thesis findings demonstrate that the intensity of competition is essential in product, process, and organisational innovations, as these performance indicators have a positive correlation with the independent variable. Thus, the research results confirm the thesis provided regarding competition as a contributing factor to development.

9. For part of the various levels of commitment focused on the development of the enterprise, a positive correlation has been found with the relevant performance indicators (introduction of process innovation, establishment of new companies, and the increase in customer satisfaction). In contrast, for some of these aspects, no correlation has been found. Therefore, the level of commitment to some extent matters in the innovation and technology transfer process.

10. The research has examined the importance of the company's participation in networked organisations (industry associations, strategic alliances, clusters, etc., working to achieve common objectives) in the innovation and technology transfer process – a positive correlation has been found with the introduction of organisational innovation. Still, with the acquisition of new knowledge and technology, no correlation has been established. At the same time, the

research has not identified a correlation between the degree of involvement in the network organisation and the performance indicators. Consequently, it is concluded that enterprises, that form part of a networked organisation (regardless of their degree of involvement), have advantages in taking over and implementing new techniques and technologies in enterprise management. At the same time, it is observed that networked organisations' potential to acquire new knowledge and technology has not been fulfilled among the enterprises studied.

11. Intellectual property rights policy is considered one of the most critical factors for innovation since the existence of this policy at the enterprise has shown a positive correlation both with the introduction of product and process innovation and with the sale of intellectual property rights created by the enterprise. At the same time, the intellectual property rights policy has been developed only at around a third of the enterprises surveyed. Consequently, it can be concluded that enterprises in Latvia do not take advantage of the intellectual property rights policy and do not reach innovation potential.

12. The results of the empirical research demonstrate the importance of performing internal research and development work for the acquisition of new knowledge and technology, the introduction of innovation, and the increase in enterprise performance, but only about half of the respondents indicated that R&D had been carried out. It is therefore concluded that the potential of internal research and development in Latvia is not exploited. This also can be observed by the relatively low investments in research and development in Latvia, particularly in the enterprise sector. At the same time, this research has not identified any relevance for the types of the performed research, the regularity of its performance, and the purchase of external research services. Therefore, the performance of internal research and development is essential.

13. The research results confirm the importance of acquiring new knowledge and technology for innovation and increasing enterprise performance. At the same time, the acquisition of new knowledge and technology has only been identified by around half of the respondents, while the national innovation survey data show that the share of enterprises cooperating with external partners in the implementation of innovation is even lower. Consequently, it is concluded that the potential for acquiring new knowledge and technology is not being exploited in Latvia.

14. The research results demonstrate that, in general, innovation is vital in increasing enterprise performance because both process and organisational innovations have a statistically significant positive correlation with enterprise performance. Although the research has not identified any correlations between product innovation and enterprise performance, as well as marketing innovation and enterprise performance, it does not exclude the potential positive effects of these

types of innovation on enterprise performance. This result demonstrates that, within the limits of given research, existing enterprises do not use the potential of the relevant types of innovation to increase their performance and that the relevant correlations should be further researched.

15. Despite the fact that different classifications of innovation levels are widely addressed in the literature, the achieved level of innovation in the research has not identified a correlation with the enterprise performance indicators, so innovation in practice can be considered as significant if it is new only for the respective enterprise. The obtained results confirm that existing approaches to collecting statistical data in national and European innovation surveys are meaningful.

16. In the case of product and process innovations, the research has identified a higher level of innovation being achieved by enterprises acquiring new knowledge and technology from enterprises from other sectors abroad and sources of new knowledge and technology abroad in general. At the same time, the acquisition of new knowledge and technology from abroad has been identified in slightly more than half of the cases (56 %), while the acquisition from enterprises from other sectors abroad is only in somewhat more than one-quarter of the cases (28 %). Consequently, it has been concluded that the potential for acquiring new knowledge and technology from enterprises from other sectors abroad is not exploited.

17. The innovation-level correlations identified in the research with the sources of acquisition of new knowledge and technology demonstrate that the classification of levels of innovation by Altshuller (2007) is not only relevant to the creation of new products, but also the introduction of new technologies and/or methods in the process of producing and supplying a product or providing a service (process innovation), thereby expanding the knowledge base on this issue. Further studies should also assess the possibility of extending this classification to marketing and organisational innovation.

18. The hypothetical barriers to innovation and technology transfer processes included in the empirical research (lack of skilled labour, the resistance of employees to changes, fears that the knowledge at their disposal will be disclosed to others, and difficulties in establishing initial contacts for cooperation) has not identified a negative correlation with the resulting indicators, on the contrary, for example, there has been a positive correlation established in resistance of employees to changes to several performance indicators (marketing innovation, turnover, and productivity growth). Accordingly, the defined variable of resistance to change, based on the theory of change, has been interpreted as introducing a change as such, considering that resistance to changes is naturally observed in the event of their introduction. Consequently, the

results of the research demonstrate the importance of introducing changes to increase enterprise performance.

19. Management solutions developed as a result of the Doctoral Thesis – approbation of the integrated flowchart of the enterprise growth demonstrate the efficiency of their use since they allow enterprises to identify the issues that need to be addressed for ensuring their growth. At the same time, it should be taken into account that the solution developed should be complementary – one of the practical tools in business management.

As a result of the Doctoral Thesis, the author has formulated the following proposals for enterprises and business managers, networked organisations, public authorities, and policymakers, as well as for researchers:

1. Business managers are recommended to look at the intensity of competition in the sector as a driving force and use the acquisition of new knowledge and technology from external sources to introduce innovation. The enterprise growth will be sufficient if the introduced innovation is unique for the enterprise. Still, new knowledge and technology are recommended to be acquired from abroad and, more specifically, from companies from other sectors to reach a higher level of innovation.

2. To facilitate the acquisition of new knowledge and technology, enterprises are recommended to perform internal research and development work, including using external support instruments. It is more appropriate to plan to strengthen an enterprise's research capacity than to purchase external research services.

3. To encourage innovation, enterprises are recommended to strengthen their commitment to introduce the necessary changes, to make sure that the objectives of the organisation are clear among employees, to motivate employees to cooperate, to implement appropriate training for upgrading their qualifications regularly, to engage in networked organisations, to develop and implement intellectual property rights policies. Business managers have to consider that the importance of innovation is increasing with the age of the enterprise, with the increase of the number of employees, as well as when expanding markets.

4. For business expansion, it is appropriate for enterprises to plan the establishment of new companies by retaining shares of the newly created company.

5. In view that promoting knowledge exchange is usually one of the functions for networked organisations they are recommended to make sure that their activities effectively coordinate the issues of acquisition of new knowledge and technology for enterprises involved in the organisations.

6. To promote the introduction of innovation with innovation support programmes, state, local government, networked, and other support organisations should contribute directly to internal research and development capacity and the acquisition of new knowledge and technology, particularly from abroad and enterprises of other industries.

7. The Investment and Development Agency of Latvia should consider modifying the support activities in innovation vouchers and providing support to companies to perform internal research and development work, as well as further emphasising the possibility of using vouchers for the recruitment of new employees.

8. Policymakers and other stakeholders should clarify the point of view from which the innovation term is used in public discussions and national policy planning documents to create a shared understanding of the particular context.

9. It is recommended that the statistics summarising bodies specify the methodology for determining the proportion of innovative enterprises either by including all groups in the survey sample or by performing separate studies for groups not currently included in the survey. At the same time, it is recommended that the research methodology be improved by exploring the correlations between the characteristics of innovative activities and the performance indicators of enterprises.

10. Researchers, in future studies, are recommended to summarise the characteristics of modern economic and societal concepts and perform empirical research to identify which concepts and in which regions prevail and how they affect the stakeholders.

11. With the account of the fact that activities on foreign markets have a positive correlation with the acquisition of new knowledge and technology, but the variables could be both a cause and a consequence (a broader market both requires the necessity and gives more opportunities to acquire new knowledge and technology), it would be helpful to explain in further research whether and which of the explanations prevail in practice. At the same time, further research would also have an inverse of this relationship by examining whether and what impact the acquisition of new knowledge and technology has on the market expansion.

12. It would be recommended in further research to clarify more profoundly the following:

12.1. The impact of the enterprise's being a part of a group of companies on the acquisition of new knowledge and technology and the introduction of innovation.

12.2. Positive effects of creditor funding for the acquisition of new knowledge and technology.

12.3. Correlations between the levels of commitment of the various aspects of enterprise development and the corresponding performance indicators.

13. Because of the importance of establishing new companies identified in the empirical research, researchers are recommended to perform further studies of such cases to explain more precisely the circumstances in which the establishment of new companies is meaningful for the extension of business activities of an enterprise.

14. Further on, researchers are recommended to analyse the correlations between product and marketing innovations and enterprise performance more closely, based on the fact that no correlations have been identified in this research.

15. In the light of the results obtained in the Thesis, researchers are further recommended to analyse the possibility of extending the classification of Altshuller levels of innovation to marketing and organisational innovations.

16. In addition, researchers are further recommended to analyse other factors (barriers and incentives) not addressed in this research to exploit the innovation potential of enterprises.

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