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Small States and Knowledge Governance: the Case of Latvia

Lauma Muižniece

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Declaration:
Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for doctoral or equivalent academic degree.

Lauma Muižniece

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III Muižniece, L.; Cepilovs, A. (2017). Supporting University Technology Transfer – Struggles and Barriers in Latvia. Economic Thought and Practice, 1, 321−342. (1.2.)

IV Cepilovs, A.; Muižniece, L. (2016). Latvia after EU accession: weathering the storm? In: L. Briguglio (Ed.). Small States and the European Union: Economic Perspectives, 87−110. Routledge. (3.1.)

Author's Contribution to the Publications

Contribution to the papers in this thesis are:

I The publication was single-authored by the author of this thesis.

II Author of the thesis was the lead author formulating the research problem, structuring the research design, conducting data collection and analysis, writing a major portion of the paper and coordinating correspondence.

III Author of the thesis has contributed equally with the co-author as the main idea for the paper was developed jointly. The author of the thesis was responsible for the overall research design, collection of data, correspondence and coordination.

IV Author contributed to data collection, analysis and participated in write-up of the chapter, while correspondence, coordination, research design was the sole responsibility of the other author.

Introduction

Movement towards an increasingly knowledge-intensive economy and society has put the governance of knowledge at the centre of policy debate for at least the last three decades. Knowledge is a recognised driver of growth, and a region's ability to develop economically and socially is linked to its ability to produce and utilise knowledge (Schmitz et al., 2017). Facilitating production, diffusion, and appropriation of knowledge are key priorities in policymaking. This means ensuring a steady supply and finding the most efficient ways for the supply and demand sides to meet and interact (OECD, 2011).

Universities have played increasingly important roles in these processes – as key providers and diffusers of knowledge. They have become more and more relevant to the debate through institutional changes (though these changes have taken place in different countries during different time period[1])—first, when research was integrated with teaching (i.e., the move from a teaching college to a research university) and second, in the shift from research universities to an entrepreneurial universities that also translate the knowledge created into economic benefits (see e.g., Etzkowitz, 1990, 2003b). Starting in the United States, policy aspirations to strengthen science–industry linkages and diffusion of knowledge produced in universities have also been legitimised and enforced through facilitation of a wide range of technology transfer activities. The overall emphasis on fostering dynamic government–science–industry relations in the European agenda significantly increased in the early 1990s when the European Commission raised the issue of the apparent struggle to transform the results of technological research and skills into innovations and competitive advantages, known as the "European Paradox" (European Commission, 1995). Policies in the European Union (EU) were already strongly directed towards increasing science and technology linkages (Sachwald, 2015), and a more active role in technology transfer was encouraged for universities through structural changes and support incentives (Grimaldi et al., 2011). Meanwhile, universities have welcomed this trend due to the potential for large revenues from research commercialisation and the possibility of contributing to economic and regional development (Link et al., 2007; Stephan, 2012).

Many catching-up countries have gone through this transformation during the last decades. Latvia, a small post-Soviet country, went through this transformation very rapidly after regaining its independence in 1991. It had to restructure all domains of its economy, including knowledge creation and diffusion processes, as these processes in the USSR were very different – with a separation between teaching, basic research, and applied research. As Latvia moved towards and eventually joined the EU in 2004, significant external (EU) funding for these transformations became available to facilitate the catching-up process. During this process, the policy rhetoric shifted from a "science and technology policy" towards an "innovation policy," and the EU has acted as a key variable influencing innovation policy evolution in Central and Eastern European (CEE) economies since the late 1990s (Karo, 2011; Suurna & Kattel, 2010; Varblane, 2007). The impact of the EU on the national level is reflected through the establishment of long-term strategic documents and policies related to innovation and research and development (R&D), through strengthening the role of the public sector and through

[1] Etzkowitz (1990, 2003b) discusses two academic revolutions – first taking place in the 19th century when universities integrated research as a function in addition to teaching and the second academic revolution originating from the US in the 20th century; however, in the case of Latvia, these changes took place after the collapse of the Soviet Union.

funding. EU funding became the major source for research and innovation policies, including institutional transformation of universities. Still, despite the influence and accompanying funds, local idiosyncrasies affected the implementation of European policy ideas and guidelines (Karo, 2011; Lepori et al., 2009; Radosevic & Lepori, 2009; Suurna & Kattel, 2010; Veugelers, 2016).

Statistics and research show that Latvia and other CEE countries have had limited success in capitalising on their science base since regaining independence (Arnold et al., 2014; Kravtsova & Radosevic, 2012; Meske, 2004; Radosevic, 2006; Veugelers, 2016). Latvia's aims and targets in science, technology, and innovation for the more recent 2014–2020 period have been addressed in multiple documents. The National Development Plan 2020 foresaw an increase in R&D funding, reaching 1.5% of Gross Domestic Product (GDP) by 2020,[1] emphasising the cooperation of higher education, science and the private sector, university–industry technology transfer, and research commercialisation. The main aim of Latvia's science, technology, and innovation policy was to increase the competitiveness of Latvian science and innovation and to facilitate its contribution to the national economy and society (Ministry of Education and Science of the Republic of Latvia, 2013). As a sub-target it also foresaw strengthening in the innovation capacity of the private sector, resulting in business expenditure in R&D reaching at least 48% of total investments in R&D (fact – 24% in 2019), an increase in the percentage of innovative companies – 40% of total number (fact – 32.9% in 2018), as well as an "increase [in] the return on investment of scientific institutions in research and development, creating a more efficient transfer of knowledge and technology environment" (Ministry of Education and Science of the Republic of Latvia, 2013, p. 40).

One of the targets of Latvia's science, technology, and innovation development policy, which was fulfilled in 2016, was for Latvia to reach the group "Moderate innovators" (with an overall innovation performance below the EU average) in the European Innovation Scoreboard (EIS) – an annual report comparing the innovation performance of European countries and regional neighbours. However, some areas in Latvia's innovation performance (e.g., "linkages," "private co-funding for public R&D," and overall R&D expenditure), both for the overall economy and that of the business sector, have struggled to substantially improve despite the policy commitments, significant funding flows, and periods of relatively high economic growth and with science–industry linkages continuing to be a focus of innovation policy. Additionally, while according to OECD (2019), Latvia fares better in research excellence than many other CEE countries such as Slovenia, Lithuania, Hungary, Czech Republic, Slovak Republic, and Poland, it still lags behind the OECD average and performs worse than its Baltic or Eastern European peers in the share of small and medium-sized enterprises (SMEs) engaging in collaboration with research institutions and international collaborations in research.

To investigate the causes of this and propose policy recommendations, this thesis uses a "knowledge governance" approach as a framework. The approach was proposed by Burlamaqui (2010, p. 562) as a better way to understand the issues of knowledge production, appropriability, and diffusion. However, knowledge governance is not the first approach to look at knowledge production, diffusion, and appropriation systemically. Three periods for how science and innovation processes were viewed

[1] The National Development plan foresaw an increase in R&D funding to 1.5% of GDP during the period of 2014–2020 (from 0.69% in 2014), and during the same period, Latvia went through a period of relative prosperity; however, R&D funding was still a worryingly low, at 0.64%, in 2019.

theoretically and approached by policymakers are distinguished (Schot & Steinmueller, 2018; Smits & Kuhlmann, 2004). The first period focused on science and technological development as one of the main drivers of economic growth (Kuznets, 1973), which resulted in the facilitation of a linear approach in innovation and increases in active government funding for R&D (Schot & Steinmueller, 2018). The second period saw the rise of the systems approach and the emergence of concepts like the National Innovation System (NIS) that emphasise knowledge flows and the interaction of different actors as key to fostering innovation and put more emphasis on facilitating dynamic government–science–industry relations (Freeman, 1987; Lundvall, 1992). However, as Burlamaqui et al. (2012) and Kattel (2012) argue, NIS-related research strands emphasise linkages and interactions among the actors but do not focus on the need to coordinate these processes. Meanwhile, knowledge governance encompasses intellectual property rights, innovation, and competition policies and looks at how supervision, rulemaking, regulation, policy prescriptions, and institutional coordination influences knowledge processes (Burlamaqui, 2010; Burlamaqui et al., 2012). The need to govern these processes is all the more important as the approach to science and innovation is changing yet again. Smits and Kuhlmann (2004) argue that science and technology should be understood as opportunities rather than ready-made solutions and can be adapted and implanted through various types of learning. That changes the role of the government from builder and sustainer of innovation systems to facilitator of such learning processes. Meanwhile Schot and Steinmueller (2018), Mazzucato et al. (2020), Borrás and Edler (2020), and others describe the emerging focus on socio-economic challenges such as climate change and poverty, questioning how science can be used in tackling these challenges and how such use can be stimulated by the state taking an active role through science and innovation policy measures. Addressing the grand challenges is a difficult task not only for policy but for science, technology, and innovation actors and requires bringing these actors together, providing an opportunity for them to transform and facilitate emergence of new ones as well (Kuhlmann & Rip, 2018). This highlights the need to evaluate the ability of universities to contribute and build the capacity of the public sector to govern all the related processes and design and implement a wide variety of appropriate policy measures that go beyond the dominating financial instruments (Smits & Kuhlmann, 2004).

Because of significant attention by the policy makers on directing funds to R&D and the commercialisation of research, this thesis combines a knowledge governance approach with research on “triple-helix” academic–industry–government relations (see Etzkowitz & Leydesdorff, 1995, 1997; Leydesdorff & Etzkowitz, 1996) and the “entrepreneurial university” (Etzkowitz, 2003b, 2013; Etzkowitz et al., 2000) to address the transformations taking place at universities – to what degree universities have transformed since Latvia regained its independence, what governance mechanisms have been used to facilitate universities fulfilling their role in a knowledge-based economy with the changing characteristics of government–university–industry relations, and if these mechanisms correspond with the transformations needed.

While the idea of the entrepreneurial university is embraced in EU policy rhetoric, it is also critiqued as a model designed on the successful case of the Massachusetts Institute of Technology that works poorly when applied to more average universities and regions (Cooke, 2005). Grimaldi et al. (2020) argue that there is currently a fixation on cutting edge technologies and there have been remarkably few studies on how universities can contribute to the growth of companies in traditional sectors, which is also relevant for

Latvia. Still, it has been widely used and referenced when designing policy measures in countries like Latvia. Therefore, this thesis aims to contribute to the debate and investigate whether this approach is justified and whether universities have transformed and became "entrepreneurial." It also aims to investigate if and how the chosen policy measures have addressed local needs and capabilities (such as mismatched knowledge supply and demand and innovation absorption capacity of the local industry) and if the chosen policy mix is justified to address the emerging science and innovation framings (such as focus on grand challenges and key tendencies in public policy influencing knowledge governance).

However, among other factors, the size of the country can influence policies and the process of making them (Thorsteinsdóttir, 2000) and is a source for a variety of constraints (Armstrong & Read, 2003). That also includes the realm of knowledge governance; however, previous research has not focused on what role the size of the country plays in knowledge governance. Size-related challenges (discussed in more detail in the Section 4.2) affect the ability of these countries to deal with broader emerging policy governance issues and are the focus of this thesis. Latvia provides an interesting case as a country where path-dependency and need for rapid changes have caused significant challenges in the realm of knowledge governance but where capabilities are significantly limited due to it being both a small and a catching-up country. This thesis aims to contribute to a wider understanding of knowledge governance by addressing a gap in the literature on knowledge governance related challenges in a small state context – how do small state–related constraints influence knowledge governance processes? What impact do the capabilities of the public sector have on the ability to respond to new approaches to science and innovation policy? How does that, the small domestic market, and the direction of the private sector affect science–industry linkages, wide diffusion of knowledge, and the ability of universities to contribute to economic growth?

The following research questions are addressed:

1. What knowledge governance mechanisms have been used to facilitate effective government–university–industry interactions and more specifically the emergence of entrepreneurial universities?
2. What contextual factors have affected knowledge governance and university–industry linkages in Latvia?
3. How have universities in Latvia responded to the knowledge governance mechanisms implemented in Latvia?

The challenges described above are echoed in most other CEE countries. The findings of this thesis could be useful for other catching-up economies, especially the small states among them. However, as statistics show that even EU countries with a far better innovation performance are stagnating, a discussion about rethinking the ability of universities to generate sufficient income as well as evaluating whether that is in line with the shift in policy rhetoric would be beneficial, and this thesis aims to contribute to that discussion.

The main arguments of the thesis are laid out in four original articles that discuss processes and circumstances that have influenced the design and implementation as well as the success of policy measures for strengthening science–industry linkages. First, the chapter "Latvia after EU accession: weathering the storm?" **(IV)** in the book *Small States and the European Union* edited by Lino Briguglio (chapter co-authored with Aleksandrs Cepilovs) looks at Latvia's EU accession by referring to the economic structure and performance of the Latvian economy, covering three broad periods: the period

beginning at the country's independence (1918–1940), the Soviet period, and the pre–EU-accession years. This chapter also discusses Latvia's specific opportunities and constraints as a small country. Second, the article "Disregarding History and Context: Innovation Policy in Latvia Post 1990" **(II)**, co-authored with Aleksandrs Cepilovs, explores changes in Latvia's innovation and research policy along with changes in the economy after the collapse of the Soviet Union and discusses the approach that has been used to improve the country's innovation performance**.** The article "Supporting University technology Transfer – Struggles and Barriers in Latvia" **(III)**, co-authored with Aleksandrs Cepilovs, discusses the existing government policy measures in Latvia that are aimed at fostering science–industry linkages and university technology transfer and their management on the government and university level. A more in-depth analysis on how funding incentives and their sources affect the autonomy of universities and how that shapes and affects the implementation of support incentives is carried out in article "University autonomy and commercialisation of publicly funded research: the case of Latvia" **(I)** by looking closer at a specific funding incentive.

Abbreviations

CEE	Central and Eastern Europe
DUI	Learning-by-doing, by-using, and by-interacting
EIS	European Innovation Scoreboard
EU	European Union
FDI	Foreign direct investment
GDP	Gross Domestic Product
NIS	National Innovation System
NPM	New public management
OECD	Organisation for Economic Cooperation and Development
RIS3	Research and Innovation Strategies for Smart Specialisation
R&D	Research and Development
SME	Small and medium-sized enterprise
STI	Scientific and technologically-based innovation
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
TTO	Technology transfer office
WTO	World Trade Organisation

1 Methodology

The main goal of this thesis is to investigate what specific challenges a small and catching-up country faces in terms of knowledge governance in order to improve university–industry linkages and promote evolvement of universities beyond the role of teaching and research.

To allow an in-depth exploration of organisations and processes, seek causal relationships among them, and provide an explanation of occurring issues, the single case-study method was chosen. The case-study method is the preferred method when "how" or "why" questions are being posed about a contemporary phenomenon within a real-life context over which the investigator has little or no control (Yin, 2017).

Latvia is a typical case in different contexts. First, it is a typical case among CEE countries that are EU member states – despite favourable conditions for improving innovation performance (influx of EU funding, focus on this policy area), with a few exceptions, most of them have struggled to improve their performance. While there is a large degree of heterogeneity among CEE countries and not all are small states, statistical records show that various indicators are similarly stagnating and slowing the catching-up process. Additionally, similar policy measures are used to facilitate commercialisation of research.[1] However, in some features, Latvia is not a typical case in the EU context but rather in the catching-up context – the case of Latvia could therefore contribute to the debate about how universities can facilitate economic growth when traditional sectors are dominant and supply and demand of knowledge is mismatched. The findings could be used by both small states and catching-up economies, as both contexts are considered in the thesis. The thesis aims to find out how these contexts affect knowledge governance and whether are the reasons for the policy failure. Latvia was also chosen due to the author's personal professional interest and engagement in the country's innovation policy making and implementation as well as a long-term engagement in university technology transfer activities.

Within this single-case study, multiple embedded sub-units are analysed. The overarching unit of the case study is universities. The variables that are investigated are the changing role of universities in knowledge governance policy, the preconditions for them to transform into entrepreneurial universities, the implemented policy instruments and policy and administrative capacity. The geographical focus of this case study is Latvia (see Figure 1).

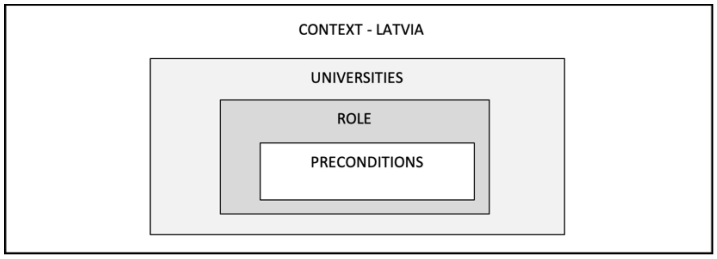

Figure 1. Case design (source: author's construction)

[1] Similar policy instruments are, however, used in both the more- as well as the less-advanced EU member states or regions.

The policy makers' perspective is left out in this thesis, providing a potential for bias. However, the aim is to go into more depth with universities and their transformations; therefore, the focus is on the contextual factors that affect that process. These sub-units need to be examined as they provide additional context and reveal rich information on the processes taking place. Path-dependency and context influence these processes, and it was necessary to understand the conditions to explain the outcomes.

There are certain limitations of this approach such as the majority of influencing factors being restricted to time, location, specific history etc. However, Flyvbjerg (2006) emphasises that case studies are particularly well suited to producing context-dependent knowledge. Case studies are generalisable to theoretical propositions and provide a possibility for analytical, rather than statistical, generalisation (Yin, 2017). Yin (2017) further argues that the lessons learned can help define new research or be applied in reinterpreting the results of existing studies.

Case studies rely on multiple sources of evidence (Yin, 2017), and to ensure validity of the data, data triangulation was used with the sources, including documentation, archival records, and statistical records and interviews. Documentation and statistical records were collected from publicly available sources including reports, policy documents or legal acts, regulations for funding programmes, lists of approved projects etc. Specific sources for research carried out in this thesis are as follows:

- For theoretical background, three main directions of academic literature were explored: 1) literature on public policy instruments for stimulating university–industry linkages; 2) research strands discussing university–industry linkages to understand how they have changed over time – triple helix relations, NIS (**I**, **II**); and 3) university entrepreneurship and tools that are used to facilitate it (**I**, **II**, **III**). Additionally, paper **IV** drew from the literature on small states and previous studies on Latvia discussing different periods of time, including the collapse of the Soviet Union, Latvia's EU accession, and the period after the crises period.
- To describe the economic structure of Latvia and its changes, statistical records on various economic indicators such as exports and imports and industrial production were used (for more details see **IV**).
- Statistics (e.g., patent and publication data, R&D expenditure, number of researchers) and performance reports (such as EIS) were used to describe the R&D landscape in Latvia (for more details see **I**, **II** and **III**).
- To investigate the landscape of support instruments, policy documents, project calls, and regulations for funding programmes were explored (for more details see **I**, **II,** and **III**). This allowed the collection of information about variations in funding allocation rules and sources. Additionally, legal documents were investigated to track changes in legislation such as the Law on Scientific Activity, ownership of intellectual property, etc.
- It was crucial to understand the underlying issues of implementing the support instruments and the challenges of establishing effective technology transfer processes from the perspectives of universities. Publicly available annual reports and published mid-term strategies of universities were investigated, which provided insight on formal priorities and goals for universities and insight into how entrepreneurial activities and technology transfer fit among them. To discover the motivation and concerns related to the implementation of public support instruments, the development of

internal ones, and the organisational processes within universities, 11 semi-constructed interviews were conducted with university staff and a foreign expert in innovation policy and development of support instruments. The interviews focused on the funding sources for R&D at the respective research organisations and the interviewees' experiences with available funding instruments (for more details see **I**).

As path-dependency plays an important role in the development of innovation systems and related processes, statistical data and policy documents were explored during various periods of time to illustrate changes in the economy and discuss crucial decisions by policy makers that have influenced knowledge governance processes.

This thesis also benefitted from the author's personal professional experience – experience gained as a project manager and technology transfer specialist at the University of Latvia (2010–2017) has provided an in-depth understanding about various processes taking place at universities and their governance as well as motivation for technology transfer of different groups (e.g., researchers and administration). From her current role as Director of the Technology department at the Investment and Development Agency of Latvia, the author has gained an understanding of issues related to policy making and implementation – challenges in designing support incentives, monitoring the progress and auditing the implementation.

The introductory part of the thesis is constructed as follows. First, changing characteristics of university–industry relations as well as the changing role of universities in economic development is described. After that, the knowledge governance approach, overall emerging policy issues, and other issues related to knowledge governance that are specific to the context of a small, catching-up country are discussed; this section looks at the existing literature and serves as background information for the case study. Further, the case of Latvia is discussed in more detail, and the last section presents conclusions and describes directions for further research.

2 Changing characteristics of university–industry linkages and the role of the state

2.1 Changes in approach to science and innovation policy

Facilitation of economic growth calls for investigation and understanding of its sources; hence, there has been interest from both policy makers and scholars in the subject, and a vast amount of literature has been dedicated to it. While innovation is universally acknowledged as a driver for growth, views on how innovation should be facilitated have evolved, causing changes in innovation theory and the policy measures responding to those changes.

Schumpeter (1947, 1949), for example, focused on the entrepreneur – their role and ability to innovate. Later on, following World War II, the focus shifted to a greater role of technological developments in facilitating economic growth and modernisation of industry as well as an increased role of the state (also by funding mission-oriented research targeting specific areas). This shift resulted in increased funding for research and development (R&D) from the state and development of applications of research outputs by the private sector – an approach that stimulated linear thinking of innovation and basically defined innovation as a commercialised invention (Schot & Steinmueller, 2018). Policy instruments developed because of this understanding included implementing tax incentives; strengthening intellectual property regimes; and facilitating a supply of researchers in science, technology, engineering, and mathematics through education. These instruments were intended to motivate companies to direct a share of their investments to technological innovation. Additionally, both public and private expenditure in R&D became indicators by which countries were compared (Schot & Steinmueller, 2018). However, when applied to a catching-up country, this approach failed to stimulate convergence with higher income countries (with exceptions such as Finland; (Ornston, 2012b), contradicting the view that scientific and technological knowledge is a good that is available to everyone. Instead, an understanding of factors such as absorption capacity (Cohen & Levinthal, 1990) and the role of path-dependency in technological development emerged (Arthur, 1983; David, 1975).

Thus, the ways in which policy was rationalised and used changed (Fagerberg & Hutschenreiter, 2020). While modified policy practices from the previous period were still used, the focus shifted to knowledge flows and interaction of different actors as key to fostering innovation and put more emphasis on facilitating dynamic relations between the state, research organisations, and the private sector. There were differentiations to this approach – Metcalfe (2005) defined it as a system of interconnected institutions which contributed to the creation and diffusion of new technologies both individually and jointly. Systems thinking aimed to encompass a wide array of determinants of innovation (Edquist & Johnson, 1997) including the surrounding infrastructure, human resources, and institutional structures on different levels. While some authors discussed the national aspects of such systems (Freeman, 1987, 1988; Lundvall, 1988; Lundvall, 1992) discussed the national aspect of such systems, others distinguished systems within different technology fields (Carlsson & Stankiewicz, 1991) or specific sectors (Malerba, 2002). The systems approach departed from the previous emphasis on the state's role in innovation development and linear thinking and moved towards an interactive model, building alliances and coordinating interactions among the actors, but still shared the view that science and technology are necessary to maintain a country's competitiveness

(Schot & Steinmueller, 2018). Innovation was perceived as the driving force of a long-run economic change (Fagerberg & Hutschenreiter, 2020).

Gibbons (1994) discussed similar arguments in their research on modes of knowledge production, distinguishing two modes, Mode 1 and Mode 2, of knowledge production. Mode 2 emphasised institutional links and interactions. Another related research strand is the Triple Helix model of interaction and changing roles between universities, companies, and the government sector and the necessity for universities to become "entrepreneurial" (Etzkowitz & Leydesdorff, 1997) discussed in more detail in Section 3.3). A diverse set of policy practices have been used to facilitate the evolvement of such systems and interactions through the development of technology parks and science hubs, conditioning funding on the requirement that the project involves interaction among a variety of partners, and building different organisations' absorption capacity through education and training among other strategies (Schot & Steinmueller, 2018). Another approach that has had a significant impact on EU member states' innovation policies, which requires strong networks and communication among the actors of innovation systems, is the introduction of the concept of Research and Innovation Strategies for Smart Specialisation (RIS3; (Foray et al., 2009). RIS3 was proposed as a tool to identify "the research and innovation domains in which a region can hope to excel" (Foray et al., 2009, p. 2) through the process of entrepreneurial discovery – an inclusive, interactive bottom-up process involving policy makers, companies, and academia to identify potential opportunities that may arise from utilising knowledge distributed among these sectors and assessing the outcomes of pursuing these opportunities (Foray, 2015; Hausmann & Rodrik, 2003).

However, the approaches discussed previously erroneously assumed that faster catching-up and reduction of inequality between higher and lower income countries was possible through investing in R&D and building national systems of innovation. It was assumed that innovation is positive and an important driver for growth; however, the currently established path is not viable for continued growth, as benefits from economic growth have not been distributed evenly (Fagerberg, 2019; Fagerberg & Hutschenreiter, 2020). Therefore, transformations towards sustainability should take place, and questions arise about whether investing in R&D will help in tackling pressing social and environmental challenges (Borrás & Edler, 2020; Mazzucato et al., 2020; Schot & Steinmueller, 2018). Schot and Steinmueller (2018, p. 9) further argue "existing R&D and national systems of innovation frames for science, technology and innovation policy are unfit" (p. 9) to address such challenges – instead a focus on directionality in socio-technical systems and the use of more participatory and inclusive approaches are needed. Additionally, there is a need to not only think about economic growth but also address transition to sustainability and distribution of benefits (Fagerberg, 2019). Thus, this shift marks an emerging third period of how science and innovation are framed and what policy measures are used.

In summary, there have been distinct periods in how science and innovation was framed or perceived and what policy instruments were used; however, the approach is changing yet again towards solving grand challenges through mission-oriented policies. Given that the existing approaches to science, technology, and innovation policy are not sufficiently effective, rethinking the role of universities and how their influence can play in is necessary – how can universities ensure the widest diffusion of the knowledge they produce? How is this ability affected by the knowledge governance mechanisms used? How should knowledge and technology transfer processes be adjusted?

The next sections revisit the rationale for technology transfer as well as the concept of the entrepreneurial university as it has been conceived in the political agenda for both advanced and catching-up economies, with a significant emphasis on framing the role of universities and related support instruments.

2.2 University technology transfer

Overwhelming evidence shows that technology drives economic growth (Audretsch et al., 2002); therefore, it is not surprising that both the public and private sectors are concerned about the different ways in which technology is diffused and appropriated and what influences them. "Technology transfer" and "Technology diffusion" and various aspects of these processes have been increasingly discussed in literature for a few decades.

Many different definitions are provided for technology transfer in the literature, and they vary according to the discipline and purpose of the research (Bozeman, 2000). Technology transfer, which can generally be defined as "the application of information into use" (Rogers, 2002, p. 326), has been used to increase competitive advantage on many levels – supra-national, national, regional, and organisation levels; thus, it is of concern to various academic disciplines, policy makers, and decision-makers (Reisman, 2005; Zhao & Reisman, 1992). Academic disciplines that deal with technology transfer include, for example, economics, anthropology, sociology, and management. The economics literature explores the micro- and macroeconomic aspects of technology as well as the flow and content of technology (see e.g. Arrow, 1969; Dosi, 1988); anthropology research takes a cultural, institutional, and geographic perspective; the sociology literature takes on the institutional perspective and also discusses the nature of technology (see Rogers, 1962; Rogers & Shoemaker, 1971); while management research (e.g. Teece, 1977) explores ownership and control and the nature, modality, and phases of technology transfer and tends to focus on transfer between sectors and the connection between technology transfer and strategy (Reisman, 2005; Wahab et al., 2011). Before the 1980s and the introduction of the Bayh-Dole Act in the United States, research on technology transfer mostly focused on cross-national transfer; however, later it shifted to exploration of domestic transfer, especially to the dynamics of transfer within universities and among U.S. scholars (Bozeman, 2000). This led to discussions around the entrepreneurial university (Clark, 1998; Etzkowitz, 2003b, 2013; Etzkowitz et al., 2000), channels for university–industry technology transfer (Lockett et al., 2005; Phan & Siegel, 2006; Siegel et al., 2007), and the role of various actors such as technology transfer offices (TTOs) (Geoghegan et al., 2015; Osenga, 2007; Siegel et al., 2007; Siegel et al., 2003) or individual researchers (Jensen & Thursby, 2001; Thursby & Thursby, 2007).

While the focus on increasing R&D expenditure and bridging the private and research sectors had been on the European agenda since the early 1990s (Sachwald, 2015), the transition into a "knowledge economy" seemed to have been more successful for the United States (Soete, 2002). Much of this success has been attributed to the Bayh-Dole Act and the subsequent establishment of TTOs, and the increase in licensing activities in universities facilitated viewing the commercialisation of publicly funded research as a remedy for insufficient innovation performance, which inspired other countries to "borrow" this approach (Link et al., 2007; Mowery et al., 2001; Mowery & Sampat, 2004; Stephan, 2012).

However, enthusiasm about the Bayh-Dole Act and the following focus on formal technology transfer has been criticised on various fronts. Patenting activities and the creation of TTOs have been taking place at universities before the Act was passed, and while it accelerated these activities and changed the way universities managed their intellectual property, solely crediting the Bayh-Dole Act is an oversimplification (Mowery & Sampat, 2004; Stephan, 2012).[1]

The Bayh-Dole Act drew focus to "formal"[2] means of technology transfer through the licencing or acquisition of technology; however, there are various other types of media through which technology can be transferred. Moreover, studies show that publications, conferences, collaborative research, networking, informal interaction, and consulting play more important roles in most industries, and technology transfer channels rated by R&D managers rarely include patents and licensing (Cohen et al., 2002; Mowery & Sampat, 2004). They also argue that patents (especially those coming from university laboratories) have varying importance depending on the industry and technological fields – in some fields, patents are important, but the inventions come from non-academic research. This factor is especially prominent in fields like physics and mathematics where, in academic research, there is significant lag in getting applications to market.

Still, because of its potential to serve as another revenue stream, universities have welcomed formal technology transfer channels (licensing agreements, joint ventures, and university-based start-ups), and a considerable amount of literature has been dedicated to the topic (Bozeman, 2000; Link et al., 2007),[3] especially to formal technology transfer mechanisms. Meanwhile informal interactions are more difficult to capture and study (Grimpe & Hussinger, 2008; Link et al., 2007).

Despite insufficient empirical evidence and vast differences between the situation in the United States and elsewhere, a number of OECD countries including Latvia have tried to emulate similar instruments,[4] and the EU has provided significant means for its member states to direct funding for strengthening university–industry linkages, often through formal technology transfer (**I**, **II**, **III**). Therefore, this thesis focuses particularly on in-depth analysis of policy instruments implemented to stimulate formal technology transfer and investigates what particular reasons have prevented these policies from acting as accelerators of technological development and economic growth in Latvia.

The next section gives an overview of the Triple Helix model, which is the dominant approach to university–industry linkages. Though it is widely used among policy makers

[1] Others (see So et al., 2008) further argue that the contribution of the Bayh-Dole Act has been overstated and point out that while patents are a source of revenue for some universities, they are concentrated at a few successful ones and the total revenues are small overall. Other lines of criticism include the impact of university patenting activities on developing countries and their effect on technology diffusion and catching-up processes (Hemel & Ouellette, 2017) and the impact on basic research (for a discussion see e.g. Thursby & Thursby, 2011).

[2] Types of technology transfer that result in a legal instrumentality and are focused on allocation of property rights (licensing, joint ventures, etc.) are considered "formal," while "informal" ones diffuse knowledge through communication processes and the associated obligations are more normative than legal (Link et al., 2007).

[3] Much of the literature explores the case of the United States and the effects of the Bayh-Dole Act, paying far less attention to how similar approaches have affected other countries (Grimaldi et al., 2020).

[4] However, Mowery and Sampat (2004) argue that the actual instruments implemented in some European countries focus on things other than those that were the main aim of the Bayh-Dole Act.

in both developed and catching-up countries, it does not sufficiently consider the catching-up context or the size of the country, which both affect the implementation of the approach. Therefore, the next section discusses the approach, its shortcomings, and its relevance for small, catching-up countries with the aim to provide a new theoretical contribution to understand the university–industry relationship through knowledge governance perspective.

2.3 The Triple Helix model and its implications for universities

Systematic university–industry interaction as such is not a recent phenomenon and can be traced back to the second half of the 19th century (Leydesdorff & Etzkowitz, 1996). How this interaction takes place, however, has changed, with a shift taking place from a linear approach to innovation to dynamic interactions. The focus on interactions between institutions of fundamental research "on the supply side" and corporations has been reflected not only in technology policies but also in technology studies. Evolutionary models that analyse network developments have superseded linear models of "demand pull" or "technology push" (e.g., Dosi, 1988; Leydesdorff & van den Besselaar, 1994; Nelson & Winter, 1982). Non-linear dynamics have provided us with co-evolutionary models: How do technologies and institutions co-evolve (Nelson, 1994)? Under which conditions do they "lock in" (Arthur, 1989; David, 1985)? When can a "lock in" be deemed part of an emerging infrastructure, and when should it be avoided (cf. David & Foray, 1994)? And over time: How is the social infrastructure adjusted to cycles of emerging techno-economic developments (Barras, 1990; Freeman & Pérez, 1988)?

Systems thinking became the dominant approach in the 1980s, moving the focus to different actors and to the interaction and knowledge flows taking place between them. Based on empirical findings from developed industrialised countries throughout the 1970s and 1980s (Lundvall, 2007), the National Innovation Systems (NIS) concept (Freeman 1987, 1988; Lundvall 1988, 1992), which focuses on the national-level aspects of these interactions, emerged and quickly took centre stage in policy discussions and academic work (Arocena & Sutz, 2000). The NIS approach is based on the notion that innovations are the result of complex national-level relationships between actors and institutions, such as universities, companies, networks, government organisations, the surrounding infrastructure, human resources, and the available incentives (OECD, 1997), and almost all of the literature on the NIS emphasises the importance of the connections among the actors (Arocena & Sutz, 2000). Interactive learning as a driver of economic development also became a central focus (Fagerberg & Sapprasert, 2011). The NIS approach facilitated the implementation of incentives that allowed for network building, interactions, and learning, and that inspired international comparisons as well as a search for best practices that could be used. The questions asked are as follows: "What kind of innovation policies are my neighbours, partners, rivals or 'models' devising and implementing? Which of these policies could possibly be applied at home, and at what cost?" (Arocena & Sutz, 2000, p. 56).

As a source of knowledge, universities play an important role in the NIS approach. The NIS approach emphasises the shift from universities as "ivory towers" to universities as important institutional actors in facilitating economic growth (Mowery & Sampat, 2006). This turned the focus to effectively linking universities with other actors within the NIS and ensuring knowledge flows.

A NIS-related approach likely to be a key component of any national or multi-national innovation strategy in the late 20th century is the Triple Helix model of

university–industry–government relations. The Triple Helix model emphasises the role of universities in innovation in contrast to firms (Etzkowitz & Leydesdorff, 2000). Specifically, it calls attention to the need for the government to foster an environment where the industry taps into the knowledge of universities while universities take a more entrepreneurial approach and seek economic benefits from their research outputs. The role of universities within government–university–industry relations has changed over time, first, through the integration of research and knowledge production, and second, through entrepreneurial activities involving the knowledge produced and the Triple Helix model of innovation (Etzkowitz & Leydesdorff, 1995; Leydesdorff & Etzkowitz, 1996). Furthermore, an increasing shift has taken place toward "open" or "networked" and "distributed" innovation as a response to the private sector's need to access and use external knowledge (Scarbrough & Amaeshi, 2009). This knowledge includes both tacit knowledge and codified knowledge[1].

The Triple Helix model has been embraced in countries with strong innovation performance as a model with optimal conditions for innovation. It is also promoted among policymakers in the countries that are trying to catch up to them (Cai, 2014). Etzkowitz and Leydesdorff (2000) differentiated among three Triple Helix model configurations/ policy models, with the most desirable being a configuration with overlapping institutional spheres that each take the role of the other. Incentives often implemented to reach this configuration include strategic investments, the facilitation of an intellectual property exchange through joint university–industry research, the establishment of cooperative research centres, strategic alliances, incubator facilities, and the facilitating of university spin-offs (Etzkowitz, 2003a).

An integral part of this model is the "entrepreneurial university" that goes beyond producing and disseminating knowledge by exploiting it to generate economic benefits. Understanding innovation as an evolutionary process involving various sectors (Rasmussen et al., 2006), and considering the increasing expectation for universities to commercialise their research (Etzkowitz, 1998), universities have had to adjust to these new directions and ultimately evolve beyond the traditional missions of teaching and research. They must now closely interact with both the industry and the government (Etzkowitz, 2003a). However, according to the Triple Helix model approach as well as the technology transfer literature, a number of prerequisites need to be met and challenges overcome for them to take on this new role.

Universities need to have some control over their strategic directions and relationships (Clark, 1998). They must then increase their technology transfer and commercialisation activities while simultaneously coordinating them with other core activities (Rasmussen et al., 2006). Technology transfer activities should be recognised as a priority and should be supported through the necessary infrastructure, resources, and accompanying procedures (see e.g. Maicher et al., 2019; McCutcheon, 2019; O'Shea et al., 2005).

Both formal and informal support mechanisms can come from the public sector "top-down" or emerge "bottom-up" from within universities (Goldfarb & Henrekson, 2003; **I**; **II**; **III**). The intellectual property ownership regime plays a significant role in facilitating technology transfer (Rasmussen et al., 2006), and as previously mentioned,

[1] Still, as discussed previously, the focus is often (and also in the case of Latvia) on formal types of linkages, such as licensing and the acquisition of technology, which is an important element of the Triple Helix model research (Schot & Steinmueller, 2018).

significant reforms including changes in the legislation concerning university intellectual property rights took place in the United States with the enactment of the Bayh-Dole Act. While in the United States this process emerged "bottom-up", it was implemented "top-down" in Europe with many countries adopting similar legislation to various degrees of success (Baldini, 2009; Baldini et al., 2006; Goldfarb & Henrekson, 2003; Grimaldi et al., 2011). Besides changing the intellectual property regime, other common measures include establishing TTOs and business incubators, introducing motivational programmes for students and researchers, facilitating access to venture capital, and facilitating university spin-offs (Siegel et al., 2007). Additionally, capacity and skills regarding managing intellectual property, which has been found to be an issue in almost all European countries (Directorate-General for Research and Innovation, 2013), need to be developed. Capacity and skills also plays an important role in dealing with multiple technological fields and developing commercialisation strategies at universities (Osenga, 2007). Sometimes implementing joint pursuits by various actors to reach critical mass is also important to strengthen this area (Commission, 2008).

Universities in various EU member states have implemented a wide array of activities. Best-practice cases were recently collected in an EU-funded project called "Progress-TT" and were discussed in detail in Torrisi (2019). These cases include technology scouting among university faculties and departments to identify ideas with commercial potential; mentorship for scouts from companies; trainings for researchers to increasingly establish spin-off companies; and increasing the number of invention disclosures, patent applications, and research agreements; and boosting collaboration between partners (Torrisi, 2019). Universities often also have to deal with technology transfer in a broad range of technological fields, which requires specific knowledge that is difficult to have with a limited number of staff (Osenga, 2007). This can be tackled by implementing joint activities with government-funded business development centres that are part of the university but have a certain degree of independence. This allows for focusing on specific technological fields and developing the skills and business knowledge of the research groups linked to them (Torrisi, 2019).

Another important incentive for universities is to reduce complexity and uncertainty in intellectual property rights negotiations (Baldini et al., 2006; **I**). This can be done by developing a national-level framework for research commercialisation and by providing guidance on expected norms for universities and other public research organisations when giving access to state-funded research (**I**).

Despite the wide use of the triple helix approach, scholars argue that this approach could prove difficult in various countries and that it does not consider various contextual (including specific national) settings that would influence the ability to sufficiently apply it (Cooke, 2005; Saad & Zawdie, 2005; Saad & Zawdie, 2011; Shinn, 2002). The concept of such relations has been developed based only on the experience of advanced economies, and insufficient empirical and analytical evidence exists regarding how attempts to implement and operationalise it have taken place in differing national contexts (Abd Razak & White, 2015; Cai, 2014). The government's role is to provide viable incentives to motivate these types of collaboration while also considering path dependency and local context (So et al., 2008), especially taking into account specific constraints – for example, those of small states.

Regardless of the above, the common enthusiasm about the model combined with the insufficient analysis of contexts can be seen when one looks at the homogenous support incentives that exist among EU member states regardless of their very different

levels of development and domestic needs (Izsak et al., 2015; Karo, 2010; Veugelers, 2016). This often makes the incentives inefficient for achieving the states' goals (**I**, **II**, **III**). Mowery and Sampat (2006, p. 3) argued:

> Universities fulfil broadly similar functions in the innovation systems of most industrial and industrialising economies, the importance of their role varies considerably, and is influenced by the structure of domestic industry, the size and structure of other publicly funded research performers, and numerous factors. (p. 3)

Additionally, the success of facilitating technological innovation depends on the proportion of publicly funded research and its focus (basic vs applied), the capabilities of industry partners, R&D funding, and the nature of university–industry linkages (So et al., 2008). This can be problematic for CEE countries, as most companies in the region rely on process innovation through, for example, acquiring new equipment (Kattel et al., 2010). This makes it more challenging for universities to accomplish their "third mission" in the local context due to the already small markets and limited demand there.

Additionally, even with the wide array of instruments used to develop "entrepreneurial" universities and to implement a dynamic triple helix model, the question of whether that has actually happened beyond policy rhetoric remains. Statistical data (see, e.g., Eurostat; OECD) show that despite these efforts, the proportion of university revenue from the private sector remains small and is actually declining (Stephan, 2012). Stephan (2012) argued that from the total R&D funding that universities have received, the share coming from the industry in the United States peaked in the 1980s (contributing approximately 7.4%). Similarly, many EU countries face either stagnation or declines in this indicator, suggesting that the efforts to establish R&D funding from the industry as a significant source of revenue has not been widely successful.[1]

To conclude, the analytical frameworks that come from the NIS and the triple helix approach can help with understanding the different roles of universities in driving economic growth. However, they do not offer much help with developing policies (Mowery et al., 2001). The NIS approach has been developed on the basis of advanced economies, and in this context, it has been used as an ex-post concept. It has not been used for system building to the same extent. Meanwhile, for developing economies, it is used as an ex-ante concept and implies best practices that could be transferred and used in developing NIS (Arocena & Sutz, 2000; Lundvall, 2007), disregarding the fact that the policy prescriptions it facilitates tends to favour developed economies. Both the NIS and the triple helix literature provides a number of uniform policy prescriptions – for example, an emphasis on building networks, establishing joint research activities and other types of collaboration, strengthening the capacity of university technology transfer activities through the establishment of TTOs, and the establishment of favourable intellectual property rights regime, among others. However, specific constraints exist when it comes to implementing these incentives due to a country's size or stage of development.

[1] According to statistical data that the OECD collected (included in the OECD Main Science and Technology Indicators), the percentage of higher education R&D that the business sector has financed overall in OECD countries has slightly increased (from 5.51% in 2013 to 6.18% in 2018), and the same is true for in the EU (from 6.73% in 2013 to 7.32% in 2018). However, some countries, including such innovation leaders as Finland, Denmark, Sweden, and Germany, have experienced declines or stagnation, and only a handful of countries have seen increases (e.g., Ireland, Greece, Italy).

The NIS and the triple helix approach should be adapted to the situation if it is to be used in system building (Lundvall, 2007).

Although the NIS and the triple helix literature discuss the actors, the types of interactions that take place between them on different levels, and their roles, they do not discuss how a specific context, such as catching up, and the small size of a country impact these interactions, as well as how this impact should be mitigated. This thesis is aimed at addressing this gap in literature and proposing a knowledge governance approach for doing this.

3 Knowledge governance challenges in the context of a small, catching-up country

3.1 Knowledge governance approach

Addressing the changing perspectives on science and technology calls for a re-evaluation of the respective policies – their role and the instruments they encompass. Moreover, new forms and types of organisations are emerging in the process of knowledge diffusion. Thus, the role of the state in involving and coordinating existing and new actors, defining priorities, designing policies, and shaping markets for these organisations to develop is becoming more and more significant. However, this is a complex policy arena involving multiple policy areas, such as innovation, research, and competition policies, as well as the intellectual property rights regime. Thus, the knowledge governance approach was proposed in an effort to bring together public governance mechanisms (such as policy prescriptions, institutional coordination, rulemaking, regulation, and supervision) as well as knowledge production, diffusion, and appropriation.

Knowledge governance is an analytical framework "that cuts across the fields of public policy, economic supervision and regulation, knowledge and organisation management, and innovation, competition and competitiveness analysis" (Burlamaqui et al., 2012, xix). It is a broad concept that emphasizes the role of public policy and discusses the use of governance mechanisms in the creation, protection, and diffusion of knowledge (e.g. What is the role of the state and funding for innovation? What knowledge governance structures should be established, and what competences and capabilities does the public sector need to possess to do this? How should governance mechanisms be coordinated?) (Burlamaqui, 2010). Whereas the NIS literature (see, e.g., Freeman, 1987, 1988; Lundvall, 1988, 1992; OECD, 1997) focuses on the need for various actors to interact and form networks for innovation to arise, and whereas the triple helix model literature focuses on the different and changing roles of these actors, the knowledge governance literature discusses how these relationships should be governed.

At the core of knowledge governance is the market features approach (Burlamaqui, 2010, 2012) and its counterpart – the market-shaping policy perspective (see e.g. Mazzucato et al., 2020) – whose aim is to achieve the broadest diffusion of knowledge through promotion and regulation. Knowledge governance policies should establish priority areas and then shape them and their respective markets through institution building, legal change, and administrative guidance to facilitate diffusion (Burlamaqui, 2010, 2012).

Different sets of knowledge governance mechanisms have been used and have changed together with the varying approaches to science and innovation policy thinking. Table 1 summarises the knowledge governance mechanisms corresponding with each approach.

Table 1. Knowledge governance mechanisms corresponding to varying approaches to science and innovation policy thinking (source: author's construction)

Linear approach	NIS and related approaches	Missions approach
• Investments in R&D through priority setting for government funding • Tax incentives • Strengthening of the intellectual property regime and creating varying regulations for university-industry technology transfer • R&D indicators for measuring and benchmarking performance • Priorities in education to supply researchers in key areas	• Coordination mechanisms, such as the Entrepreneurial discovery process • Priority specialisation areas • Joint research ventures and experimenting with various types of collaborations and funding mechanisms • Networks trough establishment of clusters, technology parks etc. • Funding priorities shifted to facilitate collaboration	• Inclusive coordination mechanisms providing effective-feedback loops • Cross-cutting governance structures • Coordination of R&D activities and patent pools to facilitate the development of prioritised areas • Mechanisms for defining and prioritising grand challenges/ missions • Varying intellectual property rights regimes • Public subsidisation for developing standards • Joint mission-oriented research ventures

Based on historically successful development experiences, three ideal-typical knowledge governance regimes are proposed (Kattel, 2012):

- The common knowledge governance regime is aimed at facilitating domestic linkages, the use of knowledge and absorption capacity, the creation of a shared knowledge pool, and the building up of linkages and capacities in the private sector through a lax intellectual property rights regime. It also focuses on domestic trade and development funding while also maintaining a long-term view on policymaking.
- The dynamic knowledge governance regime is aimed at using the established linkages and capitalising on the knowledge generated. It focuses on building activities with increasing returns on top of the established linkages, as well as reinforcing these through short-term monopolies (e.g., through standards, regulations, intellectual property rights), managing foreign direct investment (FDI) flows to and within sectors, facilitating new actors (e.g., organisations emerging from the industry) and gradually opening trade, while maintaining a mid-term view on policymaking.
- The social knowledge governance regime is aimed at maturing industries' activities and upgrading, as well as capitalising on the linkages and knowledge base. It focuses on promoting exports, skill development, tax incentives for R&D, and liberal trade and antitrust policies.

These three regimes also highlight the need to apply a different regime for different industries depending on their stages of development and the market for knowledge, thus indicating a need for developing countries to be able to coordinate different regimes at the same time and to develop various types of policy capacity (Kattel, 2012). These aspects also need to be considered when one is defining the priory areas and shaping the markets – are the defined areas and their actors/ respective industries on the same maturity level? If not, does the state have a sufficient policy capacity to deal with these differences? How can the widest dissemination be achieved through policy and institutional design, especially if the supply and demand sides are not aligned?

The current literature on knowledge governance does not sufficiently discuss these elements.

Thus, this thesis's aim is to fill this gap. It will (a) look at the dynamics between knowledge governance mechanisms and contextual factors that impacts their implementation, as well as how to enable the contribution of university-generated knowledge through knowledge governance mechanisms, such as setting national-level priority areas and industry standards, implementing incentives for R&D and design, and establishing and coordinating institutions and organisations that regulate and monitor the production and diffusion of knowledge, the intellectual property rights regime, and its enforcement. The thesis will also look at whether the focus on the entrepreneurial university concept and on formal technology transfer is justified considering the economic structure and demands of the private sector.

3.2 Constraints of small states

As discussed previously, knowledge governance is a broad concept cutting across a number of fields. The knowledge governance literature mostly discusses general problems with knowledge processes and how governance mechanisms can influence them. Still, among a variety of factors, the size of the country is a source of a variety of constraints and can influence policies and the process of making them (Thorsteinsdóttir, 2000). Knowledge governance processes have been discussed in the literature on innovation systems as an important part of them, as well as in the small-state context – for example, in Freeman and Lundvall (1988) and Edquist and Hommen (2008) – but these works mainly deal with general innovation system problems and do not particularly discuss size-related difficulties (Kattel et al., 2010). This thesis's aim is to address this gap in the literature and to look at how the common constraints of small states have influenced the knowledge governance process.

No consensus exists on a single definition of what a small state is; rather, multiple definitions exists based on size, military power, the ability to influence supra-national processes, and other aspects (Thorhallsson & Wivel, 2006). However, Baldacchino and Wivel (2020) proposed a synthesised working definition, emphasising that a small state is one that (a) has political, economic, and administrative systems with limited capacity, and (b) is a weaker part of the asymmetric relationships that they cannot change on their own.

The literature on small states lists a number of common constraints that such countries face and that have an impact on knowledge governance processes.

Small states are exposed and vulnerable to external factors beyond their control (Baldacchino, 2019; Briguglio, 2016). Responses to these factors, such as global market conditions, generate political decisions that heavily impact the development and sustainability of a productive labour force and the production of goods (Baldacchino, 2020). Globalisation has had a double-sided effect on small states: Although it has offered an opportunity to boost trade, it has also facilitated migration and brain drain (resulting in a loss of productivity; (Baldacchino & Wivel, 2020; Crossley et al., 2009). Migration and brain drain have negatively impacted the already small pool of students and specialists, as well as the ability to provide diverse learning opportunities. This impacts the ability to provide the necessary number of professionals to the emerging skill areas (Crossley et al., 2009).

Additionally, path dependency heavily influences small states (Maass, 2020). In contrast to global challenges, this constraint can be turned around with flexibility in

governance and strategic planning (Baldacchino, 2019; Baldacchino & Wivel, 2020). Nonetheless, this might be challenging to do in the realm of knowledge governance, especially in small states with lower levels of development (Kattel et al., 2010; Walsh, 1988) due to the complexity of the policy arena and insufficient administrative capacity (the skills of running the state and the number of civil servants in the central administration; (Thorhallsson, 2006)). Developing administrative capacity is a challenge for small countries, where it is often limited and, in some cases, further weakened by chosen political, economic, and administrative reforms (Kattel et al., 2010; Randma-Liiv, 2002). Decentralisation, fragmentation, reduced coordination among policy arenas, as well as weakened administrative capacity impact the development of a well-coordinated knowledge governance system (Burlamaqui et al., 2012).

However, despite the limited resources (human resources as well as small domestic markets of ideas and commodities) (Baldacchino & Wivel, 2020), small states still need to perform the same number of functions as large states, and this tends to cause multi-functionalism on the levels of individual officials and entire public organisations (Sarapuu & Randma-Liiv, 2020). Although multi-functionalism creates a better understanding of various processes and policy realms (see the "big picture"), it prevents sufficient specialisation and in-depth expertise (Crossley et al., 2009; Sarapuu & Randma-Liiv, 2020), thus impacting both the realm of education and governance.

Small states also run into various governance paradoxes (Sarapuu & Randma-Liiv, 2020) that also concern diversifying their economies to make them less dependent on international trade while still being able to specialise to effectively use their already limited resources. Both small states and catching-up economies need to exploit foreign knowledge and technologies, as well as combine them with the local ones (Fu & Soete, 2011; Radosevic & Ciampi Stancova, 2015). With insufficient resources (including the fiscal strain under which the public sector has been operating in many countries, particularly since the crisis in 2009), the need exists to prioritise and specialise to gain the critical mass. This causes a dilemma for small countries, as they need to balance between addressing local R&D needs and still being able to participate in global value chains. For universities in small states, there is a risk of either focusing on international demand and losing relevance to local companies or becoming too focused on local needs and thus becoming isolated from the international community (Thorsteinsdóttir, 2000). A small country's inability to diversify scientific activities requires the use of foreign knowledge and technologies. For this reason, participation in the international science community is crucial. Furthermore, the size of a country also plays a role in what types of innovation take place in the private sector, and innovation policies should be built using a bottom-up logic that, in turn, requires administrative stability. This is already difficult for small countries and is further exacerbated by new public management (NPM) reforms (Kattel et al., 2010), which are discussed in more detail in the next section.

To conclude, the constraints arising from the small size of a country impact the implementation of policy instruments based on the NIS, the triple helix approach, and knowledge governance approaches. Although using these approaches as analytical frameworks can provide some guidance, it is important to also consider this impact and how it has changed the course of policy implementation. Table 2 summarises how the size-related constraints relate to the implementation of the NIS, the triple helix model, and knowledge governance–based policy instruments.

Table 2. Impact of size-related constraints on NIS, triple helix approach, and knowledge governance (source: author's construction)

	Exposure and vulnerability to external factors	Limited resources and small domestic markets	Migration and brain drain, resulting in insufficient human capital	Vulnerability to path dependency
NIS and triple helix approach	• Need to follow research directions enforced by supra-national funding schemes, which might be mismatched with the local demand, challenging the possibility of establishing university–industry linkages	• Affects the ability to produce knowledge • Due to path dependency, the needs of domestic companies might be mismatched with what universities are offering, as they also need to fit into the international research arena. • Dependency on foreign knowledge	• Difficulty of developing excellency in multiple technological fields and types of research (fundamental and applied)	• Inability to change the structure of the economy, and switch to a different innovation mode
Knowledge governance	• Facilitation of uniform policy approaches, as well as governance mechanisms	• Makes it difficult to specialise to gain critical mass and to be integrated into international value chains on which small states are often dependent	• Weak policy and administrative capacity to ensure adequate ability to navigate the complex policy arena	• Reduced flexibility is developing strategies.

This highlights the inter-relatability of various constraints and the impact they have. Previous research on both the NIS and knowledge governance has not focused on these aspects. However, it important to discuss the dynamics in more depth to develop a more elaborate insight into how the effects could be tackled.

However, small size is not the only factor influencing knowledge governance processes. They are also impacted by emerging global tendencies, the catching-up context, and, in the case of Latvia, specific historical developments echoed among CEE countries, which are discussed in the next section.

3.3 Contextual factors influencing knowledge governance in CEE countries

The knowledge governance approach draws attention to changes in how knowledge is governed and how a number of tendencies in public policy have impacted it. For example, Burlamaqui et al. (2012) argued that these key tendencies have negatively impacted the field of knowledge and innovation:

- Emergence of homogenised policy reform prescriptions also implemented in catching-up countries, thus diminishing the domestic policy space;
- Rise of the NPM approach, leading to a number of practices, such as the "marketisation" of governance, out-contracting public services, and agencification;

- Difficulties with coordinating complex policy arenas, such as higher education and others dealing with knowledge generation and diffusion due to the aforementioned issues.

The homogenisation and convergence[1] of policies are seen as taking place due to generic events, such as globalisation (Karo & Kattel, 2010), and can also be facilitated by international organisations, such as the WTO or the EU (Burlamaqui et al., 2012). For example, the transition period after the collapse of the Soviet Union brought forth a number of reforms in Latvia and other CEE countries, as they needed to both develop and restructure their core institutions and introduce new policies. Most CEE countries focused on adjusting to the Washington Consensus policies and implemented a standard set of reforms, as they "were considered by many CEE countries as *the* implicit innovation and industrial policy measures, and in essence, there were no other policy initiatives in the 1990s" (Suurna & Kattel, 2010, p. 650). Additionally, through voluntary transfer, these countries sought external expertise on, for example, assessing their research systems and giving policy recommendations. Later, for some of the countries, the EU became the new source of reforms in the area of research and innovation, and some elements of coercive transfer were used by tying funding mechanisms for member states to certain preconditions, such as the RIS3 strategy (II). Additionally, international organisations have set targets and indicators that require voluntary or conditioned action, and these targets and indicators have influenced domestic policies (Borras & Radaelli, 2011). Economic and innovation policy, and public policy and administration were the two key areas where these countries received the advice (Karo & Kattel, 2010).

Policy learning and policy transfer can be effective mechanisms for developing and improving policies. However, strong policy and administrative capacity has to be in place, as the process requires evaluation, analysis, and appropriation so that the changes serve local needs and implementation is effective. This is especially important due to the complexity of contemporary policy problems (Wu et al., 2015).

As Wu et al. (2015) summarised, policy capacity is a set of skills (competences) and resources (capabilities) needed for policymaking (see also Gleeson et al., 2011; Gleeson et al., 2009). Moore (1995) pointed out three types of key skills comprising policy capacity on different levels: analytical, operational, and political skills on the individual, organisational, and systematic level. These refer to (a) the ability to receive evidence and

[1] Bennett (1991) referred to policy convergence as the movement of policy goals, policy content, policy instruments, policy outcomes, and policy styles to a common point, where they become alike, and proposed four processes that cause it: emulation, elite networking and policy communities, harmonisation, and penetration. The different mechanisms through which policy convergence can take place are discussed in various literature strands. The policy learning and "lesson drawing" literature explores the rational evaluation of a set of actions experienced elsewhere that can be used to solve domestic problems (Rose, 1991, 1993). The policy transfer literature (see Dolowitz & Marsh, 1996; Dolowitz & Marsh, 2000) includes a wide spectrum of mechanisms, such as voluntary transfer (e.g., seeking advice from international experts to solve problems), as well as direct coercive (where supra-national institutions have a key role) and indirect coercive transfer (caused by, e.g., interdependence, technological development, or international consensus). Meanwhile, the Europeanisation literature (see e.g. Knill & Lehmkuhl, 2002; Radaelli, 2003) explores how the EU impacts domestic policymaking and discusses the entire spectrum of mechanisms of policy change. Since the early 2000s, this research strand has increasingly explored new EU member states and candidate countries (for a review see e.g. Sedelmeier, 2011), as negotiations for EU accession have affected, among other aspects, the process of policymaking and intra-governmental relations in CEE countries (Grabbe, 2006).

to use it by having access to high-quality information, skills, and technical capabilities; (b) the development of managerial skills (the training of individual managers, the relationships between public sector organisations, and the ability to coordinate efforts among them to address challenges); (c) understanding key actors and their interests, and establishing a dialogue (Wu et al., 2015). Regarding innovation policy, "policy capacity refers to the ability of the political system to decide or compromise on the best approach (what is 'desirable' and what is 'feasible') to innovation and development" (Karo & Kattel, 2010, p. 171).

Regarding public policy and administration, as Randma-Liiv (2008) pointed out, due to a lack of strong civil service traditions and experience with evaluating risks and uncertainties, CEE countries implemented a mix of changes from different origins. At the time, the public administration paradigm was NPM (Randma-Liiv & Drechsler, 2017) – the application of business principles and techniques to the public sphere and decreasing any public activities (Drechsler, 2005). A practice within the NPM toolbox (Drechsler & Randma-Liiv, 2015) – agencification – has added to the decentralisation and fragmentation of government administration (Randma-Liiv, 2008).[1]

CEE countries in particular have had a specific trajectory of agencification. This is true in the sense that it has been a comparatively recent trend (Randma-Liiv et al., 2011; Thiel, 2011). In addition, many are ranking among the most "agencified" countries in the world (Randma-Liiv et al., 2011) and have delegated a notable amount of executive and regulatory tasks to various agencies due to a rapid agencification process (Drechsler & Randma-Liiv, 2015). Pollitt (2004) pointed out that in Latvia, this rapid agencification during the first decade of the independence process was more on an ad hoc basis, and in many cases, the overseeing ministries did not meet the prerequisites for successfully steering them, such as possessing sufficient information, appropriately skilled staff, and authoritative levers. Europeanization – influence of EU on domestic policy making, policies and institutions – was also a significant factor that impacted the innovation policies in CEE (Börzel & Risse, 2000) and contributed to agencification. Influx of EU funding required the establishment of domestic organisations to administer these funds. Europeanization also pressured development of normative policy documents and policy mixes that strongly reflected EU-level objectives and priorities (Suurna & Kattel, 2010). The effects of Europeanization in Latvia can be seen in further exacerbation of mismatch between the domestic demand and supply in R&D (**I**), choice of support incentives (**II**, **III**) and fragmentation among government organisations.

For countries in transition – such as CEE countries, with their limited administrative capacity to monitor changes and evaluate uncertainties, and with insufficient legal and regulatory frameworks, decentralisation, fragmentation, and deregulation – NPM further weakens the policy and administrative capacity (Randma-Liiv, 2008)[2]. It also negatively impacts knowledge governance, for which a strong policy capacity is necessary to coordinate the complex and interconnected arenas of research, education, and innovation. Burlamaqui et al. (2012) emphasised that NPM led to a one-size-fits-all

[1] Agencification refers to the creation of semi-autonomous public organisations to carry out public tasks, such as service delivery and policy implementation/regulation (Pollitt et al., 2004). Although agencies have existed before, NPM has influenced the motives behind the establishment of such organisations (Verhoest, 2018).

[2] However, cases have existed where traditionally low-tech economies defied these patterns and successfully confronted disruptive economic challenges. For a discussion on Finland, Ireland, and Denmark, see Ornston (2012b).

approach to the privatisation of public services and resulted in more fragmented and uncoordinated policy arenas, with the key steering mechanism being cost-effectiveness. This also stemmed from the policy reforms that the WTO suggested to developing countries because they promoted the implementation of universal rules and institutions, thus decontextualising domestic policymaking (Kattel, 2012). For example, inspired by foreign success stories and influenced by international organisations, many catching-up countries direct their innovation policies to strengthening university–industry linkages. However, they often lack both dynamic private sector actors and policy capacity to successfully implement them (Kattel, 2012). Their policy mixes should instead be based on the local requirements, customised to address the real challenges related to the activities of the innovation system (Borrás & Edquist, 2013). These are, in turn, based on analysis and defined strategic priorities/goals, also taking the country's distance to the technological frontier into account (Izsak et al., 2015). The implemented policy reforms eventually caused double fragmentation in CEE EU member states. Fragmentation and a divide among the actors in the innovation system, and fragmentation among education, research, and other policy arenas make coordination, policy design, implementation, and evaluation very difficult (Karo & Kattel, 2010).

Another factor that impacts both institutions and organisations is path dependency. The ideas of path dependency that evolutionary economists - for example, David (1975, 1985) and Arthur (1989) – originally developed provided insights into locking processes. However, social scientists later modified them for usage in the institutional area and in comparative politics (e.g., North (1990) Pierson (2000). The basic notion of every path dependence argument is the significance of past actions for future actions and the idea that past decisions can restrain future choices. In addition, self-reinforcing processes can act as major drivers in accumulating a specific path (Schreyögg & Sydow, 2010). At the base of path dependency is the notion that both smaller and bigger events can act as critical junctures or triggering events that set the direction of a specific path to a wide range of possible outcomes (Pierson, 2000). Additionally, once the particular course of action is introduced, it is almost impossible to reverse (Pierson, 2000). Path dependency is one of the key concepts of historical institutionalism that examines the development of institutions over time, with the aim of explaining particular institutional choices (Christiansen & Vanhoonacker, 2008). Critical junctures can trigger institutional change and instability, sending countries on different paths that constrain the further evolvement of institutions (which happens in response to changes in environmental conditions and politics; (Thelen, 1999).

To sum up, after regaining independence, CEE countries needed to introduce new policies and change the structures of their institutions. However, the paths that many chose due to the homogenisation and convergence of policies weakened the capacity of the public sector, thus causing difficulties with coordinating complex policy arenas, such as education, research, and innovation. The public sector's capacity in small states is typically limited. Thus, this further exacerbated the issues in the small states among the CEE countries.

The government plays a crucial role in facilitating interaction between the various actors of innovation systems. This is a role that requires understanding the changes and needs within the systems, as well as the capacity to implement solutions. In Latvia's case, a multitude of factors have strongly impacted the choice of knowledge governance mechanisms, their implementation, and their success. These factors include the constraints stemming from the country's small size, as well historical developments,

path dependency, and the catching-up context. These contextual factors are inter-dependent and need to be explored as a whole.

To fill the aforementioned gaps in the NIS, triple helix approach, and knowledge governance literature, this thesis is aimed at bringing them all together and exploring the case of Latvia using the framework shown in Figure 2.

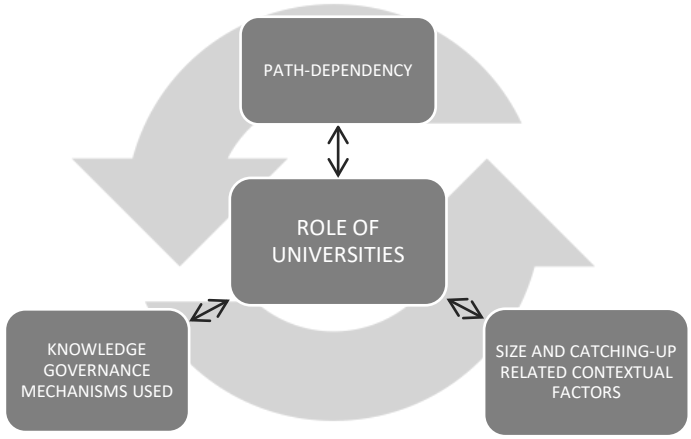

Figure 2. Analytical framework for the exploration of the role of universities in the knowledge governance system (source: author's construction)

Within this framework, the intent is to highlight the issues arising from all of these contextual factors, as well as the reduced possibility of implementing such concepts as the NIS, triple helix relations, and the entrepreneurial university. The thesis's aim is to show that countries whom these types of constraints affect need to re-evaluate the role of universities and pursue a different path to facilitate scientific contributions to contemporary challenges.

4 Development of the knowledge governance system in Latvia

4.1 Structure of economy and domestic needs

After regaining its independence in 1991 (*de facto*) and during the subsequent transition period, Latvia, just like other former Soviet republics, found itself in an environment that did not allow for a gradual transition process, so it had to transform rapidly (**III**, **IV**). Latvia focused on adjusting to the Washington Consensus policies and implemented a standard set of reforms, but the rapid transformation set Latvia on a path that restricted policy choices in the future (**IV**).

Latvia has had to reshape its economy multiple times. During the interwar period, Latvia was a predominantly agricultural economy, and textiles and food processing, timber, and mechanical and electrical engineering, metallurgy, and chemicals were areas in which Latvia specialised (**III**, **IV**). After annexation by the Soviet Union, Latvia went through a gradual integration into the Soviet economy and was transformed into a predominantly industrial economy (while retaining some of the developed manufacturing capabilities). After the dissolution of the Soviet Union, Latvia had to transform its economy again; with the previous suppliers and consumers gone, Latvia opened up its markets almost instantly, which did not allow for a gradual transformation and sustainability of the manufacturing capabilities it had developed, causing the proportion of GDP constituted by manufacturing to drop significantly (**IV**). Active privatisation took place, and many capable industries diminished due to brain drain and further fragmentation.

Just like the rest of the economy, the research and innovation system had to go through transformations – the same as other CEE countries, not only in terms of funding, but regarding the instruments and actors as well (Radosevic & Lepori, 2009). Although Latvia was a part of the massive and overall inefficient Soviet research system, it had strong industrial research capacities (European Commission, 1999). However, after the dissolution of the Soviet Union, there was excess R&D capacity in Latvia that exceeded the needs of the small country and its local industry. It was necessary to adjust and develop the innovation system, which was done by involving foreign experts (e.g., the Danish Research Council in 1992, regarding research) to analyse and evaluate the existing infrastructure and provide recommendations on how to proceed. The main concerns at the time were providing at least the bare minimum amount of funding horizontally across fields (priority areas were therefore broad and inclusive, and no decisions towards specialisation were made), as well as integrating research and higher education, which were operating separately within the Soviet system (**III**). However, these concerns drew focus away from other issues that small and catching-up countries should face – dealing with the need to prioritise and specialise to gain critical mass and developing policy and administrative capacity to develop appropriate innovation policy.

The de-industrialisation that took place impacted the realm of knowledge governance significantly – manufacturing is essential for the development of high-quality knowledge-intensive services (Reinert & Kattel, 2007), and industries with high added value (which declined during the transition period) is the natural partner for R&D and technology transfer (**III, IV**). Investments in R&D (see Table 2 for some economic indicators) and the pattern of collaboration between companies and the research sector in Latvia suggest that the dominant type of innovation among companies is process

innovation – innovation based on learning by doing, using, and interacting (DUI). The DUI mode is an experience-based mode of learning opposed to the science, technology, and innovation (STI) mode based on production and use of codified scientific and technical knowledge (Jensen et al., 2007), making formal technology transfer (often targeted through research funding) irrelevant to the majority of companies in Latvia (**I**, **III**). Despite understanding and acceptance of the two different types, policy makers remain biased towards considering innovation processes to be connected mainly to formal R&D processes, resulting in, for example, emphasis on strengthening university–industry linkages and training researchers in bio- and nano-technology, benchmarking variables related to STI, and so on (Jensen et al., 2007). Similar bias and a mismatch caused by that can be seen in Latvia, despite the fact that the country's competitiveness has been based on low costs, which has impacted attraction of FDI. Attraction of FDI was one of the priorities after regaining independence; however, in manufacturing, it went into relatively resource-intensive low-tech industries (**IV**).

Therefore, the main priorities during the last decade have been to increase the overall innovation capacity, increase the competitiveness of Latvian science, increase R&D expenditure, develop human capital, increase the proportion of medium and high technologies, and optimise science management. Additionally, there is an emphasis on returning investment in university research projects through technology transfer, as well as increasing the absorption capacity of the private sector and creating demand for science and innovation (Ministry of Education and Science of the Republic of Latvia, 2013).

Table 3. Latvia: some economic indicators (source: Central Statistical Bureau of Latvia)

Parameter	**Value**
Population (2020)	1 907 675
Area	64 589 km^2
GDP (2019)	€30.5 billion
GDP per capita (2019)	€15 928
Expenditure on R&D (all sectors), % of the GDP (2019)	0.64
Business sector expenditure on R&D % of total expenditure on R&D (2019)	24%
"Basic" funding for research (2019)	23.4 mil. EUR
Number of research organisations (2019)	69
Number of research organisations eligible for "basic" funding (2019)	22
Patent filings (resident filings, filings abroad, including regional; 2018)	175

4.2 The landscape and governance of R&D and innovation

For Latvia as well as other EU member states, policymaking has transformed through emerging supra-national policies and national adaption of these (Trondal, 2002). As Adamsone-Fiskovica et al. (2011, p. 134) pointed out, establishing and developing university–industry linkages is a "relatively new phenomenon in Latvia with far less experience accumulated compared to many developed countries". Therefore, innovation policy documents and policy mix in Latvia, just as in other CEE countries, were formulated rather recently, largely because of the pressure from the EU. Therefore, they reflected EU priorities in R&D and innovation through implemented activities and targets set for funding programmes (Borras & Radaelli, 2011; Suurna & Kattel, 2010). Both voluntary

and coercive policy transfer could be seen during the early transition years, as well as later, when Latvia was on the path of joining the EU, and even after that. A variety of incentives similar to what other EU member states were implementing were launched, with significant focus being also on improving university–industry linkages (Veugelers, 2016; **II**; **III**). Figure 3 shows some of the main events, with a more detailed review below.

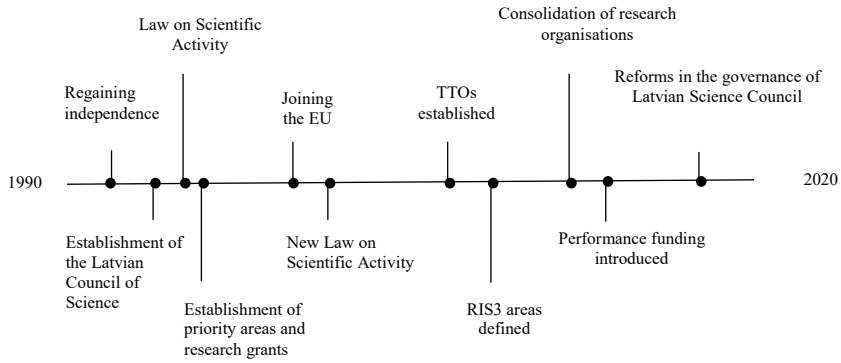

Figure 3. Critical events concerning research commercialisation activities in Latvia (source: author's construction)

The first major challenges Latvian policy makers faced in the early 1990s were integrating research with teaching and adjusting the research system to a market economy and competition-based funding (**III**). A Law on Scientific Activity was enacted in 1992, and it formulated the main organisations involved in developing and coordinating processes in the research system. Over time, the landscape and the roles of these organisations have changed significantly (**II**, **III**), with, for example, the Latvian Council of Science and Academy of Sciences not acting as significant government advisers anymore but rather, respectively, fulfilling the roles of a funding agency and a promoter of research, technology, and innovation. The fragmented landscape has also changed due to the influx of EU funding and its heavy use in research and innovation policy (Directorate-General for Research and Innovation, 2018).

As Latvia joined the EU, the process of integration imposed on national policy makers a range of issues, along with the general commitment to the goals of the EU, and required active coordination and support measures. A new Law on Scientific Activity was adopted in 2005, and a number of other changes took place:

- A register of research organisations was established for both private and public research organisations – organisations that met the criteria to register were eligible for receiving competition-based government funding.
- Competition-based government funding was available for basic and applied research, and a separate programme was envisioned for market-oriented research to promote university–industry linkages.
- Public research organisations, including universities, became eligible for the aforementioned annual "basic" funding to ensure research activities.[1]

[1] Although these changes were very important for the integration process, they caused several issues with coordination and fragmentation. As it was relatively easy to establish a public

- Research activities were now an obligation for higher education institutions.
- To ensure continuity of research activities, a substantial part of EU funding was directed towards both generating knowledge (R&D activities and infrastructure) and strengthening knowledge governance at the university level (**I**, **II**, **III**).
- Although the Law on Scientific Activity foresaw that research institutions did not own the intellectual property they developed with state funding up until 2013, EU regulations set different rules within EU-funded programmes; therefore, it was possible to exploit the economic benefits of outputs generated with their support (with some challenges; **I**).

Although priority research areas were established in the early 1990s, the task to specialise was also necessary because of Latvia's accession to the EU. The EU and its funding incentives supported introduction of various innovation policy instruments – that, as well as expert advice and benchmarking, facilitated both voluntary (e.g., lesson drawing or imitation) and coercive policy transfer. To facilitate a more focused approach to research and innovation policy, the EU introduced an overall framework – RIS3 – that had to be implemented in the member states as a precondition for research and innovation funding in the latest planning perspective (2014–2020). The previous laissez-faire approach to research and innovation policy (which was disadvantageous to Latvia at the time because strong coordination and dialogue between organisations was needed to develop targeted incentives, develop capabilities, reduce fragmentation, and gain critical mass), and use of horizontal policy instruments could have also been addressed by this approach. However, this approach that calls for a bottom-up identification of priorities involving both entrepreneurs and the public sector with the aim of using the existing regional advantages and diversifying the local economy into industries with higher value added (Coffano & Foray, 2014; Landabaso, 2014; **II**) had to be implemented in a short period. Additionally, the concept of entrepreneurial discovery that is the basis of setting the priorities requires strong coordination skills and dialogue between the public and private sectors. The insufficient timing and lack of existing coordination mechanisms resulted in a formal dialogue between the sectors and dominance of academic interests (e.g., focus on high technology; (Karo et al., 2017; **III**). As Karo et al. (2017) further argued, in all Baltic states, including Latvia, the process of entrepreneurial discovery has not focused on the need to support experimentation, search, and discovery but rather been understood as a process of public–private coordination. The formal dialogue and insufficient policy capacity in Latvia resulted in a broad selection of specialisation areas that included almost all industrial and research areas. Latvia is a small country; therefore, a concept for regional specialisation was created on a national level, showing how the smallness of a country again impacts knowledge governance – determining the "right" priorities is challenging; therefore, policy makers fear pointing out specific sectors or industries, as there is a possibility of choosing the wrong ones (**II**, **IV**). Broadly defined priority areas with limited funding available prevent gaining the critical mass necessary for producing high-level research outputs and developing the required industrial R&D capabilities at universities. By losing their local

research institute (only five PhDs needed) and guaranteed annual "basic" funding that allowed a certain level of autonomy was available, there was an increase in research organisations. For a small country with already scarce funding, that was a negative effect and exacerbated issues with coordination and fragmentation. Only in 2015 did eligibility for "basic" funding become more demanding, and the EU-funded consolidation of research institutions took place.

relevance for the private sector, universities became dependent on the state budget and mainly funding from the EU (**III**).

R&D expenditure has been fluctuating (see Figure 4 on data since 2000). Although at the beginning, the main elements of research funding system were various national grants, "basic" funding (impact visible since 2004) was later introduced, and EU financial instruments for candidate countries or potential candidate countries became available. European funding in the form of Structural and Investment funds and the Framework Programme eventually become the main sources of R&D funding (**I**, **II**, **III**).

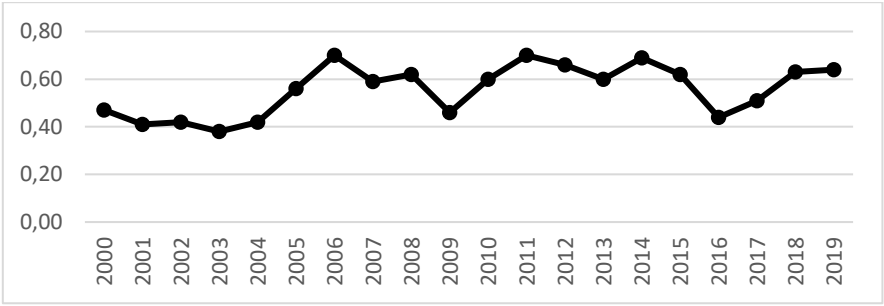

Figure 4. R&D expenditure, % of GDP (source: author's construction based on the data from the Central Statistical Bureau of Latvia (2020)

Overall, R&D funding was increasing a few years before the recession, but then it dropped and again recovered mostly due to the influx of EU funding (Figure 5).

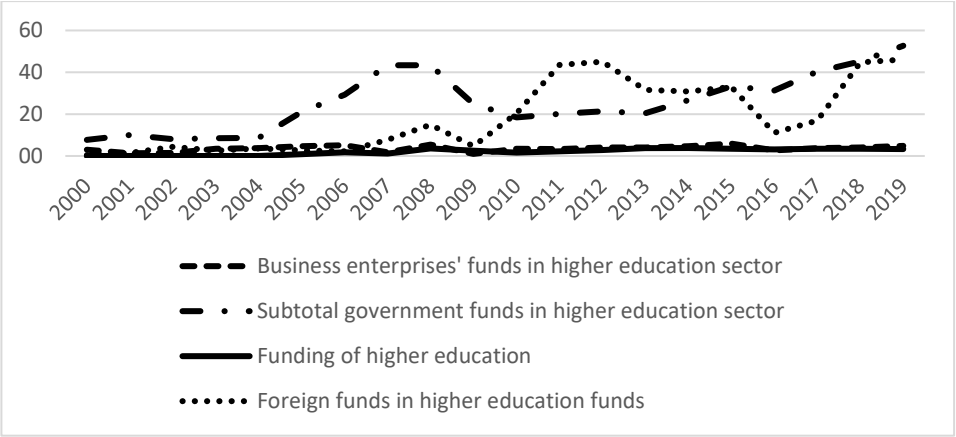

Figure 5. Expenditure on R&D in the higher education sector (mln euro; source: author's construction based on the data from the Central Statistical Bureau of Latvia (2020)

Over time, it became apparent that the fragmented knowledge production system with many research organisations was preventing effective use of the already scarce funding, and consolidation of research organisations was suggested through external evaluation (Arnold et al., 2014). Consolidation was later carried out by reducing the amount by roughly half. Additionally, a new, three-pillar model for financing higher education and research was introduced and replaced the previous input-based one with

one including performance-oriented components (Directorate-General for Research and Innovation, 2018).

To sum up, the main knowledge governance mechanisms implemented in Latvia on the system level include establishment of a regulatory framework and governing bodies for research and innovation, establishment of priority/specialisation areas, developing monitoring mechanisms (specifically for RIS3 and research performance-based funding), launching incentives for R&D and technology transfer, and facilitating establishment of structures within universities to improve university–industry linkages.

Besides system-level changes, universities had to transform as well to be able to use the support given to them. The transformation of universities took place with a set of activities (**I**, **II**, **III**):

- To ensure that the outputs could be exploited economically, TTOs were developed at public universities. However, TTO activities are largely tied to EU funding and targets set for this funding. The targets and uniform approach in support measures do not reflect the domestic situation.
- TTOs were given a task to initiate changes in procedures and routines related to intellectual property management at research organisations.
- A number of universities established business incubators or other measures involving students in entrepreneurial activities.
- Procedures for facilitation of contract research were established.
- Production of economically relevant knowledge and development of linkages with the private sector were established as priorities in their development strategies.

To sum up, the main knowledge governance mechanisms implemented in Latvia on the university level include prioritisation of technology transfer activities, internal procedures for technology transfer processes, developing capacity-building initiatives, and developing structures to facilitate and manage university–industry linkages, such as TTOs and business incubators. These mechanisms were largely designed and implemented in a "top-down" manner, with varying impact and success (for more details and examples, see **I**, **II**, **III**). As discussed previously, there are multiple contextual factors arising from a country's size and level of development that affect the implementation, and this impact, drawing from the case of Latvia, is discussed in more detail in the next section.

4.3 Impact of contextual factors on governance mechanisms for facilitating university–industry linkages

With the EU emphasising the significance of strong university–industry linkages in fostering innovation and economic growth, a significant amount of funding has been available to intensify commercialisation activities at universities in Latvia. As the previous section shows, universities were given means through funding (via specific incentives) and a legal framework allowing them to not only engage in research activities and generate knowledge but also to diversify the diffusion processes and seek economic benefits.

Some of the mechanisms have had a positive impact, such as consolidation of research organisations to enable building critical mass and research excellence in prioritised areas and reducing fragmentation of the research system (**I**, **II**), as well as the introduction of performance-based funding as an addition to the annual "basic" research funding that

enabled the development of smaller-scale, experimental funding programmes arising bottom up from universities (**I**). Still, some other mechanisms fell short – funding for R&D technology transfer activities has not generated an influx of funds from the private sector, and envisioned changes in R&D expenditure and overall innovation performance also have not come to fruition.

There are multiple reasons for that – the governance mechanisms have not always been implemented with sufficient coordination, monitoring, and evaluation, and in some cases not at the right time (**I**, **II**, **III, IV**). Additionally, path dependency and local context have been insufficiently addressed[1], and certain size-specific issues and the catching-up context have shaped the implementation (**I**, **II**). A summary of how the existing knowledge governance structures and mechanisms in Latvia and the small state and catching-up context affect one another is provided in Figure 6.

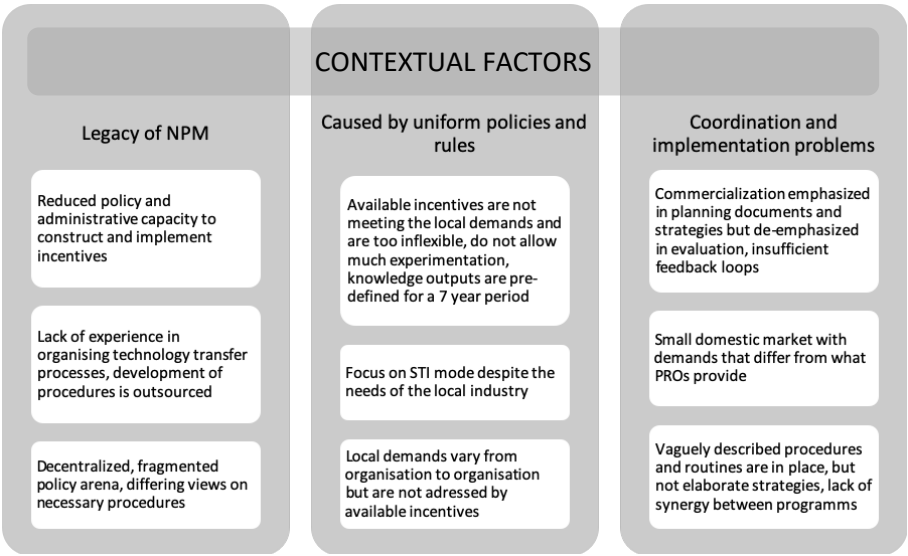

Figure 6. Problems with existing knowledge governance structures and mechanisms (source: author's construction)

A significant constraint has been the insufficient policy and administrative capacity to construct and implement incentives (**I**, **II**), affected negatively by the high fragmentation and large pool of involved organisations with limited cooperation, a general lack of commitment among policy makers, and differing views on necessary procedures (Directorate-General for Research and Innovation, 2018; Ministry of Education and Science of the Republic of Latvia, 2013; Smidova, 2015). The policy and administrative capacity is also important for policy learning and transfer to be effective, as emulated or transferred policies call for evaluation and appropriation so that they fit in the local context. It has also affected the delivery of guidance for universities and development of procedures, routines to ensure seamless university–industry interaction on the university level (**I**). Institutionalised cooperation in developing new supply-side resources and typical patterns of cooperation present in corporatist countries (such as engaging

[1] Path dependency is not necessarily negative; however, this thesis focuses particularly on the negative aspects.

the industry in venture capital and pension funds, placing less emphasis on employment protection in favour of collaboration in skill formation, and placing less emphasis on state aid and state-owned enterprises but increased private–public and interfirm cooperation in research) can help countries respond better to disruptive economic shocks (Ornston, 2012a). However, it is also important to note that the fragmentation and insufficient capacity of the public sector have affected the ability to establish mechanisms that would allow a dynamic and inclusive dialogue between various sectors. This was seen during the development of RIS3 in Latvia. Establishment of smart specialisation areas through the process of entrepreneurial discovery prompted improvements in the weak coordination of domestic policy; however, coordination mechanisms ensuring dynamic feedback loops and evaluation of various incentives are still mostly absent in Latvia.

The commercialisation system within universities in Latvia is fragmented, with individual mechanisms funded by different sources, thus causing insufficient flexibility and ability to experiment and coordinate – they often lay out very specific requirements for results and rules for what activities are funded; however, that does not always match the needs of research organisations whose capacity in commercialising research is sometimes very different. Complicated implementation rules also shift the concern of following the procedures rather than contributing to the economic development (**I**). EU funding has in many ways facilitated commercialisation of research and improving the commercialisation system by requiring the development of internal structures and procedures in universities. However, the differences between incentives and their requirements make the procedures different, thus making internal rules fragmented and processes difficult to coordinate. Lack of experience and capacity in both the public sector and universities made these processes even more difficult as, for example, university TTOs were not equipped with sufficient knowledge for constructing the procedures, and no guidelines were available from those who designed the incentives (**I**).

Fragmentation, while reduced because of consolidation efforts, can be seen among research organisations as well, further exacerbating issues caused by limited funding and increasing the need for prioritisation and specialisation. Not only is there still a high number of regionally dispersed research organisations, but there is also a high number of funding programmes from different sources (the majority still from the European funds) managed by different organisations, and there is a mismatch in research topics pursued by the public and private sectors (Directorate-General for Research and Innovation, 2018; Kuļikovskis et al., 2018; Ministry of Education and Science, 2020).

In small states, local universities need to build capacity to be able to integrate into international networks and supply knowledge to international partners. On the other hand, they also need to think about maintaining local relevance. Although research capacity has been addressed in Latvia through various uniform EU funding mechanisms and smart specialisation, the funding mechanisms implemented are targeted at a linear model of innovation by supporting research and expecting commercialisation activities afterwards rather than collaboration and joint innovation activities. Funding sources facilitate development of areas such as nanotechnology, biomedicine, and photonics, which do not meet the existing need of traditional sectors dominant in Latvia. Domestic industry in Latvia is dominated by low-tech sectors and micro and small-sized enterprises that do not have a sufficient R&D funding capacity. This has limited the domestic relevance and opportunities for local university–industry linkages, as the innovation patterns in local industry show that companies do not necessarily require knowledge and technology transfer from universities, especially in a formal way, for example, through

acquisition of IP rights. Development of university–industry linkages has been a rather recent focus for Latvia, and the private sector development has not been that long, so both universities and companies are still developing skills in managing their collaborations (Adamsone-Fiskovica et al., 2009). Additionally, significant focus has been put on developing procedures related to management of codified knowledge and a technology-push approach, but not to ones that regulate means of commercialisation of tacit knowledge available for universities (with the exception of contract research), such as academic spin-offs, collaborative research, ad-hoc consultations, or participation in networks with practitioners (Dahlborg et al., 2017). Considering that the majority of companies in Latvia engage in the DUI mode of innovation, this also impacts establishment of frequent university–industry linkages.

The contextual factors discussed above need to be considered when designing some other knowledge governance mechanisms that have mostly not been addressed but are crucial for the current transformation to emerging mission-oriented and market-shaping policies and enabling universities to contribute to solving societal challenges. Such policies require coordination, alignment of cross-cutting policies (e.g., R&D, FDI, trade) on different levels, and capabilities within the government to coordinate, as well as development of governance structures responsible for that. That also includes coordination of other realms, such as research and production of knowledge and development (and facilitation) of standards within the prioritised areas to facilitate their growth. It is also necessary to define performance indicators of these areas and respective missions/challenges that should be addressed. To do so, establishing mechanisms to involve various actors and facilitate the emergence of new ones is crucial, as that would allow for more efficient feedback loops, monitoring, and analysis.

5 Knowledge governance structures and mechanisms and their impact on university–industry linkages

As seen from the information discussed in the previous sections, the case of Latvia can give insights into how the contextual factors arising from the size of the state and those of the catching-up context, as well as the use of knowledge governance mechanisms and path dependency, can impact each other and eventually shape university–industry linkages and the particular role of universities – a topic this thesis aims to explore deeper.

Table 4. Impact of contextual factors, path dependency, and university-industry linkages on implementation of knowledge governance regimes (source: author's construction)

	Size- and catching-up-related contextual factors	Path dependency	University–industry linkages
The common knowledge governance regime	• Impacts the ability to establish linkages because of the mismatch between the supply and demand sides • Insufficient policy and administrative capacity impact the abilities for long-term policymaking and designing effective support mechanisms for demand and supply sides to meet	• Path dependency can exacerbate the constraints to establish linkages • Impacts the ability to successfully implement the mechanisms and prevents flexibility	• Specialisation of universities influences the domestic collaborations and development of a shared knowledge pool • Focus on formal university-technology transfer impacts the ability to generate interest from the domestic industry • Skills of staff at universities need to be developed to address insufficiencies on the university level
The dynamic knowledge governance regime	• Causes a need to balance between domestic needs and international value chains • Insufficient policy and administrative capacity impact the ability to implement cross-cutting policy instruments and coordination to establish standards, develop regulations, address intellectual property rights, manage FDI flows, facilitate new actors	• The choice of past governance mechanisms and support instruments such as funding programmes or specialisation areas impacts the ability to capitalise on the knowledge if mismatch has not been addressed	• Existing university-industry linkages impact the ability to capitalise on the knowledge generated, if there is a mismatch, poor coordination, different maturity levels • The abilities of universities' staff to manage the intellectual property and develop seamless procedures for technology transfer can impact the frequency of university-industry linkages
The social knowledge governance regime	• Insufficient policy and administrative capacity impact the ability to coordinate maturing industries' activities and upgrading, and identify the knowledge pools that should be developed • Also impacts the ability to identify priority areas that match the industries' interests and capabilities	• Insufficient knowledge-based activities impact the industries' ability for exports and participation in international alliances, consortia	• Existing linkages impact the universities' ability to identify the directions for development of skills • Existing linkages also impact the ability to understand and match the development interests with the industry

Section 3 discussed three knowledge governance regimes based on historically successful development experiences – the common knowledge governance regime, the dynamic knowledge governance regime, and the social knowledge governance regime (Kattel, 2012). Table 4 summarises the findings from the case of Latvia by looking at the impact of contextual factors and path dependency on the implementation of these regimes, and their interplay with university–industry linkages and the role of universities.

One of the main aspects of the common knowledge governance regime is the establishment of linkages, development of common knowledge pools, and development of domestic trade. As creators and diffusers of knowledge, universities play an important role – providing knowledge that would be beneficial for the local industry so that cooperation is possible. However, size- and catching-up-related contextual factors, path dependency, and the existing set of knowledge governance mechanisms impact the ability of universities to play that role.

The mismatch between the supply and demand sides results in limited interest by domestic companies to tap into the knowledge available at universities. Additionally, micro, small, and medium-sized companies that dominate the economy often cannot afford services offered by universities or do not have the necessary absorption capacity (**IV**). This situation calls for mechanisms that facilitate the creation of linkages. However, the small size and insufficiencies in the administrative and policy capacity affect the ability to design and coordinate these mechanisms (**I**, **II**, **III**). Inappropriate choice of instruments can exacerbate the impact of contextual factors; for example, focus on the STI mode, supply-side instruments, and formal technology transfer can prevent sufficient diffusion of knowledge and improvements in university–industry linkages. Demand-side instruments have so far been insufficiently explored (**II**, **III**). The choice of knowledge governance mechanisms can also set a specific course for development that impacts the current possibilities and the possibilities for path creation in the future. For example, the priority areas were defined when implementing smart specialisation not to exclude any of the important industries (**I**, **II**). FDI policy impacted skill development on the company level, leading to diminished absorption capacity (focus on low-wage, low-skill, and low added value industries) (**IV**), which affects the possibilities to implement certain support measures. The establishment of fragmented governance structures with reliance on EU funds limits flexibility and the possibilities for effective coordination (**I**, **II**, **III**, **IV**).

Linkages and knowledge pools are essential for implementing the dynamic knowledge governance regime aimed at using the established linkages and capitalising on the knowledge generated. Therefore, it is important to address the causes of insufficient cooperation. As the case of Latvia shows, the incentives aimed at facilitating the entrepreneurial role of universities have had lacklustre results due to a linear view on innovation, focus on formal technology transfer, unclear procedures on both government and university level (**I**). These issues can also prevent effective management of intellectual property and export of knowledge.

Meanwhile, the social knowledge governance regime is focused on maturing industries' activities and upgrading and focuses on promoting exports, skill development, tax incentives for R&D, and liberal trade and antitrust policies. Implementation of activities to promote these areas calls for cross-cutting coordination, effective feedback loops, and analysis of potential areas of collaboration.

Countries may need to combine elements from all of the regimes at the same time (however, challenging because of limited administrative and policy capacity), but it is important that linkages are established as a basis for implementing either and universities

have a significant role in that by a) addressing the local needs for collaboration; b) creating demand by facilitating university incubators and spin-off companies; c) exploring the existing linkages for collaboration opportunities; and d) providing seamless transactions and procedures for collaboration ensuring effective management of their intellectual property.

These findings emphasise the struggle of small and catching-up countries to facilitate approaches such as NIS and triple helix and direct universities to become entrepreneurial. Although there are solutions that can be implemented to improve that, the design and implementation are still impacted by many factors and path dependency, thus raising the debate on whether the types of university–industry linkages and the role of universities should be re-evaluated.

The emerging knowledge governance approach and the market features approach, with the emphasis on wide knowledge dissemination and the ability of universities to contribute to addressing grand societal challenges, as well as governance mechanisms for local knowledge dissemination, need to be implemented. In the case of Latvia and small, catching-up countries, that means implementation of mechanisms that consider the needs of the domestic industry and establishing linkages as well as mechanisms that facilitate the ability of universities to be able to disseminate knowledge relevant to international value chains, such as boosting organisation-level intellectual property management skills and participation in international networks.

6 Conclusions and directions for further research

The case of Latvia highlights the impact that contextual factors arising from the size of the state and the catching-up context can have on knowledge governance. It also highlights the interrelated dynamics between knowledge governance, the size of a country, the catching-up context, and path dependency. The impact of the contextual factors and knowledge governance mechanisms on university–industry linkages and the role of universities brings forth a number of challenges but also gives insights into what kind of solutions might be needed to overcome these challenges.

The case of Latvia emphasises several shortcomings of small states and how they have impacted the process of designing and implementing various initiatives to facilitate the emergence of the "entrepreneurial university". The case shows that an increase in funding and inspiration from foreign success stories is not enough to navigate and develop the complex research and innovation policy arena.

To answer the first question posed – "What knowledge governance mechanisms have been used to facilitate effective government–university–industry interactions and more specifically the emergence of entrepreneurial universities?" – the thesis shows that a wide array of knowledge governance mechanisms typically used elsewhere have also been implemented in Latvia since the country regained its independence. The choice of mechanisms has been heavily affected by external factors and supra-national policies, largely due to Latvia joining the EU. The mechanisms included establishment of new governance structures, changes in legislation, establishment of support structures and procedures within universities, as well as incentives to motivate researchers to participate in technology transfer activities. However, despite the prioritisation of university–industry linkages and the funding allocated to this area, universities in Latvia have failed to significantly increase collaboration with and revenue from the private sector. This leads to the second question posed in the thesis: "What contextual factors have affected knowledge governance, university–industry linkages, and universities in Latvia?" The thesis shows that knowledge governance, university–industry linkages, and universities in Latvia have been affected by contextual factors arising from the size of the country, catching-up context, and path dependency, such as the following:

- Limited policy and administrative capacity (also due to the legacy of NPM) – this impacts the ability to design, implement, and evaluate mechanisms. There is insufficient administrative capacity on the level of both policy makers and implementers as well as universities.
- The limited capacity leads to limited capability to design flexible governance mechanisms and experiment with incentives, facilitating uniform policy approaches and governance mechanisms that do not sufficiently address the domestic needs and context.
- Uniform policy approaches originating from advanced economies complicate introduction of appropriate knowledge governance mechanisms in catching-up economies. In the case of university–industry linkages, introduction is caused by a mismatch between what is supplied by the local universities (following research directions enforced by supra-national funding schemes) and what is demanded by the domestic industry.
- Difficulty developing excellency in multiple technological fields and types of research (fundamental and applied) and the need to specialise impact the frequency and types of university–industry linkages and the relevance of

universities to local companies, as well as international value chains and research communities.

- Path dependency and vulnerability to it affect the choice of knowledge governance mechanisms used and the possibility to later modify the mix, reducing the flexibility in developing strategies.

The interrelated dynamics between these factors make it very difficult for a country such as Latvia to implement the same range of instruments that advanced economies frequently use to facilitate university–industry linkages. Although not all the factors arise from Latvia being a small state (as the small size can also be an advantage in some cases), there are factors arising from the catching-up context as well. Eventually, as the case shows, these contextual factors in many cases exacerbate the negative effects from each other, making it crucial to understand and consider these dynamics if viable incentives were to be provided and at the right time.

To answer the third question posed – "How have universities in Latvia responded to the knowledge governance mechanisms implemented in Latvia?" – the thesis shows that universities have responded to various knowledge governance mechanisms by establishing corresponding procedures and support structures and have formally prioritised facilitation of technology transfer; however, they have failed to significantly increase revenue from the private sector. Universities have also been cautious in seeking economic benefits from their research outputs due to the lack of a unified framework for the procedures and unclear requirements of intellectual property management, highlighting the significance of institutional coordination. As the case of Latvia shows, many issues are exacerbated by a high fragmentation among governance structures and diverging agendas among policy makers. As a result, this complicates the possibility to carry out activities such as monitoring and ensuring dynamic and frequent feedback loops critical for designing knowledge governance mechanisms. Both are important for evaluating the approaches used and understanding their shortcomings. This is also important for experimentation with incentives and ensuring flexibility of the support programmes.

To sum up, the case of Latvia emphasises the need for elaborate coordination, as well as improved capacity addressed on multiple levels – on both the policy makers' and implementers' level, as well as among and within universities. This could be addressed by cross-cutting governance structures involving various actors of the innovation system, implementing feedback loops and monitoring mechanisms to better capture context-related issues, and designing the appropriate governance mechanisms to overcome such issues.

Additionally, the case of Latvia highlights the need to evaluate and perhaps reconsider the role that universities can play in the economy of a small and catching-up country. Universities in Latvia have failed to significantly increase revenue from the private sector despite numerous support incentives aimed exactly at that. The focus on formal technology transfer and supply-side instruments largely copied from advanced economies and less attention to development of skills, tacit knowledge, and implementation of demand-side instruments has impacted universities' ability to sufficiently diffuse knowledge. Eventually, the incentives aimed at facilitating technology transfer have actually limited it. This indicates that a more nuanced and context-sensitive conceptual understanding of the possibility of entrepreneurial universities needs to be developed, especially because wide dissemination of knowledge is crucial for the recent shift towards solving grand challenges and implementing mission-oriented policies.

Therefore, through the lens of university–industry linkages and the role of universities, this thesis addresses a gap in the literature by highlighting the shortcomings of the NIS and triple-helix approaches when applied to small and catching-up countries. The thesis explores aspects that NIS and triple-helix, as well as knowledge governance literature, have so far not focused on – the role of size in implementing knowledge governance mechanisms to facilitate university–industry linkages and the emergence of the "entrepreneurial university".

However, as the research focuses on one country, it would benefit from a cross-case analysis to develop a more nuanced understanding of the dynamics between the size of a country and knowledge governance mechanisms. A cross-case analysis would give insights into what other relationships between the factors can be observed and show how and why they differ between countries. This research would also benefit from investigating these issues from the lens of policy makers and the industry, as it now focuses particularly on universities – that would provide a more encompassing view of the different roles of each of these elements and how they fit with the changing approach to science and innovation policy. As the case of Latvia shows, these roles are impacted by various interrelated contextual factors that must be considered in developing mission-oriented and market-shaping policies.

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Abstract

Small States and Knowledge Governance: The Case of Latvia

Movement towards an increasingly knowledge-intensive economy and society has put the governance of knowledge at the centre of policy debate for at least the last three decades. Facilitating the production, diffusion, and appropriation of knowledge is a key priority in policymaking, and universities have played increasingly important roles in these processes. They have become more and more relevant to the debate through institutional changes made when research was integrated with teaching and through a shift from research universities to an entrepreneurial universities that translate the knowledge created into economic benefits.

Many catching-up countries have gone through this transformation during the last decades. Latvia, a small post-Soviet country, went through this process very rapidly after regaining its independence in 1991. EU funding became a major source of funding for research and innovation policies, including for the institutional transformation of universities. However, statistics and research show that Latvia and other Central and Easter European (CEE) countries have had limited success in capitalizing on their science base since regaining independence.

To investigate the causes of this and propose policy recommendations, this thesis uses a "knowledge governance" approach as a framework. Because of significant attention from policy makers on directing funds to research and development and the commercialisation of research, this thesis combines a knowledge governance approach with research on "triple-helix" relations and the "entrepreneurial university" to address the transformations taking place at universities – to what degree universities have transformed since Latvia regained its independence, what governance mechanisms have been used to facilitate universities becoming "entrepreneurial," and how the country's size-related constraints and other contextual factors have affected the implementation of policy instruments aimed at facilitating this transformation. It also aims to investigate if and how the chosen policy measures have addressed local needs and capabilities and if the chosen policy mix is justified and addresses the emerging science and innovation policy trends.

Latvia provides an interesting case, as it is a country where path-dependency and need for rapid changes have caused significant challenges in the realm of knowledge governance but where capabilities are significantly limited due to it being both a small and a catching-up country. This thesis aims to contribute to a wider understanding of knowledge governance by addressing a gap in the literature on knowledge governance related challenges in a small state context. The challenges described above are echoed in most other CEE countries. The findings of this thesis could be useful for other catching-up economies, especially the small states among them.

To allow an in-depth exploration of organisations and processes, seek causal relationships among them, and provide an explanation of occurring issues, the single case-study method was chosen. Latvia is a typical case in different contexts. First, it is a typical case among CEE countries that are EU member states–despite favourable conditions for improving innovation performance (influx of EU funding, focus on this policy area), with a few exceptions, most of them have struggled to improve their innovation performance.

The thesis shows that a wide array of knowledge governance mechanisms typically used elsewhere have also been implemented in Latvia since the country regained its

independence. The choice of mechanisms has been heavily affected by external factors and supra-national policies, largely due to Latvia joining the EU. However, despite the prioritisation of university–industry linkages and the funding allocated to this area, universities in Latvia have failed to significantly increase collaboration with and revenue from the private sector. The thesis shows that universities and university–industry linkages in Latvia have been affected by path-dependency and such contextual factors arising from size of the country and its catching-up context like limited policy and administrative capacity, a small domestic market, and a mismatch between supply and demand, among others. The inter-related dynamics between these factors make it very difficult to implement the same range of instruments that advanced economies frequently use to facilitate university–industry linkages. The case of Latvia highlights the need to evaluate and perhaps reconsider the role that universities can play in the economy of a small and catching-up country. This indicates that a more nuanced and context-sensitive conceptual understanding of the possibility of entrepreneurial universities needs to be developed, especially because wide dissemination of knowledge is crucial for the strategies needed for the recent shift towards solving grand challenges and implementing mission-oriented policies.

Lühikokkuvõte

Väikeriigid ja teadmiste juhtimine: Läti juhtum

Liikumine üha teadmistemahukama majanduse ja ühiskonna poole on seadnud teadmiste juhtimise vähemalt viimase kolme aastakümne jooksul poliitilise arutelu keskmesse. Teadmiste loomise, levitamise ja omandamise hõlbustamine on poliitikakujundamise peamine prioriteet ja ülikoolid on neis protsessides etendanud üha olulisemat osa. Need on muutunud arutelu jaoks üha olulisemaks institutsionaalsete muudatuste tõttu, mis tehti teadusuuringute integreerimisel õppetööga, ning teadusülikoolidelt ettevõtlusülikoolidele ülemineku tõttu, mis muudavad loodud teadmised majanduslikuks kasuks.

Paljud järelejõudvad riigid on viimaste aastakümnete jooksul selle muutuse läbi teinud. Läti, väike Nõukogude Liidust vabanenud riik, tegi pärast taasiseseisvumist 1991. aastal selle protsessi väga kiiresti läbi. EL-i rahastamisest sai teadus- ja innovatsioonipoliitika, sealhulgas ülikoolide institutsionaalse ümberkujundamise peamine rahastamisallikas. Statistika ja uuringud aga näitavad, et Läti ning teised Kesk- ja Ida-Euroopa (KIE) riigid on pärast taasiseseisvumist saavutanud oma teadusbaasi ärakasutamises piiratud edu.

Selle põhjuste uurimiseks ja poliitiliste soovituste andmiseks kasutatakse selles väitekirjas raamistikuna “teadmiste juhtimise” lähenemist. Kuna poliitikakujundajad pööravad märkimisväärset tähelepanu rahaliste vahendite suunamisele teadus- ja arendustegevusse ning teaduse kommertsialiseerimisse, ühendab see väitekiri teadmiste juhtimise lähenemisviisi uurimustega kolmikheeliksi suhete ja ettevõtlusülikooli teemal, et käsitleda ülikoolides toimuvaid muutusi: millisel määral on ülikoolid pärast Läti taasiseseisvumist muutunud, milliseid juhtimismehhanisme on kasutatud ülikoolide ettevõtlusülikoolideks muutumise hõlbustamiseks ning kuidas on riigi suurusega seotud piirangud ja muud tausttegurid mõjutanud selle muutumise hõlbustamiseks mõeldud poliitiliste vahendite rakendamist. Samuti on selle eesmärk uurida, kas ja kuidas on valitud poliitikameetmed vastanud kohalikele vajadustele ja võimalustele ning kas valitud poliitikakombinatsioon on õigustatud ning käsitleb tekkivaid teadus- ja innovatsioonipoliitika suundumusi.

Läti kujutab endast huvitavat näidet, sest see on riik, kus raja sõltuvus ja vajadus kiirete muutuste järele on püstitanud teadmiste juhtimise valdkonnas märkimisväärseid väljakutseid, kuid kus võimalused on oluliselt piiratud, sest tegu on nii väikese kui ka järelejõudva riigiga. käsitledes teadusjuhtimise väljakutseid kajastavas kirjanduses esinevat lünka väikeriikide konteksti kohta, on selle väitekirja eesmärk on kaasa aidata teadmiste juhtimise laiemale mõistmisele. Ülalpool kirjeldatud probleemid kajastuvad enamikus teistes KIE riikides. Selle väitekirja järeldused võivad olla kasulikud ka teistele järelejõudvatele majandustele, eriti väikeriikidele.

Organisatsioonide ja protsesside põhjalikuks uurimiseks, nende vaheliste põhjuslike seoste otsimiseks ja olemasolevate probleemide selgitamiseks valiti üksikjuhtumi analüüsi meetod. Läti on tüüpiline näide erinevates kontekstides. On tegu tüüpiline näitega KIE riikidest mis on EL-i liikmesriigid: hoolimata soodsatest innovatsiooni tulemuslikkuse parandamise tingimustest (EL-i rahaliste vahendite sissevool, keskendumine sellele poliitikavaldkonnale), välja arvatud mõned erandid, on enamik neist oma jõudluse suurendamise nimel pingutanud.

Väitekiri näitab, et alates riigi taasiseseisvumisest on Lätis rakendatud mitmeid selliseid teadmiste juhtimise mehhanisme, mida tavaliselt kasutatakse ka mujal.

Mehhanismide valikut on tugevalt mõjutanud välistegurid ja riigiülene poliitika, peamiselt tingituna Läti ühinemisest EL-iga. Kuid hoolimata ülikoolide ja tööstuse vaheliste seoste prioriseerimisest ning sellesse valdkonda eraldatud rahalistest vahenditest ei ole Läti ülikoolid suutnud koostööd erasektoriga ja sealt saadavaid tulusid märkimisväärselt suurendada. Väitekiri näitab, et Lätis on ülikoole ning ülikoolide ja tööstuse vahelisi seoseid mõjutanud rajasõltuvus ning sellised riigi suurusest ja järelejõudmise kontekstist tulenevad tausttegurid nagu näiteks piiratud poliitika ja haldussuutlikkus, väike siseturg ning pakkumise ja nõudluse vaheline mittevastavus. Nende tegurite omavahelise dünaamika tõttu on väga keeruline rakendada sama instrumendivalikut, mida arenenud majandused kasutavad sageli ülikoolide ja tööstuse vaheliste sidemete tekkimise hõlbustamiseks. Läti näide toob esile vajaduse hinnata ja võib-olla uuesti läbi mõelda ülikoolide roll väikese ja järelejõudva riigi majanduses. Ettevõtlike ülikoolide võimaluste kohta tuleb luua nüansirikkam ja kontekstitundlikum kontseptuaalne arusaam, eriti seetõttu, et teadmiste laialdane levitamine on üliloluline käimasolevate suurte probleemide lahendamise ja missioonile orienteeritud poliitikate elluviimise jaoks.

Appendix

Publication I

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University Autonomy and Commercialization of Publicly Funded Research: the Case of Latvia

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Abstract

Commercialization of publicly funded research has been widely discussed in academic literature since the introduction of the Bayh-Dole Act in the 1980s in the USA. Existing literature primarily focused on the role of universities, models of technology transfer, and incentives that facilitate it. By focusing on university autonomy as one of the key variables, this article shows that incentives for research commercialization can be affected by a top-down implementation that disregards the needs and capabilities of universities to exploit them. By examining research commercialization in Latvia using secondary data and interviews, this exploratory case study shows that external funding sources set the overall direction of policy instruments, focus on quantifiable outputs to increase accountability, and are excessively restrictive while at the same time not addressing the path dependency. The results of this study suggest that by allowing greater flexibility and experimentation with funding, universities could develop entrepreneurial culture and address other deficiencies and commercialize their research more successfully.

Keywords Innovation policy · Commercialization of publicly funded research · Technology transfer · University autonomy

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Introduction

For Latvia, just as for the other EU member states, improving innovation performance has been on the agenda for some time. The current long-term development strategy Europe 2020 and the next Horizon Europe focuses heavily on reducing the innovation

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gap among EU member states. A significant emphasis has been put particularly on increasing R&D expenditure to do that, and it has been a concern already since the early 1990s (Sachwald 2015).

Despite a substantial effort to stimulate innovation, the EU has, for a long time, suffered from the so-called "European Paradox"—the inability to transform the results of technological research and skills into innovations and competitive advantages (European Commission 1995). It was failing to transition into "a knowledge economy" as successfully as the USA seemed to have (Soete 2002). The enactment of the Bayh-Dole Act in the USA in 1980 significantly changed the way how publicly funded research is commercialized (Grimaldi et al. 2011) and has contributed to the success. It has, therefore, inspired other countries to view commercialization of publicly funded research as a remedy for insufficient innovation performance.

EU has provided significant means of funding for these efforts and facilitated the emergence of the "entrepreneurial university" in a top-down manner as a response (Etzkowitz 2003b). The main interest (particularly among transitioning countries) is to pursue instruments like competitive funding for R&D, grants for collaborative R&D, and support programs for technology transfer (e.g., the establishment of technology transfer offices (TTOs), etc.) (Veugelers and Schweiger 2015).

Commercialization of university research has also gained traction among scholars. Etzkowitz and Leydesdorff (2000) proposed a more enhanced role for universities in knowledge-based societies and a model that analytically differs from the national systems of innovation (NIS) (see, e.g., Lundvall 1992; Nelson 1993) where companies are playing the leading role in innovation.

Another literature strand focuses on the dynamics within universities—characteristics and requisites of an entrepreneurial university (Etzkowitz 2013; Etzkowitz et al. 2000; Clark 1998; Etzkowitz 2003b), channels for commercializing university technology (Lockett et al. 2005; Phan and Siegel 2006; Siegel et al. 2007), the role of university TTOs (Geoghegan et al. 2015; Osenga 2007; Siegel et al. 2007; Siegel et al. 2003), and the role and motivation of individual researchers (Jensen and Thursby 2001; Thursby and Thursby 2007).

There is also a vast amount of literature on policy implications and support incentives—the implications of a "one-size-fits-all" approach in innovation policy (Karo and Kattel 2010; Tödtling and Trippl 2004; Veugelers and Schweiger 2015; Izsak et al. 2015; Karo 2010) and incentives that could be used to facilitate commercialization of university research (Goldfarb and Henrekson 2003; McCutcheon 2019; Rasmussen 2008; Rasmussen et al. 2006).

The article aims to bring these research strands together and explore:

1) How has the "one-size-fits-all" approach has influenced commercialization of research in a catching-up country?
2) Are the incentives that are provided for universities to commercialize research relevant and address their needs? If not, what should be changed?
3) What preconditions have to be in place for universities to be able to transform into an entrepreneurial university?

A particular focus in this article is on the aspect of autonomy. Increasing university autonomy through reforms—aimed at transforming universities to act more like private

sector organizations—has been on the European agenda due to the belief that universities must play a more significant socioeconomic role (Maassen et al. 2017). However, implementation of Bayh-Dole like laws and top-down provision of homogenous incentives that do not match the capabilities and needs of universities strengthens formal and not actual autonomy (Christensen 2011). This paper aims to explore if this can be a cause for incentives for commercialization of public research to fail.

This exploratory case study focuses on the Republic of Latvia—a country that regained its independence from the Soviet Union in 1991. It became a part of the European Union (EU) in 2004 and has received funding to improve its national innovation system (particularly its major weakness—insufficient science-industry collaboration) and contribute in closing the innovation performance gap in the EU. However, this particular area, despite a number of support incentives, has been improving at a slower pace than desired. The article aims to explore how commercialization of publicly funded research is complicated by limited autonomy of universities, characteristics of the country's economy, and state of development. It also provides recommendations on what elements should be added to the policy mix to tackle the issues.

A case study approach was chosen to provide an in-depth exploration and also explanation of a contemporary phenomenon in a real-life context (Yin 2003). The article mainly relies on secondary data, such as publicly available documents, studies, reports, and statistical data. Semi-structured elite interviews with researchers and other university staff involved in commercialization of research, as well as selected experts, were used as additional data sources to gain a more in-depth understanding of the processes.

The rest of the paper is organized in the following way: "Literature Review" discusses existing literature; "Methodology" describes the method used in the study. "Development of an Innovation System in Latvia: a Brief Overview" describes the development of Latvia's national innovation system since regaining independence. "Facilitating Commercialization" introduces a particular program for commercialization, and "Discussion: Commercialization of Research in Latvia: Why Lacklustre Results and What Can Be Done to Improve Those" discusses the main issues with the approach and potential solutions; "Conclusions" concludes the study.

Literature Review

Universities have not always had a central role in innovation—they have instead been seen as a support structure. Earlier literature focusing on innovation emphasized the role of the entrepreneur and their ability to innovate (Schumpeter 1939). Research on innovation that emerged in the late 1970s–1980s introduced a more systemic perspective, addressing the impact of the surrounding infrastructure, human resources, and institutional structures on a national (Freeman 1987; Lundvall 1992), regional, and sectoral levels (Nelson 1993) or on specific technology fields (Carlsson and Stankiewicz 1991). The "systems of innovation" approaches aim to encompass a wide array of determinants of innovation (Edquist and Johnson 1997) but still considers companies as having the leading role in innovation (Etzkowitz and Leydesdorff 2000).

However, with more attention to the concepts of the knowledge society and knowledge-based economy, the role of universities in innovation has become much

greater. An analytically different model from NIS—the triple helix model—that proposes a more enhanced role for universities was proposed by Etzkowitz and Leydesdorff (1995). The triple helix model proposes that institutional actors should be viewed on an equal level in the network (see, e.g., Etzkowitz and Leydesdorff 1995, 1997, 2000; Leydesdorff 2000; Leydesdorff and Etzkowitz 1996). Within the triple helix relations, universities and industry become partners with the government in policy formulation.

Entrepreneurial University

An integral part of the triple helix model is the "entrepreneurial university"—a university that not only produces and disseminates knowledge but also puts it to use and does not operate according to a linear model of innovation. Academic literature discusses the evolvement, characteristics, and requisites of an entrepreneurial university. The role of universities has changed over time because of both internal and external developments. First, research became a part of the "teaching university" (Storr 1953; Metzger 1955; Veysey 1965; Jencks and Reisman 1968). Then, starting bottom-up from the USA, the "research university" transitioned into an entrepreneurial university that not only encompasses the research university but also extends it and has the necessary infrastructure to capitalize on the knowledge it produces (Etzkowitz Etzkowitz 2003a, b). However, to evolve into an entrepreneurial university, two conditions have to be met—the university has to have some control over its strategic directions and relationships (Clark 1998), and it has to closely interact with both the industry and the government (Etzkowitz 2003a).

Rasmussen et al. (2006) point out that the main challenges for universities when evolving beyond the traditional missions of teaching and research are to increase commercialization activities, think of how they can contribute the economic development, and coordinate commercialization with other core activities. Formal and informal mechanisms are implemented both in a "top-down" manner coming from the public sector or emerging "bottom-up" from universities and individuals within them to overcome these challenges (Goldfarb and Henrekson 2003).

Meanwhile Grimaldi et al. (2011), p 1048) discuss the development of technology transfer capabilities/competencies and point out that they can be considered at three levels: "(a) system-level specificities (governmental actions, institutional configurations, local-context characteristics, etc.); (b) university-level internal support mechanisms; and (c) individual scientist level factors". Depending on how far a university has transitioned, different sub-dynamics are taking place within it, and different instruments are needed (Etzkowitz 2003a).

A first step would be to establish infrastructures like liaison offices or TTOs and incubator facilities to operate an assisted linear model of innovation and add technology transfer element to the academic outputs. Second would be an introduction of mechanisms like joint projects with the industry to ensure that sources within and outside the university define research problems and finally evolving to a structure where knowledge-based economic activity precedes academic work (ibid.). However, the steps should be tailored to correspond with the university's level of competence in technology transfer and entrepreneurial activity (Grimaldi et al. 2011).

Vast amount of literature is dedicated to the analysis of TTOs as they are central in increasing university-industry-government relations (Geoghegan et al. 2015), acting as hubs in the regional innovation ecosystem (Maicher et al. 2019). Technology transfer should be established as a priority area for TTOs to be able to perform their role, and it should be accompanied by strong institutional support (Maicher et al. 2019; McCutcheon 2019; O'Shea et al. 2005) that includes the development of procedures and performance assessment mechanisms, designing flexible university policies and developing a rewarding system among other measures (Siegel et al. 2003; Zhao 2004). Strategies and respective structures and procedures should be aligned with the organization's general activity to be successful (Clark 1998; Zhao 2004).

Literature also discusses the impact of entrepreneurial culture and involvement of researchers on the success of science-industry technology transfer. It is affected by path dependency; therefore, entrepreneurial culture (which universities in Europe lack as opposed to those in the USA) needs to be facilitated and sustained (O'Shea et al. 2005, 2007).

Informational and cultural barriers between universities and the industry, as well as an insufficient reward system for researchers, are the main obstacles for successful technology transfer (Siegel et al. 2007). As many new technologies require further input from researchers, their motivation for entrepreneurial activities, e.g., through salary, royalties, and equity, should be a priority (Goldfarb and Henrekson 2003; Jensen and Thursby 2001; Thursby and Thursby 2007; Chrisman et al. 1995).

Policy Measures and Their Implications

Various incentives on different levels can be used to facilitate commercialization of research and universities taking a more entrepreneurial approach. However, as Rasmussen (2008) points out, many studies have focused on the incentives within universities (such as establishment of TTOs or internal procedures), and fewer studies focus on the increasing number of incentives coming from the government side. Additionally, few studies have looked at how universities have adjusted to this more entrepreneurial role (Rasmussen et al. 2006).

Reforms in how universities are governed, organized, and funded have been implemented to push universities in operating more like businesses (Maassen et al. 2017) and increase commercialization of the results of publicly funded research (Lehrer and Asakawa 2004; Zhao 2004). Reforms can be introduced not only through establishing internal support structures such as TTOs but also through instruments for research funding (Benner and Sandström 2000; Slaughter and Leslie 1997). Benner and Sandström (2000) discuss that funding agencies play an important role in changing the institutional order—they can both foster the transformation of universities as well as hinder it, for example, through influencing the criteria for performing research and choosing the way how they are formulated—in isolation or cooperation with research organizations and other stakeholders. This influence, however, means that for universities to transition, research sponsors need to be reformed as well.

Meanwhile, universities have become more dependent on sources other than basic public funding, which has been the main funding source for public universities and that has usually allowed them a considerable operating autonomy (Slaughter and Leslie 1997). Not only because of the university reforms taking place (Christensen 2011) but also due to recurrent financial crises and cutbacks in public funding that directed them

to seek private funding (Etzkowitz et al. 2000). At the same time, funding authorities and other stakeholders demanded greater accountability and exercised more control, resulting in decreased actual autonomy. Etzkowitz further argues that "public sector has left universities with a new autonomy without providing the managerial knowledge necessary to organize a for-profit range of activities" (ibid. p 322), as legislation in many countries today allows universities to benefit economically from their research outputs. However, the often top-down reform processes strengthen formal autonomy instead of actual autonomy (Christensen 2011).

There has been increasing attention to incentives focused on stimulating commercialization of university research since the 1970s, emerging from the USA. The focus was a result of fears of the USA potentially losing its competitive advantage and seeing the exploitation of state-of-the-art technology as a remedy. The Bayh-Dole Act was both an outcome and a response to this change (Grimaldi et al. 2011). It encouraged universities to integrate entrepreneurial activities and gain maximum benefits. The legislation allowed universities to own the patents they generate from using federal funds, required researchers to disclose their inventions, and requested that the inventor shares the revenue (Cahoy et al. 2016; Grimaldi et al. 2011). Bayh-Dole Act also included several requirements to ensure that universities identify the best licensee. A license is the default mechanism (sale is not allowed without permission), preference of licensing to small- and medium-sized companies, and final product embodying the intellectual property (hereinafter IP) needs to be manufactured in the USA. Universities were also required to establish intermediary offices for managing the IP—TTOs. This legislation provided clarity and encouragement, which are essential incentives for universities to manage their IP (Baldini et al. 2006). Besides the Bayh-Dole Act, several other major initiatives regarding technology policy were launched in the USA, for example, Stevenson-Wydler Technology Innovation Act (requiring federal laboratories to establish TTOs), Small Business Innovation Development Act of 1982 (requires federal incentives for R&D in small businesses), and Federal Technology Transfer Act (authorizes cooperative R&D agreements and license negotiations for national laboratories) (Bozeman 2000).

Since then, other countries have tried to close the innovation gap between the USA and have implemented various incentives top-down to do that (Lehrer and Asakawa 2004). However, in the case of EU, because of the very different characteristics of EU member states influenced by path dependency, a diversified approach to improving the overall innovation performance is needed.

Etzkowitz and Leydesdorff (2000) differentiate between 3 different triple helix configurations/policy models. First, a specific historical situation where "the nation state encompasses academia and industry and directs the relations between them" (ibid. p 111). The second model (which can be used as a remedy to the first one) consists of strongly separate institutional spheres with highly limited relations and entails a "laissez-faire" policy. Meanwhile, the most desirable is the third configuration—overlapping institutional spheres that each takes the role of the other. A common target in this model is the establishment of a network consisting of university spin-offs, joint initiatives for knowledge-based economic development, strategic alliances among companies, public research organizations, and academic research groups. For example, in the case of Central and Eastern European (CEE) countries, it means moving away from the statist model that was present in the Soviet Union, where the government had

control and a dominant position driving science and industry (Etzkowitz 2003a). Due to several structural characteristics, the triple helix model has been less visible in shaping the research and innovation systems in these countries, such as insufficient integration of research and education, the insufficient entrepreneurial capacity to commercialize research outputs at research organizations, weak demand for technology transfer in the industry, and low R&D expenditure—both private and public (Ranga 2014). To make the transition to a triple helix relationship of equal and overlapping roles, a number of initiatives and actions would be beneficial. These include strategic investments in emerging research areas supported by government policy, incentivization of internal and external IP exchange through joint university-industry research funds, the establishment of hybrid organizations (e.g., cooperative research centers, strategic alliances, and incubator facilities) and reinforcing bottom-up initiatives by top-down policies and programs (Etzkowitz 2003a).

Significant means of funding in the form of European Structural and Investment funds (hereinafter ESIFs) (part of the transition funding for newest EU member states) have been directed towards the performance improvement in CEE countries, affecting both the policy content and the implementation (Suurna and Kattel 2010). However, despite the very different needs, studies show that EU member states have developed very similar policy mixes for reaching the targets, featuring a standard set of instruments (cf. Veugelers and Schweiger 2015; Veugelers 2016). The majority of relevant incentives are still implemented with the linear model of innovation and a uniform approach in mind, despite numerous studies pointing towards the need for different policy mixes due to regional differences in terms of R&D capabilities and science-industry linkages (Sterlacchini 2008; Tödtling and Trippl 2004; Izsak et al. 2015; Karo 2010; Varblane et al. 2007).

Studies (Veugelers and Schweiger 2015) show that the main interest (particularly among transitioning countries) is in linking science and industry through an increased contribution of universities and improving the commercialization of public research. That is pursued by using instruments like competitive funding for R&D, grants for collaborative R&D, and support programs for technology transfer (e.g., the establishment of technology transfer offices (TTOs), etc.). While competitive funding is important, incentives for universities that allow them to experiment with how they commercialize their research outputs are necessary, as investing in R&D does facilitate not necessarily stimulate academics to commercialize their ideas (Goldfarb and Henrekson 2003). Additionally, incentives should be designed as a part of a dynamic set (Rasmussen 2008) that develops and changes together with the setting and includes both formal and informal transfer channels to achieve local economic impact (Azagra-Caro et al. 2017).

This article aims to explore how the incentives for facilitating technology transfer impact university autonomy if applied in a top-down manner and how it in turns impacts the success of research commercialization.

Methodology

As the main goal was to provide an in-depth exploration and explanation of one single case and multiple processes and issues occurring in it, as well as to seek causal

relationships among them, a single-case case study approach was chosen. Although generalization from a single case should be done with caution, inferences from single cases to other cases can be made using theoretical/analytical generalization (Flyvbjerg 2006; Ruddin 2006). The case study method is the preferred one when "'how' or 'why' questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within a real-life context" (Yin 2003, p 1). This case study is based on secondary data (e.g., studies, reports, public documents, and statistics) as well as interviews as primary data sources. Data triangulation was applied to broaden the scope and ensure higher validity of the data (sources—research organizations, including universities, government organizations, statistics).

To explore the case in more depth, the main focus of this study was a set of policy instruments (co-funded by ESIFs) that were implemented in Latvia from 2010 to 2015, to increase the development of new products and technologies and improve science-industry linkages. This set was chosen due to the high number of organizations involved, the broad spectrum of the competences of the involved individuals, the amount of funding directed to it, and its interesting development, e.g., changes in the implementation rules.

The research process was started by collecting and reviewing existing data (statistics, reports, policy documents). Interviews were used as additional data to get a better in-depth understanding of underlying issues and identify themes. Thematic analysis was then done for identifying and analyzing patterns in qualitative data (Clarke and Braun 2013). Answers to the questions were coded, and themes and sub-themes were identified (see Fig. 2). Thematic analysis was chosen as it can be used for interviews and works with a wide range of questions and it can be used for both large and small data-sets and applied to produce data-driven or theory-driven analyses (ibid.).

Between 2017 and 2019, ten interviews were conducted (list of interviews in Table 2 Annex I). A homogeneous purposeful sampling method was chosen to gather specific examples of how policy planning has impacted university autonomy and commercialization of research. The interviewees were either from university administration (one general administration and four technology transfer staff) or researchers (four) that are involved in technology transfer activities. Interviews were conducted with staff from six research organizations, including universities and research institutes. Staff from the three largest universities (by a full-time equivalent of researchers) in Latvia was included. An interview with an external expert who has experience in working with government organizations of all three Baltic countries—Latvia, Lithuania, and Estonia—as well as several Eastern European countries was done as well. The data was collected by personal face-to-face or telephone interviews and lasted 50 min on average. The interviews were transcribed and analyzed.

The semi-constructed interviews focused on the funding sources for R&D at the respective research organizations and the interviewee's experience with available funding instruments. Five interviewees had extensive experience in projects implemented throughout the aforementioned funding incentive, while others had experience in technology transfer processes at research organizations.

Two more interviews with administrative staff at a university were conducted during a research visit to the University of Southern Denmark in 2015, where information on how a university is collaborating with the industry was collected. Insights from these interviews were also used in this study.

The homogeneous purposeful sampling method has several downsides —a high level of bias, no guarantee on the representativeness of the data, and problems with generalization. However, the main goal of this article is to explore, explain, and provide an illustrative case that would serve as a basis for further research and discussion and provide data for cross-case analysis. There are certain limitations of a single-case study approach as well. The majority of influencing factors are restricted to this time, location, and specific history and do not provide a possibility of direct replication (Yin 2003). Still, if it may not provide a basis for formal generalization, Flyvbjerg (2006) argues that a case study is especially well suited to produce context-dependent knowledge and it could be used for generalization and contribute to a broader theory. Therefore, this case study aims to explore how the case adds to the theory and provides the basis for cross-case analysis.

Development of an Innovation System in Latvia: a Brief Overview

After regaining its independence, Latvia had a number of challenges in developing a functioning innovation system. Brain drain due to instability and uncertainty of the labor market, downsizing and fragmentation of the research and industrial sectors, diminishing of sectors where Latvia had previously specialized in, a pressing need to adjust to a free market economy, and weak science-industry linkages were among the main challenges for the innovation policy at the time (Danish Research Councils 1992). Since then, despite various reforms and changes, the main challenges of Latvia's innovation system have been very similar—insufficient supply of human capital, fragmented public research and education system, lack of demand-side policy measures, and limited effectiveness and efficiency of the funding system (Kuļikovskis et al. 2018).

Lack of human capital in terms of both numbers and skill sets is one of the key issues for public and private sector organizations, including research institutions (Griniece and Nausedaite 2017; Kuļikovskis et al. 2018). According to Eurostat, total R&D personnel and researchers (full-time equivalents) were 0.6% of the total labor force in Latvia in 2018, while in EU28, it was, on average, 1.4%. This affects the capabilities of the private sector to use research outputs coming from universities and complicates the use of formal ways of technology transfer, such as licensing.

Issues with human capital are further exacerbated by the high level of fragmentation within the innovation system; despite the wide variety of support incentives that were available, it has been difficult for research organizations to gain the critical mass that would allow them to produce high-level research outputs (Kristapsons et al. 2003; Griniece and Nausedaite 2017). Additionally, high fragmentation on the government side, limited cooperation among the involved organizations, and a general lack of commitment among policymakers have impacted the capabilities of policymaking and implementation in Latvia negatively (Arnold et al. 2014; Ministry of Education and Research of the Republic of Latvia 2013; Smidova 2015). Suurna and Kattel (2010) emphasize that the government agencies established after accession to the EU have largely played the role of external funding managers in CEE countries without engaging in capacity-building or policymaking activities, further fragmenting the innovation system. It has been an issue in Latvia that has been largely left unaddressed until now, despite this being one of the known reasons for innovation policy failure (OECD and

The World Bank 2014). With no single agency focusing on support for innovation and divided policy-making functions, there have frequently been competing interests among organizations managing funding for research and innovation and difficulties to implement research and innovation policy effectively (Griniece and Nausedaite 2017; Ministry of Education and Research of the Republic of Latvia 2013).

This fragmentation has negatively impacted R&D funding—universities and research institutes faced insufficient R&D funding from the industrial sector and gradually became heavily dependent on the fragmented and scarce central government funding. As Latvia joined the EU in 2004, new funding sources became available; however, funding from the EU in the form of research grants had become a complementary source of income already during the pre-accession phase (European Commission 1999). An annual government "basic" funding (allocated to research organizations based on their research in the previous reporting period) was also introduced. That caused a period of growth; however, given the political insignificance of this domain, public R&D funding was among the very first positions to suffer cuts during the recent economic recession that began in 2008, which is unique among EU member states (Arnold et al. 2014) and is in contrast of what a catching-up country should be doing (Veugelers 2016). After the recession, implementation of projects funded by the ESIFs intensified, substantially increasing the amount of available funding for research and innovation and eventually replacing other sources of funding to a significant extent.

Figure 1 shows the changes in R&D expenditure by sector since 2000. The impact of the annual basic funding and ESIFs (indicated as foreign countries) is visible from 2004. That of the latter, even more so after the economic recession, R&D expenditure gradually increased as Latvia was experiencing a period of rapid development. However, it stopped during the recession, causing the state funding to plummet and being primarily replaced by the ESIFs. Meanwhile, the higher education sector's funding for R&D has been very limited due to very little financial support from the government and lack of other income sources.

For a time, ESIFs became the main source of funding for R&D in public universities. Table 1 shows the amount of total R&D funding and its sources in 3 universities in 2014.

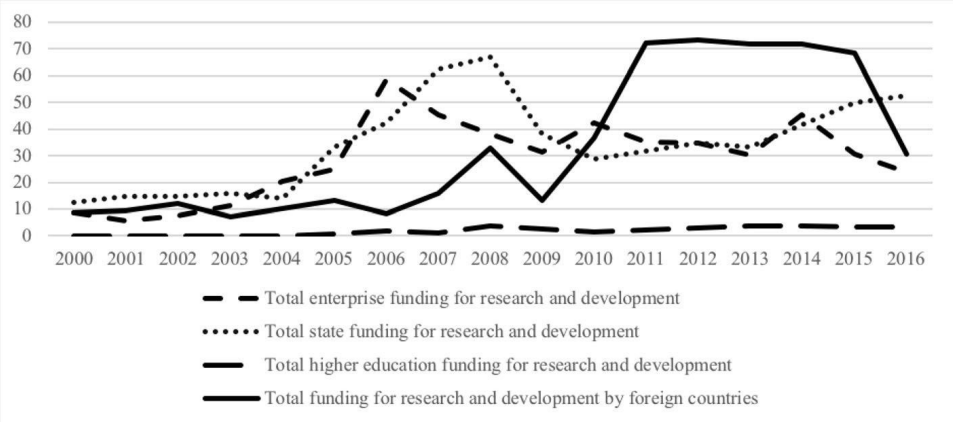

Fig. 1 Expenditure on R&D by sector, 2000–2016, millions euro. Source: author's construction based on the data from the Central Statistical Bureau of Latvia (2018)

Table 1 Scientific personnel and R&D funding sources at UL, RTU, and RSU in 2014

University	Scientific personnel[a], full-time equivalent	Funding for R&D					
		Total	State budget funding	Funding from foreign sources	Contract research	Own funding	Other sources
UL	674	14,658,000	4,805,000 (33%)	8,981,000 (61%)	97,000 (0.66%)	681,000	94,000
RTU	948	10,955,000	5,583,000 (51%)	3,633,000 (33%)	1,569,000 (2%)	147,000	23,000
RSU	176	7,393,000	2,250,000 (30%)	3,670,000 (50%	76,000 (1.03%)	1,397,000	0

Source: author's construction based on a report by MoES (Ministry of Education and Science 2015)

[a] Scientists and professionals with an academic degree or a higher education diploma, who are conducting research as well as project managers who are involved in planning and managing scientific and technical aspects of research work.

Contract research makes up a very small part of the funding, indicating low collaboration rates and very limited interest from the industry. Data from the Central Statistical Bureau of Latvia (2016) show that that the share of innovative companies is growing (30% of the total number of companies) as well as the percentage of companies implementing technological (product and process) innovations (70% of total and a 17% increase since 2012–2014). However, only a third of those companies were engaged in innovative activities in cooperation with other companies or organizations (ibid.). Additionally, for the acquisition of technology, companies in Latvia mainly targeted foreign investors and companies (Griniece and Nausedaite 2017), indicating issues in domestic technology transfer.

As the importance of supporting technology transfer became more and more acknowledged, several incentives were developed to support science-industry cooperation. Policy mix mainly focused on increasing R&D expenditure and allocating it through top-down-based incentives that mainly targeted research activities and infrastructure. Additionally, as many European countries followed a similar path to that of the USA, where TTOs were established at research universities during the last decades (Siegel et al. 2007), universities in Latvia did so as well with the aid of ESIFs. While the support was needed, the use of ESIFs has contributed to the application of a top-down approach in implementing support incentives due to the need to set specific, measurable goals and closely monitor the progress limiting the autonomy of universities. The majority of incentives for various types of research were focused on formal results and national-level implementation.

Universities have been producing research outputs. However, low internationalization and problems in gaining critical mass, as well as limited local relevance, complicate commercializing them. Local companies either lack the necessary absorption capacity or are not interested in the supply, among other reasons, and have been seeking collaboration partners elsewhere. Dependence on national and EU level funding has reduced university autonomy and increased their accountability towards numerous stakeholders. These and later developments of the innovation system significantly impacted the integration of entrepreneurial activities at universities and research commercialization.

Facilitating Commercialization

In 2010 an incentive for applied research and experimental development activities was launched to facilitate research outputs that could be of value to the industry, and its developments are discussed in this section. The incentive was a program to support applied research and experimental development and stimulate knowledge and technology transfer[1] (Phase I of the program). The main target group was research organizations that could individually or in collaboration with other research organizations or companies implement a project aimed at (1) commercial activities implementing the results and expecting revenue or (2) non-commercial activities. The majority of projects were "non-commercial"—the scarce resources could be the reason for beneficiaries to choose the option with the highest EU co-funding rate.

While the regulations allowed this kind of project to create a revenue through technology transfer activities, there were no guidelines and experience (in both government and research organizations) to facilitate that. Additionally, due to the number of institutions that were involved in the implementation of this program, there were misinterpretations of the rules, and it was not clear for the beneficiaries whether commercialization should be done and how the process should be managed. While the number of patents was listed as one of the main goals of the program (also giving a project a stronger possibility to be approved if it was targeted), technology transfer eventually took place mainly in the form of publications and presentations at events, and no licensing agreements were delivered. As the involved organizations realized the issues with the program, it was reshaped.

Phase II of the program was meant specifically for commercial projects in cooperation with companies and much lower co-funding rates. However, the interest seemed lower most likely due to beneficiaries' lack of funding—while 177 projects were submitted (122 approved) in Phase I, only 35 were submitted and 27 approved in Phase II (State Education Development Agency 2016). Some funds were left over, so Phase III was launched in 2013. While rules did not change for commercial projects, requirements for technology transfer were now entirely different for non-commercial projects implemented by research organizations.

Phase III was explicitly aimed at intensifying technology transfer activities, and a signed licensing agreement was now a mandatory output. However, the differences in the interpretation, fragmented innovation system, and issues that public funding brings turned the licensing process into a complicated affair. Overall the changes in the way how the program was implemented could be viewed as positive because now the program specifically expected the research outputs to be exploited. However, as interviews conducted for this paper show, multiple interconnected issues surfaced and complicated the implementation.

As a result of the thematic analysis of interviews conducted for this study, nine recurring themes were identified. These can be further clustered into three groups around key requirements of the policy instruments:

[1] Within the scope of the incentive, "Knowledge and technology transfer" was defined as the transfer of specific knowledge, production skills and technologies from the developer to the user for production or application necessities.

1) Predefined results—the outputs of the projects (such as patent applications and publications) had to be determined upon application as the awarded points depended on that.
2) Licensing—licensing was the mandatory way of commercializing the research outputs and was required for all "non-commercial" projects.
3) Open selection procedure—research organizations had to license the research outputs for a market price, or, if it could not be determined, it had to be set in an auction or by using protocolled negotiations also by ensuring an open selection procedure, i.e., giving the possibility for all potentially interested in acquiring a license to submit their proposals.

The underlying issues related to these requirements are shown in Fig. 2.

Predefined Results

While many interviewees acknowledged that the provided funding was necessary, various project implementation requirements and focused on "administrative quality" made the process difficult; some of the requirements include the necessity to formulate quantitative project results in advance, a very limited possibility for amendments, and strict control of formal implementation. As noted by one of the interviewees:

> Significant focus was on process control, only the process itself instead of the result (…) Writing the projects happened "administratively" not "scientifically", (…) the maximum amount of points could be reached through administrative means, (…) the results were absolutely formal. (…) The research part was limited, the projects could have, in fact, been successfully written by the administration. (Interview 6)

ESIFs are a lot less flexible than other instruments, and requirements of local origin hamper the implementation. Research process can be unpredictable, and the project

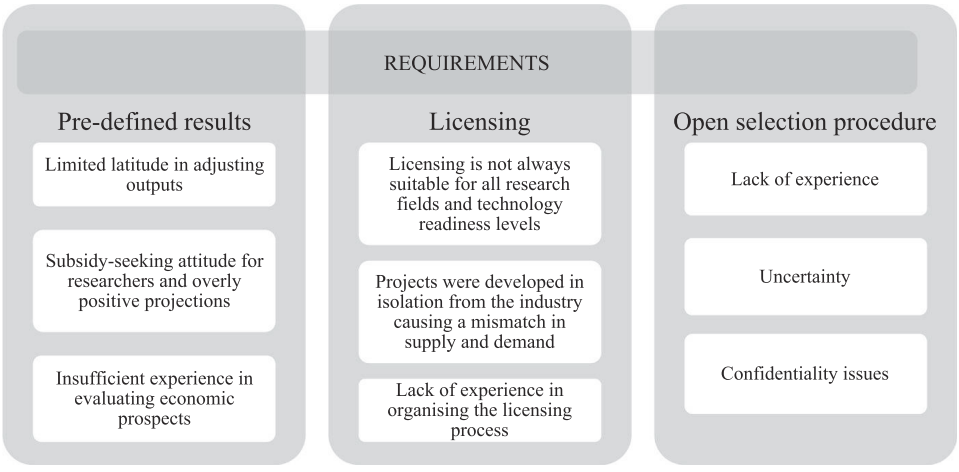

Fig. 2 Implementation issues of the commercialization program. Source: author's construction based on interviews

may need to change course to achieve the maximum benefits; however, it was very difficult to adjust the promised results.

Another aspect was the disinterest of research groups to engage in the commercialization process. Several technology transfer experts and administrative staff noted that funding acquired through the projects was mostly perceived as a way to continue research, and the goal to commercialize was perceived as secondary. A project manager at a university pointed out:

> Researchers are mostly not interested in how their research will be applied or transferred, that falls on the shoulders of the administration. (Interview 5)

Asked if there were questions from researchers regarding the commercialization aspect of the projects, one of the technology transfer specialists mentioned:

> Questions from researchers were very primitive. They ask – "what is better – patent or know-how? If more points are awarded for a patent, then should we plan a patent?" Not to even mention if there was something to patent at all. Rarely were there questions, "what do we do next? How will we be able to commercialize? (Interview 4)

However, because the program provided important means of funding, acquiring the projects was vital for many research groups. Therefore, in some cases, it led to overly positive projections in order to secure the funding. Meanwhile, the insufficient capacity of the TTOs prevented a thorough analysis and cross-checking.

Licensing

Many interviewees pointed out that the requirement of licensing caused a number of difficulties. In the majority of cases, the outputs were still in an early stage of incubation. In those cases, assigning the technology or going through acceleration/incubation processes would be more appropriate. Licensing was difficult also because of the structure of the projects—they were developed in isolation from the industry, complicating meaningful validation and pivoting. A researcher emphasized:

> Frequent relationship with the industry allows researchers to "dig" deeper in their field – if companies are willing to invest, researchers would turn their focus in that direction. Often the needs of the companies and capabilities of researchers don't match. (Interview 8)

It was also a challenge to organize the process and establish contact with companies due to insufficient experience. A technology transfer specialist in a university pointed out:

> In our case, it was completely new; we hadn't organised any auctions or negotiations. I have to admit that we don't have much experience with licensing as such, this was not an organic process. (Interview 3)

Open Selection Procedure

Government organizations designing the support incentives also have little experience with specific technology transfer issues, thus making it difficult to provide elaborate guidelines. A technology transfer expert highlighted:

> The last one[2] was I think the hardest part, where the rules of the game were not clearly defined. It is the most difficult if the ones defining the rules do not have clarity of what is and what is not and what they expect out of it. (…) if you write a program and write the rules, you have to understand what you want to expect as a result clearly. (Interview 7)

Fragmentation due to decentralized management of EU funding at independent agencies further complicated the process. Therefore, different interpretations of the rules and uncertainty stimulated cautiousness and focus on indicators rather than impact. Project implementation rules required the establishment of new internal procedures. However, it was difficult mainly due to uncertainty about how the process should be organized. It was caused by insufficient experience for both public research and government organizations. It shifted the concern on how the commercialization process will be organized, not if commercialization will take place, and how big the impact on the economy will be. Research organizations felt that there would be a bigger chance for commercialization if the requirements were not as strict:

> There is the question of whether it will or will not be a success story. From the project monitoring perspective, it might not be, because the procedures will not be followed strictly. From the university's perspective, it will be a success story. (…) We have to decide whether to follow [the requirements] or not. (Interview 4)

For some fields, confidentiality was also of particular concern—some interviewees pointed out that this hindered their negotiations with companies and made the companies less willing to obtain a license.

To sum up, the program initiated important processes at research organizations as it required establishing procedures for technology transfer and commercialization; however, the uniform approach and insufficient experience in organizing and implementing them generated numerous issues that prevented benefitting from it fully.

Discussion: Commercialization of Research in Latvia: Why Lackluster Results and What Can Be Done to Improve Those

The previous sections discussed the current innovation system in Latvia as well as a specific program for facilitating research commercialization. This section takes a closer look at why the approach did not facilitate the desired results and what could be done to make programs like this more successful in the future.

[2] Phase III – aut

Challenges in the Implementation of Policy Instruments to Support Commercialization of Research

As has been noted before, innovation policy mixes are rather similar among EU member states, despite the very different innovation performances and needs for improving it. While learning from innovation leaders can be beneficial, the instruments that are copied still need to be adjusted to meet domestic needs. Moreover, incentives in the EU have mainly been introduced top-down as a response to the increasing innovation gap. As Etzkowitz (2003a) argues, there are examples of top-down coordination of science-industry linkages where significant results were accomplished, e.g., in emergency conditions; however, a gap typically opens up between R&D providers and users when this kind of coordination is applied to normal conditions.

The program discussed in this article follows the notion of a linear innovation process and technology transfer that is based on the acquisition of IP rights rather than collaboration. However, it is more likely that university-industry technology transfer will take place if diverse, frequent, and recurring partnerships are established and the private sector's funding for public research organizations is higher (Bruneel et al. 2010; O'Shea et al. 2005). Frequent collaboration also gives experience on how the technology transfer process takes place, which is necessary because companies need to develop new operating routines and practices for managing these collaborations (Bruneel et al. 2010). It is especially important because the majority of companies in Latvia have insufficient absorption capacity and interest in university-produced IP. At the same time, internationalization at universities is low, complicating cross-border technology transfer. Another issue with the commercialization program was the very short implementation period that did not allow a lengthy development process. Therefore, the majority of outputs had low technology readiness levels, meaning that project results available for licensing needed significant development further on to become relevant for companies, thus limiting their interest to seek licenses.

Overall, integration and synergy between incentives and facilitation of strong-linkages are necessary at all levels—system-level, organization-level, and the level of an individual. Sterlacchini (2008) emphasizes that support for R&D should fit in a broader and more systematic policy network that is tailored to the needs of the local innovation system and addresses the promotion of linkages among the actors. It is especially critical in Europe as one of the weaknesses of some European regions lies particularly in insufficient interaction between the government, the research sector, and businesses, and it prevents reaping the full benefits of the efforts in these fields.

The goal of the funding incentive was to facilitate commercialization of research outputs at public research organizations. However, while it gave the financial means to develop such research, it was accompanied by greater accountability and thus limited autonomy to organize the process. Universities and other research organizations were not given enough latitude in deciding how to financially benefit from the project results in the most economically benefitting way.

Insufficient clarity was another important aspect—it is an essential incentive for universities to manage their IP (Baldini et al. 2006); however, the rules of this program were not clear to researchers and technology transfer staff. That,

in turn, led to over-cautiousness and concern over the procedure rather than the economic impact of the outputs.

Additionally, while TTOs have been established in several universities in Latvia, there still is insufficient capacity to seamlessly execute the technology transfer process due to the lack of experience and specific requirements that come with the funding. That is common across Europe as the majority of TTOs are established relatively recently and are still building up the number of employees and the necessary capabilities (Directorate-General for Research and Innovation 2013). Therefore, universities in Europe lack the established entrepreneurial culture of those in the USA, and this path dependency influences the success of science-industry technology transfer (O'Shea et al. 2007). Certainly, there are research organizations that have built a rather strong capacity in commercializing their research due to frequent collaboration with the private sector in Latvia and abroad, and these may have inspired the creation of some of the support incentives. However, as addressed in the interviews, not all of the research organizations have the same capabilities.

Last but not least, researchers play an important role in implementing the projects and developing them further, and, ultimately, bringing them to the market. Commercialization boosted only by short-term projects in scarce funding conditions does not encourage the involvement of academia beyond the initial research as researchers move from one project to another to secure funding. That leaves commercialization for the technology transfer staff (even though they are not knowledgeable enough in the specific research areas) or even other units within the administration if a TTO is not established. This leads to a situation where the primary concern for both—researchers and technology transfer staff—is the formal delivery of the output.

Experimentation as a Potential Solution

Literature and information from the interviews indicate that the chosen approach fails mainly because of insufficient experience in collaboration (for both companies and research organizations) and frequentness of collaborations, insufficient capacity to organize and manage this process, and insufficient motivation for involved parties to engage in and carry out the process.

The ability to generate economic benefits from research relies equally on the research base, industrial environment, availability of financial resources, TTOs, and professionals involved (Granieri and Basso 2019):

- Technology transfer should be a priority area in universities—that means not only strengthening the capacity but also providing funding and establishing procedures (Maicher et al. 2019; McCutcheon 2019; O'Shea et al. 2005). It also means establishment of guidelines and performance assessment mechanisms for TTOs (Maicher et al. 2019); however, as shown in interviews, it is difficult due to unclear funding-related requirements and insufficient experience and capabilities in designing the procedures.
- TTOs' capabilities regarding valorization should be developed—capacity and skills in managing intellectual property have been found to be an issue in almost all European countries (Directorate-General for Research and

Innovation 2013) and were also highlighted in the interviews. Development of these capabilities relies on the number of employees at a TTO as well as their activities, i.e., focus on valorization and not just contract research.

- Entrepreneurial culture has to be facilitated as the success of TTOs relies on path dependency and the history of universities (O'Shea et al. 2005, 2007). Developing science-industry linkages "is a relatively new phenomenon in Latvia, with far less experience accumulated compared to many developed countries" (Adamsone-Fiskovica et al. 2009, p 134), and the private sector development has not been that long, so both universities and companies are still developing skills in managing science-industry collaborations.
- Building an entrepreneurial culture includes providing funding and motivating researchers to be involved in the process of working with the industry to mature technologies.

Policymakers should consider targeting these issues with policy instruments. Some changes have already been implemented. The Investment and Development Agency of Latvia (LIAA) began to implement a comprehensive Technology Transfer Support Program that continued such typical schemes as innovation vouchers. Nevertheless, it also included a new set of available tools, such as funding for commercialization projects where the sole aim was to develop a new product or technology with the intent of commercializing it. This incentive provides funding for activities like developing a feasibility study and a commercialization strategy, as well as the implementation of informal activities that are required for commercialization beyond applied research and experimental development—foreign visits to trade fairs, conferences, etc. More importantly, within this incentive, the funds are allocated on a two-phase basis—a smaller amount for the feasibility study and commercialization strategy and then a larger sum to implement the strategy if it showed promising outcomes. That not only gives much more flexibility to the beneficiaries, but evaluation of technical merit and commercial potential that the program also provides, as evidence shows, also may impact the results of patenting and licensing (Directorate-General for Research and Innovation 2013).

Although further improvements are needed, this change in approach has addressed not only the fragmentation and capacity issues but also problems with latitude in policy design and implementation. Reports (OECD and The World Bank 2014) show that successful innovation policies have emerged from more peripheral agencies and other actors as that allow more room for experimentation, close monitoring, and applying more creative techniques during policy design. The same should be considered for support mechanisms as well—funding programs or other incentives can be designed by research organizations, non-governmental organizations, or enterprises that are much closer to technology transfer and research commercialization activities while also potentially reducing execution time, involved actors, and bureaucracy (Rasmussen 2008). Additionally, as Benner and Sandström (2000) argue, new forms of funding are essential for the institutionalization of a triple helix model as existing structures are inclined to slow down the evolution of new organizational forms. Research funding agencies could act as catalysts in this process by directing researchers in addressing needs that fit the industry, however,

through a model that is based on academic autonomy, and the initiative is taken by the researchers (ibid.).

An important change has been introduced in Latvia by the introduction of the performance-based funding that allows universities to create their own internal incentives. This gives universities the autonomy to address the needs in a tailored way according to, for example, the development level or experience in technology transfer. Incentives that target the motivation of researchers to engage in research commercialization and stimulate collaboration with the private sector on the level of individuals have been developed and funded by this funding tailored to the needs and capabilities of the respective university. It has, for example, resulted in programs like "The effective-cooperation program" and "Bonus program" implemented at the University of Latvia. These programs (1) promote joint projects with the industry with 50% funding from the university and (2) reward researchers for contract research and publications. Within the effective cooperation program, the university collaborates with at least one local or foreign company to do a feasibility study, fundamental, applied research, or experimental development on a topic that is agreed upon by the partners. However, more incentives that follow this notion should be introduced to reduce the performance gap among them.

Conclusions

Universities are increasingly pressured to play a more important socioeconomic role, particularly by commercializing their research. Scarce public funding has caused universities to rely on various EU programs (particularly ESIFs). These external funding sources impose a specific course (e.g., becoming more entrepreneurial and improving linkages with the private sector), increase accountability, and lack of latitude while not being able to address path dependency.

This article illustrates that Latvia has created the opportunity for universities to exploit the economic benefits of their intellectual property in terms of the legal framework (universities own the intellectual property and are allowed to engage in knowledge and technology transfer activities) to improve science-industry linkages and knowledge and technology transfer, but specific conditions and ways of commercializing publicly funded research are set through funding incentives for R&D. However, commercialization of research is incentivized through a top-down approach with the formulation process being separated from the implementation, the government takes a central role in shaping the support instruments and not considering different development stages and capacity of the actors and not including enough flexibility that gives latitude in implementation. Collaboration during various stages of designing support incentives (e.g., development of criteria for research funding) and during the implementation is necessary for the triple helix framework. Moreover, the approach and insufficient collaboration limit the autonomy of universities to experiment and build the capacity needed to select and organize technology transfer processes and shift the focus on accountability and reaching predefined performance metrics.

These bottlenecks could be overcome by allowing more experimentation, especially on research organization level to allow the environment to develop—setting up appropriate smaller scale incentives according to the needs of organizations and give the

flexibility to experiment with them also by creating incentives that are aimed at making researchers and companies interested in pursuing commercialization of research and allowing skills and capabilities and facilitate collaboration to develop.

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Compliance with Ethical Standards

Conflict of Interest The author has worked at two organizations discussed in the article: previously as a technology transfer staff at the University of Latvia (2010–2017) and currently at the Investment and Development Agency of Latvia as the Head of Technology Transfer Unit.

Annex I

Table 2 List of Interviews

No	Position	Date	Place
1	Researcher	21 October 2015	Sønderborg, Denmark
2	Administrative staff	21 October 2015	Sønderborg, Denmark
3	Researcher	07 November 2017	Riga, Latvia
4	Technology transfer staff	10 November 2017	Riga, Latvia
5	Administrative staff	10 November 2017	Riga, Latvia
6	Technology transfer staff	13 December 2017	Riga, Latvia
7	Technology transfer staff	28 December 2017	Riga, Latvia
8	Researcher	15 May 2018	Riga, Latvia
9	Researcher, start-up founder	25 May 2018	Phone call
10	Technology transfer staff	29 May 2018	Riga, Latvia
11	Researcher	16 April 2019	Riga, Latvia
12	Foreign expert, policy advisor	16 April 2019	Online

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DISREGARDING HISTORY AND CONTEXT: INNOVATION POLICY IN LATVIA POST 1990

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Abstract. Latvia has undergone a significant transformation in the last 25 years since re-gaining its independence, as did the other post-Soviet states. The changes have been all-pervading and have also significantly affected science. While during the Soviet times Latvia was one of the more advanced Soviet republics in terms of quality of academic research, especially in pharmaceuticals, radio-electronics and physics, science had been weakened during the transition period not only due to constant lack of funding, but also lack of continuity in funding that was available. Also, while during the Soviet times a significant part of academic research performed in Latvia was linked to the industry, it had to shift its efforts towards different objectives in the independent Latvia, as links with enterprises were cut. Project-based funding with specific criteria, such as quality of academic output had been driving scientific activity towards basic science and away from cooperation with enterprises. However, when Latvia joined the European Union (EU), the policy mix was devised to target indicators like research and development (R&D) expenditures, number of patents, as well as cooperation between science and industry, while not taking into account the context in which this policy mix was supposed to be implemented. In this paper we discuss how this policy mix came into being and what are the results so far. Desk research, statistical data and interviews with technology transfer specialists and other relevant staff members show that the policy mix focuses on supporting formal ways of technology transfer, rather treats innovation as a linear process and fails to address the persistent weaknesses of the innovation system in Latvia.

Key words: *research and industrial policy, innovation absorption, policy transfer, policy failure*.

JEL code: O38

Introduction

The importance of improving the innovation performance of EU has gained prominence in policy planning documents since the late 1990s, and policy makers of the EU member states with weaker performance have been struggling to keep up in the race and become assets in the EU innovation system (Radošević, 2005). To improve the performance and understand their position, policy makers of these countries have been largely relying on experience of the more developed countries (e.g. Germany, Denmark or Sweden) and also using benchmarking tools, such as the European Innovation Scoreboard (EUS) to benchmark their countries against the innovation frontrunners, trying to understand the bottlenecks and how their performance could be improved.

However, while engaging in this kind of policy learning and transfer, what was often disregarded were the historical legacies and policy context in the Central and Eastern Europe (CEE) countries, such as Latvia. Therefore, policy mixes adopted and implemented with the aim to support innovation without adaptation to local conditions, often missed the target (Varblane et al., 2007a; 2007b). As Izsak et al. (2015) point out, some of the reports or scoreboards (including EIS) have been constructed in the past decade and include various input and output indicators which, while important, should be evaluated carefully before being used as evidence for developing policies. One of the most recent developments in innovation policy strongly supported by the EU - the Research and Innovation Strategy for Smart Specialisation (RIS3)

- aims at tackling these deficiencies, explicitly aiming at amplifying the already existing strengths and developing new ones.

This article aims to explore the changes in Latvia's innovation and research policy along with changes in the economy after the collapse of the Soviet Union (SU) and discuss the approach that has been used to improve the country's performance. We first discuss research system that existed in Latvia during the Soviet period. We then focus on the turbulent years of transition, arguing that the peculiarities of the Soviet approach to research, innovation and production, as well as the effects of rapid transition had a profound effect on the development of research and innovation system in Latvia. The repercussions of these effects can still be observed in reports like EIS, which indicate that despite the efforts applied over the last two decades, Latvia is still one of the weakest EU member states in terms of both innovation and economic performance.

2. Theoretical framework and methodology

Although policy transfer through different means has affected almost all domains of policy making in the CEE EU member states, the domain of innovation policy is perhaps exemplary in the breadth and depth of external influence. Therefore, looking at the developments in innovation policy through the lens of policy transfer and policy learning literature can provide valuable insights into the evolution of the domain.

There is a number of lenses through which one can look at policy change under external influence: Europeanisation literature focuses on the influence of the EU on the domestic policy making and includes the entire spectrum of mechanisms of policy change; policy learning literature looks at policy change as a rational process based on evaluation and lesson-drawing; policy transfer literature includes a wide spectrum of mechanisms, from coercive (e.g. adoption of the Acquis Communautaire) to voluntary transfer (e.g. lesson drawing or imitation). It is important to note that for policy learning or lesson-drawing to occur, the experience of policy failure doesn't necessarily need to be direct (May 1992; Rose, 1991; 1993). In Latvia, the semi-permanent state of flux, which persisted over more than two decades since re-independence, provided ample space and opportunity structures for policy transfer (Evans and Davies, 1999). In the domain of innovation policy, policy transfer was largely voluntary and took place through imitation and different benchmarking exercises (e.g. IUS), as well as policy transfer through expert advice and consultancy. There was, however, still some element of coercion, as most of the innovation policy instruments were supported by the EU Structural and Investment Funds (ESIFs). Furthermore, the implementation of the RIS3 strategy was a precondition for all funding focused on supporting R&D and innovation in the latest planning perspective (2014-2020).

Policy transfer and policy learning can be an effective mean for updating innovation policy mixes in order to address certain deficiencies. However, in order for it to be effective, certain preconditions need to be fulfilled. First, a certain level of policy capacity needs to be in place in order to ensure that thorough analysis is undertaken throughout the policy implementation cycle, sufficient organisation capacity exists to support policy design and implementation, but also strong political capacity exists, which is a precondition for effective priority-setting and resource allocation (Wu et al., 2018). Second, transferred policy ideas need to fit within the existing policy environment, ideology and the existing policy routines. As we argue below, policy transfer often led to adoption of policy instruments that were following either policy fads of the time or best practices from countries with well-functioning innovation systems (e.g. Denmark or Sweden), while largely disregarding local context. Hence, instead of tackling the existing deficiencies in the innovation system, policy instruments were searching for problems, which at a particular time were largely irrelevant in the specific context (see Béland and Howlett (2016) on policies looking for problems).

The main purpose of this paper is to trace the development of innovation policy over the last twenty-five years in Latvia, and provide tentative explanations for the existing innovation policy mix and the relatively weak effectiveness of innovation policy in the country. In order to do this, we rely on qualitative case study research methodology. The aim is not to establish causal relationships between different factors and outcomes that can be observed, but rather to trace the processes through time, looking at specific institutional arrangements framing the implementation of innovation policy in Latvia. Qualitative case studies complemented by elements of process tracing are particularly useful when the objective is to study the evolution of a policy mix in a specific context, taking into account the roles different actors play in the process and the resulting outcomes. This way, case studies can be utilised for theory building (Bennett, 2004). For the purposes of constructing this case study we rely on a wide range of sources, including, national and international statistics, official reports, evaluations and policy documents, as well as semi-structured interviews. Interviewees were selected using purposive sampling (Jupp, 2006). The interviews were conducted with technology transfer specialists and administrative staff (sources are anonymous) from the relevant institutions to understand the impact on beneficiaries. Altogether 5 interviews were conducted.

3. Overview of developments in innovation policy post USSR

3.1. Restoration of independence and its impact on the innovation system

During the Soviet era, research system in Latvia was a part of the massive SU research system, which largely focused on R&D for the needs of the aerospace and defence industries. The research system was divided into three distinct domains with limited interaction between those: Academy of Sciences doing basic research; universities, mainly tasked with teaching; R&D institutes performing applied research. Applied research was directly linked to the dominant industrial branches that existed in Latvia, such as mechanical engineering and machinery, wood processing and wood chemistry, as well as pharmaceuticals and foods, while basic research served the needs of the entire SU.

As it as was with other parts of the SU, Latvia was both highly dependent on raw materials and energy from external suppliers and at the same time produced goods for the use elsewhere in the Union (Kristapsons et al., 2003). The situation drastically changed after the collapse of the SU as the best performing fields diminished and existing markets were lost.

The independence and transition period brought many changes in how research was administered and conducted and one of the challenges was finding a balance between the needs of the country and the capacity of the research institutions located in it research in Latvia became research in a small country (The Danish Research Councils, 1992). The whole economy had to be restructured to match the needs of a small state – previously different parts of value-chain were scattered across the territory of the USSR and therefore access to some was now limited or non-existent.

The Soviet research funding system was not based on competition and competitive research funding was introduced during the transition period when the whole system had to be transformed into market economy. Other challenges included not only revising the number and size of institutes but also supporting their activities to allow further development of the top ones e.g. facilitate networking with foreign research institutes and experience exchange. Integrating R&D and industry was necessary as well, however distribution of funds had to be carefully planned to ensure that not only applied, but also fundamental research receives the necessary funding.

The changes in the research system started with restructuring its management. Latvian Academy of Sciences gradually lost its status of the management institution and became an autonomous community of scientists. Latvian Council of Science was established in 1991 to advice the government about plans and budget for research activities, coordination of research policy, distribution of grants, setting the criteria and procedures for competition (Egle et al., 2002; Arnold et al.,

2014). A law regulating research activities was adopted in 1992. Although consolidation of research institutions began in the early years of independence, the pace of it was slow and therefore the process continued until the latest round in 2015.

Changes in the structure of the research and innovation system continued throughout the first decade of transition, as international cooperation had to be established and developed and changes in funding mechanisms occurred. After the collapse of the SU it was important to develop a strategy on how to adjust the research system and evaluate which institutes are the most important and capable ones and continue supporting them. Because of a decrease in public research funding, only the most experienced research groups survived, however, due to limited resources, they were not able to attract young researchers. Furthermore, the comparatively low pay in the research institutes lead to rapid emigration of researchers or shift into other activities not connected to research. Eventually, the number of researchers employed by the research institutions declined by some 80 per cent, leading to overall ageing of the research staff. (Bobeva, 1997; Egle et al., 2002; Siliņš, 1994 in Rambaka, 2012; Siliņš, 1998).

After the first years of transition it was important to maintain the system as such and keep it functioning, while later another important issue arose - it was necessary to reshape research towards European and national priorities in the context of Latvia joining the EU. Shaping the priorities started in 1997 when the Cabinet of Ministers (further – Cabinet) set priority research fields with the aim of establishing National Research Centers within these fields and later in 1998 the National Concept of the Republic of Latvia on Research and Development was developed. In 2000 national research priorities for basic and applied research (for the period 2002-2005) were set by the Cabinet with the aim to steer the work of research groups in the direction of solving current industrial, economic etc. problems (Egle et al., 2002).

To sum up, during the first ten years after the changes in science and research system were initiated, a number of significant and necessary decisions were made, triggering processes that proved to be damaging. After Latvia inherited the massive research infrastructure that was out of balance with its needs and that it couldn't simply afford due to its size and budgetary constraints, consolidation of research activities was initiated.

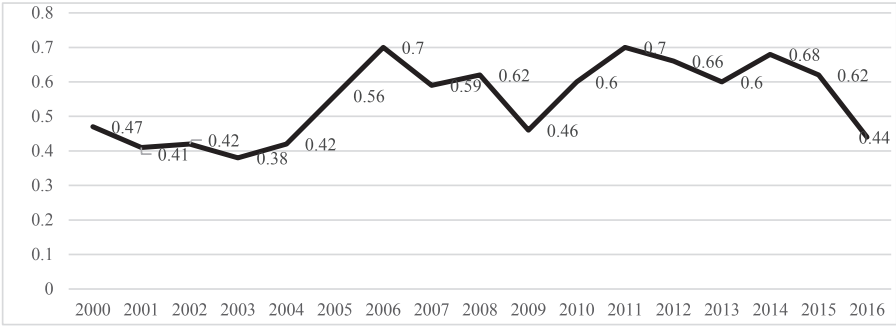
As discussed above, the whole economy experienced massive structural changes that resulted in unemployment, emigration of skilled work-force etc. Therefore, research and innovation were far from being top priorities of governments at the time. As in other policy areas, the approach to research policy was liberal – no effective mechanisms for planning or strategic prioritization of research funding were in place. Research funding system was constructed in an open and inclusive way so that representatives of any research branch were eligible for funding. The fragmented research system eventually led to a situation where Latvia was unable focus on specific research areas due to limited availability of both human and financial resources to make significant impact and had as well lost the priority status that it had during the Soviet times.

3.2. Current R&D and innovation environment

Today, more than two decades after the transition started, and 14 years after EU accession, important changes have been implemented in the area of science and research, however, the outputs of the system are far from sufficient and policy makers still struggle to propose a suitable strategy that would address the needs of the country the goals set within EU level strategies within the scope of available financial resources and taking into account the country's small size. The current research system is plagued by critical lack of financial resources that has caused dependence on EU funding via research project grants and the situation is further exacerbated because of insufficient cooperation with the industrial sector and fragmentation in a number of areas, among other issues. Latvia's accession in the EU opened many opportunities while also triggering a number of negative side effects.

3.2.1. Funding for research and development

During the years before the recession expenditure on R&D increased significantly - in 2004 it was 0.42% of GDP and already 0.7% of GDP in 2006, as shown in Figure 1.



Source: author's construction based on Central Statistical Bureau of Latvia (CSB, 2018)

Fig. 1. **R&D expenditure in Latvia 2000 – 2016, % of GDP**

The impact of economic recession on R&D expenditure can be clearly seen starting from 2007 when it started to drop. In 2009 it reached the lowest point since 2004 with R&D expenditure being 0.46% of GDP before increasing and declining again during the next years. But the decline in absolute numbers was even more significant, given that Latvia lost close to 20 percent of GDP between 2009 and 2011. The drop in R&D expenditure shows the continuous low priority status of the sector and is in contrast with what a catching-up country should be doing (Veugelers, 2016).

The main elements of research funding system in Latvia are 'basic' funding and grants from the Latvian Council of Science and state research programmes. Before the accession to the EU financial instruments for candidate countries or potential candidate countries were available and later European funding in the form of ESIFs and the Framework Programme.

'Basic' research funding was introduced in 2005 and was initially distributed using a formula based on a number of output indicators - scientific publications, patents, PhD graduates produced. Important changes in how the funding is distributed were implemented after research system's review by Arnold et. al (2014) - research organisations (or units) that received an evaluation of 4 or 5 (out of 5) are eligible for additional 10 percent, while those with evaluation 1 or 2 do not receive any basic funding. More changes were introduced in 2015 and basic funding allocated to state founded institutions of higher education to partially fund their academic personnel doing research work (Cabinet of Ministers, 2013). According to the data of Ministry of Education and Science, the amount of basic funding has been stable during the last few years, however, the number of eligible public research organisations has decreased due to the aforementioned changes - 18m EUR in 2015 (distributed among 29 public research organisations), 20m EUR in 2016 (21), 23m EUR in 2017 (22) and 25m EUR n 2018 (22). These changes were important to further integrate teaching and research as well as promote research excellence (MoES, 2018).

Meanwhile, Funding from the Latvian Council of Science (about 4.3m EUR per year (Latvian Council of Science, 2015)) and funding for applied research from state research programmes is distributed via competitive calls in priority directions approved by the Cabinet according to the Law on Scientific Activity.

As the majority of research funding comes from short-term grants, the basic funding only covers the absolutely necessary minimum and is also allocated on a yearly basis, with very limited long term planning. Veugelers (2016, p. 5) argues that "a country's optimal innovation policy mix will depend on its level of innovation capacity and should dynamically evolve along with, and drive, its development path". However, the rather rigid framework of ESIFs, requiring

significant lead times for policy planning, and allowing a limited scope for adjustments of policy instruments during the period, constrains the possibilities for such dynamic evolution. Another constraint is related to limited availability of resources and, hence, the need of prioritisation. As Pavitt (1998, p. 567) argued, it is difficult for policy makers to make accurate long-term predictions of potential major technological breakthroughs, and for governments to have influence over the rate and direction of technical change substantial R&D funding needs to be allocated to certain priority domains. Although all countries face fiscal constraints, those are particularly hard in small states.

In 2005 when a new Law on Scientific Activity was approved, it envisaged an annual increase of financing for scientific activity of at least 0.15 per cent of GDP until the State-allocated financing for scientific activity reaches at least one per cent of GDP. However, the Cabinet has so far failed to act on this objective and R&D expenditure has again returned to a downward trend. Given the political insignificance of science and research, public R&D funding is often among the very first positions to suffer cuts when budget consolidation is necessary. An optimistic perspective is set in the National Development Plan (NDP) of Latvia for 2014–2020, which is the highest level medium-term planning document in Latvia. It envisions an increase in expenditure on R&D to 0.8% of GDP in 2014, 1.2% in 2017, 1.5% in 2020 and possibly 3% in 2030 (Cross-sectoral Coordination Centre, 2012). However, the latest statistics suggest that overall R&D spending still remains at a critically low level.

3.2.2. Management of research system

In addition to changes in distribution of funds, there were some institutional changes affecting research and innovation policy. The Law on Scientific Activity stipulates that the Cabinet sets the policy for science and technology, however, this area has had a low priority status, in contrast to other EU countries. Latvian Council of Science which had a more significant role in the early transition years, has now become more of a funding agency under the Ministry of Education and Science (MoES), the Academy of Sciences lost its position as a policy making body as MoES gained a more prominent role and is currently responsible for research policy and its coordination (Rambaka, 2012).

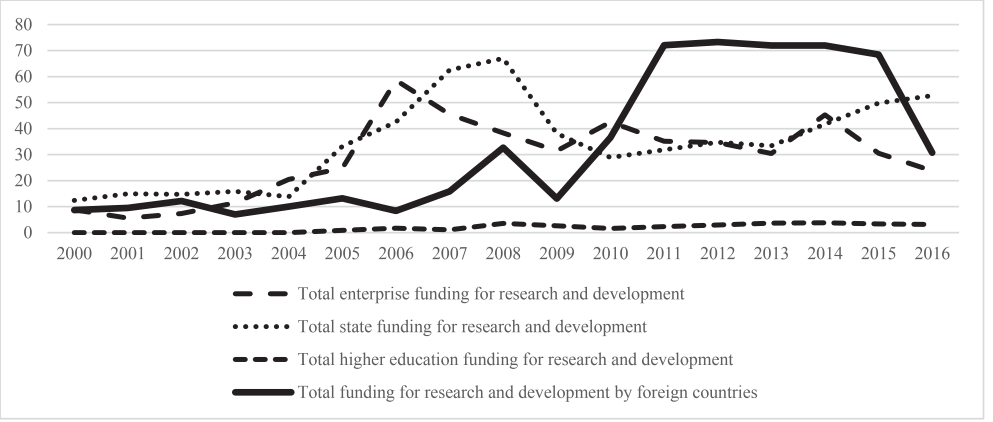
Similarly, as Council of Science serves the role of research funding agency to MoES, Investment and Development Agency of Latvia (LIDA) serves as one for Ministry of Economics when it comes to funding innovation. Neither Latvian Council of Science nor LIDA were established to fulfil these roles, but rather have gradually evolved to perform these functions (Arnold et al., 2014). Another State agency under supervision of MoES - the State Education Development Agency - was responsible for supervising the funds allocated to fundamental and applied research via ESIFs 2007 – 2013, while a number of smaller organisations have been managing Seed funding and other similar incentives. Having different government institutions that manage research and innovation have resulted in different paths for them in terms of setting priorities (*ibid.*). For example, a number of policy instruments were introduced to promote R&D cooperation and joint product development between research institutions and enterprises, most of those implemented by different agencies leading to coordination challenges.

The organisational fragmentation also causes the fragmentation of funding as the available funds are scattered across different agencies, different branches of science and divided into different programmes. The fragmentation of the research system can also be seen when looking at subordination of universities - while MoES is supervising the overall education policy and most of the state universities, Ministry of Agriculture is supervising Latvia University of Life Sciences and Technology, Ministry of Health is supervising Riga Stradins University.

Accession to the EU has substantially increased the amount of available funding, however it has also imposed constraints that have negative effect on research and innovation activities. One of such constraints (however, the same rules apply for state funding as well) are the procurement procedures prescribed by the Law on Public Procurement and related regulations, which are meant to ensure transparency and accountability, but lead to adverse outcomes (in terms of

quality of procured equipment as well as delays in research work) due to both unnecessary complexity as well as lack of administrative staff within research organisations (Interviews - 1, 2, 4). Rules applicable to publicly funded research projects create additional obstacles to commercialization. While the EU regulations as such do not prohibit commercialization of research or use of public research infrastructure for commercial purposes, lack of experience and legal expertise results in often incorrect and overly rigid interpretation (Interviews - 1, 2, 3, 4). Given that public research institutions often lack independent private funding that can be used to co-finance research projects, these projects are often co-funded with highest possible rate of public financing (mostly European Regional Development Fund (ERDF)). This, in turn, challenges commercialisation of research outputs. As a result, a significant number of research results are left unexploited.

Although implementing EU funded projects is difficult and time and resource consuming, because of the lack of other sources of funding, EU grants have tended to replace state funding - the majority of research funding tends to come from ESIFs or Framework programme projects (Fig. 2).



Source: author's construction based on Central Statistical Bureau of Latvia (CSB, 2018)

Fig. 2. **R&D Expenditure in Latvia by sector, 2000-2016, mln euro**

The transitional nature of ESIFs further complicates the current approach - the funding gap at the end and beginning of every new planning period means that many research institutions that were relying on them need to find other sources of funding in order to close the funding gap (i.e. research contracts with industry or national public funds). However, the absorptive capacity of the private sector in Latvia – with some notable exceptions – is still far from sufficient in order to utilize research outputs of local research institutes and therefore also to serve as a sustainable and reliable source of funding. Project-based and relatively short-term funding is not conducive to long-term strategic planning and establishment of long term strategic partnerships between research institutions and enterprises.

3.2.3. Science-industry linkages

Cooperation between research institutions and industry is insufficient and although business enterprises' R&D expenditure in the higher education sector has been improving, it is low in comparison to the proportion that is funded by the ESIFs. However, it differs greatly among institutions as those engaged in applied research tend to have more intensive collaboration.

A lot of attention is currently directed towards the number of patent applications from public research organisations, which remains relatively low. Universities in Latvia are often compared with the leading universities in Europe and U.S.A. in order to stress the weak performance. To manage intellectual property issues, an incentive for establishing technology transfer offices was launched by LIDA and such units were developed within universities. The incentive was important

to improve the administrative capacity regarding IPR management and explore commercialisation opportunities and, as Osenga (2006) points out, it is in fact necessary for a university to enter the patent arena. However, it was not possible to exploit the programme entirely due to insufficient experience, absorption capacity of the private sector as well as the uncertainty of the interpretation of regulations.

In recent years, the number of patent applications has been stimulated by various financial incentives, however, some negative side effects have emerged. While universities have recently been increasing their patenting ability, in many cases patenting has been done with no critical assessment of the commercial potential or the industry's absorptive capacity, which is far from what is needed to utilize the knowledge generated due to insufficient financial and human resources. Furthermore, patents were sometimes acquired in order to satisfy the requirements of funding instruments, without necessarily having commercial value. While statistics show that increased patenting has led to innovation, to reap the benefits of patenting activities, a strategy and skills to understand the market and technology are necessary (Osenga, 2006).

So far the economic development has been based on low labour costs and low tech industries indicating low innovation performance (MoES, 2013, Klāsons and Spuriņš, 2015). The private sector's capacity to absorb innovation has been affected in a negative way by the small numbers of PhD graduates and insufficient, outdated research infrastructure both in universities and in the private sector. This is, however, being tackled by diverting significant amount of ESIFs funding to this area. Still, companies also often lack skilled personnel that knows how to operate modern research equipment. However, despite the challenges, the number of companies that perform R&D activities has fluctuated, and between 2010 and 2014 it increased from 267 to 411. R&D personnel has also increased from 632 to 776, suggesting that the private sector is increasing R&D activities (CSB, 2016). The average number of R&D personnel in companies suggests that the size of the companies is very small, possibly technology intensive start-ups and in that case there is a potential for growth if the correct funding instruments are implemented – such companies are a critical resource of innovation (Audretsch et al., 2002). Besides, most of the companies operating in low and mid-tech industries (e.g. machinery) rely on the kind of innovation that Jensen et al (2007) termed DUI (doing, using, interacting), which often requires collaboration with clients and some engineering effort, but not traditional R&D.

A factor that has significantly influenced the overall development and coordination of research and innovation policy has been the decrease in capacity of the relevant institutions since the economic recession. Cuts in budget have resulted in cuts of personnel and increased turnover of human resources, which negatively affected the capacity of public institutions to design and implement effective policy instruments.

Three of the most relevant indicators identified by Pavitt (1998) as crucial for innovation and technical change, are still at relatively low levels in Latvia: 1) rate of investment in infrastructure; 2) level of education of human resources; 3) R&D expenditure 'and other change-generating activities like design, production engineering and systems engineering'. Although the policy mixes used to support innovation and research so far did target these specific factors (e.g. National Significance Research Centers for equipment, inter-sector competence raising programme and PhD scholarships for skilled human resources and funding for basic, applied research and experimental development to increase expenditure on research activities), the amount of funding was insufficient, policy instruments often uncoordinated and funding dispersed, thus not allowing for a focused support to a limited range of priority areas, and therefore having limited effect on innovation performance of industries so far. All factors mentioned above are amplified by a mismatch between the needs of dominant industries and capabilities of research institutes.

4. Recent developments and RIS3 as a new approach to innovation policy

Currently support for R&D and innovation in Latvia is discussed in a number of policy planning documents, such as the long term Sustainable Development Strategy of Latvia until 2030 (adopted in 2010) and the related National Development Plan 2014-2020 (highest level medium-term planning document) that sets various targets such as increase in private sector investments in R&D among others.

According to the Science, Technology Development and Innovation Guidelines 2014-2020 (MoES, 2013), to improve Latvia's innovation performance, a priority status has been given to improving conditions for technology transfer, enhancing science-industry linkages to increase commercialisation of R&D, supporting the expansion of innovative and technology-oriented companies as well as improving the availability of financing (e.g. seed and venture capital).

As the new EU programming period has recently started, new funding incentives have been introduced, however, a significant focus is still on increasing R&D expenditure. While it is important to increase R&D expenditure it is also very important to look in which areas or innovation capacity components the available R&D funds are invested (Veugelers, 2016) to have the most significant impact. A notable change, however, is that project evaluation based on milestone achievements (as in EC Framework programmes) has been introduced and provides more latitude on both the policy makers', funding administrators' and beneficiaries' part.

Most of funding incentives in Latvia are focused on collaborative R&D, especially on co-operation between R&D in universities and public research organizations and R&D in businesses similarly as in Germany, Finland, Sweden and Switzerland (Izsak et al., 2015). These incentives are key to improve overall science-industry collaboration but it is important to decrease bureaucratic procedures and allow flexibility for the private sector to be interested. An obstacle is that the areas of investment are too advanced for the majority of SMEs in Latvia and this surplus in the research outputs is left unexploited. Also, as Audretsch et al. (2002) point out, applied R&D is primarily funded by the private sector and is also performed there, while basic research is primarily funded by public funds and generally performed in universities and colleges. That is important for developing new instruments and deciding who is going to be the primary beneficiary and how the implementation is going to take place. In Latvia, similarly as in other countries catching-up to innovation leaders, majority of funding programmes are based on competitive-funding (Veugelers, 2016), however, it needs to be considered that this kind of approach is too bureaucratic for the private sector and slow for their fast growth.

While problems still persist, a number of important incentives were introduced to tackle the issues discussed in the previous section and a needed experimentation with funding and flexibility can be observed. To promote science-industry collaboration performance-based funding as part of the "basic" funding was allocated on the basis of how well an organisation has performed not only academically but also in terms of collaboration with the private sector. These additional funds are used to fund internal innovation support programmes that previously were lacking. This approach allows flexibility for research organisations to develop support programmes tailored to their needs. Especially organisations of higher education have been actively implementing various incentives that integrate students early on to engage in innovative activities.

Also, in 2016 LIDA established a joint National Technology Transfer Centre (funded by the ERDF) with the aim to centralize and improve science-industry technology transfer. The Centre implements a variety of activities ranging from provision of commercialization grants and innovation vouchers to technology scouts – staff that spends a significiant time at research organisations to gather information about their competences, equipment and intellectual property portfolios, as well as consults companies on these topics. The incentive aims to not only increase the capacity of research organisations in exploiting R&D outputs but also stimulate creation of spin-offs, provide support for start-ups and also build the skills and knowledge among policy makers and implementers so that strong support can be provided to the

beneficiaries. To further increase market uptake of state-of-the-art technology, three acceleration programmes have been launched in 2017 and will provide support for start-ups, especially deep-tech ones.

The most recent development in research and innovation policy was the introduction of research and innovation strategies for smart specialisation (RIS3) as an overall framework for a more focused approach to research and innovation policy in the EU. RIS3 was a precondition for implementation of funding instruments supported by ESIFs in the domains of research and innovation policy. What makes this approach different from earlier approaches is that it aims at establishing certain priority areas for targeted investment. These priorities are to be identified through a process of entrepreneurial discovery – a bottom-up process involving stakeholders from both public and private sectors, which aims at utilising existing regional advantages to diversify the local economy into industries with higher value added (Landabaso, 2014; Coffano & Foray, 2014). RIS3, as a concept, addresses some of the deficiencies of innovation policy in Latvia, which has historically been horizontal and laissez faire, without any attempts to set priorities, justified by the standard government failure line of argument. However, the pace of its implementation (RIS3 had to be implemented in a matter of months due to the conditionalities attached) disregarded the existing policy environment and institutional setting, as well as lack of policy capacity in Latvia (see Karo, Kattel and Cepilovs, 2017). The concept of entrepreneurial discovery, which requires strong culture of dialogue and coordination between the public and private sector, as well as strong policy capacity within the public sector, did not find a fertile soil in Latvia, where there is only formal dialogue between the public and the private sector, while no effective mechanisms for coordination have been developed so far (see Estensoro and Larrea, 2016 on how to overcomes some of the challenges related to RIS3 and entrepreneurial discovery). RIS3 and entrepreneurial discovery, if those will be maintained and further developed as the overarching principles of innovation policy, can potentially strengthen the institutional arrangement essential for effective coordination between the stakeholders, and therefore for effective design and implementation of innovation policy.

Conclusions, proposals, recommendations

1. Generally, lack of public interest in science, research and innovation makes the issues of science less politically profitable. As a result, research funding is often among the first positions on the list of proposed budget cuts. Short term thinking of politicians and lack of public interest undermines sustainability of science in the long term. Possibly, without a number of success stories – the proverbial Latvian Nokia – the society just doesn't seem to acknowledge the connection between research, innovation and economic growth.
2. Funding programmes are strongly aimed at improving different indicators such as commercialisation of publicly funded research outputs measured by patents, R&D expenditure, cooperation and joint projects between companies and PROs, however, there is a certain disconnect between the indicators pursued and the effect of the policy instruments on innovativeness of enterprises as the ultimate goal. Hence, policy instruments often fail to address the persisting weaknesses of the Latvian innovation system.
3. Instead of focusing on the abstract notion of R&D spending, a stronger emphasis should be put on firm investments in R&D to stimulate innovation. While there are initiatives for development of new technology intensive companies like business incubators and acceleration programmes more funds should be aimed towards this kind of instruments instead of focusing on increasing R&D expenditure in research organizations and formal ways of technology transfer such as licensing. It is also important to raise awareness among companies that innovation and cooperation is necessary to improve their competitive advantage and develop funding programmes in a way that does not promote a subsidy-seeking attitude from companies (Pavitt, 1998).

4. Although the approach has shifted, currently available funding sources like ESIFs still allow little flexibility and experimentation. More instruments, e.g. performance-based funding additional to basic funding that allow creation of institutional funding schemes should be developed in order to provide a tailored approach based on specific needs of relevant organisations instead of applying a uniform approach.
5. The new approaches, such as RIS3, or challenge or mission-oriented R&D and innovation policies (see e.g. Mowery et al., 2010; Mazzucato, 2017), can potentially result in better outcomes in terms of effectiveness of policy instruments. However, those new approaches to innovation policy will require development of different capabilities in the public sector, in particular in regards to proactive steering and cross-sectoral coordination, which have so far not been developed (e.g. Karo and Kattel, 2018). Particularly acute this challenge will be in the smaller EU member-states, such as the Baltic countries, which alone lack the critical mass necessary for substantial impact.

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Annex 1

Interviews

No	Interviewee	Position	Organisation type	Date	Place
1	Anonymous	Administrative, Technology transfer	Public research organisation	10 Nov 2017	Riga
2	Anonymous	Research	Public research organisation	8 Nov 2017	Riga
3	Anonymous	Administrative, Technology transfer	Public research organisation	13 Dec 2017	Riga
4	Anonymous	Administrative, project management	Public research organisation	10 Nov 2017	Riga
5	Anonymous	Administrative, Technology transfer	Public research organisation	28 Dec 2017	Riga

Publication III

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SUPPORTING UNIVERSITY TECHNOLOGY TRANSFER - STRUGGLES AND BARRIERS IN LATVIA

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*JEL: **O380** Technological Change: Government Policy*

Conference topic: 2. c. Science-business cooperation for a new industrial development

Abstract
The goal of enhancing science-industry cooperation with the aim to boost countries' innovation performance has been a part of various development strategies in European countries for quite some time and an array of incentives is targeted at elements of national innovation systems in order to facilitate university technology transfer. This paper aims to discuss these incentives in Latvia - a small country in transition, with a relatively poor innovation performance and with a pressure to shape its industrial and research policies towards industrial development and sustainable growth. Latvia is a country still recovering from the recent financial crisis and trying to overcome the problems of the past when it was a part of the Soviet Union - a

background that gives specific characteristics for the environment in which researchers and firms operate. This paper focuses on the chosen policy mix and incentives for supporting science-industry linkages in Latvia and how it matches the structure of the economy. We suggest that the chosen approach (which is more often than not inspired by foreign success stories) fails and causes a mismatch between both realms and thus slows down the improvement as it tries to address not the causes of low cooperation such as business sector's low innovation absorption capacity that impacts technology transfer processes in a significant way, but instead alleviates the symptoms e.g. low R&D expenditure. We use case study approach, relying on desk research, as our data sources.

1. INTRODUCTION

Knowledge and technology transfer activities are considered an important driver of innovation performance and need to be looked at when a country aims to improve this performance (Calcagnini & Favaretto, 2015). Thus, it is no surprise that a vast amount of literature is dedicated to the topic. In the US, the issue of technology transfer and university-industry collaboration became increasingly contested during the late 1970s to 1980s, in part for political reasons, but also due to concerns about the country's competitive advantage in the increasingly global marketplace (Grimaldi, Kenney, Siegel, & Wright, 2011; Mowery, Nelson, Sampat, & Ziedonis, 2004). In a similar fashion, the debate about necessary incentives to support technology transfer and science-industry collaboration has intensified in the European Union over the last decade. The worst performing Member States of the EU now face significant pressure to improve performance in these activities. To counter the apparent malperformance, governments have been developing and implementing reforms to establish well-balanced innovation systems within their countries, including university reforms to improve technology transfer (Calcagnini & Favaretto, 2015; Goldfarb & Henrekson, 2003).

However, in some cases it has been a challenge stretching out for more than two decades and still ongoing. One of such cases is Latvia – a post-Soviet country who restored its independence in 1991. Same as

for some other Central and Eastern European (CEE) EU member states, there is still a long way for Latvia to catch up on countries that are European innovation leaders – Denmark, Sweden, Finland and Germany (European Commission, 2015). When looking for solutions, policy makers often rely on case studies of best examples from the universities in the U.S. and the aforementioned European innovation leaders. However, the best practice examples from the innovation frontrunners are not that easy to implement. At the same time, government incentives (or lack of thereof) in countries with poor innovation performance is not as widely discussed and explored for policy making purposes. Additionally, while there is literature discussing knowledge and technology transfer activities as such, considerably less literature touches upon various policy instruments that the governments could exploit to support these activities and how the specific support initiatives are designed at government level (Rasmussen, 2008). Therefore, we intend to cover this gap in the literature.

One explanation for the relative weakness of innovation performance in Latvia is the weakness of its institutions – both formal and informal – largely being the result of transition. However, to explain the somewhat weak performance in terms of technology transfer, one has to look at the source of funds for R&D and innovation, which currently plays a very significant role. In many of the CEE countries with weak innovation performance, private sector R&D spending is lagging behind public investment. At the same time a substantial part of public investment in some countries, including Latvia, comes from European Structural and Investment Funds (ESIF). ESIF funds, however, have their own constraints, such as greater bureaucracy if compared with national funding, as well as limitations to commercial exploitation due to incorrect application of state aid regulation. Therefore, this paper aims to contribute to the discussion on university technology transfer of publicly funded research results. We also discuss ways to improve innovation performance in countries in transition by discussing the experience of Latvia - a small country with relatively low R&D spending both in absolute and relative terms (0.68% of GDP in 2014) and a historical background that continues to influence the economy resulting in low innovation absorption capacity among other things. Despite implementing major structural changes

the question whether they have been successful is still relevant for Latvia even after a decade within the EU.

The paper provides a case study of government incentives in Latvia that are aimed at fostering science-industry linkages and university technology transfer. The second section looks at the historical background and structural changes that impacted and continues to shape the national innovation system significantly as well as the current situation. The third section discusses the types of support programs, their management on a government and also university level. The fourth section evaluates how well the chosen policy mix matches the circumstances, while the conclusions are discussed in the fifth section.

2. R&D ENVIRONMENT AND INNOVATION SYSTEM IN LATVIA

2.1. Latvian R&D during the Soviet era and the transition period

The roots of current issues within the national innovation system and the problems related to insufficient science-industry linkages in Latvia stretch all the way back to the time when it was a part of the Soviet Union and the subsequent transition period. Because of these events numerous radical changes in the innovation system have occurred and that has left a negative effect on the country's innovation performance.

During the Soviet period Latvia was a part of a massive, inflexible, inefficient and fragmented system without a central overview and efficient coordination (Rambaka, 2012). The system that Latvia was a part of spanned the entire Soviet Union meaning that various processes were often dispersed both organisation and location wise. It could particularly well be seen by looking at elements of the innovation system - basic research, fuelled by military-driven competition, was connected to the military but not accessible for civil applications due to f issues and was conducted by the Academy of Sciences, the main decision making body in the USSR when it comes to R&D. Applied research was linked to branch institutes and industrial sector. The area that was under pressure from foreign competitors was the military sector. Meanwhile, as Egorov and

Carayannis (1999) discuss, many specialists were concentrated in traditional sectors with low potential for innovation and this heritage has also influenced Latvia's innovation performance in years after. Latvia specialised in areas like mechanical and electrical engineering, metallurgy, chemicals, timber, textiles and food processing industries - industries that were areas of specialisation for Latvia already during the interwar period. Latvia had strong industrial research capacities (European Commission, 1999) and despite the overall system being inefficient, scientific achievements were still made in both fundamental and applied research and the Baltic region even was one of few regions in the USSR that commercialised research results, thus attracting foreign investments (Kristapsons, Dagyte, & Martinson, 2003).

After the collapse of the Soviet Union, Latvia restored its independence in 1991, inducing radical changes in all spheres with a complete restructuring of the economy. Once again, Latvia almost instantly found itself without the previously accessible markets – the previous time was when Latvia was first established as an independent state in 1918. Given that peculiar distribution of industrial/applied research in the Soviet Union, where industrial research was performed by dedicated research institutes often serving the needs of industry located in other Soviet republics, after the collapse of the Soviet Union Latvia found itself with excess R&D capacity, which could not be utilised by local industry alone. A similar situation was in the industry more generally, which found itself cut off from its core trade partners. And just as in the 1920s, establishing access to other now missing parts of value chain, such as raw materials and energy supplied from other parts of the Soviet Union, was important. Meanwhile, a decision to continue the support for the enterprises basically meant turning them into burdens for the country as they were unable to respond to the new demands of the market economy. Thus, as markets dwindled, so did the industries were Latvia had specialised. Similarly, the research sector had to adjust to different funding approach, since no elements of competition were present previously.

After initial collapse in the early 1990s, manufacturing industry started to recover after 1996, however, industry was being gradually substituted with services, as the main economic sector. Besides, most

of the industry with relatively high value added – the only natural partner for R&D and technology transfer, was declining at a faster pace, initially due to demand shock, but later due to the so-called Vanek-Reinert effect (Kattel, Reinert, & Suurna, 2009). Given that Latvian government from early on decided to rely on liberal economic policies, and due to budgetary constraints, no substantial support was provided to stabilise and support industry in Latvia. In its report European Commission (1999) particularly pointed out the largest pharmaceutical company in Latvia Grindex who did not at the time receive support from the government to improve business although an R&D intensive company would have been highly favoured by a Western government.

Main policy measures focused on providing basic "life support" to the science and research system as well as integrating research with higher education and linking researchers with existing needs. Another step that needed to be taken was development of a system for research funding that would provide at least the bare minimum horizontally across all filed of science and research.

Because of the planned accession to the EU, it was necessary to direct R&D towards European and national priorities and the first priorities were indeed set in 1997 (Cabinet of Ministers defined priority research fields with the aim of establishing National Research Centres). As no decisions regarding specialization in certain domains in science were made at the time, the priority areas were very broad and inclusive. As many companies and institutes became autonomous, were downsized and in many occasions divided into smaller establishments, the innovation system became very fragmented. Besides, it had very limited funding which was not focused on specific areas in order to get the critical mass necessary to produce high level research outputs, industrial R&D capabilities, the capacity of companies to absorb innovation was reduced (Kristapsons et al., 2003). These characteristics led to challenges to implement coordinated activities and a unified research policy and have influenced science-industry linkages even until this day. Universities and institutes face insufficient R&D funding from the industrial sector as during the early transition years the links between industry and science were broken, research institutions became heavily dependent

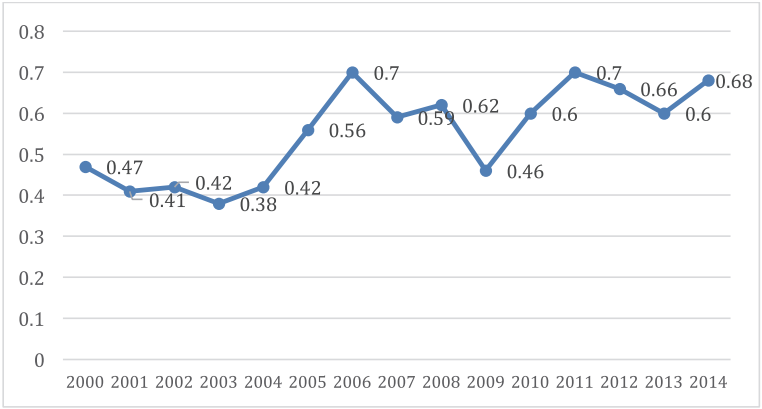
on state budgets, international co-operation and funding from the EU in form of research grants became a second source of income (European Commission, 1999). There was some development in terms of support for basic research while applied research was somewhat left behind due to insufficient coordination between the Ministry of Education and Science (MoES) and the Ministry of Economics (ME). Up until now, university technology transfer lacks significant results for a number of reasons. First, many companies are reluctant to cooperate because of the bureaucratic funding mechanisms and uncertainty of commercial benefits from investing in R&D among other factors. Second, most of the companies lack the absorptive capacity necessary for uptake of research results produced by universities and research institutions.

2.2. Current R&D and innovation environment in Latvia

According to the Innovation Union Scoreboard 2015 (IUS), Latvia's overall innovation performance has been ranked the third worst among the EU member and despite the efforts of Latvian policy makers to include support for innovation in national development strategies. In fact, as Veugelers has argued in a recent paper (2015), the divide between top performers and laggards has been increasing in the EU, where Latvia's innovation performance is just 30 per cent of that of the innovation leaders.

Strategies, Reports, assessments and evaluations done by either local ministries or by foreign experts list many causes for this poor performance, such as a fragmented national innovation system, very little funding for research, lack of cooperation and significant under-investment in research from the industrial sector, lack of commitment from the policy makers among others (E. Arnold et al., 2014; MoES, 2013; Smidova, 2015). The problems and causes of the insufficient performance are not really that different from those identified early in the transition period by the Danish Research Council (1992) and later by the European Commission (1999). Data on R&D expenditure over the last 15 years suggests that the commitment from both private and public sector to R&D has not sufficiently improved. Fluctuations of Gross domestic expenditure on R&D since 2010 are shown in Figure 1.

Figure 1. Gross domestic expenditure on R&D, 2000-2012, % of GDP

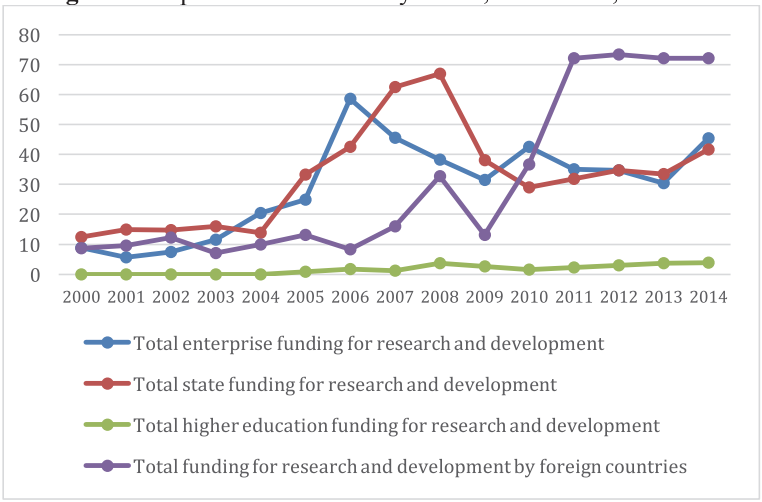


Source: Central Statistical Bureau of Latvia (CSB, 2015)

Total R&D expenditure in 2014 reached 0.68% of GDP, despite the Law on Scientific Activity (in force from 2005) that states an increase in funding should be at least 0.15% of the GDP on an annual basis until it reaches 1%. However, innovation policy has not really been among the top government priorities – the government doesn't have a long term strategic plan, but is constantly engaged in trying to solve urgent matters instead. This could be seen when the crisis hit and the budget for R&D was one of the first things that were cut and also now – investments in R&D keep fluctuating despite understanding the need to increase it.

The data in Figure 2 show that over time the funds available through various EU programmes have to some extent replaced government funding - total funding for R&D by foreign countries accounted for some 0.30% of GDP in 2014. This is a not a positive trend as the research system should be able to sustain itself when the funds eventually run out.

Figure 2. Expenditure on R&D by sector, 2000-2012, mln euro



Source: Central Statistical Bureau of Latvia

Latvia's innovation performance has fluctuated over time. According to the IUS (European Commission, 2015), Latvia is a modest innovator but shows signs of improvement and has recently become a leader in innovation growth. However, Latvia's innovation performance still is below the EU average for most indicators measured by the IUS. Data also shows that in both 2014 and 2015, indicators most important for fostering technology transfer - R&D expenditures in the business sector and public-private scientific co-publications – were among the lowest (European Commission, 2014, 2015). Given that co-authored publications are often an outcome of partnerships or associated interactions, low levels of co-authored publications point to the low level of absorptive capacity of Latvian enterprises (OECD, 2013). Although private sector's R&D expenditure overall has increased since 2000, the amount of investments has been fluctuating (showing a significant decline from 2006) and remains very low, especially when compared to the more advanced EU countries. This suggests that the rate of cooperation and absorptive capacity needs to be improved in order to integrate state-of-the-art knowledge and technology in the companies' operations.

The economic development so far has been based on low labour costs and low tech industries, while absorptive capacity of industry has not increased significantly (E. Arnold et al., 2014; Klāsons & Spuriņš, 2015). Arnold et al. (2014) also pointed out that the cluster formation in Latvia is weak and that does not encourage sharing of expertise and infrastructure among the companies, hindering ability to innovate and absorb innovation and build advantages of specialization. The majority of companies in Latvia are small and medium sized enterprises (most of which are effectively micro-enterprises or self-employed people) with limited financial and human resources for innovation that limits the capability to acquire knowledge and technology from R&D institutions and there also seems to be insufficient motivation for that.

As Rodriquez-Pose (2001) argued, in the less developed regions it is prevalence of SMEs, limited supply of skilled workforce, as well as relatively low levels of entrepreneurship that hinder practical application of academic research results, thus constraining the possible positive effects of public investment in research on innovation and economic development.

Additionally, the Commission Country Report (European Commission, 1999) suggested that Latvian companies might face additional challenges due to uneven distribution of research infrastructure in regions as most of it is concentrated in the capital city Riga. A more recent study on business activity in different regions in Latvia (Klāsons & Spuriņš, 2015) argued that only 4% of the companies would consider changing their location to be in closer proximity of R&D infrastructure, thus suggesting that they are not oriented towards technological innovation or interested in collaboration with research organisations.

According to a survey carried out by the Central Statistical Bureau of Latvia (CSB, 2014), while majority of innovative companies have developed technological innovations, most of the funds are directed to infrastructure improvements - almost 94% of expenditure went to acquisition of modern equipment or software in 2012. Only 1% of total innovation expenditure was directed to R&D outsourcing, and 3% to in-house R&D activities. In addition, the results of the survey

show that only every fourth company cooperated with someone else in innovation activities - the cooperation partners were most likely other companies or providers of components, software etc., while the least likely partner was higher education or research institutions. Despite investments, most of the companies, with a few exceptions still rely on outdated infrastructure and equipment, which makes investment in infrastructure paramount to retain competitiveness in the export markets. This pattern of investment and collaboration also suggests that the dominant pattern of innovation in Latvian companies is process innovation. As process innovation is learning-by-doing, using and interacting (DUI) type rather than science and technology-based innovation, formal technology transfer through acquisition of patents, etc. is suitable only for a small number of companies that operate in knowledge intensive sectors such as IT, electronics and pharmaceuticals, while for the rest of the economy it has little to offer.

Central Statistical Bureau of Latvia (CSB, 2015) identified 411 companies engaged in R&D in 2014, while the amount or R&D workers was 1382 – 776 R&D personnel (researchers) in full time equivalent, 606 other R&D staff (technicians and equivalent staff and research supporting staff). Although the number has increased significantly comparing to 2013, the proportion of R&D workers in the business sector is very low and the data still suggests problems with human resources and a shortage in human resources skilled in areas important for technological innovation - possible reason for low innovation absorption capacity.

However, the data on company R&D performance and staff might be imprecise and might be misleading and showing a more optimistic picture, but, as we can see now, not accounting for some innovation. After all the labor force has been declining, while the GDP has been growing since 2010, which means that there are at least some innovations, if not technological, then some process/managerial, taking place. The reason for this is the reporting on company innovation activities that has been rather poor until very recently – when the R&D tax incentive was introduced – there was no formal incentive for most companies to account for R&D and report it. The only exception might be companies with significant share of foreign capital, where accounting standards are higher and therefore also

R&D expenditure is also accounted for.

2.3. Governance of research and innovation policy

Meanwhile the science sector is highly dependent on EU funding (that has to a large extent replaced state funding) and therefore has focused its efforts on activities aimed as acquiring research funding and not necessarily addressing market demands. R&D institutions are fragmented and that has negatively affected the distribution of funding. Additional challenge for bringing this fragmented system together is the fragmentation of innovation policy making and implementation across a number of organisations, which is further exacerbated by weak coordination between ministries and in general weak and fragmented governance structures for research and innovation.

The Law on Scientific Activity determines that the Cabinet of Ministers sets the policy for science and technology, however the Cabinet is only involved as the formal decision making body. The Latvian Strategic Council for Research and Innovation, a collegial body under the cabinet created to facilitate cross-sectoral coordination in research and innovation policy, so far has not been effective in providing strategic guidance, as it failed to attract political decision makers. The Latvian Council of Science, whose role in the early transition years was more significant and was that of an advisory body, has in the recent years become more of a funding agency under the Ministry of Education and Science (further - MoES). MoES, on the other hand, has gained a very significant role as the developer and coordinator of science and technology policy since the Academy of Sciences lost its position as a policy making body (Rambaka, 2012). Innovation policy, however, is the responsibility of MoE with is own funding agency - Investment and Development Agency of Latvia (further - LIAA). Both LIAA and the Latvian Council of Science have not been established as agencies for funding innovation and research, but have instead evolved to fulfil this role (E. Arnold et al., 2014; Rambaka, 2012). However, these are not the only organisations involved in funding R&D or innovation - the State Education Development Agency (under supervision of MoES) is responsible for distributing and supervising funding allocated from ESIF to basic and

applied research. Meanwhile a number of smaller organisations are in charge of managing financial instruments to support innovation and entrepreneurship.

As noted above, research an innovation policy relies on horizontal instruments and has not sufficiently helped in focusing research, bridging science and industry, commercialising research outputs from research institutions. Fragmentation of innovation and research policy making and implementation, especially given the limited capacity and capabilities of individual organisations involved, as well as lack of priorities further exacerbate the already apparent inefficiencies.

3. INCENTIVES FOR STRENGTHENING SCIENCE-INDUSTRY LINKAGES

Objectives and instruments of R&D and innovation policy are outlined in two documents - Science, Technology Development and Innovation Guidelines 2014-2020 (MoES, 2013) and Guidelines on National Industrial Policy for 2014-2020 (NIP). This yet again points to fragmentation in R&D and innovation policy making, as STDI Guidelines were developed by the MoES, while NIP was developed by the MoE. NIP focuses on promotion of innovation e.g. improving knowledge capacity, innovation supply, innovation demand, and the technology transfer system. Meanwhile, STDI Guidelines focus on national goals and priorities for science, technology and innovation and is a part of a strategy for smart specialization, as well as promotes fulfilment of the objectives defined in national long-term and medium-term policy planning documents (MoES, 2013). Funding of policy instruments included in the STDI is administered by 3 different organisations - the Study and Science Administration (SSA), State Education Development Agency (SEDA) and the Latvian Science Council (LSC) (ibid.).

Given that innovation policy planning is directly linked to EU 7-year financial planning periods, all measures outlined in the policy documents for the current period haven't yet been launched. In this paper we therefore focus on a set of instruments that were available during the previous planning period - 2007-2013. During this period the MoES was responsible for instruments that provided funding for

R&D, while MoE was responsible for instruments aimed at supporting entrepreneurship and innovation.

Two types of support programs can be identified in Latvia, that focus on supporting science-industry collaboration. First, there are incentives that aim to strengthen the capabilities to commercialise research via structural reforms in research institutions. Second, there are incentives that support applied research projects focused on industrial application and where commercialisation of research could be a possible outcome. Some of the funding for R&D was coming from state budget, but most instruments were funded by the ESIF. The scarcity of state funding prevents implementation of internal motivational instruments thus technology transfer is largely supported by external activities.

To improve the conditions, universities and research institutions programmes like the technology transfer office (hereafter – TTO) programme have been implemented. The aim of the programme was to identify projects with an international commercialisation potential within the research organisations, provide support for securing intellectual property rights, provide consultations for both researchers and companies and provide support in technology transfer. Initially more activities were planned such as establishment of an overarching technology transfer centre that could identify projects with commercial potential in other organisations as well, would look over the unified IP portfolio of the smaller TTOs and would be as a contact point in international licencing cases, however, the economic crisis impacted the programme and it was decided to maintain the support only to the TTOs already established within research organisations.

TTOs are seen by most policy makers as the centre and primary driver of commercialisation efforts, however, as is pointed out in some studies (Grimaldi et al., 2011; OECD, 2013), only a few top universities and research institutions across the world have meaningful income from formal commercialisation of research. Therefore, one could argue, that the main objective of policy makers when developing policy measures aimed at strengthening formal technology transfer is not to improve innovation performance, but to improve the country's position in the Innovation Union scoreboard by improving

performance in terms of specific indicators where country's performance is the weakest. As a result, focus is more on the formal performance indicators and not on the real impact on innovation performance in enterprises. Bozeman (2000) describes this as the "Out-the-Door" criterion - organisations respond to external pressure by focusing on the number of deliverables such as cases of technology transfer while the impact of these cases is rarely considered. One of the reason is improvement of statistics that in return improve researchers' chances of acquiring funds while in reality the license agreements have no significant financial value.

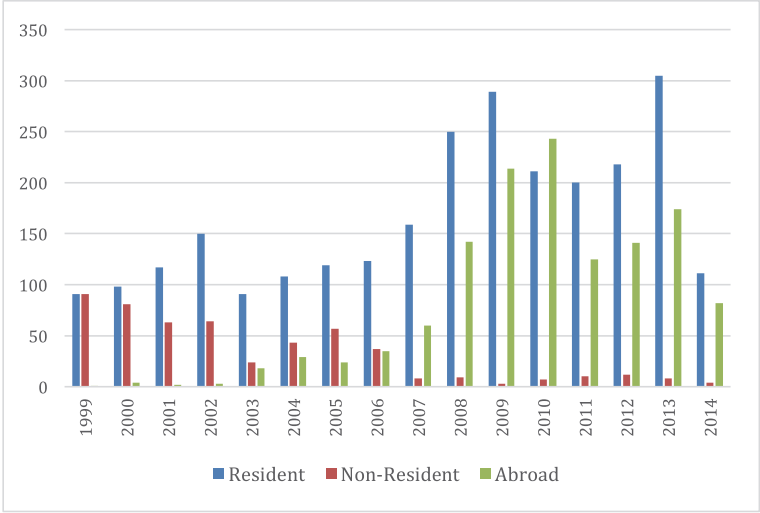
An evaluation was done on the results of the TTO programme by the MoE (2016) and the review of their activities showed that while many of the quantitative indicators (national patent applications, revenue of the TTO, contract research) were even overachieved, they had insignificant impact on the economy. During the programme there were 7 cases of sale or licensing of technologies developed by the universities and 20 cases at the Art Academy of Latvia (sales of design projects) and none of them involved foreign companies. 13 spin-off companies were developed, on average around 1000 consultations to companies or individuals were given annually. The review of the activities also states that TTOs were offering an important support for writing patent applications - while the activities and their results are important and needed, they have not visibly improved science-industry collaboration significantly in terms of technology transfer and joint ventures. Additionally, it is interesting to add that funding was distributed equally among TTOs, disregarding the type and capacity of the institutions, as well as their performance which is not motivating for the TTOs to achieve better results (MoE, 2016).

Similarly, strong emphasis is put on university patenting while university patenting just for the sake of patenting to improve statistics, should be critically evaluated, as already scarce funding goes towards patent maintenance fees, while most of these patents are likely never to be licensed at all.

Figure 3 shows that the number of patent applications originating from Latvia has increased since the 90s reaching 305 patent applications by

its residents, 8 by foreign applicants and 174 applications by this country's resident at a foreign office.

Figure 3. Patent applications from Latvia, 1999 - 2014

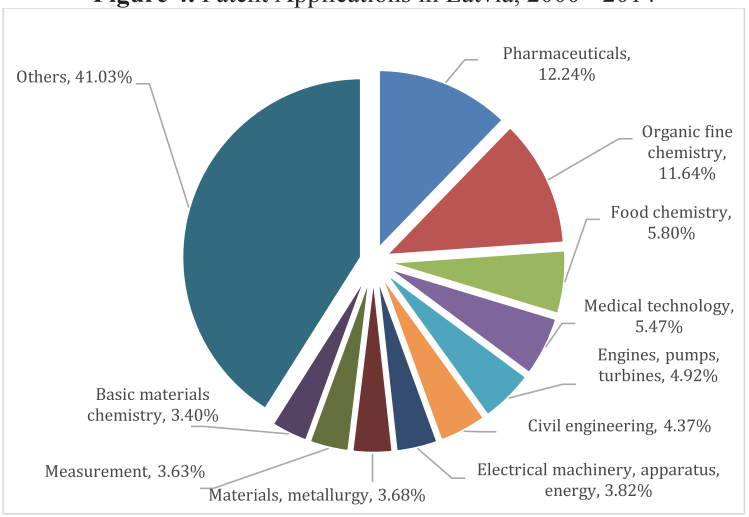


Source: WIPO statistics database (WIPO, 2016)

The sharp decline in non-resident filing might indicate the lack of interest in Latvian market, while patenting abroad suggests that local companies are seeking opportunities in foreign markets. However, it might also be misleading – as discussed above, ESIF stimulated patent applications and the years showing a significant increase match the years were patents were filed to satisfy the requirements for EU funded projects. Therefore, it does not necessarily indicate improvement. Even more - license and patent revenues from abroad have in the recent years been declining (European Commission, 2014, 2015).

Figure 4 shows the top fields where patent applications are filed. The largest amount of patents is filed within the pharmaceutical, organic fine chemistry and food chemistry which is not very surprising, taking into account the economic structure in Latvia.

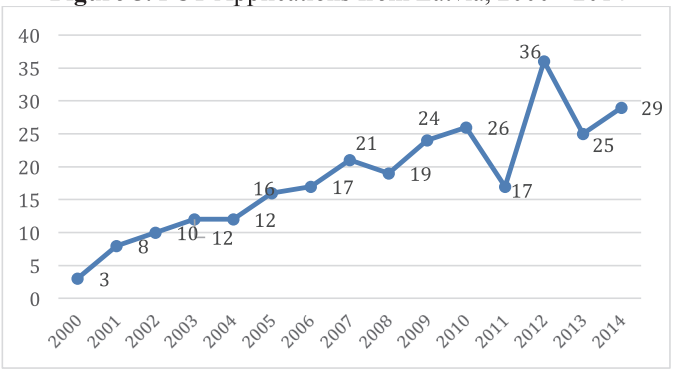
Figure 4. Patent Applications in Latvia, 2000 - 2014



Source: WIPO statistics database (WIPO, 2016)

The number of PCT applications has been steadily increasing since 2000, however, the numbers are relatively low (Figure 5).

Figure 5. PCT Applications from Latvia, 2000 - 2014

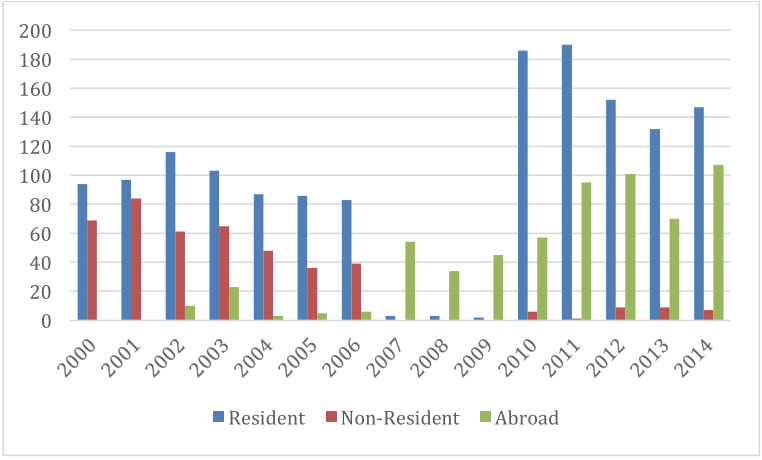


Source: WIPO statistics database (WIPO, 2016)

The top PCT applicants from Latvia are "Grindeks" – the largest domestic pharmaceutical company, Latvian Institute of Organic Synthesis working mostly on drug discovery and development, and Ventspils University College. While pharmaceuticals is the field where the most patent applications are filed, the companies in Latvia are focusing mostly on producing generic rather than original drugs.

When it comes to granted patents, data available on WIPO statistics page, shows that the overall amount has significantly increased since the first half of the 2000s, especially those granted abroad.

Figure 6. Patents granted, 2000 - 2014



Source: WIPO statistics database (WIPO, 2016)

This increase can be explained by the administrative and financial support from the TTOs and other incentives funded by ESIF. However, as mentioned previously, revenues from licensing are declining and many of the granted patents have found no use for the industry.

Along with formal technology transfer by licensing, there are other mechanisms that universities and research institutions could use, such as academic spin-offs, collaborative research, contract research and

consulting, as well as ad-hoc advice and networking with practitioners (Grimaldi et al., 2011). The more informal mechanisms of technology transfer are particularly relevant in economies with process-focused DUI mode of innovation. However, it seems that the Latvian government is more concentrating on supporting formal ways of technology transfer such as contract research and licensing.

The government is pressured to implement these incentives to meet the overall targets of the EU and success stories in other countries are being used as examples. However, the environment for technology transfer varies, therefore doing so might lead to different outcomes than expected by the policy-makers (Grimaldi et al., 2011). According to the OECD (2013), relative performance on many occasions is measured against US institutions that are widely considered to lead in terms of commercialisation outputs, however, as already discussed previously, this approach is not suitable for countries like Latvia. One of the reasons is the structure of businesses in Latvia – the needs of small and medium sized enterprises in traditional sectors often don't match with what researchers can offer. For example, many research projects in Latvia are related to key enabling technologies (such as micro and nanoelectronics, nanotechnology, industrial biotechnology, advanced, materials, photonics, and advanced manufacturing technologies) because it gives better opportunities to acquire funding, however, these technologies are often too advanced and too far from the market to be utilised even by the local industry that represent the same field. Therefore, research groups later struggle to commercialise the outputs because there are no potential users among the local companies and infrastructure for technology with a higher readiness level e.g. technology development centres, incubators, parks, prototyping laboratories and experimental plants is not sufficiently developed (MoES, 2013).

Another problem is that the complexity of the rules and regulation of ESIF funded projects and scarce budget make the beneficiaries very cautious in implementation. Therefore, research institutions seem to pay more attention to compliance with regulations rather than to concentrating on societal impact that their results could make. Although the programmes are offering new possibilities, such as the applied research projects, useful tools are overcomplicated thus

reducing the positive impact they might have had. Therefore, less complicated implementation rules might encourage not only application for support but also exploitation of the results.

While a second set of instruments helps in bringing new and better qualified human resources into companies (e.g. by raising the competences of researchers and encouraging students to purse this kind of studies), there are no instruments supporting company-subsidised research positions at universities and research institutes (MoES, 2013), as for example industrial PhD fellowships in Denmark or Sweden. That kind of collaboration would be beneficial for both and could stimulate further cooperation in other ways as well.

4. POLICIES SOLVING PROBLEMS THAT DON'T EXIST?

One could argue that throughout the last 15 years, Latvian decision makers have been copying policy instruments from more successful countries, assuming that those will ultimately improve Latvia's innovation performance. There were, however, a number of flaws in the process that did not and still, in our view, do not allow to reap maximum benefits from public sector interventions.

First, not enough attention has been paid to research and evaluation of the systemic and market failures regarding innovation and development in Latvia. Data collection on innovation activities of enterprises in Latvia has so far been limited to only a few key indicators necessary for fulfilling the EU requirements and no local initiatives to improve data collection have been introduced. Besides, collection of statistical data on innovation has not been followed by effective communication towards businesses regarding the needs for collection of these data, which ultimately negatively affects both the response rates as well as quality of data collected. With the introduction of tax subsidies for R&D spending, one could hope that at least collection of data on R&D spending will improve. However, given that Latvian enterprises are mostly engaged in the DUI type of innovation activities, most of innovative activities will still not appear in statistical reports. Lack of data undermines any efforts to evaluate gaps in the innovation system that need to be addressed via policy instruments. Therefore, if this will not be addressed, policy makers in

Latvia will continue looking for the proverbial keys where there is light, and not where the keys are.

Second, as argued elsewhere (e.g. Erik Arnold, Arnulf, Jacobsson, Romanainen, & Smith, 2010; Cepilovs, 2014), there is a general lack of capacity and capabilities in the public sector, necessary to plan, design and implement effective policy instruments. This is further exacerbated by high rates of turnover of civil servants, reaching up to 20 per cent per year (LETA, 2015). Weak capabilities and lacking capacity across the policy cycle lead to a situation where policy instruments are proposed on the basis of results of external benchmarking activities (for example, IUS), as well as best practices from more successful countries. This is not to argue that benchmarking exercises, such as IUS, are not useful or relevant, but should not substitute policy relevant research that feeds into policy practice. Normally such benchmarking exercises utilise a range of indicators that are universally applied across countries, disregarding the specificities of local environment. In case of Latvia, however, performance in a narrow range of indicators from IUS (e.g. R&D spending, PhD graduates, patenting), has served as a reference point for development of a policy mix that has been utilised to support innovation over the last decade, with very minor adjustments. This lead to a situation where solutions were chasing problems (as in Béland & Howlett, 2015).

Third, as already argued above, institutional developments that have taken place over the last 25 years, lead to a situation where science and research system has evolved in such a way as to detach itself almost entirely from the needs of domestic industry. While at the same time, given the effects of economic transition, local industry developed following a pattern persistent in many developing economies suffering from middle-income trap – relying on labour cost and not technology as a source of competitive advantage (Griffith, 2011). Reliance on low labour costs, resulted in low level of technological development across all major industries and therefore also low level of absorptive capacity necessary for utilisation of research output.

We argue that besides strengthening the capacity of existing

companies by building the competences of human resources and improving infrastructure, additional efforts should be made to support the creation of internationally oriented technology start-ups (that might be spin-offs from universities) and facilitating the interest of cooperation between sectors, not only by reminding the opportunities that innovation brings but also the dangers of not moving forwards.

5. CONCLUSIONS

A substantial mismatch between the existing policy problems and applied policy instruments exists. As a result of this mismatch, most of the policy instruments used to support innovation, and especially so those related to industry-science collaboration and technology transfer through technology licensing, have been ineffective and failed to achieve the economic effects. The only objectives that could be reached if such approach to policy making is maintained further is improving Latvia's position in the Innovation Union Scoreboard. However, this, in our view, is not likely to result in technological upgrading and increased competitiveness of local industry; neither will it lead to sustainable positive outcomes for Latvian economy, which, in our view, is the ultimate objective of public policy.

Latvian policy makers are mainly applying the "Out-the-door" criterion when developing support incentives - the results of research that is funded by public money are predefined and motivates to just deliver the numbers instead of creating the most impact as it is not relevant for receiving the funds. What matters is the number of outputs written in the proposals, e.g. license agreements, patent applications, publications. Higher possible revenue or value of the outcomes is relatively irrelevant or even unwanted as that might cause bureaucratic procedures. Due to the low amount of funding the motivation of researchers tends to be related to being able to survive instead of creating an impact on the market.

As a result, universities and other research organisations have so far focused on reaching the planned goals instead of motivating and creating entrepreneurial spirit among research groups. Incentives within universities should be implemented more to motivate researchers and students into solving existing problems for the local

market or encourage them to go international. Thus more funding for business incubators for technology-intensive companies should be planned together with university funded motivational incentives. Besides, more flexible understanding of technology transfer, including informal technology transfer through, for example, temporary employment of researchers by companies, should be encouraged. This, in combination with suitable financial incentives, could encourage creation of denser collaboration networks between industry and research institutions, potentially improving absorptive capacity of the former.

In addition, to avoid unnecessary loss of funds, the requirements of the support incentives should be balanced with the time span and tailored according to the planned outputs, e.g. if a publicly tendered licence agreement is required at the end of the protect it should apply only to projects that are working on technologies with a higher technology readiness level (TRL) and that are e.g. patentable. A large part of research conducted in universities results in know-how and thus this kind of approach with licensing is not appropriate and often further work to ensure the sustainability and continuity of the research should be done. The current approach has created a number of useless patents and caused problems with licensing the know-how – universities have developed commercially viable know-how that has potential but still needs further work and companies are not willing to obtain the licences as for them it is too far from the market to be interesting. Many companies are also driven away by the public tender requirement as it causes issues with confidentiality. A better approach would be to offer funding in steps and to carefully determine the outcomes and TRL for each step.

Governments use quantitative data on transfer cases or patent applications as indicators of how the national innovation system is improving and therefore applying this criterion is rather convenient. The increasing focus on various scoreboards and benchmarking is promoting this kind of approach in countries with a poor innovation performance. Meanwhile there are incentives like funding to establish collaboration platforms that instead does not focus on quantitative results but rather on continuous collaboration that expands beyond the

initial aim, e.g. information exchange platforms that expand into consortiums engaged in informal technology transfer activities.

Technology transfer activities of universities rarely go beyond consultations and occasional contract research or joint projects funded by the ESIF - licensing and creation of spin-offs is rare. It is important to introduce new internal incentives at universities to promote entrepreneurial spirit among researchers and raise the awareness of the benefits of technology transfer. Some universities have already developed programmes that award researcher if they bring in a company or develop a commercially viable product, however, the impact of these activities is yet to be seen.

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4 Latvia after European Union accession

Weathering the storm?[1]

Aleksandrs Cepilovs and Lauma Muižniece

1 Introduction

Latvia is located in the North-Eastern part of Europe, on the eastern shore of the Baltic Sea, sharing its borders with Estonia, Lithuania, Russia and Belarus. The population of Latvia in 2015 according to Eurostat amounted to approximately 2 million persons – it has been declining during the first two decades of Latvia's independence from its maximum of approximately 2.7 million in 1991. Latvia is relatively sparsely populated with a density of 31 inhabitants per square kilometre, spread across 64,589 square kilometres. Latvian, an Indo-European, and more specifically a Baltic language, is the official language of Latvia and one of the official languages of the European Union (EU).

Due to its strategic location and a relatively large and prosperous trading hub Riga, Latvia has over the centuries been conquered by various powers. First by the Teutonic order, then by the Polish-Lithuanian Commonwealth, by Sweden, and more recently by the Russian Empire. During the Second World War, Latvia was first briefly occupied by the Soviet Union in 1940, and invaded and occupied by Nazi Germany less than a year later, in July 1941. At the end of the war in 1944–1945 Latvia was yet again occupied by the Soviet Union, remaining a part of the Soviet Union for almost five decades, until the dissolution of the Soviet Union.

Latvia is one of the smaller economies in the European Union. With the gross domestic product (GDP) of €24,059 million (current prices, 2014), as shown in Table 4.1, Latvia is the fourth smallest EU member state, after Malta, Cyprus and Estonia.

Also in terms of per capita income, Latvia is one of the weakest performers in the EU, ranking 24th out of 28 countries, with GDP per capita of roughly €12 thousand (current prices, 2014). Latvia has a relatively high level of human development, with a rank 48th out of 187 countries in the 2014 UNDP Human Development Index.[2] While according to the earlier Gross National Income classification of the World Bank,[3] Latvia had been classified as a upper-middle-income country up to 2012, according to the new classification, it has joined the club of the rich, being named a high-income country.

Table 4.1 Latvia: some economic indicators

Parameter	*Value*
Population (2015)	1.986 m.
Area	64 589 km2
GDP (2014)	€24,059 million
GDP per capita (2014)	€12100
Government debt/GDP (2014)	40%
Government budget balance/GDP (2014)	−1.4%
Balance of trade/GDP (2014)	−0.8%
Unemployment (2014)	10.2%
Employed persons/Labour force	44.5%

Eurostat (http://ec.europa.eu/eurostat/data/database) and Central Statistical Bureau of Latvia (http://www.csb.gov.lv/en)

As we argue below, one needs only scratch the surface to see that Latvia is far from being part of the high-income club.

Latvia has not thus far attracted much attention in the literature on small states.[4] Most published studies on Latvia cover three periods, with the first relating to the collapse of the Soviet Union (e.g. Leji□š and Ozoli□a, 1997), the second to Latvia's EU accession (e.g. Mikkel and Pridham, 2004; Schimmelfennig, Engert and Knobel, 2003), and the third and most important to the recent financial crisis and the resulting economic and fiscal crises (e.g. Aslund and Dombrovskis, 2011; BlanchardGriffiths and Gruss, 2013; Kattel and Raudla, 2013; McCollum et al., 2013; Sommers and Woolfson, 2014). The post-crises literature covered different aspects from fiscal policy to migration to neoliberalism and economic policy more generally. Only a few studies have, implicitly or explicitly, used small country size as an explanatory variable (Cepilovs, 2014; Panke, 2010).

This chapter attempts to look at Latvia's EU accession in the wider context, by referring to the economic structure and performance of Latvian economy, covering three broad periods, starting from the country's independence (1918–1940), the Soviet period, and the pre-EU-accession years. The chapter also refers to Latvia's specific opportunities and constraints as a small country.

The chapter is organized into six sections. Section 2, which follows this introduction, deals with the structure and performance of Latvia 1918 and the year that the country was annexed to the Soviet Union, thus providing a background for discussion of the pre-accession period. Section 3 discusses the pre-accession period (1992–2004), and Section 4 deals with the consequences of Latvia's EU membership, culminating in the most recent financial and resulting economic and fiscal crises. Section 5 considers the positive and negative aspects of Latvia as a small state. Section 6 concludes this chapter with some remarks on future prospects.

2 The Latvian economy before 1991

2.1 Before the Soviet annexation

Before the Second World War, the level of economic development in Latvia, as well as its productive structure were comparable to that of Finland. The agrarian reform implemented in the early years of the first period of independence, which lasted from 1918 until 1940, helped develop a relatively productive agricultural sector. Between 1933 and 1935 Latvia had the third highest per capita level of grain production in Europe (Shteinbuka, 1993). By the end of the 1930s Latvia was running a trade surplus, to which exports of agricultural products to Western Europe contributed substantially. Thus, in 1938 exports of agricultural products reached 46.7% of total exports, of which exports of butter alone contributed 23.9%. Exports of timber as well as plywood accounted for a high share of non-agricultural exports, and these products still constitute a significant share of Latvia's exports today. At the same time imports were to a significant extent dominated by manufacturing equipment and machinery, fuel as well as artificial fertilisers (State Bureau of Statistics, 1939).

While agricultural commodities constituted the bulk of exports, Latvia did produce some sophisticated equipment relying mostly on German technology. Thus in the 1930s a radio and telephone equipment manufacturer VEF[5] was established and produced the smallest film camera in the world at the time – VEF Minox – designed by an Estonian engineer. The very same factory produced telephone exchanges that quickly substituted imported switches, but also were exported. In the mid-1930s Latvia began producing automobiles and trucks. While important on the domestic market, those goods did not constitute a significant share of exports at the time. As we argue below, the Latvian economy has gone full circle and after the collapse of the Soviet Union – it has returned to a productive structure very similar to that of the first Republic, namely one based on the export of commodities and products with relatively low value added.

Looking at the composition of the external trade of Latvia in the late 1930s, it is clear that Latvia depended to a great extent on its two main trade partners, Germany and the United Kingdom, that were jointly responsible for roughly 67% of Latvian exports and 64% of imports. The UK – the main trade partner at the time – was alone responsible for 39% of imported goods and consumed close to 40% of Latvian exports. Therefore, one can argue, the Latvian economy was already deeply integrated with the core European economies in the early twentieth century. This also made Latvia potentially vulnerable to external shocks, given its export structure, which was concentrated on very few commodities as well as on very few key trade partners.

2.2 The annexation by the Soviet Union

With the annexation by the Soviet Union, as the then existing trade relations were cut, the Latvian economy went through a gradual process of restructuring and integration into the Soviet economy. As specialization patterns across the Soviet Union were to a certain degree based on comparative advantage, Latvia retained some of the manufacturing capabilities that were developed earlier (e.g. telecommunication and radio equipment, manufacturing machinery).

After the Second World War, with Latvia forming part of the Soviet Union, the country went through a process of rapid industrialization, transforming itself from a predominantly agricultural into a predominantly industrial economy. A number of large enterprises were created, some of which developed and supplied parts for the soviet military industry that was spread throughout the entire Soviet Union. Most of the companies located in Latvia depended on the rest of the Soviet Union for both supplies of raw materials as well as markets. The structure of the economy changed substantially during the 1950s through 1960s, and went through a period of relatively rapid industrialization, retaining a more or less a stable economic structure in the decades before the collapse of the Soviet Union.

The total share of industry in the Latvian economy by 1980 was estimated at 56%, which subsequently declined to roughly 50% in 1990. By 1990, Latvia was still ahead of every other Soviet republic but one – Estonia – in terms of industrial production per capita. Table 4.2 shows the sectoral composition of industrial production in that year.

In some sectors Latvia held monopolistic or dominant positions in the entire Soviet Union. This was the case, for example, in railway passenger cars (100% of the total production in the Soviet Union), telephone sets (53%), motorcycles (57%), but also in electric devices for the automotive industry, agricultural machinery, pharmaceutical products, small construction machinery and instruments.

In some industrial branches most of the goods produced were exported to other Soviet republics. For example, 98% of automatic telephone exchanges, 93% of motorcycles, 89% of washing machines, 79% of radio sets and other consumer audio equipment, as well as diesel engines and diesel electric power generators produced in Latvia in the late 1980s were exported to the other members of the Soviet Union. On the one hand it meant stability of demand as long as the Soviet Union existed, on the other it yet again made Latvia dependent on a very few markets and thus vulnerable should there be problems in the core markets.

Given a relatively high share of industrial activities in the economy, many of which were with relatively high value added, and also given the availability of mass education, Latvia had a well-educated and skilled workforce, especially when compared to other Soviet republics. Another two distinctive features of the Latvian labour market were a high participation rate of women in

Table 4.2 Sectoral composition of industrial production (1990)

	Share in industrial output (%)	*Number of firms*	*Employment (% of industrial employment)*
Total	**100**	**407**	**100**
Heavy industry	**56**	**240**	**70**
Electric power	1.6	1	1.8
Fuel	0.4	10	0.7
Steel and other metal manufacturing	1.6	4	0.9
Chemicals	7.4	15	5.7
Machinery	27.9	87	38.9
Wood processing, pulp and paper	5.4	55	9.6
Construction materials	3.1	30	4.6
Glass and porcelain	0.6	6	1.5
Light industry	**18.6**	**74**	**17**
Food	**24.7**	**89**	**12.7**
Others	**0.7**	**4**	**0.3**

the labour market, as well as ethnical segmentation, which meant that the majority of Russian speakers were employed in the industry, whereas the majority of Latvians were employed in agricultural activities (Shteinbuka, 1993).

The production system of the Soviet Union was well adapted to the dominating techno-economic paradigm of mass production. Production specialization patterns were driven to a large extent by considerations of both existing manufacturing capabilities and economies of scale, as well as agglomeration effects, given that integration into large scale vertically and horizontally integrated conglomerates was a fundamental principle of the Fordist paradigm (Perez, 2002). It was not, however, well-suited to the requirements of the contemporary paradigm of information and communication technologies, where five-year plans as well as vertical integration are not as relevant due to much faster pace of technical change as well as possibilities for distributed manufacturing provided by all-pervasive information and communication technologies.

By the end of the 1980s a significant share of Latvian exports consisted of consumer goods, where Latvia's trade was in significant surplus. However, most of the goods produced were exported to other Soviet republics. Therefore, when the Soviet Union finally collapsed, Latvia, similarly to other Soviet Republics, found itself outside the existing supply chains and with no markets

to sell to. While one can only speculate, whether it was the shift of techno-economic paradigms that provided the basis for dissolution of the Soviet Union, it is clear that the economies that broke away in the early 1990s, found themselves in an environment where they had to transform themselves almost entirely in order to remain afloat, or else be submerged by the wave of competition from both East and West.

3 The post-Soviet period

3.1 Latvia regains independence

Latvia followed a liberal trade regime from the very first years after re-gaining independence in 1991. By submitting a Trade Memorandum in preparation for accession to the World Trade Organization (WTO) and engaging in negotiations with WTO members, Latvia clearly signalled its willingness to abandon any remaining restrictions on trade and to participate in international markets on equal terms. In early 1995, a free trade agreement with the EU became effective, eliminating tariffs on the majority of industrial goods, as well as defining a schedule for reduction of tariffs on a range of agricultural products over the next five years. Liberalization of trade reached its climax in 2004 when Latvia together with nine other countries joined the EU, where Latvia has since been an equal partner. The question, however, is whether this has led to convergence towards European levels of productivity and welfare, or whether conversely this has led to increasing divergence and long term unsustainability of the Latvian economy.

3.2 The restructuring of the economy

Latvia and its northern neighbour Estonia were perhaps the most ardent proponents of shock therapy[6] as a means of restructuring of the economy away from a rigid system of Soviet planning and towards a free market economy. It was, however, a shock without the subsequent therapy. Most of the Central and Eastern European (CEE) countries set off on a reform path in the early 1990s, focusing on a standard set of reforms often propagated by the Western institutions including the International Monetary Fund (IMF) and the World Bank, complemented by a range of reforms of institutional nature – the so-called 'Augmented' Washington Consensus (Rodrik, 2006). The primary emphasis of the reforms was on the liberalization of the economy. There was a clear and widely shared understanding that a move away from the past public ownership strategy towards a market economy was necessary. The reforms thus primarily focused on handing over the decision making over allocation of resources to the private sector, which was met with increasing enthusiasm both among the elites and population more generally.

The other side of the reforms was focused on containing inflation and ensuring wage and price stability, reducing the tax burden and in general

strengthening the workings of the market. Following a spurt of inflation in 1991, after 1992 the Government of Latvia focused on anti-inflationary policy as part of the programme supported by the IMF. The programme, widely advocated in countries across the post-soviet space, emphasized price liberalization as well as strict fiscal, monetary and incomes policies, as a basis for economic development. These policies were effective in reaching the objectives posed. Thus, by late 1992 the consumer price index was stabilized, the Bank of Latvia strengthening the Latvian rouble (temporary currency introduced as a passage from the Soviet rouble to Latvian lats), as well as gradually reducing interest rates for commercial lending. These policies also helped to turn both current account and trade balance positive, as well as keep the state budget balanced. However, while the financial conditions were showing signs of stabilization, the real economy was facing a steep cliff. At the time not many realized that rapid and deep liberalization of prices, trade barriers and elimination of state intervention would ultimately result in the collapse of output, a spike in unemployment, poverty and subsequent depopulation. Between 1990 and 1993, following the collapse of the Soviet Union, Latvia experienced a GDP per capita drop of 40% in real terms and since then lost more than 20% of the population along the way.

While many of the analysts ascribed the decline of output to a typical Keynesian recession, fuelled by decline in consumption (e.g. Berg et al., 1992), Calvo and Coricelli (1993) argued that it was not a normal Keynesian recession, but an effective 'trade implosion', as a result of the break from the old system of economic coordination and production. This argument served as grounds for development of the theory of optimal transition speed (e.g. Aghion and Blanchard, 1994; in Tiits et al., 2008).

3.3 Trade in the aftermath of the Soviet period

Before the break-up of the Soviet Union, Latvia depended on a few Soviet republics for its exports. With the break-up of the Union, demand for goods produced in Latvia in the post-Soviet space collapsed almost instantly. The shift to world market prices for energy, oil and other raw materials resulted in adverse terms of trade with the former Soviet Union countries – the main suppliers of raw materials as well as consumers of products produced in Latvia. Sharp increases of prices on energy and raw materials resulted in rapid increases in production costs, which further exacerbated the fall of output. The volume of industrial production fell sharply, in 1992 representing only 65% of the level of output in 1991. A similar situation could be observed in agriculture, where in 1992 output constituted just 70% of that in 1991, while at the same time prices continued to grow faster than expected. By 1993 GDP was 40% lower than the 1990 GDP (see Figure 4.1) with the largest decline in the construction industry (-65.4%).

Due to their small domestic markets, small countries are significantly more dependent on exports than larger ones, and especially so in manufacturing

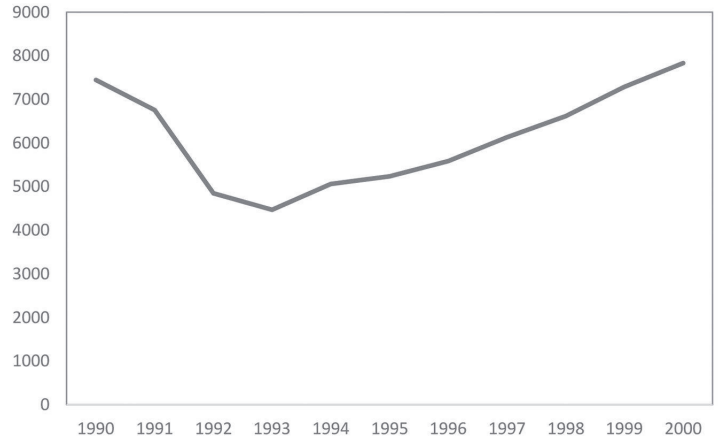

Figure 4.1 GDP at current US$ (millions)
United Nations (UN) DATA and World Development Indicators (http://data.un.org/Data.aspx?d=WDI&f=Indicator_Code%3ANY.GDP.MKTP.CD), the World Bank

industries (where volume tends to have a large impact on selling price). With the increasing liberalization of trade regimes across the world, larger countries have also been increasing their share in international trade, especially during the 1980s and in the following decades. This resulted in increasing competition on international markets and as a result, a much more difficult environment for a small state like Latvia.

As Reinert and Kattel (2007, 2004) argue, the earlier wave of European integration that brought the southern countries of Greece, Italy, Spain and Portugal into the union with France and Germany, allowed for gradual adjustment. The above-mentioned Southern European states (perhaps with the exception of Greece) were able to develop productive structures similar to those of the core countries through a period of gradual and relatively slow liberalization of their trade regimes. It is hard to claim that integration of the Southern-European states was an absolute success, particularly given the effects of the recent financial crisis. They do, however, still exhibit higher levels of GDP per capita, value added and productivity than Latvia. Integration of the Southern-European states was similar to the upgrading of the East Asian countries, which went through a process of sequential technological upgrading – the so called flying geese pattern of development (see e.g. Ozawa, 2003). In the case of the Nordic countries, to use a taxonomy of integration devised by Reinert and Kattel (2004), integration was symmetrical, as all countries were at a relatively similar level of technological development, and their economies were largely built upon increasing returns

activities In the case of the Baltic States, including Latvia, and more generally across the rest of the former Socialist countries, integration was of a rather different nature.

In contrast to the previous wave of integration, Latvia opened its markets almost instantly, which did not allow for a gradual transition and restructuring of the economy. Neither did it allow Latvia to maintain and further develop the manufacturing capabilities it had in place at the time of the disintegration of the Soviet Union. By the late 1990s the proportion of GDP constituted by manufacturing declined from above 50% to around 30%.

Latvia along with other CEE countries, was integrating into a union made up of countries with substantially higher productivity levels, and thus the Latvian companies that operated in the same markets as companies from Germany or Denmark, were not competing on a level playing field. This had led to a so-called Vanek–Reinert effect, meaning that in the case of rapid liberalization of trade and markets between countries (or regions, as in the case of integration of East Germany with the West) with significantly different levels of development, the first to suffer will be the most advanced industries in the least advanced country (or region) (Reinert, 2004). This is what effectively happened in Latvia during the 1990s. As Figure 4.2 suggests, over the last decade, productivity in all Baltic States, including Latvia, has improved only marginally and has remained at significantly lower levels than in the more advanced European countries, but also below the EU average. Therefore, convergence of the Baltic States with the rest of Europe in terms of productivity remains a long-term objective.

While one could argue that this was an effect of the tertiarization of economy, similar to what has happened across the developed world since the 1970s, data suggest this was not the case. For high quality knowledge-intensive services to

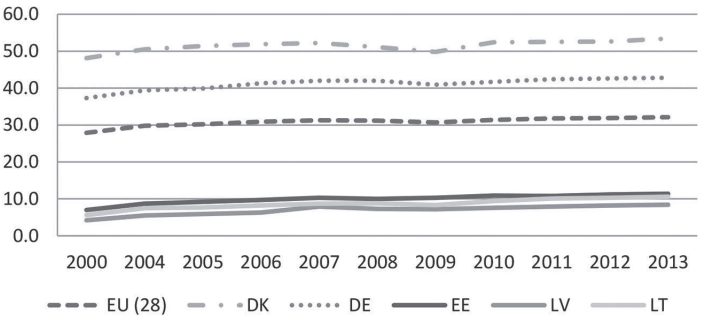

Figure 4.2 Labour productivity per hour worked (in euros)
DK – Denmark; DE – Germany; EE – Estonia; LV – Latvia; LT – Lithuania
Eurostat (available at: http://ec.europa.eu/eurostat/en/web/products-datasets/-/TSDEC310)

develop, manufacturing is absolutely essential, as it ensures domestic demand necessary for development of such services (Reinert and Kattel, 2007). The deindustrialization of the 1990s did not lead to the development of knowledge-intensive services, with the exception of consumer banking, which was driven in part by the influx of non-resident finance from the East as well as the entry of several Scandinavian banks onto the market. Value added data suggest that Latvia did not develop any significant knowledge-intensive services with export potential.

Thus, during the 1990s the share of industrial employment and value added declined, whereas the share of services in both employment and value added increased. This structural change led to significant trade imbalances, which was, however, offset by inflow of foreign direct investment, which gradually picked up from the mid-1990s onwards.

3.4 FDI as a development strategy: promises not fulfilled

From the early 1990s Latvian policy makers focused on the attraction of foreign direct investment (FDI) as the single most important policy instrument for economic development. Many believed at the time, as many still do, that by creating an environment favourable to FDI primarily through lowering taxation and weakening regulation of business activities, FDI would instantly flow in and transform the economy, ultimately leading to prosperity. The common view was that FDI would not only bring the financial resources necessary to restructure the newly liberalizing economies. It would also provide the necessary managerial and accounting skills, technology and knowledge, as well as access to new markets that would not be accessible otherwise. It was thus argued that FDI would inevitably lead to faster economic development in countries that opened their borders to it (Porter, 1990).

Latvia was not alone in favouring such a strategy. A number of countries relied on FDI to a lesser or greater extent in order to drive the structural transformation of their economies. FDI can serve both as a source of finance to balance the current account, as well as a source of technology and knowledge necessary for economic transformation. One such mechanism for technological upgrading through foreign direct investments is integration in global value chains. However, as Tiits et al. (2008) suggest, this strategy does not necessarily and always lead to success. Unlike larger countries that are able to pool capital to achieve the minimum necessary scale, smaller countries face greater challenges not being able to rely solely on domestic savings in order to finance development and industrialization and therefore often have to rely on foreign investment as the core source of funds.

Some countries, such as Singapore or Ireland, managed to utilize FDI as a development strategy more or less successfully (for Ireland see Buckley and Ruane, 2006; for Singapore, Lim and Pang, 1991). History offers examples of both positive and negative effects of FDI on economic development. What historical examples also suggest is that FDI operating within a broader

context of government strategy or development plan is more effective as a means to industrialization than an approach that relies on private sector driven FDI choices only.

The Latvian government did not opt for a strategic approach to FDI, but rather allowed the market actors to decide on this matter. Therefore, the approach to specific policy measures to attract FDI was also focused on a relatively standard set of instruments, such as tax incentives. An important factor during the early 1990s was privatization of state-owned enterprises, which, however, was not as successful as in Estonia, given the powerful domestic interests that often created obstacles for strategic foreign investors willing to invest in Latvia. Apart from the relatively low taxation, accompanied by low levels of regulation of business activity, the two main attractions for foreign investors to invest in Latvia, similarly to the other CEE countries, were new markets as well as relatively inexpensive production inputs, including labour, energy, and some raw materials (Johansen, 2000).

The Nordic countries from early on perceived the Baltics as part of their home markets, resulting, since the mid-1990s, in an increasing presence of Nordic financial companies, as well as wholesale and retail operations in Latvia and the Baltics. Some of the companies entered Latvia directly, for others Estonia became a platform for entering the other Baltic markets, as well as Russia (Tiits, 2006). As Figure 4.3 suggests, throughout the two decades after re-independence, FDI into manufacturing remained relatively insignificant in Latvia, staying at around 20% until 2003 and then declining steadily, as FDI flowed into the FIRE (finance, insurance and real estate) sector. In manufacturing, most of foreign direct investment in Latvia went into relatively resource-intensive low-tech industries, such as wood processing, food processing, as well as textiles and clothing, and to a much lesser extent into mid-tech or high-tech manufacturing, such as electronics (Tiits, 2006, see also Figure 4.3). Similarly to other countries that liberalized their markets, Latvia had quickly developed substantial current account deficits and FDI played an important role in balancing both trade and current account deficits, which Latvia would not have been able to balance through exports alone.

By focusing on low taxation and low cost of inputs as the main advantage for attracting FDI, Latvia was competing on the market with a number of developing countries around the world. While Latvia did have a relatively well-educated workforce, it did not focus enough on upgrading skills and human capital more generally. It is, however, difficult to sustain a low cost strategy in the long term, whilst at the same time trying to increase the standard of living, given that at some point the costs of inputs will eventually increase. Most of the CEE countries, including Latvia, had experienced difficulties in providing the skills necessary for enterprises operating in global production networks. The earlier experience of East and South East Asian economies suggests that focusing on development of specific skills that are considered important for future industries is crucial to both sustaining the

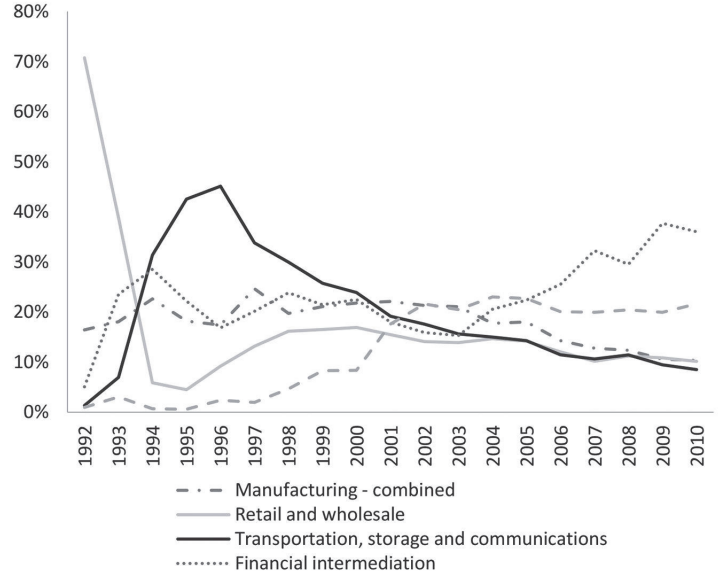

Figure 4.3 Cumulative FDI by type of activity, 1992–2010
Central Statistical Bureau of Latvia (http://www.csb.gov.lv/en/statistikas-temas/investment-database-30534.html)

inflow of FDI as well as developing local industries. This also, to a degree, explains the pattern of FDI in Latvia, where most of the FDI inflow is in the FIRE (for finance, insurance and real estate) sector, as well as retail and transportation, with a relatively small share going into low- and medium-tech manufacturing.

The inflow of FDI fuelled consumption expenditure and construction, at a time when the Latvian labour force was contracting, led to rapid wage increases. The major European industrial countries managed to contain the increase of labour costs at relatively low levels, relying on the mechanisms of a coordinated market economy,[7] managed to contain growth of labour costs at relatively low levels, relying on domestic institutions. This, together with growing productivity, led to divergence and not convergence of competitiveness between the 'old' and the 'new' EU member states (Hancké, 2013). As Figure 4.4 suggests, while labour costs in the 'core' countries of the EU kept stagnating, in Latvia they were growing steadily most of the years between the break-up of the Soviet Union and the recent financial crisis of 2008, thus severely affecting the competitiveness of local industry as well as Latvia's attractiveness as a low cost destination for FDI.

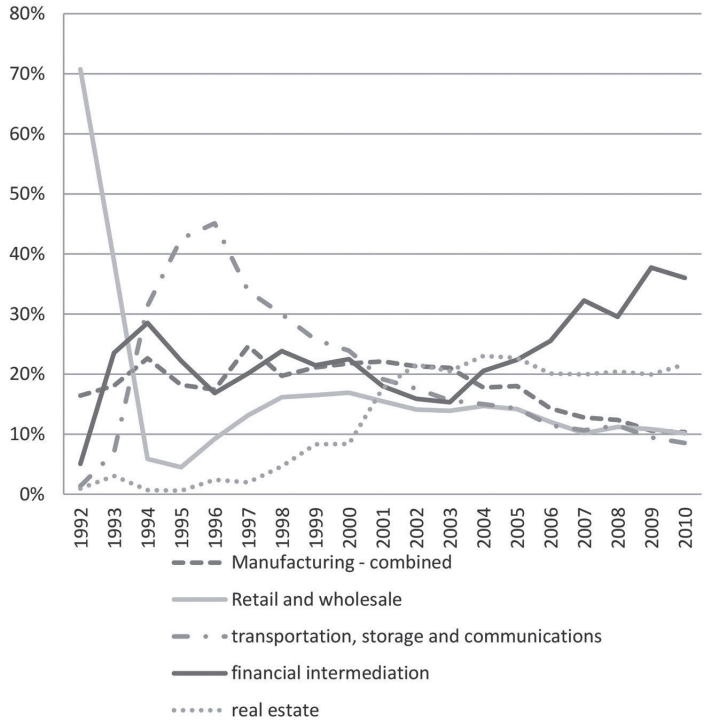

Figure 4.4 Labour cost index in Latvia compared to selected market economies (2000=100%)
DK – Denmark; DE – Germany; LV – Latvia; NL – Netherlands; AT – Austria; SE – Sweden
Eurostat (available at: http://ec.europa.eu/eurostat/web/labour-market/labour-costs/main-tables)

The approach adopted initially – welcoming all kinds of FDI in all industries – failed to take into account the aspects discussed above, thus failing to utilize FDI for domestic industrialization and therefore also creating a system relying on foreign capital inflows in order to balance the current account. The massive inflow of foreign investment that began in the years leading to accession to the EU, and subsequently continued until 2008 driving the consumption and real estate boom, had effectively destabilized an already fragile system.

4 Latvia as an EU member

4.1 The prelude

With the benefit of hindsight it can be said that Latvia entered the EU from a policy environment that determined the subsequent outcomes. Certain policy decisions made over the first decade of independence created a path which it was politically difficult to leave. First, it was a conscious choice to rely on liberal economic policies without creating an institutional environment necessary for the normal functioning of a market economy. Second, the decision to maintain the currency peg did not allow Latvia to develop internal capacity for effective monetary policy. Third, the choice to have a relatively low tax burden effectively limited the power of government when dealing with financial and economic crises.

During the first decade after re-gaining independence, Latvia had to re-create a market economy from scratch. However, given the already mentioned lack of resources – both financial and human – Latvia faced severe difficulties in creating an institutional environment to support the effective and efficient functioning of a market economy. The insolvency and bankruptcy law was underdeveloped, and the court system lacked, and arguably still lacks, the necessary resources in order to effectively carry out its duties. Regulations of financial markets and institutions were lax, and the capacity and capabilities of regulators were weak, resulting in a number of banking crises in the 1990s and the last two banking crises in 2008 and 2011. This, in turn, led to a very unstable economy. In contrast to its northern neighbour, Estonia, from the early 1990s Latvia developed its own oligarchy, which affected the process of privatization, the functioning of state-owned enterprises, as well as the political system. Latvia also had relatively high levels of tax evasion, which had a negative effect on both public service provision and the efficiency of the Latvian economy more generally. Therefore, EU membership offered an opportunity to strengthen the institutional environment and thus improve the efficiency of the economy.

Since the very early years of the new republic, there had been commitment to maintaining the currency peg, first to the currency basket, and later to the euro. The exchange rate at which the lats was pegged to the SDR[8] in 1994 was relatively high, which in turn had two effects on the Latvian economy: first, to the benefit of consumers, imports became relatively cheap; second, to the disadvantage of the exporting producers, their exports instantly became more expensive, making them less competitive in their export markets. The conditions under which Latvia was integrating into the wider Europe therefore strongly resembled the conditions under which Eastern Germany integrated with Western Germany with somewhat similar consequences (see e.g. Pohl, 1991).

There was also the commitment of centre-right governments to maintain low tax burden over the last two decades, with the average tax burden

fluctuating somewhere close to 30%, substantially limiting the scope of instruments at the government's disposal in case of a major economic crisis.

4.2 Latvia accedes to the EU

Latvia acceded to the EU in 2004, together with nine other countries, seven of which were Central and Eastern European countries and two Mediterranean island states. Following accession, the average annual growth rate between 2004 and 2007 was 10.3% – a growth rate Latvia had never experienced before. The growth, however, has not been organic or sustainable, as it was to a large extent based on foreign lending which fuelled the real estate market. It was also accompanied by a double-digit inflation, a housing boom with housing prices tripling in just five years between 2003 and 2007 (European Commission, 2010), and an appreciating real exchange rate (see Figure 4.5), all which signalled an overheated economy.

Throughout the boom years, unemployment went down from 14% in 2000 to 6% in late 2007. Labour market imperfections[9] in Latvia led to unprecedented wage increases throughout the pre-crisis years, in the whole economy, and particularly in sectors related to real estate.

The rapid wage rate increases could also have been caused by the relatively high emigration rates as surplus labour left the country (for a detailed account see Woolfson, Sommers and Juska, 2015). According to the most recent census of 2011, Latvia lost close to 15% of its population over the prior decade and this trend has continued since (see Figure 4.6).

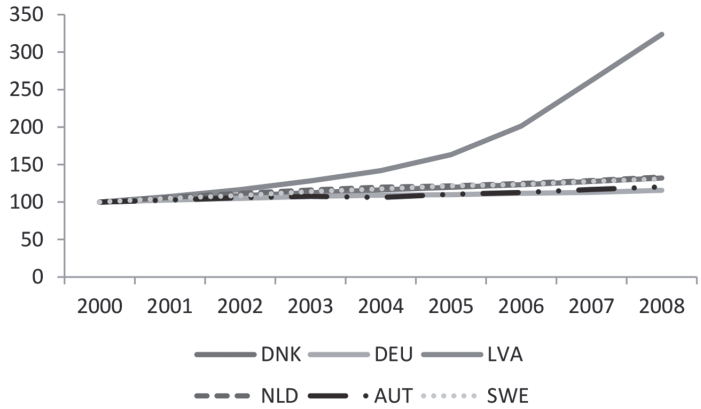

Figure 4.5 Real effective exchange rate (CPI-based) 67 trade partners
Bruegel database (available at: http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/)

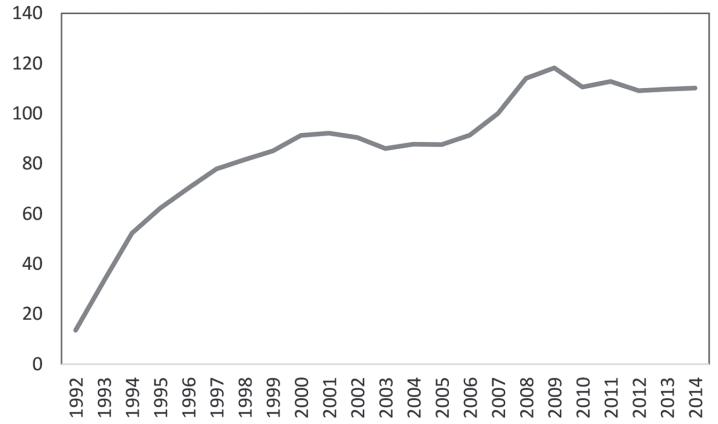

Figure 4.6 Population dynamics
Eurostat – Population change – Demographic balance and crude rates at regional level, NUTS 3 (available at: http://ec.europa.eu/eurostat/en/web/products-datasets/-/DEMO_R_GIND3)

Wage growth significantly exceeded productivity growth and led to a deterioration of the competitiveness of domestic exporting industries and of those producing for the local market. This in turn led to growing trade deficits in the balance of payments.

There are different strategies available for adjustment to the balance of payments imbalances. Some countries, including Latvia, tightened monetary policy through interest rates (foreign lending was already very limited at the time) and cut public spending. These measures, in combination, led to a severe recession, with substantial losses of output (over 20% of GDP over three years from 2008–2010).[10] Other countries, such as Poland or Iceland used external devaluation in order to deal with the crisis. (Iceland is a special case here, being a member of the EEA, but not a member of the EU.) Hungary went for a combination of both – currency depreciation and budget cuts. There are different explanations for the variation in choices between different countries, but what is clear is that policy makers' choices in terms of macroeconomic policy responses to this kind of crises are not determined solely by rational economic considerations, but also by path dependencies, existing commitments, political considerations and certain ideas dominating policy discourse. This was the case in Latvia with regard to the policy decision as to whether internal devaluation, by adjusting unit labour costs, was to be preferred over external devaluation, by adjusting the exchange rate of the domestic currency.

While in theory currency devaluation could have helped exporting industries, it would not have helped those industries where the import content of

produced goods was high. At the same time currency depreciation would have hurt those individuals and firms owing debt denominated in foreign currencies. One of the possible solutions to avoid bankruptcies would have been to legislate debt re-denomination according to the new currency exchange rate. However, this would have been politically difficult given that most of the banks that would have been negatively affected were Swedish banks, and Sweden was one of the bilateral partners providing part of the rescue funds in 2009. Arguably, Sweden could have also blocked both IMF and EC funds if necessary, as was the case with the UK and the Netherlands when these countries blocked an IMF rescue package for Iceland (see e.g. Boyes 2009). Thus here again factors that could have limited policy options for Latvia were the small size of the country and the corresponding weakness in political and economic clout.

As Kuokštis and Vilpišauskas (2010) have argued, internal devaluation was a preferred policy choice grounded in the consensus of both policy makers and expert communities. They suggest that even though the policy of external devaluation was proposed by a number of prominent economists, such as Krugman (2008) and Roubini (2009), this policy option was not given any substantial thought. As Raudla and Kattel (2013) argue, adoption of the euro was viewed as an exit strategy by governments of all Baltic states, hence giving up the peg would have meant giving up – at least for the time being – the adoption of the euro, and therefore also losing a real, almost tangible objective for policy action. In addition, given the history of monetary policy in Latvia, the Central Bank had no experience with managing a free-floating currency, and thus no competences to manage a non-automatic currency system (Raudla and Kattel, 2011).

5 Latvia as a small state

5.1 Integration – not simply an economic problem

While it is clear that integration into the wider Europe was essential for Latvia for purely economic reasons, there was certainly more to it than just economics. Small countries have been seeking for some kind of economic, political or military protection for centuries (Alesina and Spalaore, 2005), mostly through bilateral arrangements, in order to compensate for their weakness (Handel, 1990). In the twentieth century with the establishment of a number of international organizations in the aftermath of the Second World War, small states turned to multilateral arrangements to provide them shelter. These states, some of which had gained their independence from colonial powers in the 1960s, sought economic protection in such multilateral organizations as the International Monetary Fund, the World Bank, and the World Trade Organization.

The small Western European countries also utilized multilateral organizations in order to compensate for their weaknesses – the Organisation for Economic Co-operation and Development, the Organization for Security Co-operation in Europe (OSCE), as well as NATO and the EU. Nordic countries

formed their own alliance – the Nordic Council – in order to increase both economic efficiency through cooperation, and enhance their political power.

As Thorhallsson (2011) argues, small states can adopt different approaches to dealing with the effects of the globalized economy coming in the form of financial or economic crises, or both. Some small states, following Katzenstein (1987, 1985), rely on a domestic buffer in order to deal with the effects of economic openness. This domestic buffer comes in the form of domestic corporatist arrangements and development of a comprehensive welfare state and active labour market policies, as was the case in the Nordic countries facing economic uncertainty in the mid-1980s.

Given that small countries can be hit by a crisis swiftly and particularly hard due to their high degree of trade openness, especially when their most important exporting industry suffers a blow, this kind of corporatist and welfare arrangement can help soften the shock and manage the crisis, thus containing the potential long-term damages. These arrangements, Thorhallsson (2011) argues, worked well at the time of the Bretton Woods system, which regulated capital flows, thus effectively limiting the effects of the crisis to the level of an economic sector or, at worst, a national currency. With the liberalization of international financial flows that ensued after the break-up of the Bretton Woods system, these internal arrangements have become increasingly less effective as a mechanism for containing financial or economic shocks.

A major challenge in the case of small open countries is managing an independent currency. In spite of limitations relating to policy capacity and currency reserves necessary, even a relatively small country can successfully manage its own currency, as examples of Norway and Sweden suggest. However, for some countries, having their own currency can at times be more of a disadvantage. One such example is Iceland, which suffered a substantial currency depreciation after its recent financial crisis (see e.g. Boyes, 2009; Thorhallsson and Kattel, 2012). This was also the case with the UK in 1992 and a number of Asian countries in 1997 (for an account of such financial crises see Eichengreen, 2004).

On the economic front, as Latvia was transferring to a free market economy and restructuring its industry, there were many unknowns with regard to the policies most suitable for the creation of a sustainable economy that would be capable of weathering both internal and external shocks. The new system required both new political leadership, capable of steering a nascent market economy, as well as a new bureaucracy, capable of implementing the policies. As domestic capacity to effectively manage change was very limited, Latvia had no other option but to seek external support in both carrying out the reforms, and in ensuring external security.

5.2 National security considerations

Latvia also found itself in a system with too many unknowns on both economic and political fronts. Until 1994 Latvia still had a Russian military

presence on its territory, posing an immediate threat from within. However, Latvia was successful in exploiting its membership in international organizations such as the UN and the OSCE in order to put pressure on Russia to move its military forces out of Latvian territory.

National security was at the core of the process of integration. Latvia, being itself a small state, was surrounded by other small states – most of them sharing a similar post-Communist background. At the same time Latvia, along with Estonia and Finland was (and still is) sharing a border with Russia – a rather unpredictable neighbour, especially in the light of the war in the Chechen Republic (see e.g. Baumanis, 1996). At the same time Latvia's expenditure on defence remained around 1%, rising up to 1.4 in the post-accession and pre-crisis years of 2004–2007. Both its Southern neighbour Lithuania and Northern neighbour Estonia spent substantially more, at around 3% and 2% respectively. However, given the size of the countries, their independent military spending in absolute terms is so minuscule, that without an external partner they can hardly protect themselves in case of military aggression from the East. Thus, for Latvia, joining international organizations such as the EU and NATO was a question of national security and therefore of paramount priority (see e.g. Apinis and Leji□š, 1995, 1996; Baumanis, 1996; Leji□š and Bleiere, 1996).

Thus in addition to the neoliberal economic ideology dominating within the political elite, which was the main force driving economic integration, it was also the uncertain security situation that served as an additional stimulus for faster integration into the wider union.

5.3 Latvia's small size and EU accession

In large part, it was the size of Latvia that limited the scope of available policy options. Thus, lack of local capacity and capabilities within the public sector, often found in small countries (see e.g. Randma-Liiv, 2002), affected the quality of policy making in all areas. Here, integration in the EU had a positive effect, improving policy-making at least in some areas. Weak regulation of the financial sector, with regulators unwilling or unable to take an active stance, resulted in a fragile system, which, in turn exacerbated the effects of the recent global financial crisis. A passive approach to economic policy-making, marked by unwillingness to engage in strategic steering of the economy, resulted in a productive system that is still relying on cost of inputs as the main competitive advantage – hardly a sustainable strategy for a small open economy.

The same unwillingness to prioritize and focus resources in certain strategically important areas of science and research, in large part grounded in government failure, resulted in a fragmented science and research system, with too few resources available in order to reach the critical mass. Even the process of implementation of the concept of smart specialization (see e.g. McCann and Ortega-Argilés, 2013), which has specialization at its core,

resulted in selection of areas of specialization defined so broadly as to include all industrial and scientific branches. Smart specialization, is a regional concept, and is used as such in large countries, however, in smaller countries, such as Latvia, it is used on a national level. Yet again, one can see that smallness affects policy choices – policy makers fear specializing in certain sectors or industries as there is the possibility that the wrong one might be chosen.

6 Conclusions

The objective of this chapter was to point out the challenges faced by Latvia during the pre-accession period, the impact of EU integration on the Latvian economy, and to define the context within which the changes took place. Covering all aspects of European integration within the confines of a single chapter is something we did not intend to do; instead we focused on economic challenges. Of course, addressing economic challenges should also have included a discussion of the Latvian research and innovation system and the challenges pertinent to it. The idea that innovation is essential for sustainable economic growth and development is no longer on the margins of economic thought and policy-makers across the world, and especially in the EU, place strong emphasis on innovation as one of the main drivers of the economy. Science and research thus become essential, as they are the main sources of inputs into both the knowledge and human resources necessary for innovation in the public and private sectors. However, due to space limitations, we decided to avoid this discussion altogether. The chapter also discussed some implications associated with Latvia's small size.

We argued that some policy choices made before accession to the EU to a great extent predetermined the policy landscape within which new policies were and are being designed and implemented. We also argued that, to a large extent, it was the size of Latvia that limited the scope of available policy options.

As to the advantages and disadvantages of Latvia's accession to the EU there are, as always, two sides to the argument. One can only speculate, what would have happened to Latvia, should the country have chosen not to join the EU – it is after all impossible to run experiments on such a scale. Integration in the EU provided a sense of security. It also provided a source of investment in infrastructure, which Latvia most likely would not have been able to secure on its own. It also improved policy making in no small way, especially when it comes to fiscal and financial policy making in the post-crisis years. But it also had its negative effects, leading to deindustrialization and the resulting substantial emigration – mostly of those most needed in the economy, and also contributing to the severe economic crisis that Latvia went through following the global financial crisis. It therefore remains to be seen whether Latvia will find its own path for sustainable development or remain dependent on the rest of Europe in future.

Notes

1 *Acknowledgement: the authors thank Riaz K. Tayob for comments on the earlier draft of the chapter. All remaining mistakes and omissions remain the authors' responsibility.
2 Available here: http://hdr.undp.org/en/composite/HDI.
3 Information about the World Bank classification of countries into income-group categories is available at: http://data.worldbank.org/about/country-and-len ding-groups. The World Bank periodically revises the income per capita thresholds.
4 With the exception of a number of studies published by two institutions – Latvian Institute of International Affairs and the Bank of Finland Institute for Economies in Transition.
5 Valsts elektrotehniskā fabrika is the Latvian State Electro-technical Factory.
6 This refers to the rapid implementation of a comprehensive set of reforms aimed at transforming a post-socialist into a normal market economy (see also e.g. Sachs, 1995).
7 According to a varieties of capitalism typology suggested by Hall and Soskice, 2001.
8 Special Drawing Rights – a reserve asset, created by the IMF on the basis of four international currencies.
9 On the role of labour market institutions in explaining the outcomes of the crisis for the members of the euro zone see (Hancké, (2013).
10 For dissenting views see Blanchard, Griffiths and Gruss (2013) and Walter (2013).

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