European Commission

Specific Support to Lithuania

Background Report

Horizon 2020 Policy Support Facility

Research and Innovation

Specific support for Lithuania – Background report

European Commission
Directorate-General for Research and Innovation
Directorate A — Policy Development and Coordination
Unit A4 — Analysis and monitoring of national research and innovation policies

Contact (H2020 Specific Support for Lithuania):
Eugenija PUČIŪTĖ, Policy Officer: eugenija.PUCIUTE@ec.europa.eu

Contact (H2020 PSF coordination team):
Román ARJONA, Chief Economist and Head of Unit A4 - Roman.ARJONA-GRACIA@ec.europa.eu
Stéphane VANKALCK, PSF Head of Sector, Unit A4 - Stéphane.VANKALCK@ec.europa.eu
Diana SENCZYSZYN, PSF Team Leader, Unit A4 - Diana.SENCZYSZYN@ec.europa.eu

RTD-PUBLICATIONS@ec.europa.eu
European Commission
B-1049 Brussels

Manuscript completed in September 2017.

Luxembourg: Publications Office of the European Union, 2017

PDF ISBN 978-92-79-69838-5 doi: 10.2777/496082 KI-AX-17-009-EN-N

EUROPEAN COMMISSION

Specific Support for Lithuania

Background Report

Prepared by the independent experts:
Agnė Paliokaitė, Visionary Analytics

2017 Directorate-General for Research and Innovation EN

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ABBI	Alliance of Baltic Beverage Industry
ASU	Aleksandras Stulginskis University
BERD	Business Expenditure on Research and Development
CEE	Central and Eastern Europe
DDT	Design, development and training
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Funds
FDI	Foreign direct investment
FTMC	Centre for Physical Sciences and Technology
GDP	Gross domestic product
GOVERD	Government intramural expenditure on research and development
GTC	Nature Research Centre
GVC	Global value chain
HEI	Higher education institution
HERD	Higher education sector expenditure on research and development
ICT	Information and communications technology
KIS	Knowledge-intensive services
KPI	Key performance indicator
KTU	Kaunas University of Technology
LAEI	Lithuanian Institute of Agrarian Economics
LAMMC	Lithuanian Research Centre for Agriculture and Forestry
LMT	Research Council of Lithuania
LMTA	Lithuanian Academy of Music and Theatre
LPK	Lithuanian Confederation of Industrialists
LSMU	Lithuanian University of Health Sciences
LSTC	Lithuanian Social Research Centre
LVPA	Public Institution Lithuanian Business Support Agency
MITA	Agency for Science, Innovation and Technology
MoE	Ministry of Economy
MoES	Ministry of Education and Science
MOSTA	Research and Higher Education Monitoring and Analysis Centre
OAC	Open access R&D infrastructure (concept used as of 04-2016), open access centre (concept used until 04-2016)

OECD	Organisation for Economic Co-operation and Development
PRO	Public research organisation
PSF	Project support facility
R&D	Research and development
R&I	Research and innovation
RDI	Research, development and innovation
RI	Research Infrastructure
RIO	Research and Innovation Observatory
SME	Small and medium-sized enterprise
SSC	Shared services center
STEAM	Science, technology, engineering, arts and mathematics
STEM	Science, technology, engineering and mathematics
TTO	Technology transfer offices
UNCTAD	United Nations Conference on Trade and Development
VAT	Value added tax
VGTU	Vilnius Gediminas Technical University

INTRODUCTION

The European Commission's Directorate-General for Research and Innovation set up a Policy Support Facility (PSF) under the European Framework Programme for Research and Innovation 'Horizon 2020' to support Member States in reforming their national science, technology and innovation systems. The PSF provides best practice, leading expertise and guidance to Member States and Associated Countries on a voluntary basis, through a broad range of services to address their specific needs: (1) 'Peer Reviews' of national R&I systems; (2) 'Specific Support' to countries; and (3) 'Mutual Learning Exercises' on specific R&I topics. The Lithuanian Government expressed its interest in a PSF Specific Support activity focused on two subjects:

- Cooperation between the public science base and business; and
- Attracting innovation-oriented foreign direct investment (FDI).

The **aim of this report** is to provide experts with the main background information regarding the two key subjects outlined above. It provides information in a concise way by concentrating on data not available in other recent reports, such as OECD (2016) or the Research and Innovation Observatory's RIO reports for Lithuania. Numerous reviews and studies on Lithuania's innovation system and innovation policy have already been carried out. Therefore, this report has referred to them in order to summarise relevant findings and build upon them.

The **questions** addressed in each topic are as follows:

- Business-science cooperation: data on industry-research cooperation (including recent trends and comparison with other countries in the Baltic Sea Region and Central and Eastern Europe); demand for technological upgrading; and current policy framework and the main challenges that exist.
- FDI: evidence on Lithuania's FDI performance (including recent trends and comparison to the country's main competitors), the country's position in global value chains, and innovation-oriented FDI in Lithuania; and the main drivers for and barriers to FDI in Lithuania.

It is also important to note that both subjects are interlinked – all the points raised regarding cooperation between the public science base and business are directly relevant and highly pertinent to attracting innovation-oriented FDI.

The author would like to express her sincere gratitude to the specialists at Invest Lithuania, Agency for Science, Innovation and Technology (MITA) and Research and Higher Education Monitoring and Analysis Centre (MOSTA) for providing the required data and materials, as well as the experts (Alasdair Reid, Michel Lemagnen and Emily Wise) who provided valuable insights on the possible outline of this report. While thanking these people for their time and expertise, the analysis and any errors therein remain the responsibility of the author.

EXECUTIVE SUMMARY

The Lithuanian Government expressed its interest in a PSF 'Specific Support' activity focused on:

- Cooperation between the public science base and business; and
- Attracting innovation-oriented foreign direct investment (FDI).

Both subjects are interlinked – all the challenges with regards to cooperation between the public science base and business are directly relevant and highly pertinent to attracting innovation-oriented FDI.

The analytical Background Report provides an overview of the main facts and figures in relation to the two focus areas and of the existing public policies, legislations, strategies and/or concrete initiatives/measures related to these topics.

1 COOPERATION BETWEEN THE PUBLIC SCIENCE BASE AND BUSINESS

1.1 Overview of the existing evidence on science-busines cooperation

Recent trends in industry-research collaboration in Lithuania do not provide a positive outlook for the future. First, although data indicates that Higher education sector expenditure on research and development (HERD) funded by business is comparable to that of Germany as a percentage of GDP, this does not correlate well with other indicators. For example, the shares of innovative companies collaborating with higher education institutions (HEI) and research institutes are 2.4 % and 1.4 %, respectively (2014 data). These shares are in decline. Also, there is a mismatch between official data on HERD funded by business and that on contract research and development (R&D). Secondly, contract R&D fell from EUR 7.3 million in 2009 to EUR 4.1 million in 2014, although it remains generally volatile. Thirdly, although the performance of open access centres shows positive trends (in 2015, the value of contracts from Lithuanian business increased to EUR 5.1 million, and from foreign businesses to EUR 1.25 million), the overall performance remains very limited. In comparison, Fraunhofer-Gesellschaft in Germany (67 institutes and research units) generates EUR 1.8 billion from contract research annually[1], i.e. on average, EUR 26.87 million per *one unit* per year (EUR 9.6 million in revenues from industry). According to Technopolis Group and Ernst and Young (2014), Open access R&D infrastructures (OACs) are likely to face a sharper increase in expenses than revenues at least until 2020 and will not have enough funds to

[1] About 70 % of total contract research comes from industry and publicly financed research projects, the remaining 30 % being provided by federal and state governments. Industrial revenues reached EUR 641 million in 2015, i.e. approximately EUR 9.6 million per unit (Fraunhofer-Gesellschaft (2016)).

reinvest in research infrastructures (RI) (about EUR 118 million will be needed to keep them up to date).

Most contract R&D is performed in technological sciences. Information and communications technology (ICT) companies demonstrate a high level of collaboration with universities and other research organisations. However, a lot of this cooperation is in the field of higher education rather than R&D. Other fields receive significantly less attention from businesses.

According to some surveyed businesses, the main *drivers* of cooperation are: a) less costly services; b) faster services; c) more support from government agencies if projects are implemented together with research and HEIs (MOSTA and LPK, 2014). Five key *barriers* to cooperation are:

- Mismatch between supply and demand of public R&D services and knowledge (due to limited business absorptive capacities, public R&D system being too focused on basic science, and a lack of international-level R&D results);
- Information asymmetry and limited access to public RIs, bureaucratic and complicated procedures applied by public RIs, and a lack of flexibility and motivation. Most RI projects are dominated by the host institution's agenda and are too weakly linked to a wider partnership (industrial, societal) strategy.
- Unfavourable researcher career rules, internal institutional policies and other career and funding conditions, such as: over-dependence on academic publications, high teaching load, etc.;
- Lack of professional technology transfer services and active approach when working with business (both local and foreign);
- Insufficient human capital in R&I and poor work (salary) conditions, especially for young researchers. Not only has delivering R&D services to business become a challenge, but it is also a bottleneck for achieving any mid-term and long-term R&I goals.

1.2 Demand for technological services from business sector

Data on business absorptive capacities show limited capacities to absorb public R&D knowledge or investments without simultaneously dealing with capacity building. According to the European Commission (2016a), Lithuania rates as the seventh lowest of the 141 countries analysed, regarding overall knowledge absorption in 2015.

'Pure' R&D innovation is pursued by firms in those industries or market niches where there are more technological opportunities, the knowledge base is more closely linked to natural or engineering sciences, and the returns from private investment can be appropriated, at least partially. In Lithuania, this is only the case in a small number of niche industries. Several small high-tech sectors are shooting up from the research base, namely biopharmaceuticals, ICT and photonic technologies. However, these sectors are small and fragmented. Furthermore, most of business R&D investments are made by SMEs, in contrast to some other peers (e.g. Hungary) where a small number of relatively big

performers create the majority of business expenditure on research and development (BERD) and companies are better linked to the global value chains. Both aspects point to the lack of critical mass to produce high impact innovations and /or innovations new to the market.

In other industries, firms invest much less in research and focus more on development, or innovate either by acquiring new technology produced by others, modifying products or using industrial design. Nevertheless, there is potential in these more traditional fields, such as the food sector, energy, transport, etc., as reflected by Lithuania's Smart specialisation priorities and emerging success stories like the 'BOD Group' or 'Amilina'.

In 2014, Lithuania defined its Smart specialisation strategy based on its national strengths. The strategy identifies 20 priorities[2] which are grouped into six priority areas. Data from the first call for 'Intelektas. joint science-business projects' funding joint R&D projects suggests that:

- Most good-quality applications were submitted by 'Health technologies', 'Transport and ICT' and 'New production processes, materials and technologies'. The poorest-quality applications were in the 'Inclusive and creative society' priority area.
- The lowest demand for cooperation (as per share of total number of applications with a science partner) was in 'Agro-innovation and food technologies' and 'Energy and sustainable environment' whilst the highest demand was in the 'Inclusive and creative society' and 'Transport and ICT' priority areas. These results should be considered with caution because some of partnerships may be 'formal' in order to score higher evaluation points in the project selection process.

1.3 Policy framework and proposed changes

Large investments made previously in public RIs (EUR 364 million, excluding investments in clusters) were necessary considering the poor condition of the research base. However, in itself, investment in RI did not improve firm competitiveness, and now a lot relies on how effectively it will be used. Despite improving the public science base, these investments also contributed to RI fragmentation, due to the poor coordination of activities (OECD, 2016). The policy mix for 2014-2020 was expected to be more focused on exploiting the RIs created for economic R&D results, thereby strengthening industry-research collaboration. To achieve this, innovation culture and skills in the Lithuanian universities and institutes were urgently required.

On the positive side, compared to the policy mix of 2007-2013, the current one pays greater attention to encouraging cooperation between science and business. At least five policy instruments ('Innovation vouchers', 'Joint science-business projects' (Ministry of Education and Science), 'Intellect. Joint business-

[2] Priorities and their implementation Action Plans in English are available here: http://www.sumani2020.lt/en/

science projects' (Ministry of Economy), 'Development of competencies of researchers in knowledge-intensive firms' and 'Inocluster') provide direct investments for cooperation. Indirect investments are made in innovation promotion services, matchmaking (Inogeb LT) and development of technology transfer centres. The policy mix also provides a larger variety of instruments and is better balanced in terms of addressing innovator types, the innovation cycle covered, innovation supply-and-demand side instruments (including a pre-commercial procurement measure), and measures aimed at R&I-based foreign direct investment (FDI). Nevertheless, current policy framework still has several flaws:

- High fragmentation of documents, public agencies, research and HEIs, etc., also leading to over-regulation.
- High fragmentation of R&D infrastructures and their different types (valleys, open access centres, competence centres, technology transfer centres, innovation centres, etc.), information asymmetry regarding available R&D services, and lack of effective knowledge and technology transfer programmes.
- Lack of cooperation in designing instruments, which does not allow for the creation of synergies.
- Slow implementation of funding instruments from the 2014-2020 operational period.
- Specific gaps in the policy mix concerning joint industry-research projects which may discourage institutions from participating, rendering funds devoted to intersectoral cooperation obsolete**.**
- Overcomplicated European Structural and Investment Funds (ESIF) regulations and rules (EU and national) leading to a lack of easy-access and easy-to-manage instruments.

In response to the above, previous studies of the Lithuanian innovation system proposed the following:

- Research and HEIs should be encouraged to pursue more active technology transfer activities and to open technology transfer institutions.
- The system of research careers should be modified so that commercialisation of R&D results would have a more positive impact on the career advancement of researchers.
- Investment in developing RIs should be limited to cases where it is clearly shown that such improvements would be beneficial for the business sector.
- Strengthening management capacities in research and HEIs so that they provide better conditions for intersectoral cooperation.
- Priority should be given to those R&D projects which include industry-research cooperation, and financing intensity should be lower than 100 %.
- The network of innovation-support institutions should be optimised; developing RIs or technology/competence centres should be more clearly

linked to the clusters' projects and soft measures for networks, R&I collaboration and capacity building.

- Recent key changes to the regulatory framework include: a) revisions of the Law on Research and Studies (2016); b) the Lithuanian Science and Innovation Policy Reform Guidelines, proposed by the President of Lithuania (2016) which focus on reforming R&I governance (coordination and funding) and consolidating the public network of RIs and HEIs; and c) a process for optimising the network of public research and HEIs initiated by the Lithuanian Government. Currently, the stated ambition is that up to five universities will remain.

2 INNOVATION-ORIENTED FDI

General trends

Lithuania's main competitors in terms of attracting FDI are other countries in the Baltic Sea Region and Central and Eastern Europe. Compared to regional competitors, Lithuania is a modest performer in this respect. Furthermore, FDI investments are of a comparatively lower quality, and have not served as a catalyst for Lithuanian sectors to improve their position in the global value chains (GVC). Lithuania's position in the GVCs has not improved significantly and the country shows low 'backward participation'[3]. Growth in inward FDI is amongst the lowest in the group of countries of reference (see Chapter 2.1). As regards greenfield projects attracted per million population, Lithuania was one of the leading performers in the Baltic Sea Region (2011-2015). However, the size of value per greenfield investment for 2012-2015 was low, even though 2011 saw a large amount of inward FDI. Compared to all Lithuanian companies, on average, foreign-affiliated enterprises established in Lithuania create more jobs, have a higher turnover, invest more per person employed, create more value added at factor cost, and are more productive. However, compared to competitor countries, they do not perform particularly well. This is especially true for turnover per enterprise and value added at factor cost per enterprise.

In the period 2010-2015, the majority of FDI (in terms of employment) went into knowledge-intensive services sector (KIS), or more specifically – shared services sector (SSC) – making Lithuania a regional hub for exported SSC services. The number of shared services centres increased over time, totalling 45 during 2010-2016 (with 7115 jobs planned). However, this may become a risk in the longer term since labour costs are expected to rise significantly in Lithuania. Meanwhile, FDI in the medium-high technology sector is increasing, although its share is over five times smaller than that in KIS. A worrying trend is the lowest and declining FDI in the high-technology sector. The highest share of FDI is in financial services (except insurance and pension funding), real estate activities, and the manufacture of coke and refined petroleum products, chemicals and (bio)pharmaceuticals.

Vilnius attracts more than half of the FDI projects, followed by Kaunas (15 %) and Klaipėda (9 %).

Lithuania's performance

Although Lithuania only attracts a small number of R&D projects, FDI is considerably higher in the area of design, development and training (DDT), making Lithuania one of the top performers in the region. The majority of DDT projects are implemented in ICT. With nine FDI projects in R&D over 2010-2016, Lithuania is above Latvia and Estonia, but well below most other competitor countries, and the share of R&D projects in the total FDI portfolio is

[3] This indicator corresponds to the value added of inputs that were imported in order to produce intermediate or final goods/services to be exported.

small. According to Create Lithuania (2016), in the period 2010-2014, the number of R&D projects per million population was 0.7 in Lithuania compared to 34.3 in Ireland, which is among the top performers in this respect. During the same period, the share of R&D-based FDI projects was 2 % in Lithuania compared to 20 % in Ireland. Nonetheless, the number of R&D projects attracted by Invest Lithuania tripled from 2013 to 2015 (from one to three projects per year).

There are positive trends in terms of emerging ICT 'hot spots' in the fields of gaming, cyber security and fintech, while success stories in the life sciences/biotech sector were more evident a few years ago.

Drivers and barriers

According to investors, the availability of a highly skilled workforce is the main motive for choosing Lithuania as the location for investment, whilst also being a key emerging barrier. Other drivers mentioned by investors include business environment and regulation, domestic market potential, and infrastructure and logistics. Lower costs seem to play a smaller role than might be expected (MCJ Lemagnen Associates analysis based on *Financial Times* fDi Markets database). However, this may be also understated as data is only available for public announcements. Nonetheless, there are indications that Lithuania is losing the advantage of being a low-cost country.

Given the regulatory environment, restrictiveness for FDI is not high in Lithuania, and is found primarily in specific sectors only (e.g. air transport). Despite this, the regulatory environment has several structural flaws:

- Relatively high level of labour taxation;
- Too rigid regulation of labour relations (121st out of 138 according to the World Economic Forum (WEF), 2016);
- High administrative/regulatory burden (92nd out of 138).

In addition to regulation-related barriers, skills mismatch and diminishing availability of a skilled workforce (especially in regions other than Vilnius) play an important role. Lithuania fails to both retain and attract talent. According to the World Competitiveness Index, it ranks only 106th in retaining talent, while the ability to attract talent is even worse (111th place) (WEF, 2016). The potential shortage of human resources in important fields such as ICT or engineering may force investors to choose other countries.

Finally, all critical issues in the R&I area, such as lack of coordination, poor working conditions for young researchers leading to a lack of human resources to deliver R&D services, or lack of open access to RIs, are relevant. Combined with the inadequate availability of a workforce, they could further hinder attracting innovation-oriented FDI, especially R&D projects. Create Lithuania (2016) shows that investors already lack availability of and accessibility to RIs. Other than that, additional improvements such as better air traffic connectivity between Vilnius and major cities and better economic diplomacy are also advocated.

FDI policy and reform proposals

Invest Lithuania is the main institution for facilitating active FDI. Its strategy for 2016-2020 sets targets for 2020, among them: 182 FDI projects in high- or medium-value-added sectors, and at least 43 R&D-based FDI projects. This strategy identifies specific target sectors: manufacturing (electronics, metal manufacturing, industrial equipment, consumer products); life sciences (medical and industrial biotechnology); and services (shared service centres, technical support centres, design, development and testing – including IT development – and data centres). To some extent, they overlap with the country's Smart specialisation priorities.

To attract innovation-intensive FDI, three European Structural and Investment Funds (ESIF) funded instruments have been launched: SmartParkas LT (EUR 13m) funds infrastructure for free economic zones; Smartinvest LT (EUR 5.8m) funds active facilitation of FDI; and Smartinvest LT+ (EUR 43.4m) funds FDI in R&D activities, RI and organisational innovations. Nonetheless, to date, the quality of the project pipeline for Smartinvest LT+ has been poor and the majority of the applications were rejected. In addition, Lithuania provides corporate profit tax incentives for R&D. In the case of investment projects, a reduction of up to 50 % in corporate profit tax is available. Start-up visa was introduced in 2017.

Recent years have witnessed the advocated reforms needed to increase Lithuania's attractiveness to foreign investors, both in general and with innovation orientation in particular. This includes reform guidelines put forward by Invest Lithuania (2016b), and a study by Create Lithuania (2016), etc. Recent Science and innovation policy guidelines (2016) also focus on attracting foreign investment.

The main reforms proposed by previous studies include: a) restructuring education systems to ensure that the demand for skills is satisfied; b) introducing measures to retain and attract talent; c) increasing the availability and accessibility of RIs; d) strengthening institutional cooperation and increasing institutions' efficiency; e) increasing funding and support for FDI; and f) making the business environment more friendly through improved regulation (labour tax system, regulation of labour relations, etc.).

1 COOPERATION BETWEEN PUBLIC SCIENCE BASE AND BUSINESS

1.1 Overview of the existing evidence on business-science co-operation

1.1.1 Mapping key institutional actors

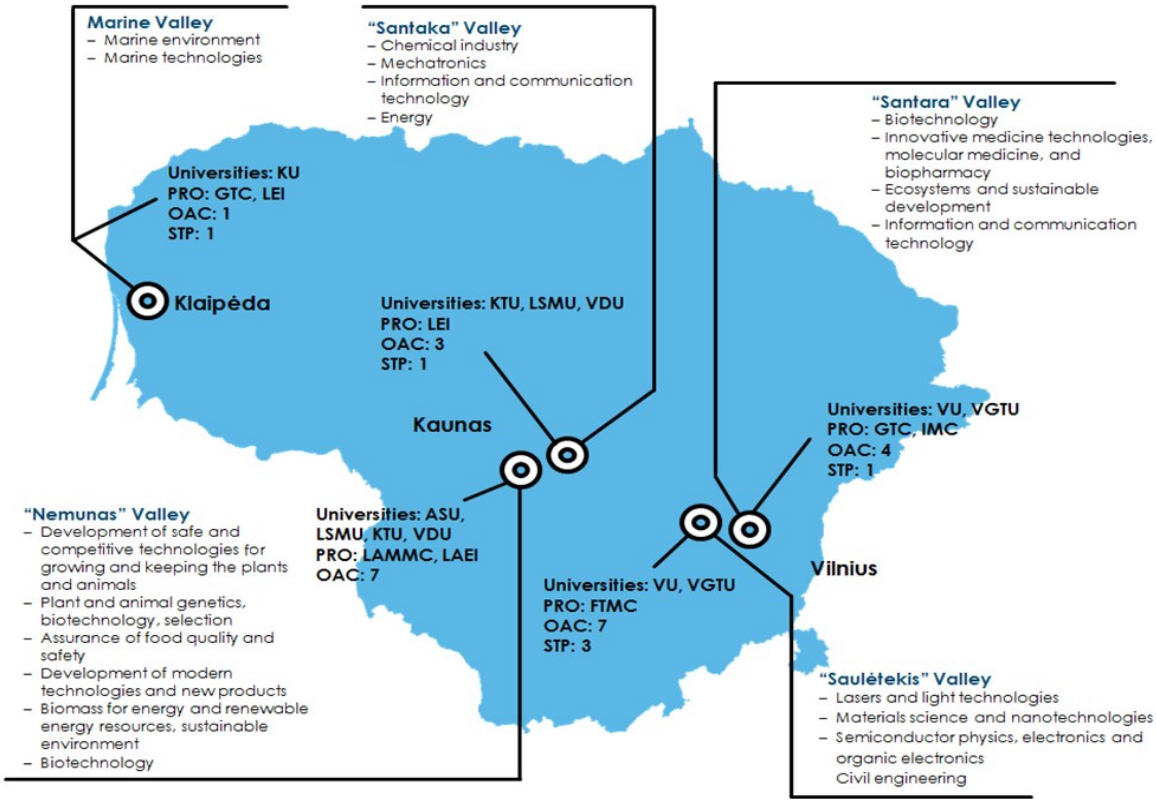
In Lithuania, the R&D effort is predominantly ensured by the public sector, represented by 14 state universities and 13 research institutes as well as other public research organisations (PROs) created and/or managed by them. The quality of public R&D varies greatly[4]. Although there are islands of excellence, overall Lithuania is lagging behind (22nd in the EU with respect to percentage of publications in the top 10 % most-cited publications). International collaboration in publishing and international publication are also lower than the EU-28 average (24th in the EU in both cases). This means that either publication, especially in top-quality journals, is not incentivised, or there are serious issues with the quality of human resources as a consequence of limited funding and lack of science internationalisation policies (Paliokaitė, Krūminas, Stamenov, 2016). At the same time, public R&D commercialisation and systemic collaboration have faced serious problems (reflections of path-dependency): over-dependence on basic science, outdated public R&D base and unattractive research careers, confrontation between high- and low-tech industries, lack of social capital and network failures, weak innovation diffusion system, and low motivation to learn (Visionary Analytics, 2015).

Since 2007, substantial policy focus was on upgrading public R&D infrastructures (RIs), which led to creation of the concept of science, studies and business valleys (further on – **valleys**) and development of **open access centres** (OAC)[5].

[4] For a detailed overview of R&D quality in different R&D fields in Lithuania please see hyperlinks: a) Evaluation of the national research potential for the national smart specialisation process, based on quantitative data (2013); b) Research Assessment Exercise including panels of international experts (2014-2015): a summary and thematic reports. For more on the roles and quality of various institutions, see OECD (2016), chapter 4.2. 'Higher education institutions and public research institutes' (p.89), and 'Incubators, science and technology parks (STPs) and networks' (p.147).

[5] Although regulation on open access infrastructure adopted in 2016 no longer uses the concept of 'open access centre', this report employs this term as it was used for the majority of the period analysed and is still being used in various public information sources.

Figure 1: Mapping valleys and open access centres by their R&D specialisation



Notes: PRO – public research organisation, OAC – open access centre, STP – science and technology park.
Source: MITA (2016b), publicly available information on valleys

The main idea behind valleys and OACs was the development of RIs which would enable the public research system by providing services to external users both from the public and private sectors. In parallel, several other types of institutions were developed to promote cooperation: **clusters**, **science and technology parks**, **technology transfer and/or innovation centres** (managed by universities), etc. An interpretation of the roles of these institutions is provided in the Annex 6.

Table 13 in **Annex 4** provides data on 2007-2013 ESIFs invested in the OACs/clusters, and structures OACs according to their size, income from business, related clusters and number of employees (so as to provide an estimate of the current 'workforce' on the supply side). Meanwhile, Table 14 In the same **Annex** provides detailed mapping of existing industrially relevant labs and services structured by Smart specialisation priorities and types of organisations. Data in these tables show that previous European Regional Development Fund (ERDF) investments into RIs were quite fragmented in terms of R&D fields and competences. As a consequence, the OACs network is also fragmented, and many OACs are very small and lacking critical mass (some

with only a couple of employees which points to a clear lack of human potential to exploit created RIs).

In 2015, OACs employed a total number of 870 employees, of whom 622 were researchers. The main OACs in terms of human resource capacity were: the National Open Access Scientific Research Centre for Future Energy Technologies (181 employees, of whom 133 are researchers), the Centre for the Advanced Pharmaceutical and Health Technologies (111 and 79), the Centre for Innovative Medicine (89 and 66), and the Research Centre for Animal Nutrition, Health, Biotechnologies and Food, and the Centre for the Material of Animal Origin Quality (jointly 89 and 71). The least number of people were employed in Open Access Centre of Prototype formation and integration (1 and 0), Open Access Center of Processing Technologies – BALTFAB (2 and 0) and Joint Open Access Center (2 and 1)[6].

The average number of employees per OAC is 48.5, and the average number of researchers – 29.3, with medians being 21.5 and 17, respectively. Only 7 OACs have more than 50 employees. In comparison, in Estonia, the Competence Center of Food and Fermentation Technologies employs 55 people[7]. In 2015, Fraunhofer-Gesellschaft's 67 institutes and research units employed 24 084 people (i.e. on average 359 people per single unit)[8].

The main technology fields covered by the valleys and OACs are depicted by Figure 1 above. There is no clear classification of OACs according to technology areas. Some of the OACs are very broad thematically (e.g. National Innovation and Entrepreneurship Centre), while others concentrate on very narrow fields (e.g. Open Access Centre for Modeling of Fruit and Vegetables Processing Technologies).

A country of Lithuania's size has a large number of **clusters**, which is yet another indication of high fragmentation (see Chapter 1.3.1 for a more detailed discussion on this). The concept of the development of Lithuanian clusters 2014 sees clusters as "an accumulation of companies and (or) science and study institutions and other entities which operates on the principle of partnership and whose members acting in different interrelated areas of economic activity and initiatives seek to improve economic performance and increase its effectiveness". According to the concept of developing Lithuanian clusters, they must include at least five independent companies. Specifics for research and HEIs are not listed[9].

---

[6] Note: Data on Vilnius University Physical Sciences and Technologies Research Center, Vilnius University Laser Research Centre Facility "Naglis", the Open Access Centre of Conversion and Chemical Coatings, and the National Innovation and Entrepreneurship Centre were not available.

[7] Information on the Centre of Food and Fermentation Technologies is available here: http://tftak.eu/about_us/

[8] Fraunhofer-Gesellschaft (2016).

[9] "Structures or organised groups of independent parties (such as innovative start-ups, small, medium and large enterprises, as well as research and knowledge dissemination

According to MITA (2016a), in 2016, there were 53 clusters (although one of them had started bankruptcy processes)[10]. Some of them are still at the embryonic stage or are represented only by groups of enterprises whose collaboration was sparked by the desire to take advantage of the EU Structural Funds. Only a quarter of the clusters identified are formed naturally, by developing new products or services through long-term co-operation and seeking to gain a bigger market share, thus enhancing the overall competitivity of the cluster enterprises.

MITA also states that there are only a few clusters operating[11] successfully: Photovoltaic Technology Cluster, Alliance of Baltic Beverage Industry (ABBI), Laser and Light Science and Technology Association, and Modern Housing Development Cluster. Other sectors with the potential to form the clusters in Lithuania include: wood processing and furniture manufacturing; machinery and devices, metal processing industry; food industry; textile and clothing; chemistry industry; laser and their component manufacturing industry; information and communication technologies; biotechnology industry; creative industry; wellness and well-being industry; 'eco' industries.

MITA (2016a) indicated that all clusters are carrying out R&D activities, but these are of limited scope as they lack financial resources. More precise data on the scope or areas of R&D activities is not available. At the same time, there is a lack of information on infrastructure available in clusters. The main source of available information is a list of research infrastructure projects that were supported through the ESIF in 2007-2013. This includes 11 clusters which developed research infrastructure in the following areas: a) ICT (e-services, anti-piracy, banking); b) photovoltaic technology; c) food; d) biomedicine (orthopaedics, rehabilitation, stem cells, odontology); e) creative industries and cinema; f) lasers; and g) engineering (see Annex 4 for more detailed information).

Despite the emergence of a significant number of clusters, Lithuania ranks only 97th out of 138 countries with respect to the state of cluster development (World Economic Forum, 2016). A study on clusters (Knowledge Economy Forum, 2012) showed that they primarily emerged in services (including information technologies), the chemical industry and food and beverage sectors, centred either in the most populous locations (Vilnius, Kaunas, Klaipėda, etc.) or those with specific strengths (e.g. spa cluster in

---

organisations, non-for-profit organisations and other related economic actors) designed to stimulate innovative activity through promotion, sharing of facilities and exchange of knowledge and expertise and by contributing effectively to knowledge transfer, networking, information dissemination and collaboration among the undertakings and other organisations in the cluster."

[10] A list of Lithuanian clusters is available here: http://www.klaster.lt/en/clusters

[11] For example, in the context of the Incluster instrument, the main expected results are: a) new members attracted to supported clusters; and b) prototypes/concepts of products, processes or services created in supported clusters. This indicates a willingness to increase the size of existing clusters and encourage them to carry out innovative activities.

Druskininkai). Existing clusters are small (most less than 10 companies) and depend on external funding, including funds from the EU. In almost all cases, the cluster members' investment into cluster activities has not exceeded 60 %. Among the clusters, 84 % indicated they had experienced an increased turnover and 83 % agreed that their exports were also higher than at the start of the cluster (Knowledge Economy Forum, 2012). However, it is not clear how much of the increase can be attributed to clustering itself.

MITA is taking an active role in the clusterisation process as a facilitator/coach.

In addition, eight **science and technology parks** and an increasing number of **technology transfer and innovation centres**, such as National Innovation and Entrepreneurship Centre at Kaunas University of Technology (KTU), provide commercialisation services. They include contracted research and equipment rental; transfer of technology solutions for business; intellectual property management; science entrepreneurship and search for funding sources; and consultation. In 2012, Demola was established in Vilnius, and currently has 30 annual projects with 150 students. Importantly, partners have licensed 40 % of project outputs. The main platform for finding and ordering relevant R&D services from PROs is the online **eScience Gateway**[12] managed by MITA. This website provides access to more than 2500 different R&D services, but it is somewhat underdeveloped. For example, less than a fifth of listed R&D services are assigned to a particular industry sector, and less than a third of listed R&D services are assigned to a specific science field. Therefore, it is not easy for private companies to identify services relevant to developing their product or technology.

To conclude:

- From 2007-2015, Lithuania upgraded its public, semi-public (clusters) and private R&D infrastructure. A network of public R&D laboratories was created referred to as open access centres and managed by HEIs. Currently, exploiting these R&D resources remains a challenge.

- A lack of coordination has led to fragmented development of institutions responsible for co-operation between science and business. As a result, various institutions (for example, science and technology parks, technology transfer centres, open access centres, MITA, Lithuanian Innovation Centre, and so on) play (or at least should play, according to the definition of their operations) a similar role. All of these institutions compete for funding which is allocated to them as "thin layer", making it impossible to provide professional services to attract qualified professionals. It is therefore necessary to reduce fragmentation, clarify operations and ensure better coordination (Visionary Analytics, 2014).

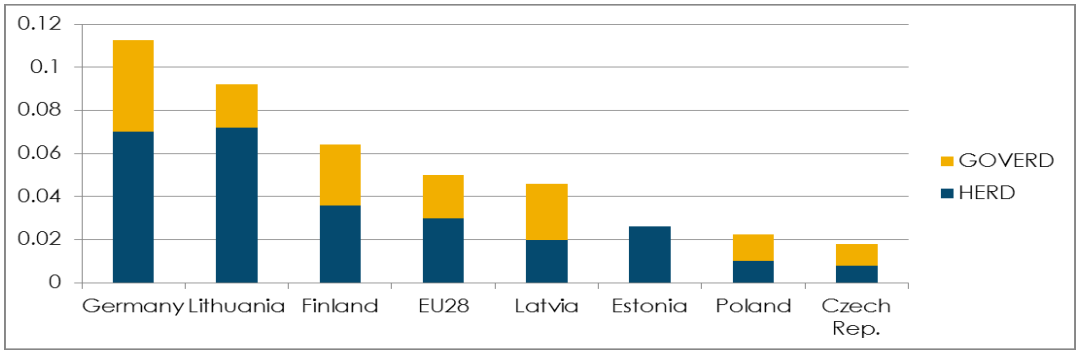
[12] The eScience Gateway can be accessed here: https://www.e-mokslovartai.lt/welcome

1.1.2 Current state and trends in business-science co-operation

General data on co-operation

Reference to the general statistics on R&D funded by the business enterprise sector and performed in the higher education sector (higher education sector expenditure on research and development (HERD) as % of GDP) gives an impression that industry-research co-operation is well developed in Lithuania. It is also above the EU-28 average, which remains constant at 0.03 % of GDP. In absolute numbers, over the period 2007-2015, it fluctuated between EUR 17.9 million (2010) and EUR 30.3 million (2013).

Figure 2: HERD and GOVERD financed by business enterprise sector as percentage of GDP (average for 2011-2015)



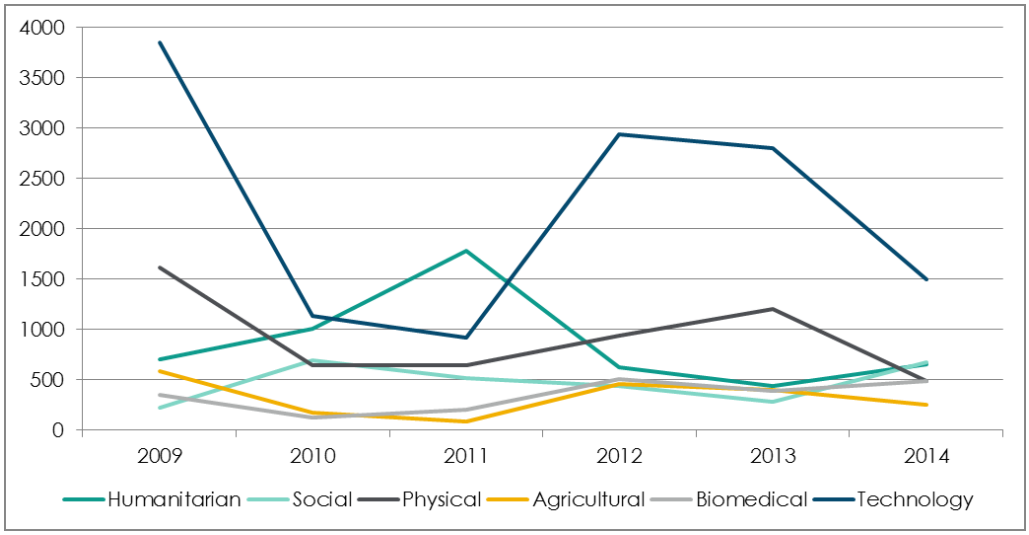
Note: EU-28 and German data were calculated for 2011-2014, data for 2015 is not available.
Source: Eurostat

Given the relative amount of R&D funded by business and performed in the higher education sector, Lithuania's results are similar to those of Germany and better than competitors in Central and Eastern Europe (CEE) and even in the Nordic countries. Although R&D performed in the government sector (government intramural expenditure on research and development (GOVERD) as % of GDP) is lower than in some other countries, the total HERD and GOVERD funded by business is only behind Germany.

With reference to other data on science-business co-operation, it is difficult to explain how such a high number is obtained (Paliokaitė, Krūminas & Stamenov, 2016)[13]. Furthermore, contrary to expectations, given the amount of HERD funded by business, in terms of private-public co-publications per million population, Lithuania even lags behind its neighbouring countries. In 2014, there were 1.7 private-public co-publications per million population in Lithuania, while in the EU-28 on average it was 33.88, in Estonia – 6.84, in Poland – 3.66, and in the Czech Republic – 13.79 (JRC data). The low number of public-private co-publications indicates that even if businesses fund R&D performed in the academia, such co-operation does not lead to a high level of research outputs.

[13] This may also be illustrated by looking at absolute amounts of funds provided by the business enterprise sector to HEIs. In 2015, the total was €25.02 million in Lithuania and €32.46 million in Poland. Given the differences in the size of economy of the two countries, there is reasonable doubt about the situation in Lithuania as described by the data. There is also is a mismatch with official contract R&D figures i.e. €4 million in 2014

Figure 3: Contract research carried out by research institutes and HEIs and ordered by business, by science field (EUR thousands)



Notes: the data only reflects those cases where experts from the Research Council of Lithuania (LMT) accepted that the contracted services were R&D. Data does not include research carried out by university hospitals, since it was separately assessed only in 2012-2014.
Source: LMT (2012, 2015)

According to the innovation survey, innovative enterprises which co-operated with universities or other HEIs totalled only 2.4 % of all enterprises, and the share of innovative enterprises which co-operated with the government, public or private research institutes was 1.4 % of all enterprises (Statistics Lithuania, 2016). Compared to 2012, both these indicators fell from 3.6 % and 1.9 %, respectively. The ICT sector has the highest share of innovative enterprises co-operating with HEIs (22.9 % of innovative enterprises are co-operating), followed by mining and quarrying (10.7 %). This is a good result, even in the context of the CEE and the Baltic Sea Region countries. Only Finland has a higher share of innovative ICT enterprises which co-operate with HEIs. No sectors stand out regarding co-operation with government, public or private research institutes, but the leaders are financial and insurance activities (11.4 % of innovative enterprises are co-operating) and water supply, sewerage, waste management and remediation activities (9.4 %). Compared to other CEE and Baltic Sea Region countries, Lithuania is below the majority. It must be noted that there are many data gaps for specific sectors depending on country-years; hence, comparisons across countries should be made with caution.

Given the actual amounts for contract R&D, current co-operation between enterprises and research and HEIs is low. Data on contract R&D also seems to contradict data on HERD funded by the business enterprise sector, as the numbers for 2012-2014 do not even reach EUR 6 million per year for all the science fields taken together. The data also shows that the amount of contract R&D is volatile – sharp annual increases or decreases are possible, as can be seen for technology sciences.

Data for 2009-2014 shows that by 2014 the total amount spent by business on contract R&D fell from EUR 7.3 million to EUR 4.1 million. These changes are mainly due to a decline in the purchase of contract research in technology sciences, which is also the main field of science where research is contracted. Such a decline might be related to the end of Operational Programme 2007-2013. This would signify **that a significant share of contract research is only carried out when funded from external sources**. However, additional evidence to support this claim is needed as data for the following years is not available, and there is high volatility in the amount of contract research.

Institution-level data

The **main performers of contract research** are Kaunas University of Technology (KTU), Vilnius University (VU), Centre for Physical Sciences and Technology (FTMC)[14], and Vilnius Gediminas Technical University (VGTU), which together account for 63.2 % of the total contract research carried out in 2012-2014.

Centralisation of contract R&D depends heavily on **specific science fields**. In humanities, the main organisations performing contract research are Klaipėda University (KU), Lithuanian Academy of Music and Theatre (LMTA) and Lithuanian Language Institute (LKI) (70.3 %), while in social sciences, the top three performers are VU (together with its Business School), Lithuanian Institute of Agrarian Economics (LAEI) and Lithuanian Social Research Centre - LSTC (75.9 %). Physical sciences are even more concentrated – VU and FTMC perform 87.2 % of total contract research. In agricultural sciences, 99.5 % of contract research is carried out by the Lithuanian Research Centre for Agriculture and Forestry (LAMMC), Lithuanian University of Health Sciences (LSMU) and Aleksandras Stulginskis University (ASU). In biomedicine, 76.95 % of contract research is done by LSMU, Nature Research Centre (GTC) and VU. Finally, in technology sciences, KTU, VGTU and FTMC carry out 80.7 % of contract research. In addition, it is worth mentioning that university hospitals also carry out contract research: LSMU hospital conducted research for EUR 0.81 million and VU hospitals for EUR 0.07 million[15].

Income from business for OACs has been increasing since 2013, which is normal since the last OAC project was only finalised in 2015. Most of the income comes from Lithuanian enterprises as the majority of OACs focus on working with local business; 14 OACs each received income of less than EUR 5000 from foreign enterprises.

The National Innovation and Entrepreneurship Centre (KTU) is a leader with respect to income from enterprises in Lithuania. It attracted 46 % of total OAC income from Lithuanian enterprises, followed by the National Open Access

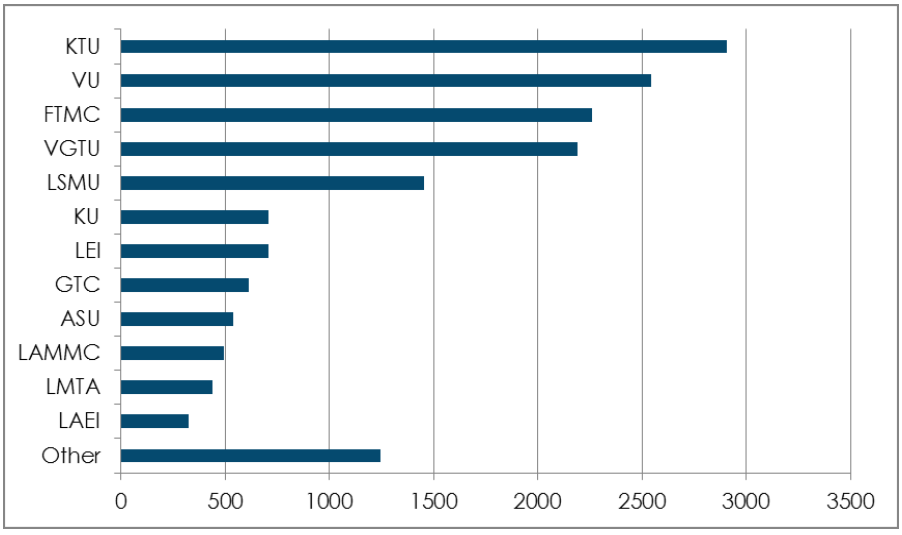
[14] The largest R&D institute in Lithuania, established in 2010 by merging three state institutes: the Institute of Physics, the Semiconductor Physics Institute and the Institute of Chemistry.

[15] It should be noted that VU hospitals did carry out more contract research for business than this number implies, but did not submit full documents for evaluation by the LMT.

Scientific Research Centre for Future Energy Technologies (22 %). The latter OAC and Vilnius University Joint Life Science Centre are also leaders in attracting income from foreign companies, together attracting 45 % of total OAC income from such sources. While some OACs provide services relevant to several fields, others mainly concentrate on specific areas. As regards the latter, OACs which provide services related to engineering and energy, and biological and medical sciences are the most attractive to Lithuanian companies.

In comparison, Fraunhofer-Gesellschaft in Germany (67 institutes and research units) generates EUR 1.8 billion from contract research annually[16]. On average, that makes EUR 26.87 million per unit per year (EUR 9.6 million in revenue from industry).

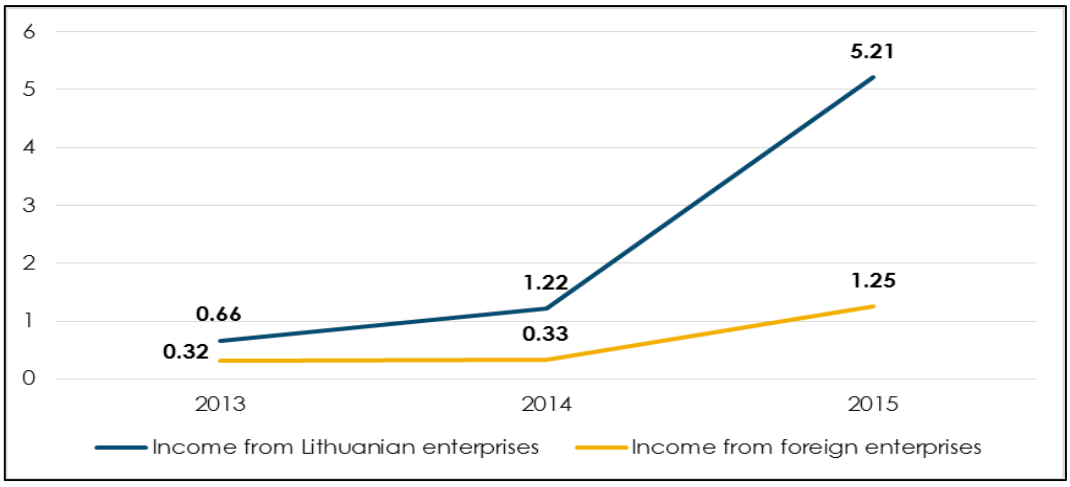
Figure 4: Contract R&D ordered by business and carried out by research institutes and HEIs, by performing organisation, 2012-2014 (EUR thousands)



Notes: data only reflects cases where LMT experts accepted that contracted services were R&D and supporting evidence was provided for their evaluation. Value for VU includes VU Business School. Data includes contract R&D carried out by university hospitals (LSMU and VU). *Source: LMT (2015)*

[16] About 70 % of total contract research comes from industry and from publicly financed research projects, the remaining 30 % being provided by federal and state governments. Industrial revenue reached EUR 641 million in 2015, i.e. approximately EUR 9.6 million per unit (Fraunhofer-Gesellschaft (2016)).

Figure 5: OACs' income in 2013-2015 (EUR millions)



Note: due to changes in the regulation of OACs, data for 2016 is not available.
Source: Author's own calculations based on data received from MITA

According to the Technopolis Group and Ernst and Young (2014), OACs are likely to face a sharper increase in expenses than in revenues at least until 2020, even though income from international programmes and external sources should increase from EUR 8.92 million to EUR 19.32 million over the period 2014-2020. This also means that OACs will not have enough funds to reinvest in research infrastructure to keep it up to date. According to the same study, these RIs are expected to incur heavy upgrading and maintenance costs in the national budget – they will require an **additional ~ EUR 118 million for the upgrading of outdated equipment** by 2020.

To conclude, recent trends do not give a positive outlook on industry-research collaboration. There has not been much improvement over time as regards industry-research co-operation in Lithuania, and there are indications that this depends on the availability of EU funds for research and innovation. Although HERD funded by the business enterprise sector is comparable to that of Germany as a percentage of GDP, this does not correlate well with other indicators.

Although it was expected that the development of valleys and open access centres would encourage collaboration, many of these projects began later than expected. After the end of 2007-2013 financing period, the volume of contract research declined and remains low even though some science fields (e.g. technology sciences) and economy sectors (e.g. ICT) show a greater receptiveness for collaboration.

It should also be noted that different sectors demonstrate very different results. As data on contract research shows, most contract R&D is done in the technological sciences. ICT sector companies demonstrate high collaboration with universities and other research organisations, although a lot of such co-

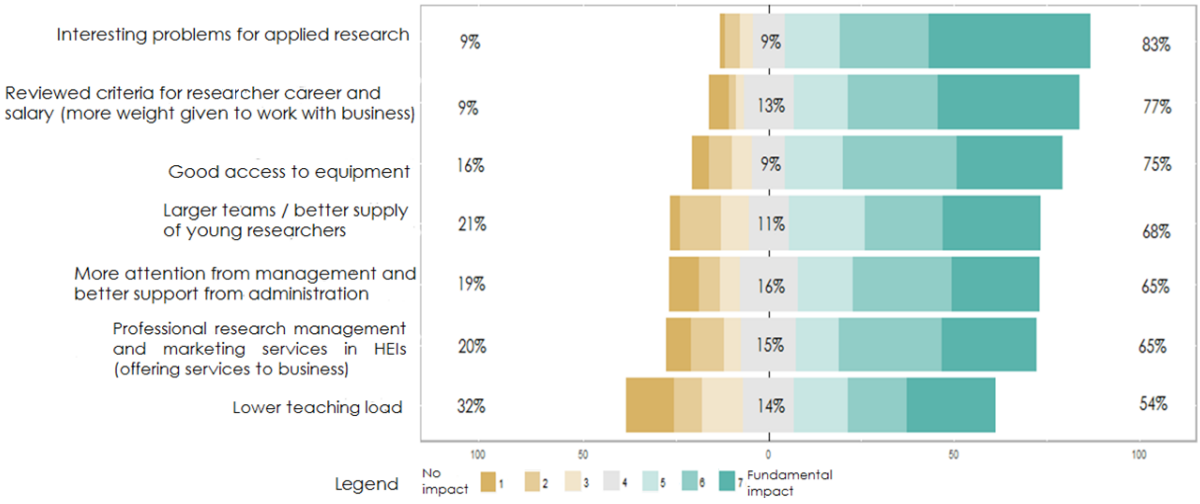
operation is in the field of higher education and not R&D. Other fields receive significantly less attention from businesses.

1.1.3 Barriers to and drivers for co-operation

Although there has been little research into the **drivers** of business-science co-operation in Lithuania, apparently this does include the formal criteria for ESIF investments. According to some businesses surveyed, the main drivers of cooperation are: a) the lower price of services; b) faster services; c) greater support by government agencies if projects are implemented together with research and HEIs (MOSTA & LPK, 2014).

Five key **barriers** for co-operation are discussed below based on a variety of studies. First, there is **a mismatch between business needs and research done in the public R&D organisations**. On the one hand, this is induced by the nature of current R&D demand from business (or rather lack of it) and its short-term orientation, as discussed in Chapter 2.2. On the other hand, there has been a lot of public discussion about the **lack of R&D quality** (e.g. in the case of social sciences) and the fact that the public science system (including its regulation) is **too focused on basic research**. Both business and academia agree that finding a common goal is important for successful co-operation (MOSTA & LPK, 2014). Nonetheless, given that researchers and companies perceive research results differently (Visionary Analytics, 2017), this may be problematic, especially when experienced researchers are working with inexperienced SMEs (survey of participants in the innovation vouchers instrument, 2016). Visionary Analytics (2017) found that "interesting research problems" is the factor rated highest as being able to improve business-science cooperation in Lithuania (see figure below). According to the respondents from research and HEIs, a different understanding of the intended project results between science and business is another notable barrier.

Figure 6: Factors that could encourage business-science co-operation (researchers' opinion)



Source: Visionary Analytics (2017); N=149 selected researchers who provided contract R&D services

Secondly, studies have concluded that the public R&D infrastructure available in Lithuania is not suitable for business needs[17] and/or access to it is not consumer friendly. At the moment, the potential of R&D infrastructure is very fragmented and scattered between the universities, institutes, clusters, and science and technology parks. About 30 % of manufacturing companies surveyed lack prototype testing and pilot manufacturing services (Visionary Analytics, 2014). Nevertheless, public infrastructure covering all technology sectors, and/or all Smart specialisation priorities, and all technology readiness levels is not justified in a small country like Lithuania. Therefore, more important related barriers are that (Visionary Analytics, 2014):

- Companies do not have access to the infrastructure and/or they do not know what infrastructure and under what conditions is available for use;

- Complicated procedures applied by public infrastructures, bureaucracy, long execution periods, lack of flexibility and responsibility were confirmed by several firms surveyed.

Thirdly, there is a substantial factor limiting public-sector researchers' collaboration with companies. This includes the **researcher's career rules**, **internal institutional policies** and other research career and funding conditions, such as over-dependence on academic publications, high teaching load (compared to research), and little attention to economic R&D results in institutional policies and researchers' contracts. Of the researchers surveyed (see Figure 6) 77 % agreed that better researcher career and funding criteria would have a significant impact on improving business-science co-operation. The current system does not sufficiently encourage public-sector researchers to focus on commercialising R&D results or provide R&D services for business[18]. Studies (e.g. Visionary Analytics, 2014) have suggested necessary changes, such as:

- Researchers' contracts should be adjusted to provide time to work with the business community. The employment contract should also specify the allocation of time between teaching and R&D as well as remuneration options in case of successfully applied R&D or R&D commercialisation.

- The researcher should be able to choose between two career directions: teaching and performing R&D (with a small number of lecturing hours). The researchers' career rules and performance requirements should be revised to adapt them to different types of researchers' careers.

---

[17] It should be noted, however, that at the time of many studies (i.e. 2012-2014) not all open access centres had been launched, therefore later improvements in availability of necessary research infrastructure are possible.

[18] To understand the current system of public R&D funding (competitive vs. institutional), please see Paliokaitė, Krūminas, Stamenov (2016), chapter 3.4 'Public funding for public R&I' (p.32-35).

- In case of projects with business (or other R&D partners), a researcher must be able to delegate part (or all) of his/her teaching obligations to others.

- A researcher must be able to receive remuneration if co-operation with a company or individual R&D leads to a commercial product/service, in accordance with the university's internal IP policy.

- A similar change should occur across the institutional level.

Fourth, there has been a **lack of professional technology transfer offices (TTO) and active approach** when working with business. Technology transfer and innovation centres are emerging, along with the availability of e-gateway, as discussed in the previous sub-chapter. However, the quality differs from case to case, and current TTOs lack human resources. Previous studies (e.g. Visionary Analytics, 2014) suggested that:

- TTOs, science and technology parks (STPs) and OACs should strengthen their human resources substantially – employ and train specialists qualified to work proactively with business companies, potential foreign investors, researchers and start-ups. The proactive approach needs to be applied, moving from "they will come to us" to "we will come to them".

- It must be ensured that OACs have qualified specialists trained to work with sophisticated equipment, and can rent those specialists to companies with use of equipment services. Specialised work clothes and occupational safety measures must also be available for hire.

- Professional management of the infrastructure of OACs and clusters should be ensured, including the professional marketing of available prototype testing/pilot manufacturing and other equipment and related services, according to the unified classification system based on business terminology.

Finally, **insufficient human capital in R&I** has been widely acknowledged as both a key barrier to delivering contract R&D services to business (e.g. MOSTA & LPK, 2014; RIO reports 2015 and 2016; Visionary Analytics, 2014) and a bottleneck for achieving any mid- and long-term R&I goals. This challenge also affects R&D infrastructure: even though it is upgraded and up to date, there might not be enough researchers to use it to its full extent.

The challenge of modest human capital in the field of R&I is further reinforced by **inadequate working conditions and unattractive career prospects for researchers** (MOSTA, 2016). Salaries are low compared to other EU countries, which provides an incentive for experienced, young and potential researchers to emigrate. This creates a twofold problem: on the one hand, young people willing to pursue research careers are in short supply, therefore there are too few doctoral students and early-stage researchers. On the other hand, experienced researchers lacking younger assistants in research are overloaded with work. In addition, there is little actual distinction between researchers and professors, meaning that researchers spend a significant part of their time giving lectures and carrying out similar activities (MOSTA, 2016).

1.2 Demand for technological services from the business sector

The starting point is rather weak. The private sector, in its current specialisations, does not perceive innovation as a critical factor for long-term competitiveness. This leads to limited capacities to absorb public R&D (investments) without simultaneously dealing with capacity building. With respect to business expenditures on R&D (BERD), Lithuania ranked 23rd in the EU-28 in 2014. Furthermore, in 2015, BERD dropped by 10.5 %. Over the last decade, Lithuania has advanced from the 'modest' to 'moderate' innovators group, mainly due to more spending on non-R&D-based innovation (improvements in design, brand creation or process optimisation). Businesses in Lithuania still rely more heavily on the acquisition of machinery (more than 70 % of their innovation expenditure) as one of the most important mechanisms for knowledge acquisition.

As noted by the European Commission (2016a), **Lithuania's ability to absorb and assimilate external information appears to be very limited**. In 2015, the country was placed seventh lowest out of the 141 countries analysed, regarding overall knowledge absorption. In particular, it is quite striking that royalties and licence fee payments, as well as high-tech imports seem to remain persistently at very low levels. Examining Lithuania's ability to absorb external knowledge in a European context provides similar results with the country at the bottom of the league (i.e. Lithuania is last in the EU). Some key factors are discussed below.

First, Lithuania can be considered as a country **specialising in labour-intensive industries**. Export and competitiveness are highly dependent on relatively large traditional sectors such as transport and logistics, retail, agriculture, construction, the manufacture of food products, beverages and tobacco products, and the manufacture of furniture, which come under the headings "present locomotives" and "sectors in transition" (see below).

Figure 7: Map of potential for knowledge-driven growth

Source: Martinaitis et al. (2013)[19]

Despite their current success in international markets, most of the "current locomotives" depend on natural resources and cheap labour. Shifts in the regulatory regime and the rising prices of natural resources and labour could undermine their competitiveness. For the time being, the majority of enterprises in these sectors are consumers rather than creators of innovation. To sustain current competitiveness, these sectors need further technological upgrading, investments in productivity, and strengthening of the potential for

[19] The analysis of current sectors' competitiveness relies on: a) export performance, b) demonstrated growth in value added, c) intensity of high-tech and/or skilled labour in production, d) increasing productivity and high-quality jobs, e) substantial investments by Lithuanian and foreign investors, f) critical mass created in the economy, and g) priorities in previous public R&D funding decisions. The analysis of potential for growth in the knowledge-driven sectors is based on: a) high proportion of innovative enterprises, b) development of new to market products, c) allocation of considerable funds to R&D, d) investments in intramural or extramural R&D, and e) participation in international networks for innovations. Sectors which were not assessed are human health activities, real estate activities, mining and quarrying, accommodation and food service activities, legal and accounting activities, head office activities, management consultancy activities, activities auxiliary to financial services, and insurance activities (Martinaitis et al, 2013).

innovation. However, recently the first results of restructuring are emerging, such as the BOD Group[20], Amilina or Rūta[21].

Second, there is the **challenge of critical mass** to produce high-impact innovations and/or innovations new to the market, or to absorb larger public R&D investments. Sectors characterised as potential creators of future innovations ("natural priorities" and "emerging sectors") are typically medium- and high-technology sectors. Several small high-tech sectors are sprouting from the research base, namely the biotechnologies, IT and laser technologies. Most of the production is exported and many companies have managed to successfully attract FDI. However, these sectors are small and fragmented. Furthermore, most business R&D investments are made by companies with fewer than 250 employees, while about 20 % are made by companies with 500 employees or more, in contrast to peers (e.g. Hungary) where a small number of relatively big performers make the majority of BERD.

To sum up, 'pure' R&D innovation is pursued by firms in those industries or market niches where there are more technological opportunities, the knowledge base is more closely linked to natural or engineering sciences, and the returns from private investment can, at least partially, be appropriated. In Lithuania, this only applies to a small number of niche industries. In other industries, firms invest much less in 'research' and focus more on 'development', or innovate either by acquiring new technology produced by others, by modifying products or by using industrial design. Considering that the majority of Lithuanian companies do not have 'pure' R&D capacity, there is high demand for technology upgrading to help them to enhance their efficiency in the context of declining labour-cost competitiveness, and to upgrade the competences required to move up in the value chain. This also means that non-R&D innovation remains an important target, as is research in social sciences, humanities, service design, etc. (not only 'high-tech') and applied research/development (not only basic research).

Furthermore, innovation policies may either want to foster the process of creation, financing, support, organisation, growth of new firms, or rather consolidate and expand the activities of established firms. The goals,

[20] **Baltic Solar Energy** case study (2012) discussing its evolution from CD producer to solar energy producer is available here: https://www.eurofound.europa.eu/observatories/emcc/erm/restructuring-case-studies/baltic-solar-energy. The company currently operates under the name 'Solitek' and is building a solar power plant in Malaysia.

[21] **Amilina** is an example of how a low-tech-based flour factory transformed into one of the leading producers of wheat starch, gluten and wheat glutted feedstuffs in Europe. The company uses 'white biotechnology' in their production processes and collaborates with Vilnius University Joint Life sciences open access centre. **'Rūta'** is one of the main Lithuanian chocolate producers which co-operates regularly with at least three Lithuanian research institutions. The company implemented a EUREKA-funded R&D project and received an award for 'Lithuanian Product of the Year' in 2012 (Paliokaitė A. (2016)). 10+ business-science collaboration routes. Presentation at the "Smart Lithuania" conference, available at: http://www.visionary.lt/wp-content/uploads/2016/11/presentation.pdf

instruments and tools differ significantly in the two cases. The number of existing R&I performers is rather limited in Lithuania. Moreover, these performers are small and lack critical mass. In this case, the country's efforts can be based on increasing the number of innovators by focusing on (a) newcomers, such as start-ups, spin-offs, knowledge-based FDI, and (b) encouraging previously non-innovative companies (potential innovators) to transform their businesses towards more innovative activities (Visionary Analytics, 2015). Some of these firms can be potential partners for business-science cooperation because (in contrast to established R&D innovators) they do not have their own R&D departments or specific infrastructure.

The study by Visionary Analytics (2014) concluded that 'potential innovators' from more traditional industries and 'emerging innovators' (start-ups, spin-offs) are also potential clients for OACs, specifically due to the lack of in-house infrastructure capacities. Indeed, the focus on co-operation may differ according to the needs of a specific innovator group. A key limitation is availability of skills within those companies to understand the value of new knowledge (even if it is not produced in-house), and the lack of networking links. This is an important issue given that only two out of 20 Lithuanian Smart specialisation priorities can be attributed to the 'mature innovators' group (Paliokaitė et al., 2016).

Table 1: Map of motivations and routes in the co-operation process

Type	Technology consumers	Potential innovators	Emerging/new innovators	Mature innovators
Type of companies	Manufacturing companies and services providers (incl. public sector) lacking technological and managerial capacity and productivity Examples: state hospitals, state defence	Large manufacturing companies or service providers in more traditional sectors ("the cornerstones of economy") facing the need to upgrade their competitiveness strategy Examples: Achema, Amilina (Malsena), Lietuvos Energija	Young and small (below 100 employees) companies, export-oriented, high growth Examples: Brolis Semiconductor, Ars Lab, BioMe	R&D-based large (above 100 employees), a long time in the market (10 years plus), operating in the high-tech sectors, export-oriented, with well-developed networks with research institutions Example: Thermofisher
Challenges	Modernisation, absorptive capacity building	Diversification, search for new products and new business models, absorptive capacity building	Acceleration of business (seeding/scaling), attracting investments	Moving to higher-impact innovations, large-cale R&D projects, new markets, spin-outs
Motivation and routes of cooperation with public R&D institutions	**Need for new technologies and/or non-&D innovation – processes, design, etc. that can be delivered by researchers**	See researchers as partners in search for new ideas (contract R&D); Access to labs (esp. prototype testing and similar, later stages of the technology cycle); Preparing specialists using PROs' equipment	Access to specific knowledge (contract R&D); Access to labs and human resources (esp. testing, certification); Science entrepreneurship – spin-offs of public R&D institutions	Access to specific knowledge, labs and human resources: - IP acquisition (patents, licences); - Large joint R&D projects (e.g. Horizon 2020) Preparing specialists using PROs' equipment
Relevant incentives **(see 2.3.3 for instruments available in Lithuania)**	**Pre-commercial procurement** 'Prize' challenges like Finnish 'Challenge 100' and similar focused on solving a relevant challenge/problem	Innovation vouchers etc. for experimentation and contract R&D Clusters R&D grants for later stages of technology cycle (Intellect LT) Innovation promotion services, matchmaking	Innovation vouchers Spin-off investments Innovation promotion services (start-up development) Attraction of foreign investments	Joint business-science projects R&I clusters Facilitation of international R&D e.g. Horizon 2020 projects (Inogeb LT) Industrial PhDs

		(Inogeb LT)		

Source: based on Visionary Analytics (2014)

During the identification of specific R&D and innovation priorities in Lithuania, the main business needs in terms of technology and knowledge were identified (MOSTA, 2013). Given the current specialisation of the economy (see Figure 7), areas such as IT and engineering appear to be overarching and to cover a broad range of sectors. Laser technologies, material and process development, process management and control would also benefit companies in a broader range of sectors.

1.3 Current policy framework and evidence of its effectiveness

1.3.1 Existing regulatory framework and recent developments

As regards R&I policy, there is no single strategy. The National Development Strategy 'Lithuania 2030' and the National Progress Programme for Lithuania for the period 2014-2020 (NPP), which broadly define the direction of the country's development, also cover R&I even if only in general terms. The overall national targets are that the country should become one of the 15 leading EU Member States in terms of R&I performance by 2020 (among 10 best performers by 2030). R&D funding should reach at least 1.9 % of GDP for GERD and at least 0.9 % for BERD by 2020. However, there is little chance that GERD and BERD targets will be met (Paliokaitė, Krūminas, Stamenov, 2016).

Overall, research-industry co-operation is high on the political agenda and is subject to numerous regulations at different policy levels (cf. OECD, 2016). Some key documents are outlined in the table below.

Table 2: Key policy documents

Document	Year	Short description
The Science and Innovation Policy Reform Guidelines	2016	The document outlines expected reforms in science and innovation policy. Among the most important action areas are: a) reform of the institutional R&D assessment and funding system (more focus on indicators from international research and innovation activities monitoring system); consolidation of the potential of research and HEIs, valleys and technology parks; reform of R&I policy coordination.
Law on Education and Science	2009 (latest revision – 2016)	This Law introduces contracts with PROs on education accessibility and results (renewed every three years), research and education quality, and domestic and international cooperation.
Programme on the Implementation of the RDI Priority Areas and their Priorities	2014	This programme sets out the Lithuanian Smart specialisation priority areas and their priorities and discusses some elements of the implementation and monitoring instruments. In addition, Action Plans for Priorities were approved in 2015. They establish the monitoring indicators, budgets and quotas per policy instrument and specific priorities, among other aspects.

Lithuanian Innovation Promotion Programme 2014-2020	2013	One of the objectives is to increase collaboration between business and science. It stresses the lack of a well-coordinated approach to various aspects of innovation policy, e.g. the role and regulation of science and technology parks. The action plan for 2014-2017 outlines the importance of industry-research cooperation in Smart specialisation areas, cultural and creative industries. Furthermore, investment in infrastructure and cluster development is foreseen.
Programme for Development of Studies and R&D for 2013-2020	2012	One of the objectives of the programme is the creation of new knowledge and conditions for the integration of science, businesses and culture. Thus, co-operation between science and business, and technology transfer are encouraged. Its action plan for 2016-2018 specifically notes integration into science and business networks.
The concept of the establishment and development of integrated science, studies and business centres (valleys)	2007 Latest changes – 2014	Valleys are expected to enable effective science and business cooperation in RDI and to advance technology development and transfer. The document also foresaw joint projects which would be implemented by research and HEIs, enterprises, institutions promoting innovation and public-private cooperation, and other entities. It also promoted the development of OACs.

Source: collected by author

The most relevant recent changes to the regulatory framework include:

- Approved revisions of the **Law on Research and Studies** (June 2016).

- The Lithuanian Science and **Innovation Policy Reform Guidelines**, proposed by the President of Lithuania and approved by the Parliament in September 2016. According to the Guidelines, the Parliament should ensure clear responsibility for innovation policy design, and Strategic R&D, and the Innovation Council under the Government would be responsible for innovation policy coordination. The Action Plan for implementing the Guidelines has been drafted and is awaiting government approval.

- Initiation of the process for **optimising the network of public research and higher education institutions**. Parliament prepared a draft decision regarding optimising the network of public universities, proposing that the government analysed the current situation and prepared recommendations for optimisation. The draft decision was amended in November 2016, and the Committee of Science and Education approved it for further consideration. The Ministry of Education and Science should present an analysis in the first half of 2017. The working group on optimisation of the higher education system began working in March 2017.

- The new government took office in December 2016. The **Government Action Plan** for 2016-2020 announced in March 2017 intends to:

- Consolidate the network of public R&D and studies institutions – a working group was established by the Lithuanian government in February 2017, and the first proposals for consolidation will be available by May 2017;

- Review the R&D evaluation system (to be carried out annually based on formal indicators and every five years based on benchmarking by experts). This is to be complemented by a new R&D funding model, whereby 60 % of funds would depend on benchmarking and 40 % of funds on formal evaluation results;

- Create a joint system for the state to contract R&D;

- Encourage spin-offs and the commercialisation of R&D results;

- Improve coordination of experimental development through innovation policy implementation and coordination;

- Improve public R&D system governance, and ensure policy integrity and more efficient co-operation between institutions;

- Create an effective chain of knowledge and technology transfer to business;

- Create a motivational system for businesses to invest in R&D;

- Make society and business more aware of the benefits of research, technological advancement and innovation;

- Incentivise traditional industry to transform towards knowledge-intensive product creation.

On their side, universities are encouraged to co-operate with the business-enterprise sector by means of **competitive institutional funding**. The LMT carries out an assessment to determine the allocation of funds every three years. Two of the components of the final score, which impacts the amount of funds allocated to a particular institution, are: a) funding received from R&D contracts with business companies; and b) public funding from participation in joint R&D projects with business companies (funding of business subcontracts)[22].

There is also a regulation on the open access provided by the OACs in Lithuania, which was approved in 2010. Its latest revisions in April 2016 abandoned the concept of 'open access centre', preferring instead the term 'open access resources and services' (despite all the OACs and publicly available

[22] To understand the current system of public R&D funding (competitive vs. institutional), please see Paliokaitė, Krūminas, Stamenov (2016), Chapter 3.4 'Public funding for public R&I' (p.32-35).

information on the MITA website, for example, still using the term open access centre). Consequently, these centres have remained an integral part of their managing institutions. Furthermore, open access centres are no longer obliged to report their key performance indicators, such as contract R&D, to MITA, and the new regulation does not cover any specific indicators. Rather, open access services should be part of the assessment of research and HEIs carried out by LMT, as described above.

Only a few programmes, by-laws, etc. are presented here. Fragmentation of strategic planning and lower-level documents regulating cooperation in R&I add to the institutional fragmentation at ministerial level (two responsible ministries), agency-level (LVPA, MITA), research institutes and HEIs (e.g. research infrastructure), clusters (over 50), etc. Such fragmentation is noted repeatedly in studies on innovation in Lithuania (cf. OECD, 2016; Paliokaitė, Krūminas & Stamenov, 2015), and the new science and innovation policy reform guidelines stress the need to consolidate governance of innovation policy and reduce fragmentation in the higher education system.

At a lower level, there are other regulatory documents, indicating **potential for over-regulation and lack of coherence between foreseen actions**. Different programmes lack inner coherence – even the expected values for similar indicators vary from one document to another. For example, projected business expenditure on R&D varies from 0.9 % to 1 % for 2020 depending on the document. This indicates that they lack synergies and coordination. The same criticism can also be applied to an indicator on cooperation between universities and business, where Lithuania's expected global ranking in 2020 varies from 12th to 19th.

The dispersal of responsibilities and approaches across different high-level policy documents indicates a **lack of policy coordination**. Indeed, the entire system of innovation policy governance suffers from fragmentation (OECD, 2016). The new Lithuanian Science and Innovation Policy Reform Guidelines also identify fragmentation of the country's innovation system. Therefore, improving coordination is critical for facilitating business science co-operation. Previous studies highlighted the failures of previous governance reforms. For example, it has been noted that "even if the problems and possible solutions are correctly identified, their successful implementation often fails – a 'celebrated birth' of another strategic council eventually turns into 'slow death', and the establishment of a new agency in no way diminishes the fragmentation of institutions, programmes and policy measures" (Visionary Analytics, 2014). Hence, it is important to learn from mistakes and to focus on the quality of implementation.

1.3.2 Key lessons from 2007-2013

The main policy focus during the previous period was on upgrading the public science base. This led to the creation of the concept of valleys (see table above) and the development of OACs. A few lessons can be formulated based on the available evaluations and studies.

First, the business-science collaboration objectives and related policy challenges **were not transformed into more substantial policy instruments**. Large investment in public R&D infrastructure (EUR 364 million from the ERDF was necessary in light of the poor state of the research base. Despite improving the public science base, this investment has also contributed to infrastructure fragmentation, due to the poor coordination of activities (OECD, 2016). Investment in research infrastructure also failed to attract business investment or to improve the commercialisation of R&D activities (Visionary Analytics, 2015). This is in line with findings reported by ESTEP (2015) which indicate that **in itself, investment in infrastructure did not increase company competitiveness**, and a lot now relies on how effectively it will be used (ESTEP, 2015). The share of other ERDF funds allocated to knowledge and technology transfer was residual (less than 3 %).

A second weakness lies in **over-dependence on intermediaries** such as science parks, etc. and more specifically the focus on their 'hard' rather than 'soft' infrastructure (brokers, consultants, mentors and acceleration services). The majority of funds (74 %) for 'innovation promotion services' were allocated for the physical infrastructure of science and technology parks and incubators. A lack of 'soft' business R&D capacity building, seed capital funding and business acceleration created a vicious circle, leaving the development needs of possible newcomers – in the shape of start-ups, spin-offs and potential innovators from traditional industries – out of the scope.

Thirdly, no significant impacts from cluster support were found (Visionary Analytics, 2015). Positive economic effects of clusterisation policy instruments may occur in the long run, because now the environment for clusterisation processes is in the early development stage. However, cluster members are currently not willing to invest money into clusters, but are joining a cluster for pragmatic reasons. Thus, it is doubtful that clusters will remain when the financial 'support' is discontinued.

Fourth, many instruments and programmes implemented over 2007-2013 were not coordinated, despite continued efforts to do so. Therefore, the **complementarity of various instruments was relatively limited**. There was a lack of effective and systematic **programme management capacities**, especially in terms of developing valleys.

Thus, although there were positive effects from investment during 2007-2013, significant strides in industry-research co-operation did not emerge. On a positive note, counterfactual evaluation of the innovation vouchers instrument identified a positive impact on business-science co-operation. Overall, such 'fixed-sum' simplified instruments are considered a success, and are highly popular and relatively well regarded among the business and science communities.

The policy mix for 2014-2020 was expected to be more focused on exploiting the infrastructure created for economic R&D results, including by business, thereby strengthening industry-research collaboration. To achieve this, innovation culture and skills in Lithuanian universities and institutes urgently

need to be developed. Indeed, studies on Lithuanian innovation policy and evaluation of instruments and programmes implemented in 2007-2013, as well as other reviews of Lithuania's innovation system propose the following:

- Research and HEIs should be encouraged to pursue more active technology transfer activities and to open technology transfer institutions (Visionary Analytics, 2014; OECD, 2016); see also Chapter 2.1.3;

- The system of research careers should be modified so that commercialisation of R&D results would have a higher positive impact on researchers' career advancement (Paliokaitė, Krūminas & Stamenov, 2016; MOSTA & LPK, 2014), and overall researchers should be encouraged to collaborate more with business (BGI Consulting, 2015);

- Investment in developing research infrastructure should be limited to cases with a clear collaboration dimension (Paliokaitė, Krūminas & Stamenov, 2016; DG REGIO, 2016);

- Strengthening management capacities in research and HEIs so that they provide better conditions for intersectoral co-operation (BGI Consulting, 2015); as well as overall programme management capacities (Technopolis Group and Ernst and Young, 2012);

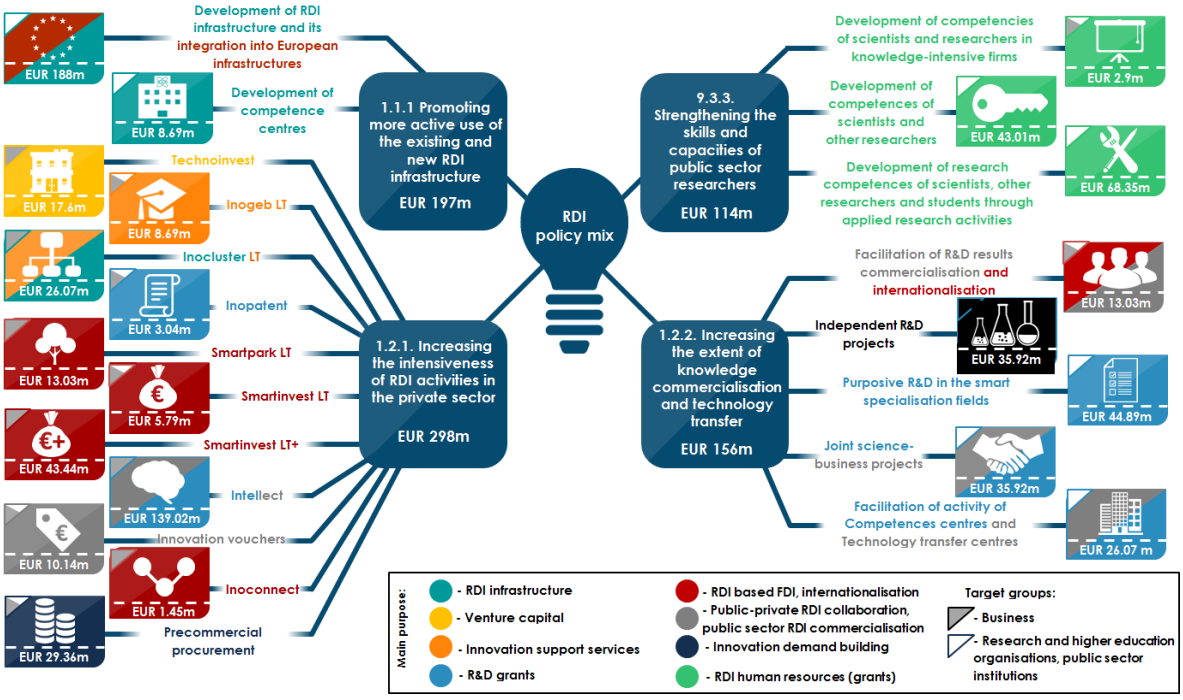
- Priority should be given to those R&D projects which include industry-research cooperation, and financing intensity should be lower than 100 % (ESTEP, 2015);

- The network of innovation support institutions should be optimised; development of RIs or technology/competence centres should be more clearly linked to the cluster projects and soft measures for networks, RDI collaboration and capacity building (Visionary Analytics, 2014).

1.3.3 Policy mix 2014-2020

On the positive side, compared to the policy mix of 2007-2013, the current one pays more attention to encouraging co-operation between science and business (see policy instruments marked in grey in Figure 8 with a description provided in the Annexes). It also provides a larger variety of instruments and is better balanced in terms of innovator types addressed, covering the innovation cycle, innovation supply and demand-side instruments, measures aimed at international networking, RDI-based FDI and cross-sectoral collaboration.

Figure 8: Lithuania's ESIF-funded RDI policy mix (2014-2020)



NB: 'Independent R&D projects' focused on basic research will probably be cancelled.
Source: www.esinvesticijos.lt; only approved instruments

Annex 5 indicates measures expected to encourage industry-research co-operation. Measures, except purposive R&D, national research programmes and pre-commercial procurement are funded by the ESIF Operational Programme for 2014-2020. ESIF measures share similarities with regard to funding intensity for business. Basic intensity for research activities is 50 % and 25 % for development activities. Medium-sized enterprises get additional an additional 10 % and small or very small enterprises an extra 20 %. Moreover, in the case of collaborative projects, funding intensity may be increased by a further 15 % if they comply with Commission Regulation (EU) No 651/2014, Article 25, section 6b. Regarding funding intensity for research and HEIs, discussions on the extent to which state aid regulations should be applied are ongoing. In the case of national research programmes or high-level research in research and HEIs, no co-funding is required.

All instruments are subsidies, and some are also state planning (e.g. 'Development of RDI infrastructure and its integration into European infrastructures'). The list starts with the most relevant instruments, and only those instruments which are indirectly related are at the bottom.

As regards **'soft' match-making support services**, the Ministry of Economy plans to implement a technology scouts system. Taking into account companies' needs, scouts will help them identify new technologies and technological processes that could be developed. The scouts will then try to locate these

processes (related R&D competences) in the network of public research institutions. If the necessary R&D services and/or competences are identified, the next step will be the evaluation of the technology/ technological processes, including their commercial potential. The scouts will also provide additional related consultancy services. Technology scouting will be implemented as part of the 'Inospurtas' project funded by the ESIF through the Inogeb LT measure. The plan is that 80 consulted companies will create or adopt innovations, 15 technology transfer agreements will be signed and 35 prototypes (or concepts) of products, services or processes will be created.

Although the policy mix for 2014-2020 is more balanced than that used in 2007-2013, there are still limitations in the way it is structured, a few of which are discussed below.

Most public R&D infrastructure projects focus on the development or renewal of RIs instead of promoting (business) usage of existing laboratories and facilities. Previous studies suggested a shift from building new RIs to creating incentives to use existing ones. It is unlikely that the planned infrastructure investments will have a substantial impact on 'business usage of open access RIs' (relevant OP result indicator).

Secondly, the lack of coordination between R&D instruments was noted in the evaluation of the 2007-2013 policy mix (ESTEP, 2015); a similar trend persists in the new policy mix. This can be illustrated by an example of measures such as 'Joint science-business projects' and 'Intellect. Joint science-business projects'. Although originally it was expected that the projects would continue across these two measures, the finalised instruments do not have direct synergies and are under the responsibility of different ministries. A similar challenge relates to synergies and coordination between the activities of various organisations responsible for facilitating co-operation. In addition to the technology scouts described above (their organisation affiliate is not known at the moment), science and technology parks as well as technology transfer centres at universities should deliver co-operation facilitation services. How the activities of various organisations (including MITA, OACs, technology transfer and innovation centres, STPs, etc.) will support each other, and how synergies will be created and coordinated – is unclear at the time of preparing this report (March 2017).

Thirdly, although the operational period began in 2014, many ESIF-funded measures have yet to be launched. This time gap has hindered capabilities for closer industry-research co-operation, and the first calls are likely to be highly competitive due to a large number of applications. Furthermore, although the first call for the measure 'Intellect. Joint science-business projects' was launched in December 2015, the decisions on which projects should be financed were only made in January 2017. Thus, the whole process took more than a year, which is a burden on companies' planning.

The lack of progress in instrument implementation also limits the possibility to analyse the interests of different business sectors in applying for investment (the demand side). However, the 'Intellect' instrument launched by the Ministry

of Economy (a similar instrument from the Ministry of Education and Science is on hold) provides some insight. Although the measure is expected to increase co-operation between business and research, only about a quarter of all initial proposals proposed cooperation with research and HEIs. The measure's two-step proposal submission process showed that even if some companies envisioned cooperation, they had decided to drop it by the second stage (see Table 3) when the agency asked for a joint co-operation agreement. Nonetheless, an analysis of the results of the first stage of proposals shows that of the 292 proposals, 75 included research and HEIs. The main proposals came from KTU (11 projects), VGTU (10 projects) and BPTI (8 projects).

Finally, considering the attractiveness of existing instruments aimed at industry-research cooperation, there is a funding gap between the main instruments encouraging co-operation 'Innovation vouchers' (maximum aid of about EUR 5000) and 'Joint science-business projects'/'Intellect. Joint science-business projects' (minimum EUR 50 000). Considering the challenge of the critical mass of Lithuanian innovators (see Chapter 2.2), this gap could be relevant for business, as has already been voiced on several occasions.

Furthermore, there is a challenge regarding interpretation of state aid with respect to investment given to research and HEIs. Although the question is still under discussion, it is likely that research organisations and universities applying for aid jointly with businesses will be equated to enterprises, meaning that they will be required to co-finance projects. Given the size of universities, they will be treated as large enterprises and co-financing requirements will be high (funding intensity could vary between 25 % and 50 %, depending on the specific activity, with possible exceptions[23]). Anecdotal evidence indicates that such a situation may discourage research and HEIs from participating in joint projects, effectively rendering obsolete some of the funds devoted to intersectoral cooperation.

To conclude, current regulation and support for industry-research suffers from several flaws:

- High fragmentation of legislation, public agencies, research and HEIs, etc., also leading to over-regulation;

- High fragmentation of research infrastructures and their different types (research institutes, valleys, open access centres, competence centres, technology transfer centres, innovation centres, etc.), poor information environment regarding available R&D services, lack of effective technology transfer programmes;

[23] An additional increase in funding intensity for large companies is possible but under specific circumstances. For example, when there is effective co-operation in a project with at least one SME participant, the project is implemented in at least two Member States or a Member State and Contracting Party of the EEA Agreement, and none of the companies cover 70 % of eligibly expenses. Exceptions are listed in Commission Regulation (EU) No 651/2014, Article 25, section 6b.

- Lack of cooperation in designing instruments, which does not allow for the creation of synergies;

- Slow implementation of funding instruments in the 2014-2020 operational period;

- Specific gaps in the policy mix concerning joint industry-research projects, and in general over-complicated ESIF regulations and rules (EU and national) leading to the lack of easy-access and easy-to-manage instruments.

1.3.4 Smart specialisation

The instruments outlined are mainly implemented in the context of Lithuania's Smart specialisation strategy for 2014-2020[24]. The strategy identifies 20 priorities[25] which are grouped into six priority areas: a) energy and a sustainable environment; b) inclusive and creative society; c) agro-innovation and food technologies; d) new production processes, materials and technologies; e) health technologies and biotechnologies; and f) transport, logistic and information and communication technologies. Smart specialisation is closely related to the first priority of the Operational Programme 2014-2020. Funds distributed through this priority must be given to projects related to the 20 Smart specialisation priorities. Although these priorities were agreed in the period 2013-2015, and there is still a lack of progress in related instruments, discussions are already ongoing about reducing the number of priorities. There are plans to carry out a review process to establish whether or not the priorities will still be relevant in 2018.

There are few data to suggest that **demand for industry-research co-operation varies widely among different priority areas**. The priorities were chosen on the grounds of their potential in both the business and higher education sectors; therefore, industry-research co-operation is expected to be high among them.

[24] With the exception of the following instruments: a) development of competencies of scientists and researchers in knowledge-intensive firms; b) development of competences of scientists and other researchers.

[25] Specific priorities and their implementation action plans in English are given here: http://www.sumani2020.lt/en/

Table 3: Industry-research co-operation in 'Intellect. Joint science-business projects'

Thematic priority area	Stage I		Stage II – only selected ideas can move forward		Funded projects		Average evaluation score
	No. of applications	Involving a research org./HEI partner	No. of applications	Involving a research org./HEI partner	No. of funded projects	Involving a research org./HEI partner	
Inclusive and creative society	24	10 (42 %)	8	4 (50%)	8 (33%*)	4 (50%)	43.9
Energy and a sustainable environment	33	12 (36 %)	19	6 (32%)	9 (27%)	3 (33%)	58
Health technologies and biotechnologies	71	19 (27 %)	43	12 (28%)	28 (39%)	9*** (32%)	61
Transport, logistic and information and communication technologies	54	14 (26 %)	23	9 (39%)	15 (28%)	5 (33%)	49.2
New production processes, materials and technologies	73	16 (22 %)	37	9 (24%)	31 (43%)	7 (23%)	59.9
Agro-innovation and food technologies	35	4 (11 %)	15	3 (20%)	7 (20%)	1 (14%)	54.6
Total	**290**	**75**	**145**	**43**	**98****	**29*****	

*Note: * - percent of total no. of applications submitted in stage I; ** - 100 projects were selected for funding, but only 98 were funded, submitted by 96 companies; *** - in one of the projects, the research partner was not awarded public funding. Source: LVPA data*

Data from the first call for 'Intellect. Joint science-business projects' (Table 3) suggest that:

- The highest number of good-quality applications were submitted in the 'health technologies', 'transport and ICT' and 'new production processes, materials and technologies' areas. The poorest quality is in the 'inclusive and creative society' priority area (confirmed by LVPA interviewees).

- The lowest demand for co-operation is in 'agro-innovation and food technologies' and 'energy and sustainable environment' while the highest demand is in 'inclusive and creative society' and 'transport and ICT' priority areas.

However, these conclusions should be interpreted with caution. First, it is hard to tell at this stage if planned partnerships are based on joint R&D and not just 'formally' organised to get higher evaluation points. Secondly, established quotas per priority area also have an impact on how many applications are selected in a given field (if the quality is average, more lower-quality projects can be selected). There can be a significant variety in the number and quality of applications among the different priorities in each priority area.

2 INNOVATION-ORIENTED FDI

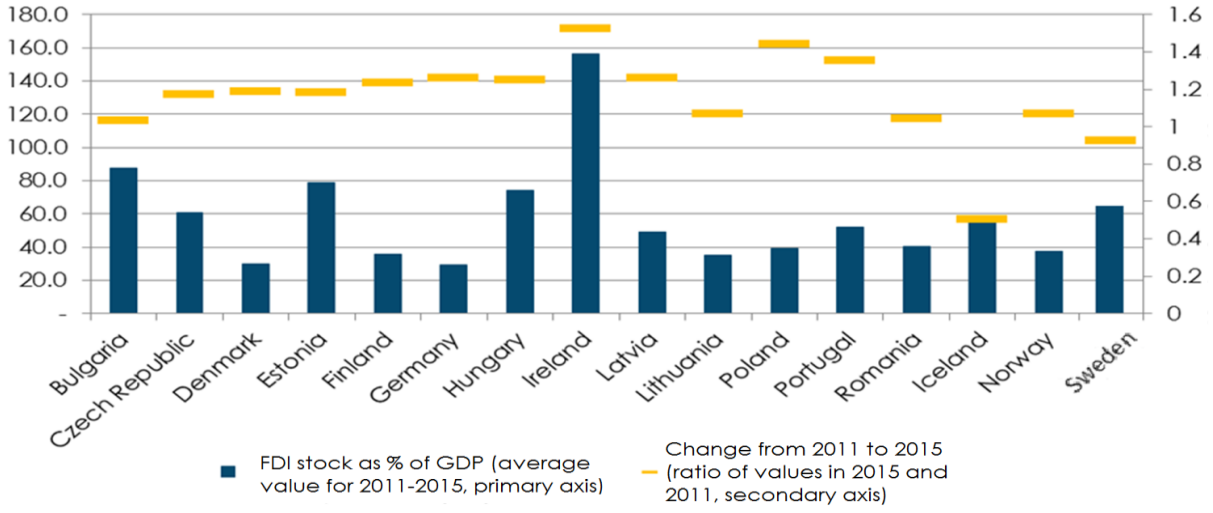
2.1 Lithuania's success in exploiting innovation-oriented FDI

2.1.1 Lithuania's relative FDI performance

Benchmarking FDI performance. According to the long-term strategy of Invest Lithuania (2016d), Lithuania's main competitors come from the CEE region and include Poland, Latvia, Estonia, the Czech Republic, Romania and Bulgaria. Other competitors are Ukraine, Ireland, Norway, Portugal, Serbia, Finland, Sweden and India. However, some of these competitors are likely to be specific to the area of investment, e.g. competitiveness with India is likely to be relevant to attracting service centres. Therefore, the following benchmarking analysis mainly concerns itself with countries in the Baltic Sea Region and Central and Eastern Europe.

As regards inward FDI stock as a percentage of GDP, Lithuania is not a strong performer. Growth is among the slowest among several countries, and overall FDI stock is relatively small. This indicates FDI's relatively stronger role among regional competitors. However, it also reflects the strength of domestic companies (e.g. Ireland has relatively weaker ones).

Figure 9: Inward FDI stock as % of GDP (average value for 2011-2015) and change from 2011 to 2015



*Source: UNCTAD 2016, Annex tables; for more detailed data on stocks and flows in 2011-2015, see **Annex 3**, **Figure 18***

Additional disaggregation of FDI flows over the period 2011-2015 indicates that Lithuania is behind many of its competitors with respect to the total number and average value of **mergers and acquisitions**. However, if country size is taken into account, Lithuania can be seen as a medium performer. The country managed to attract large **greenfield FDI** projects in 2011. Since then, its performance in terms of the average value of greenfield projects has been

relatively weak, even though the annual number of projects remained at similar levels.

Table 4: Cross-border mergers and acquisitions, and greenfield investment, 2011-2015 (EUR million)

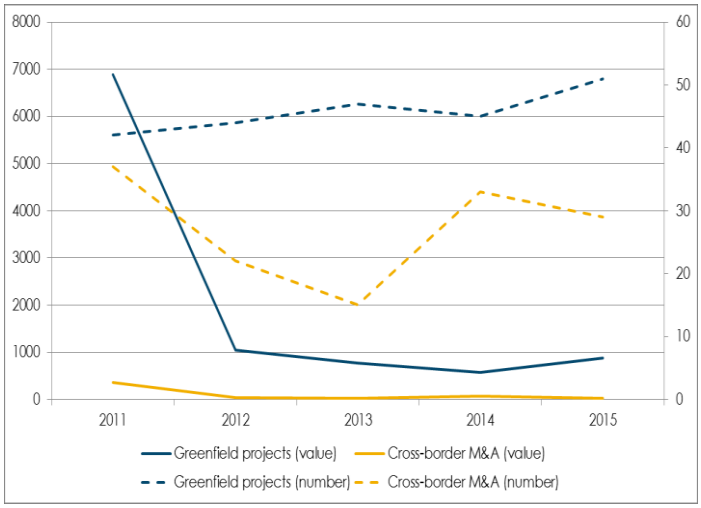
Country	Average annual number of M&A projects	Average value** per M&A project	Average annual number of greenfield projects	Average value** per greenfield project	Number of annual M&A projects per million population ***	Number of annual greenfield projects per million population ***
Bulgaria	20	1.66	66.8	35.66	2.78	9.27
Czech Republic	74.6	19.69	130.4	25.99	7.08	12.37
Denmark	117	34.89	60.2	15.99	20.67	10.64
Estonia	21.2	1.8	25	24.82	16.12	19.01
Finland	83.2	36.3	114.8	16.75	15.21	20.98
Germany	574.4	23.2	846.8	13.89	7.07	10.44
Hungary	28.4	2.99	106.2	25	2.88	10.77
Ireland	82.2	174.92	198	26.21	17.76	42.77
Latvia	21.4	2.09	17	32.54	10.77	8.56
Lithuania	**27.2**	**3.86**	**45.8**	**44.32***	**9.31**	**15.68**
Poland	147	17.08	271.8	30.98	3.87	7.15
Romania	40.8	2.63	211.6	35.4	2.05	10.65
Sweden	210.6	25.78	70.4	28.15	3.25	1.09
Norway	132	55.78	34.4	23.16	25.55	6.66
Russia	353.8	-3.05	287.4	50.92	2.46	2
Ukraine	59.6	5.27	64.4	36.18	1.39	1.51

Source: author's calculations based on UNCTAD 2016, Annex tables and Eurostat

Notes: * in 2011, greenfield investment in Lithuania was very high compared to the years that followed. The average value per greenfield project for 2012-2015 was **17.46**; ** values have been converted from US$ to EUR according to exchange rate 0.9360. Total value of M&A also accounts for sales of foreign-owned affiliates in the country, therefore the average value per M&A project indicates how much larger an average M&A project is than an average sale of foreign-owned affiliate; *** population numbers are for 2015. Key: red – low performance among countries with respect to specific indicator, yellow – medium performance, green – high performance.

Greenfield investment dominates in Lithuania, compared to cross-border mergers and acquisitions, both in terms of value and of number. Mergers and acquisitions declined from 2011-2015, which is to be expected given that over time the main companies attracting foreign investors are likely to have been acquired already, while the emergence of replacements is slower. The number of greenfield investment projects was more stable and mainly increased from year to year, but there was a sharp fall in their value from 2011 to 2012.

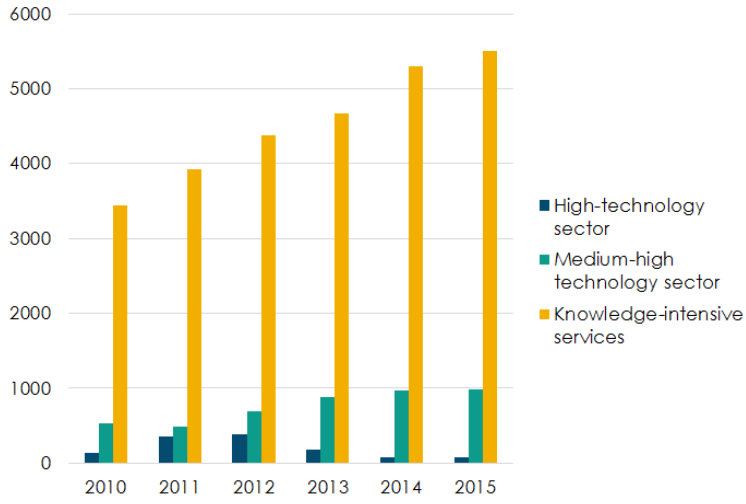
Figure 10: Cross-border mergers and acquisitions, and greenfield investment inflows from 2011-2015 in Lithuania (EUR million)



Source: UNCTAD 2016, Annex tables

Note: values converted from US$ to EUR according to exchange rate 0.9360; total value for M&A also accounts for sales of foreign-owned affiliates in the country

Figure 11: FDI stocks in high-technology, medium-high technology and knowledge-intensive services in Lithuania (EUR million)

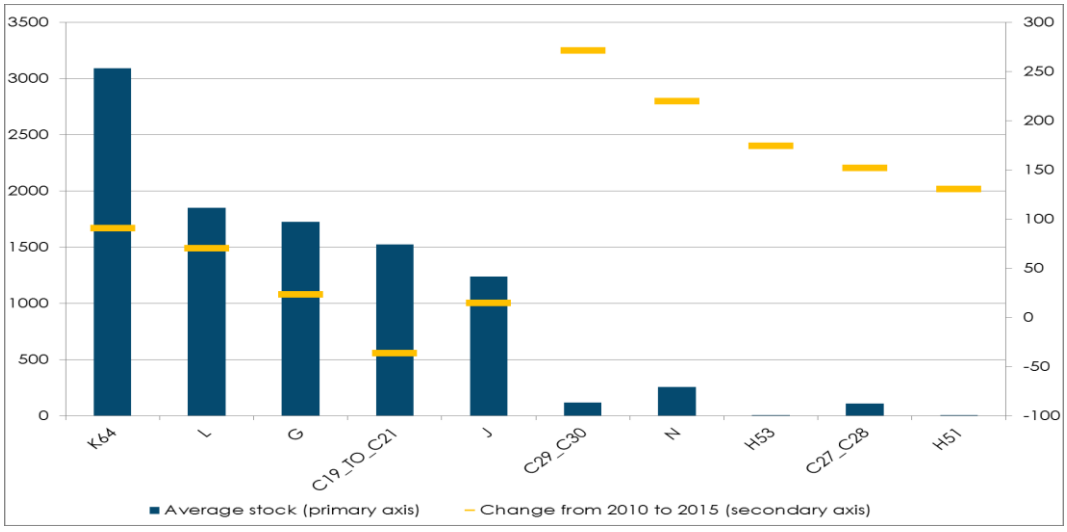


Source: Statistics Lithuania

Sector-level FDI data. The largest share of (increasing) investment was in knowledge-intensive services (KIS) from 2010-2015. An increase in the KIS-related FDI shows that foreign companies see Lithuania as attractive for specific types of services. Data by Invest Lithuania indicates that the number of shared-

services centres increased over time, totalling 45 during the period 2010-2016 (with 7115 jobs planned). This may help explain the investment growth in KIS.

Figure 12: Sectors with largest (annual average over 2010-2015, EUR million) and fastest growing FDI stock in Lithuania (%)



Source: Statistics Lithuania, level of disaggregation used at lowest provided level for specific sector.

NACE codes (in bold) used in the figure: **K64** – financial service activities, except insurance and pension funding; **L** – real estate activities; **G** – wholesale and retail trade and repair of motor vehicles and motorcycles; **C19-21** – manufacture of coke and refined petroleum products, manufacture of chemicals and chemical products, manufacture of basic pharmaceutical products and pharmaceutical preparations; **J** – information and communication; **C29_30** – manufacture of motor vehicles, trailers and semi-trailers, manufacture of other transport equipment; **N** – administrative and support service activities; **H53** – postal and courier activities; **C27_28** – manufacture of electrical equipment and manufacture of machinery and equipment n.e.c.; **H51** – air transport.

Sources of FDI. Statistics Lithuania (2015) indicates that the main countries from which investment comes to Lithuania are Sweden (EUR 3122m), the Netherlands (EUR 1691m) and Germany (EUR 1247m). Eight other countries have FDI in Lithuania between EUR 840m and EUR 400m, including Norway, Poland, Estonia, Finland, Denmark, Switzerland, Cyprus and Malta (stock values at the end of 2015). Among these top investors, the highest change since 2010 was registered in Sweden (205.9 %), Malta (174.6 %) and Norway (164.7 %). From this data, it is quite clear that the most important sources of FDI are in the Baltic Sea Region, or are Lithuania's neighbours, although not in all cases.

Regional FDI data. There are huge differences in FDI among different regions across Lithuania with regions attracting the most FDI in manufacturing projects. Over the period 2010-2015, Vilnius attracted 52 % of all FDI projects, Kaunas 15 %, and Klaipėda 9 %. All other municipalities taken together attracted only 24 % of FDI projects (Create Lithuania, 2015). This indicates that while Vilnius is a relatively attractive city for investment, other regions are not, even given

the lower costs. Furthermore, Vilnius attracts more high-value-added FDI. However, it is not unusual for a capital to lead in high-value-added FDI, while FDI projects requiring more space are implemented in other regions, and FDI tends to cluster nearer to larger business centres.

The role of foreign-affiliated companies in the economy. There were 3629 foreign-controlled companies in Lithuania in 2014, while the total number of companies was 174 611[26]. Compared to other EU countries, in Lithuania, the share of foreign-affiliated companies is medium (2.1 %). The main competitors, such as Latvia (7.1 %), Romania (6.5 %), Slovenia (5.1 %), Hungary (3.6 %), Bulgaria (3.5 %), Croatia (2.8 %) and Norway (2.4 %) had higher shares, while others had smaller shares (data for 2014)[27]. Compared to all Lithuanian companies, on average, foreign-controlled firms employ more people and have higher turnovers. They also tend to invest more per person employed, create more value added at factor cost, on average, and apparently have higher labour productivity. Given the total value added created, foreign-affiliated companies created EUR 3 857 4 million at factor cost, while the total was EUR 14 557 6 million. However, compared to competitor countries, foreign-affiliated enterprises established in Lithuania do not perform that well (see **Annex 3**, **Figure 19**). This is particularly the case for turnover per enterprise and value added at factor cost per enterprise. The best performance is in investment per person employed, but in this case most of the countries are somewhat similar.

Integration in the global value chains (GVC). The OECD (2016a) points to the important position of multinational enterprises in generating value added (three times the EU-27 average at 30 % in 2013) and the increasing inward FDI. However, the position of Lithuania in GVC has not improved significantly and it shows low 'backward participation' in GVCs. It has a relatively low share of foreign value added embodied in Lithuanian exports. The country's integration into global value chains is lower than that of most of its competitors, especially with respect to backward linkages, i.e. a country's foreign value-added share of gross exports (Table 5). However, in the case of forward linkages, i.e. a country's domestic value-added exports, which count as input into exports of partner countries, Lithuania is a medium performer.

[26] Not including financial and insurance activities.
[27] Data for Ireland is not available for 2014.

Table 5: Positions in global value chains (2011)

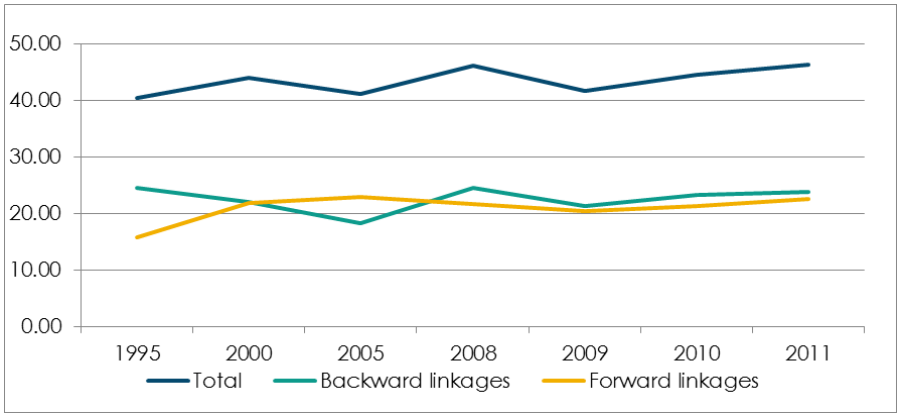
Country	Total global chains participation	Backward linkages*	Forward linkages**
Slovakia	67.44	46.84	20.6
Hungary	65.28	48.68	16.6
Czech Republic	64.88	45.28	19.6
Slovenia	58.78	36.18	22.6
Finland	57.4	34.7	22.7
Denmark	56.74	32.64	24.1
Bulgaria	56.66	39.96	16.7
Poland	55.69	32.39	23.3
Estonia	55.61	35.21	20.4
Sweden	53.8	29.2	24.6
Latvia	52.73	28.73	24
Germany	49.64	25.54	24.1
Lithuania	**46.34**	**23.74**	**22.6**
Croatia	34.07	20.17	13.9

Source: OECD, Eurostat Key: red – low performance among countries with respect to specific indicator, yellow – medium performance, green – high performance

What is most worrying is that **time-trends do not show any significant improvement**. The upward trend in the total GVC participation index is too small to draw any positive conclusions.

Given specific economic sectors, Lithuania's strengths lie in the manufacture of electrical and optical equipment; electricity, gas and water supply; manufacture of food products, beverages and tobacco; manufacture of machinery and equipment; manufacture of basic metals and fabricated metal products; and the manufacture of transport equipment. However, in none of these sectors is the global value chain participation index above 41 %.

Figure 13: Lithuania's position in global value chains (participation index, %, 1995-2011)



Source: OECD, Eurostat

2.1.2 Innovation intensity of Lithuania's foreign-owned companies

Success in attracting R&I-based FDI

Available data vary greatly according to the source, reflecting varying approaches in defining such FDI. Data from three sources – *Financial Times* (MCJ Lemagnen analysis based on *Financial Times* fDi markets), Invest Lithuania and Create Lithuania – are presented below.

According to the MCJ Lemagnen analysis based on *Financial Times* fDi markets, **Lithuania is quite successful in attracting design, development and testing (DDT) projects**. Compared to competitor countries, Lithuania performs rather well and only ranks below Poland, Romania and Finland with respect to FDI projects in R&D and DDT attracted in 2016. Nonetheless, given the size of these countries, Lithuania performs relatively better.

However, **significantly fewer R&D projects have come to Lithuania**, mainly in biotechnology and ICT. They are also usually larger than DDT projects. The majority of DDT projects are implemented in ICT, while other fields with several projects include medical devices; industrial machinery, equipment and tools; and business services. As regards the R&D projects attracted, Lithuania is ahead of Estonia and Latvia (MCJ Lemagnen analysis based on *Financial Times* fDi markets). Meanwhile, data from Invest Lithuania indicates that nine R&D projects were attracted to Lithuania. The figure below shows that these were attracted in a seven-year period, the majority of them through Invest Lithuania. According to data from Invest Lithuania[28], in 2016 there were three 'pure' R&D projects (126 jobs planned). Invest Lithuania also focuses on attracting projects from other sectors with an R&D function, i.e. manufacturing projects with R&D staff, or IT projects developing new products. In 2016, there were 15 projects with an R&D function which together plan to employ 531 people.

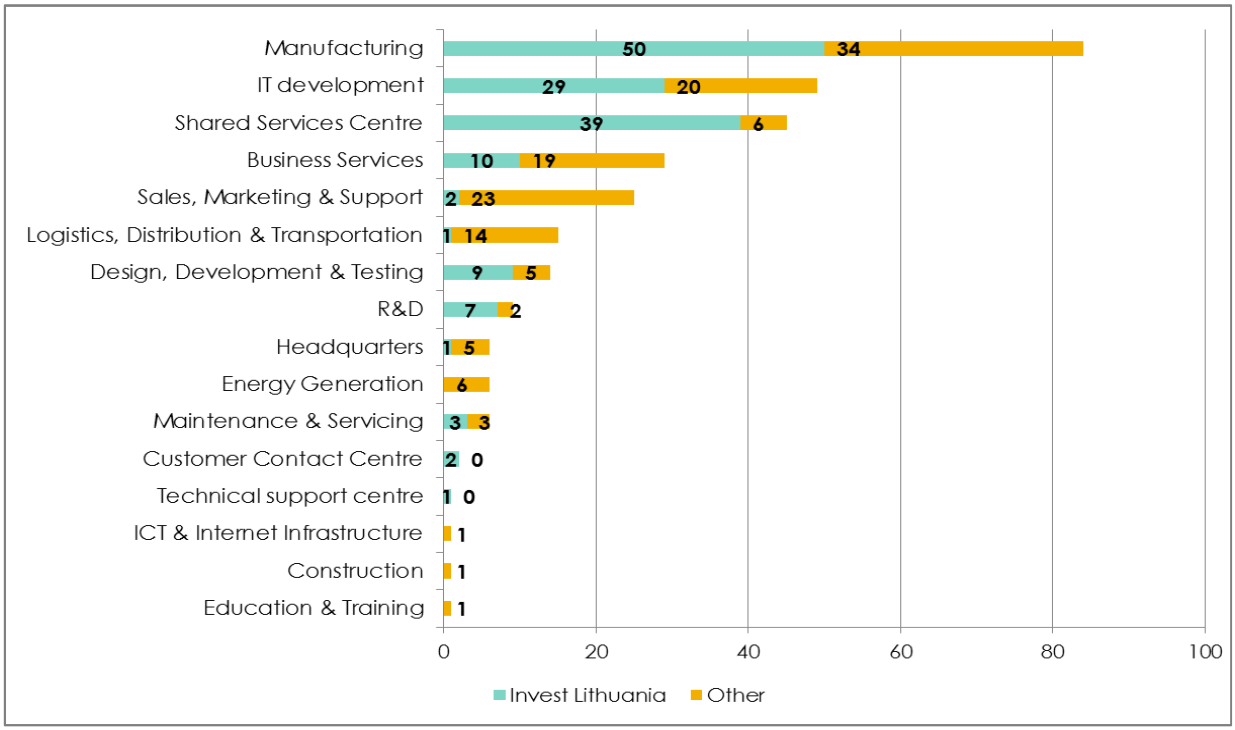
Although the number of such projects attracted by Invest Lithuania has increased (from one in 2013 to three in 2016), **the share of R&D projects in the total FDI portfolio is marginal.** According to Create Lithuania (2016a), R&D-based FDI projects per million population (2010-2014) was 0.7 in Lithuania and 34.3 in Ireland. The share of R&D-based FDI projects in the total number of FDI projects was 2 % in Lithuania and 20 % in Ireland during the same period. However, it should be noted that overall Ireland is a very strong performer with respect to FDI projects in R&D.

Most of Invest Lithuania projects during the period 2010-2016 were in the manufacturing sector (see figure below). This sector includes companies such as Schmitz Cargobull (Germany), Mars® (US), Peikko (Finland), Cowi (Denmark), and Philip Morris (US). Narrowing the level, investment comes to oil and gas, trucks and trailers, and consumer goods, among other sectors.

[28] Data provided by the Lithuanian delegation during a meeting in Brussels on 22 February 2017.

Although most of the investing companies are not among the top global R&D performers, some are ranked highly. One such company is Huawei (China) which invested in a research laboratory in Vilnius in 2011. Huawei was ranked 8th on the R&D Scoreboard 2016 (European Commission, 2016b). Other companies which were ranked in this scoreboard in 2016 include Thermo Fisher Scientific (202nd, biotechnology, US), Danske Bank (326th, financial services, Denmark) and Wix.com (1120th, IT, Israel) among several others. However, investments by top R&D performers are far and few between. Moreover, some investments by such companies come in activities other than R&D or DDT (e.g. shared services centres).

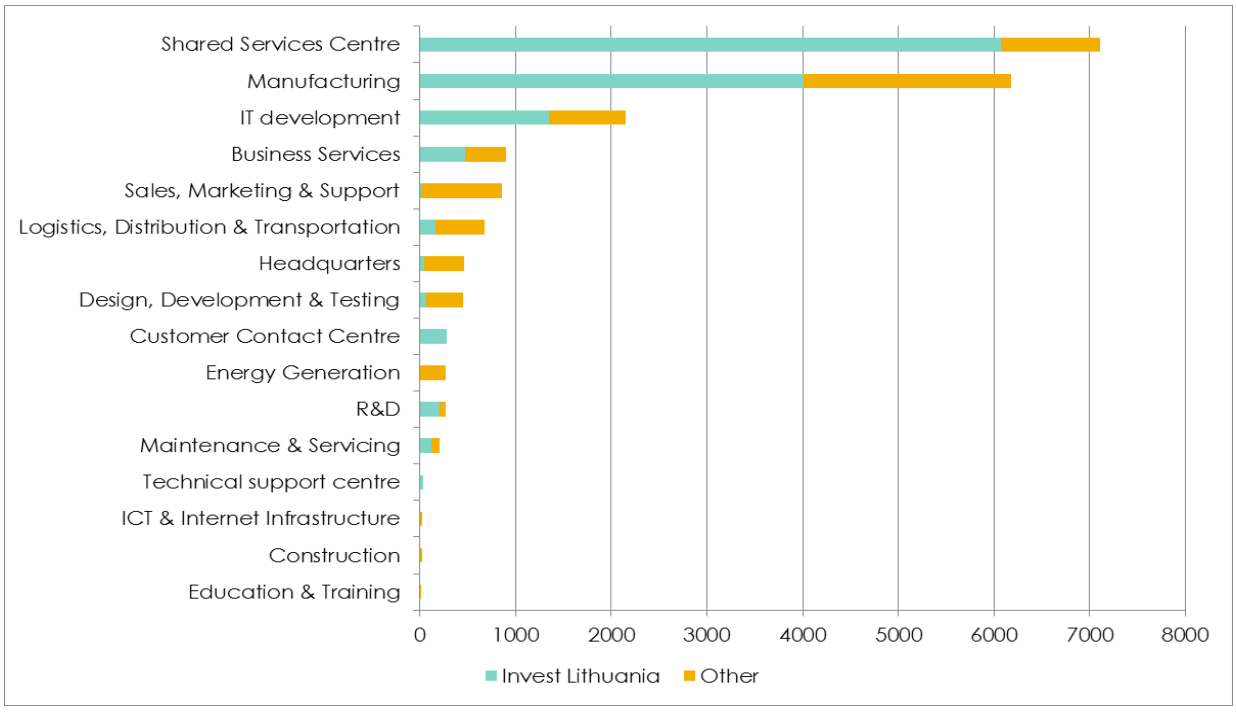
Figure 14: Total of FDI projects in Lithuania by area (2010-2016)



Source: data by Invest Lithuania, 2017

In terms of employment, shared services and manufacturing are the main job creators. Yet, even though non-R&D related FDI projects create more jobs, given the size of Lithuania, it is easier to compete with other countriesfor smaller investment projects (Invest Lithuania, 2016c). In addition to jobs directly created in FDI projects, additional jobs are created due to the multiplication effect. Invest Lithuania's annual report for 2015 indicates that the total (direct plus indirect) number of jobs due to FDI is nearly twice as many as indicated by direct numbers.

Figure 15: Total expected jobs in FDI projects in Lithuania by area (2010-2016)



Source: data by Invest Lithuania, 2017

Sector level data, trends and success stories

In Lithuania, there are already encouraging success stories on how to exploit FDI to generate new knowledge based growth areas, notably in **pharmaceuticals and biotechnology** (Paliokaitė & Kubo, 2013):

- Valeant Pharmaceuticals International, Inc. (Canada) acquired AB Sanitas for EUR 314 million in 2011. The company has in-house development capabilities in dermatology, ophthalmology and hospital injectables, and a robust pipeline of internally developed and acquired dossiers. More than 100 employees are employed in Lithuania.

- Thermo Fisher Scientific (US) acquired Fermentas, a Lithuanian manufacturer and global distributor of enzymes, reagents and kits for molecular and cellular biology research, for almost EUR 183 million in 2010. Fermentas is now integrated into Thermo Fisher Scientific's Analytical Technologies Segment and employs almost 450 people. The total capital investment to date has reached EUR 202.7 million. The company has the ambitious goal of generating 1.1 % of Lithuania's GDP by 2020.

- In 2009, Moog Medical (a subsidiary of Moog Inc., US) acquired a 100 % holding in Viltechmeda, a Lithuanian company which manufactures, sells and repairs medical equipment, devices for infusion and syringe pumps. In 2011,

Moog opened its Medical High Technologies Centre at Visoriai Information Technology Park in Vilnius.

- Teva Pharmaceutical Industries (Israel) acquired Sicor Biotech in 2006.

These examples demonstrate that targeted FDI attraction can be a viable route for boosting new knowledge-intensive economy sectors, both in manufacturing and services. Investments by Thermo Fisher Scientific, Teva and Valeant have made Lithuania an emerging hot spot for the life sciences in the CEE.

Since about 2010, there has been a growing interest from multinational and macro-regional financial services companies in relocating their regional back office operations (including IT) to Vilnius. This has strengthened Lithuania's prospects of becoming a **regional hub for financial services export**. Lithuania's Investment Promotion and Industry Development Programme for 2014-2020 stresses the country's competitive advantage in service centres (including finance, human resources and IT), manufacturing (especially mechanical engineering and electronics), data centres, IT development, and Smart specialisation priorities (see discussion below), and the need to emphasise this. As seen in Figure 14, policy priority areas are indeed areas attracting the majority of FDI projects in 2010-2016. Attracting shared services centers (SSC) was given a lot of attention, as proven by the country's recent appreciation in CEE Shared Services and Outsourcing awards. Those SSC attracted to Lithuania include Barclays (UK), Western Union (US), Danske Bank (Denmark), Nasdaq (US), Intermedix (US) and others[29], while the number of such projects continues to grow.

The prioritised and growing IT sub-fields include **financial technologies and cyber security**, which recorded investment plans in 2016 (three in each sector). Key investors include Revel Systems (US), StormGeo (Norway), among others. There have also been several FDI projects in the gaming sector in the last few years. The geographical stretch of IT investors is wide, with the US and Norway dominating.

To conclude:

- 'Pure' R&D investments are still rare in Lithuania and well below leading locations like Ireland. However, Lithuania is relatively successful in attracting design, development and testing projects.

- There are positive trends in terms of emerging ICT 'hot spots' such as gaming, cyber security and fintech, while success stories in the life sciences/biotech sector were more evident almost a decade ago.

- Currently, the majority of FDI (in terms of employment) comes in the shared services sector making Lithuania a regional hub for exported SSC services. However, this may become a risk in the longer term since labour costs, which comprise around 65 % of total SSC costs (Golnik, 2016), are expected to rise significantly in Lithuania. Doing better than cheaper locations, such as

[29] A longer list is available here: http://www.investlithuania.com/shared-service-centers/

India, Bulgaria, etc., will depend on the availability of a **skilled** labour force, and the attractiveness of the overall investment climate.

2.2 Policy environment

Institutions

The main institution responsible for attracting FDI is Invest Lithuania, which was established in 2010. This agency has attracted the majority of projects in IT development, R&D and design, and the development and testing areas. Invest Lithuania's strategy for 2016-2020 has laid out specific **key performance indicators (KPIs) for 2020**:

- Investment in projects attracted should reach EUR 689 million by 2020 (EUR 311 million should be invested in fixed assets) (strategic indicator);
- 214 FDI projects attracted by 2020 creating 13 350 jobs;
- 182 projects must be implemented in high- or medium-value-added sectors[30];
- 107 FDI projects must be carried out outside Vilnius;
- 43 R&D-based FDI projects.

These indicators show that attracting R&I-intensive FDI is a priority for Invest Lithuania. Aiming for 20.1 % of planned projects in R&D is ambitious, given that these projects comprise only a minor share of all FDI projects, and in 2016, only 8.3 % of Invest Lithuania projects where in R&D (this also depends on the definition of R&D-based FDI).

Other institutions also play a role. The Ministry of Economy is responsible for business policy in general and Invest Lithuania is accountable to it. The LVPA is responsible for implementing FDI-related instruments in the context of the Operational Programme 2014-2020 (including Smart specialisation).

Specialisation priorities

Invest Lithuania identified specific target sectors in its strategy for 2016-2020[31]:

[30] A project is considered to be implemented in high- or medium-value-added sectors if investors use high-technologies important for innovation development in Lithuania, are knowledge-intensive, and the project leads to innovative products/services. Such projects must meet at least one of the following criteria: a) have a high impact on clusterisation; b) the investing company's technology processes are important for Lithuania's higher education; c) the project has a positive impact on the country's long-term economic development, its competitiveness and social welfare; and d) the potential exists for an increase in exports.

- Manufacturing (electronics, metal manufacturing, industrial equipment, consumer products);
- Life sciences (medical biotechnology and industrial biotechnology);
- Services (shared service centers, technical support centres, design, development and testing – including IT development – and data centres);

These target sectors were identified based on an analysis of the situation while preparing the strategy. They overlap to some extent with the Smart specialisation priorities.

Invest Lithuania considers that the success in attracting FDI in Smart specialisation areas comes from international trends in R&D investment, R&D infrastructure and competences, a thriving innovation ecosystem, signals from foreign investors, and the potential for cluster development. The sales process for R&D projects comprises six steps (Invest Lithuania, 2015a):

- Proactive contacts by personnel working in the R&D area.
- Identifying needs of enterprises (working with individual enterprises as well as universities, MITA and open access centres).
- Individual value proposal (presentation for a specific enterprise on what Lithuania may offer, including partners).
- Proactive work with interested companies, including visits.
- Support for an enterprise in establishing and beginning activities in Lithuania.
- Monitoring of investment project.

FDI-related programmes and policies

Lithuania's Investment Promotion and Industry Development Programme 2014-2020 concentrates on investment policy in general, although attracting FDI is one of the priorities. Although objectives and indicators are not oriented solely towards FDI, they aim to improve the investment environment, which helps to attract foreign investors. The programme has three main goals:

- *Increasing direct investment in manufacturing and services* (ratio between Lithuania and EU in gross capital formation as % of GDP is forecast as 1.2 in 2020). Two objectives are set: a) improving the investment environment (15th in the Doing Business report by 2020); b) developing free economic zones (increased private investment in free economic zones (EUR 72.4 million in 2020)).

[31] Nonetheless, it is important to note that Invest Lithuania's web page indicates a wider variety of focus industries (e.g. oil and gas), therefore there is some confusion on the overall clarity of specialisation.

- *Modernisation, integration and development of industry* (at least 20 % of GDP in the manufacturing sector; labour productivity per hour worked – 78.44 % of EU average in 2020). Three objectives have been set: a) promoting networking and industrial cooperation among manufacturing and services companies; b) promoting the more effective use of resources and energy by companies; c) increasing high- and medium-high-technology manufacturing (share of high- and medium-high-technology manufacturing in total manufacturing production – 20 % in 2020).

- *Providing Lithuania's business with competitive human resources* (share of employers satisfied with supply of professionals – 50 % in 2020). Two objectives have been set: a) increasing the alignment between education and labour market needs (share of graduates working according to their qualifications is forecast at 50 % in 2020); b) creating permanent instruments for developing human resources (employees who participate in supported programmes – 65 000 in 2020).

Other relevant documents, such as the Innovation Promotion Programme 2014-2020, the Plan for implementing recommendations of OECD, the Concept of Valleys, etc. all stress the need to attract FDI in high-value-added sectors, especially linked to Smart specialisation. It is envisaged that science and technology parks should help attract partners from abroad to use the services provided by valleys. The action plan for implementing OECD recommendations suggests:

- Developing the infrastructure of free economic zones to attract foreign investors in Smart specialisation priorities (Smartparkas LT instrument). SmartParkas LT (total budget - EUR 13.0 million) funds investment in engineering networks and the communication infrastructure of free economic zones, where foreign companies carry out R&D activities. Funding is also foreseen for marketing activities related to investment projects. Implementation of this instrument has not started yet;

- Strengthening language teaching according to investors' needs;

- Training employees of foreign investors (including languages), analysing human resources needs;

- Developing study programmes to make them better reflect investors' needs;

- Helping to attract FDI in Smart specialisation areas. Two ESIF-funded instruments are planned. Smartinvest LT (EUR 5.8 million) funds the active facilitation of FDI in Smart specialisation priority areas. Currently, one project implemented by Invest Lithuania has been launched: Smartinvest LT+ (EUR 43.4 million), which funds FDI in R&D activities, research infrastructure, and activities related to adoption of process and organisational innovations. To date, six projects have been selected for funding (see Table 6 for details).

- Supporting international networking and searches for partners (InoConnect LT instrument).

The piloting of new radical technologies (as a way to search for new foreign investors) is not high on the political agenda, although certain incentives exist to attract such projects. For example, Vilnius Mayor invited Uber to test driverless cars in Vilnius. However, this is an individual initiative rather than a systemic approach. Lithuania's government and public are also aiming to attract large investments from well-known companies, such as Tesla and its Gigafactory. The public is heavily involved in this initiative (e.g. a home-made movie on building the Tesla Gigafactory in Lithuania was produced through Minecraft and managed to attract attention from Tesla).

As of February 2017, 28 applications had been submitted to SmartInvest LT+, with six projects selected for funding (see table below). Unfortunately, most of applications were of low quality and/or the applicants lacked financial stability (did not meet the minimal eligibility criteria) and were rejected. This may point to problems with the instrument's design (for example, its active FDI facilitation component – SmartInvest LT – had not been launched before this call).

Table 6: Data on first call of Smartinvest LT+ by Smart specialisation priority areas

Smart specialisation priority area	Applications**	Selected for funding	ESIF funds	Project budget
Transport, logistic and information and communication technologies	11*	2	EUR 2.33m	EUR 5.75m
Health technologies and biotechnologies	9	3	EUR 3.41m	EUR 5.86m
New production processes, materials and technologies	8*	0	–	–
Agro-innovation and food technologies	2	1	EUR 1.47m	EUR 3.47m
Inclusive and creative society	1	0	–	–
Energy and a sustainable environment	0	0	–	–

Source: LVPA data, 2017

Notes: * three applications were assigned to two priority areas; such applications are counted in both priority areas; ** some companies submitted two applications

2.3 Barriers to and drivers for innovation-intensive FDI

There is a broad range of FDI **drivers** in the region that foreign investors must consider when deciding to invest in Central and Eastern European countries, such as the supply of a qualified workforce, closeness of markets and clients, growth potential of local markets (although, for Lithuania it is difficult to compete with Poland here) (Invest Lithuania, 2016c). Fewer investors consider infrastructure and logistics, regulation and business climate, universities and researchers, or industrial clusters as important factors (Invest Lithuania 2016c). However, while these factors can be very relevant to innovation-oriented FDI, the pool of talent is more important.

In Lithuania, the most important motive for **all FDI investors** appears to be the availability of a skilled workforce, selected by nearly half of companies surveyed by the *Financial Times* (MCJ Lemagnen analysis based on *Financial Times* fDi markets). Still important, although considerably less so, are regulations and the business climate, domestic market growth potential, and infrastructure and logistics (each being important to around one-fifth of investors surveyed). Only some of them acknowledged that lower costs motivated them to choose Lithuania (MCJ Lemagnen analysis based on *Financial Times* fDi markets).

The majority of **innovation-oriented FDI investors** who provided their motives for choosing Lithuania indicate that skills and a highly qualified workforce are the main attraction, which is similar to the general position held by foreign investors. Various other motives are also mentioned, but by few respondents. These include the support available at the national level, low costs, research infrastructure, and quality of life. Therefore, innovation-oriented FDI differs in its needs from other types of investment, by stressing the importance of skills (MCJ Lemagnen analysis based on *Financial Times* fDi markets).

The **barriers** for FDI, and especially for innovation-oriented FDI, may come from different sources. One of these is the regulatory environment and restrictiveness specifically on foreign investments. Another is the general business environment, and the country's competitiveness in terms of taxation, costs, etc. Finally, the availability of resources, such as infrastructure or skilled labour force, is an important issue, especially given the motives of investors, as mentioned above.

Restrictiveness of FDI regulation

The overall restrictiveness in FDI regulation in Lithuania is medium compared to competitor countries, but low overall, according to the OECD data. The most restrictive sectors are transport (air and maritime), fisheries and real estate investment. Lithuania is also at the medium level (compared to other competitors) in the case of equity restriction. With respect to key foreign personnel, and screening and approval, no regulatory restriction was found.

Table 7: FDI regulation restrictiveness (2015)

Country	Equity restriction	Screening and approval	Key foreign personnel	Other restrictions	Total
Czech Republic	0.003	0.000	0.000	0.007	0.010
Denmark	0.030	0.000	0.000	0.003	0.033
Estonia	0.014	0.000	0.000	0.004	0.018
Finland	0.008	0.000	0.000	0.010	0.019
Germany	0.017	0.000	0.000	0.006	0.023
Hungary	0.027	0.000	0.000	0.001	0.029
Iceland	0.057	0.010	0.000	0.100	0.167

Country	Equity restriction	Screening and approval	Key foreign personnel	Other restrictions	Total
Ireland	0.035	0.000	0.000	0.008	0.043
Latvia	0.014	0.000	0.000	0.012	0.026
Norway	0.074	0.000	0.006	0.005	0.085
Poland	0.056	0.000	0.006	0.010	0.072
Portugal	0.003	0.000	0.000	0.004	0.007
Sweden	0.028	0.027	0.000	0.003	0.059
Lithuania	**0.026**	**0.000**	**0.000**	**0.008**	**0.034**
Romania	0.008	0.000	0.000	0.000	0.008
Russia	0.096	0.018	0.010	0.057	0.181
Ukraine	0.031	0.079	0.000	0.009	0.120

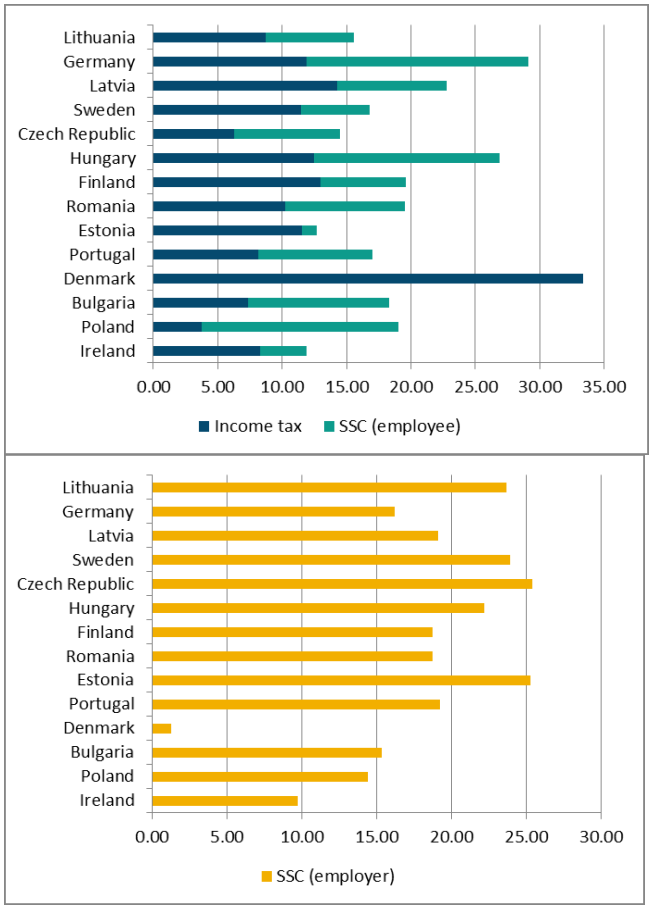
Source: OECD FDI Regulatory Restrictiveness Index 2015 Key: red – low performance among countries with respect to specific indicator, yellow – medium performance, green – high performance

Even though FDI restrictiveness is not high, other aspects of regulatory environment have the potential to discourage investors. Invest Lithuania's strategy identifies the main regulatory barriers to attracting FDI as: a) high administrative/regulatory load (92nd out of 138, according to the World Economic Forum (2016)); b) regulation of labour relations (121st out of 138, according to the World Economic Forum (2016) if the effect of taxation on incentives to work is measured); and c) high tax load (the majority of investors claim that labour taxation is the main problem with the taxation system (121st place according to WEF, 2016.

Taxation and costs

The taxation system and in particular labour taxes make Lithuania less friendly to potential investors compared to other Baltic Sea Region countries, although it depends on the specific tax. The value added tax rate is among the highest in the region, while employer's national insurance contribution is only lower than Estonia and Sweden (MCJ Lemangen, 2016). On the other hand, Lithuania's corporate income tax is among the lowest in the region.

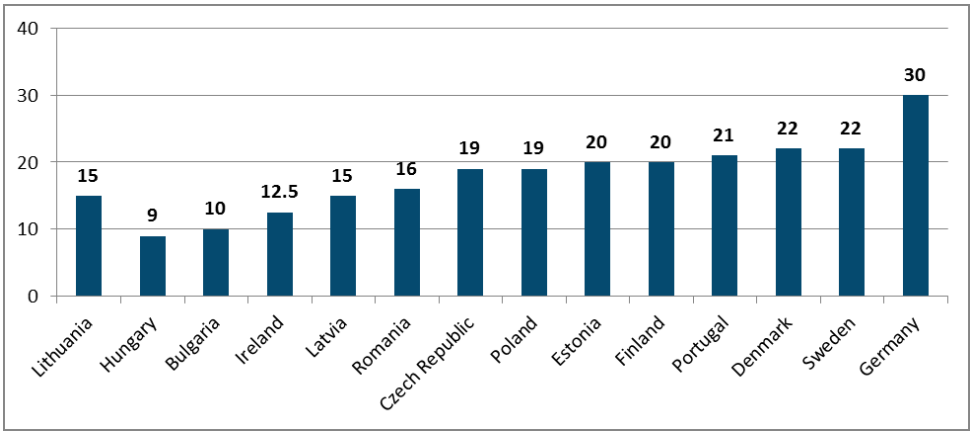
Figure 16: Tax wedge composition (single person, earnings equal to 67 % of average wage) 2015; employee contributions (left) and employer contributions (right)



Note: SSC – social security contributions Source: European Commission, Tax and benefits indicators database 2016

Given its general tax rate, Lithuania ranks below Estonia, but is above the averages of the CEE countries and the EU-28. Although Estonia has a higher tax rate, it still ranks above Lithuania with respect to attracting investment. This means that Lithuania's tax system lacks effectiveness and is not perceived as friendly by investing companies (Invest Lithuania, 2016a). Comparing corporate tax rate, Lithuania scores favourably compared to most of its competitors. However, certain taxation exceptions in other countries may make these competitors more attractive (such as 0 % corporate income tax in Estonia if no dividends are distributed).

Figure 17: Corporate tax rate (as of March 2017)



Note: these reflect national corporate tax rates (for Germany it provides a combined tax rate, due to the high local tax rate); however, there are various exceptions to the general rule, depending on the country: e.g. in Estonia, companies which do not distribute profits do not have to pay income tax; in Ireland, the tax rate is 25 % on non-trading income, etc., which may also affect investors' decisions. *Source: Deloitte (2017)*

Given its labour taxes, Lithuania is above many of its competitors in the EU, and also has one of the highest rates of social security paid by the employer; however, corporate taxation is more business-friendly than in most of its competitors. In addition to labour taxation, **the labour relations system is rather rigid**. Lithuania ranks 116th in hiring and firing practices, 105th in redundancy costs, and 61st in co-operation in labour-employer relations (World Economic Forum, 2016). Although the new labour code should improve the situation, its adoption is postponed.

Still, according to Invest Lithuania, **cost competitiveness in R&D projects is lower than that in Western Europe, the Nordic countries or Poland and the Czech Republic**. In 2015, an R&D company with 55 employees would expect to shoulder approximately EUR 90 950 in personnel costs per month, compared to EUR 93 246 in Poland, EUR 128 462 in the Czech Republic, EUR 247 639 in Finland and EUR 274 035 in Sweden (Invest Lithuania, n.d.).

Although some aspects of the taxation system are a barrier (e.g. labour taxation), there are several potentially attractive elements of taxation in Lithuania for foreign investors. First, Lithuania has taxation treaties with 50 countries. Secondly, it provides **corporate profit tax incentives for R&D** (up to three times deductible expenses). Thirdly, in the case of investment projects, a **reduction of up to 50 % corporate profit tax is available** (Invest Lithuania, 2015b).

Availability of skilled workforce ('talents')

The availability of a skilled labour force is becoming one of the key barriers to innovation-intensive FDI. From 2010-2014, the share of employers who agreed

that there is a lack of available labour force grew 2010-2014 (Invest Lithuania, 2016a).

First, sector-level analysis (biotech and medical devices sectors) of attractiveness to foreign investors indicates that the main problems are **low availability of human resources with sector-specific skills** and limited access to research infrastructure (including lack of accessible information on what infrastructure and services are available[32]) (Create Lithuania, 2016b). The current mismatch between the demand and supply of skills (OECD, 2016) is increasing competition among companies. Potential bottlenecks in human resources in areas such as ICT, transport and logistics, and health are particularly alarming (Reymen et al., 2015), even if skills in manufacturing are evaluated positively in the regional context (MCJ Lemangen, 2016). Invest Lithuania (2016a) warned that although the science, technology, engineering and mathematics (STEM) sectors created 26 500 jobs in 2010-2014, the availability of human resources is likely to decline. According to the data from Statistics Lithuania, the number of students in STEM fields[33] continued to shrink (as did the total number of students) during 2009-2016. The number of Bachelor STEM students shrank significantly (from ~37 400 to ~27 300). The number of Master or college STEM students was more stable: the former remained at ~7200 while the number of college STEM students rose from ~17 600 to ~19 000. For further discussion on this challenge, see OECD (2016a, p.134-138).

Despite falling numbers in the headcount, the share of STEM students increased in both universities and colleges: in universities it rose up to 35-40 % and in colleges up to 48 %. However, steps are being taken to increase the number of graduates choosing careers in science, technology, engineering, arts and mathematics (STEAM). For example, the Ministry of Education and Science plans to establish 10 STEAM education centres (first agreement signed in 2016). It should also be noted that between the years 2013/2014 and 2015/2016 there was a minor increase (82) in BA students in STEM fields.

Secondly, **the country fails to both retain and attract talent**. In addition to demographic trends, brain drain is a huge challenge. Even if the number of skilled graduates in relevant areas increases, the country cannot retain graduates. According to the World Competitiveness Index, Lithuania ranks only 106th in retaining talent. The ability to attract foreign talents is even worse (111th place) (World Economic Forum, 2016). Invest Lithuania suggests that a

---

[32] For broader discussion on the availability of research infrastructure, please refer to Chapter 2 report.

[33] Fields included in the calculation: nature sciences, exact sciences, mathematics and statistics, computer sciences, engineering and engineering professions, manufacture and processing, architecture and construction, agriculture, forestry and fishery, veterinary, health care, transportation services, and environment protection. Fields that were not assigned to STEM: personal abilities, training of teachers and pedagogy, fine arts, humanities, social and behavioural sciences, journalism and information, business and administration, law, social services, services for individuals, and security services.

specific body responsible for talent attraction could be set up, and fiscal adjustments introduced for highly skilled foreign labour (Invest Lithuania, 2016b). Currently, Create Lithuania, a programme for attracting young professionals with international experience, is also run by Invest Lithuania and the Ministry of Economy (MoE).

Historically, low labour costs have been one of the main attractions for foreign investors. Research shows that, in Lithuania, average hourly labour costs, including employer contributions (EUR 6.8 in 2015, according to Eurostat data) are among the lowest in the Baltic Sea Region and the whole EU due to low salaries (and despite high labour taxes). Lower costs in the Baltic Sea Region are only found in Baltic Russia (MCJ Lemangen, 2016). This serves as a potential driver for attracting FDI. However, the Investors' Forum indicates that Lithuania is losing its advantage in labour costs (Investors' Forum, 2016a), while investors consider low costs to be one of the least important reasons for choosing the CEE for investment (Invest Lithuania 2016c). Combined with a skills shortage, this could mean less FDI in the near future.

2.4 Summary of recent studies and trends

Expert reccomendations

In addition to working with potential investors, Invest Lithuania is one of the driving forces behind those reforms relevant to FDI. The years 2015-2016 saw several studies on Lithuania's attractiveness to foreign investors, the largest being Invest Lithuania's Reform Guidelines (Invest Lithuania, 2016b), which outlines priority areas for reforms (see summary above).

Recent studies by Invest Lithuania and Create Lithuania find similar weaknesses in the environment to attract FDI. Findings indicate that the government needs to urgently review the Lithuanian education system and align it better with global skills demand. Secondly, improvements in infrastructure (including a better environment for developing infrastructure) and air connectivity are necessary. With a specific reference to R&D, **Invest Lithuania** (2016a, 2016b) and **Create Lithuania** (2016a) proposed the following recommendations:

- Better institutional co-operation in the R&D area and easier access to information (clear information on schedule for calls in the relevant ESIF instruments, ensuring the availability of documentation in English and easy access to other relevant information);
- Introduction of a common operator and KPIs for OACs, appointing independent members to valley boards;
- Improving research infrastructure and access to it (centralised database on available funding and infrastructure, preparing catalogues of services and products provided by research and higher education institutions, support for public research infrastructure, when contracts with companies are signed, and reserve funds for foreign investors);

- Efficient system for ensuring supply of human resources (monitoring and assessment of supply and demand for R&D personnel, tax incentives to increase researchers' salaries, review of doctoral training system, and researcher visas).
- Increasing available funds and support (e.g. tax exemptions (also based on company's type), financial incentives for projects implemented with large foreign companies, tax credit exceptions, increasing attractiveness of EU funds, and open R&D vouchers for up to EUR 20 000 to be spent in OACs);
- Specific recommendations for **attracting education and talent**:
  - Reforms in education (prioritisation of secondary education and improvement of teacher training, better aligning student training and needs of global labour market, consolidating higher education institutions, and reviewing the system of assessment of R&D activities);
  - Reforms for attracting talent (establishing an agency responsible for attracting talent, special conditions for highly qualified professionals, tax incentives for attracting highly qualified employees from abroad, social security compensation for employing foreign researchers, increasing effectiveness of responsible institutions, lowering administrative burden, talent visas, more inclusive integration of foreigners, etc.);
- Strengthening economic diplomacy (enabling a Council of Economic Diplomacy, increasing effectiveness of distribution of human resources, creating regulation on co-operation with China, and modifying rules for double taxation);
- More effective business cycle (increasing effectiveness of public services (through blockchain lean), slow procedures for establishing foreign companies);
- Improving infrastructure and connectivity (shortening procedures for opening a factory/plant, serving business customers more rapidly (introduction of fast-track procedures, more client service points, etc.) lowering infrastructural costs for industrial companies (competitive price of electricity, support for creation of engineering infrastructure, etc.), increasing Lithuania's air connectivity);
- Improving Lithuania's image (establishing a council able to communicate with abroad which would be accountable to the government);
- Regional development (giving incentives to municipalities to create a business-friendly environment, strengthening the capacities of the regional economic development system, and investment in infrastructure important for business).

Investors' Forum (2016b) also gave a few suggestions on what changes could be made to the regulatory system and governance so that the environment becomes more FDI-friendly:

- More flexible regulation of labour relations (implementation of the new Labour Code). In addition, taxes on labour should be decreased;

- Better air connections between Vilnius[34] and major European cities (preferably those where companies are likely to invest in Lithuania), especially on workdays. The renovation of Vilnius airport is currently scheduled for summer 2017;
- Attracting talents and a qualified workforce; this should cover special visas for talents;
- Increasing funding for instruments that aim to attract FDI;
- Reforming the higher education system in order to improve the supply of highly skilled employees.

Recent trends

In terms of labour taxes and regulation, although important steps have been taken to make Lithuania's environment more business-friendly, their implementation is lacking. A new, more flexible Labour Code ('Social Model') was proposed in 2016, but a change in government also resulted in postponing labour regulation reform.

As regards innovation policy and its effects on FDI, the President of the Republic of Lithuania initiated guidelines for the reform of science and innovation policy. This document includes a requirement for attracting foreign investment into Lithuania's innovation system. Its implementation plan was prepared and is being embedded in legal acts.

A few trends concerning the availability of a skilled workforce and attracting talent include:

- The government launched a process aimed at improving the quality of higher education. This relates to raising the standards to entering university, and optimisation of the network of HEIs (the current situation envisages that three to five universities could remain). The first proposals will be available by May 2017.

- In July 2016, the Lithuanian Parliament amended the Law on Legal Situation of Foreigners, making it more favourable for the immigration of skilled specialists and start-ups. Start-ups and entrepreneurs from foreign countries will be able to get legal permission to live and work in Lithuania quicker (down from one month to 15 days); the previously existing requirement to employ at least three Lithuanians has been abandoned; the immigration of skilled specialists from non-EU countries is getting easier; and foreign students can start working from their first year of studies and will not be required to pass a previously required 'labour market test'.

- The 'Start-up visa' was adopted in January 2017.

[34] This is also stressed in the Bureau of Economic and Business Affairs (2016).

- In February 2017, the government approved a list of 27 occupations in high-value-added areas, where non-EU workers will have easier access to Lithuania's labour market. These occupations mainly relate to engineering and IT areas. The decision also includes safeguards for the non-discrimination of foreign workers.

- The MoE will introduce a support measure for industrial PhDs in 2017; a voucher worth EUR 16 500 will be provided for four years, covering half of the costs of PhD studies.

- The MoE announced its priorities in March 2017, including several that are important for investors, for example:

  - A group will be formed within Invest Lithuania to improve the investment environment and attract large manufacturing projects;

  - FDI should be affected positively by better regulation of free economic zones;

  - Administrative burden for companies should be reduced;

  - New financial and tax incentives (including higher profit tax exemptions for reinvestment) are foreseen;

  - Importantly, the plan also includes establishing a department/agency which will focus on attracting talent and improving conditions for a highly qualified workforce from non-EU countries;

  - 'Start-up visas' will be developed further, the aim being to make Lithuania very friendly to start-ups.

Another example is a privately initiated movement to provide children with micro:bit programmable learning computers. In the long run, such actions may also help to improve the country's skills base.

3 CONCLUSIONS

This chapter summarises the main findings for both topics.

Conclusions on co-operation between the public science base and business

1. *Recent trends in industry-research collaboration do not provide a positive outlook for the future*. First, the shares of innovative companies which collaborate with HEIs and government, public or private research institutes are well below the EU average – 2.4 % and 1.4 % of all companies respectively (2014 data). Furthermore, these shares are declining. Secondly, business-science co-operation may depend on the availability of EU funds – the amount of contract research declined from EUR 7.3 million in 2009 to EUR 4.1 million in 2014, but further research is needed to state this conclusively due to the large annual changes. Thirdly, although the performance of open access centres (OAC) shows positive trends, OACs are likely to face a sharper increase in expenses than revenues at least until 2020 and will not have enough funds to reinvest into RI and keep them up to date. In comparison, Fraunhofer-Gesellschaft in Germany (67 institutes and research units) generates EUR 1.8 billion from contract research annually. On average, that amounts to EUR 26.87 million per *one unit* per year (EUR 9.6 million in revenues from industry).

2. Key barriers to cooperation are:

    a. Mismatch between supply and demand of public R&D services and knowledge due to limited business absorptive capacities, the public R&D system being too focused on basic science, and a lack of international-level R&D results;

    b. Information asymmetry and limited access to public RIs, bureaucratic and complicated procedures applied by public RIs, and lack of flexibility and motivation. Most RI projects are dominated by the agenda of the host institutions and are linked too weakly to a wider partnership (industrial, societal) strategy;

    c. Unfavourable researcher career rules, internal institutional policies and other career and funding conditions, such as over-dependence on academic publications, high teaching load, etc.;

    d. Lack of professional technology transfer services and active approach when working with business (both local and foreign);

    e. Insufficient human capital in R&I and poor work (salary) conditions, especially for young researchers. Not only has it become a challenge to deliver R&D services to business, but it is also a bottleneck for achieving any mid- and long-term R&I goals.

3. Data on business absorptive capacities show limited capacities in absorbing public R&D knowledge or investments without simultaneously dealing with capacity building. 'Pure' R&D innovation is pursued by firms in those industries or market niches where technological opportunities are larger, the knowledge base is more closely linked to natural or engineering sciences, and the returns from private investment can be, at least partially, appropriated. In Lithuania, this is the case only in a small number of niche industries. Several small high-tech sectors are sprouting from the research base, namely the biopharmaceuticals, ICT and photonic technologies. However, these sectors are small and fragmented. Furthermore, most business R&D investments are made by SMEs, in contrast to some other peers (e.g. Hungary) where a small number of relatively big performers make the majority of BERD and companies are better linked to the global value chains. Both aspects point to the lack of critical mass to produce high-impact innovations and/or innovations new to the market. In other industries, firms invest much less in research and focus more on development, or innovate either by acquiring new technology produced by others, or by modifying products or by using industrial design. Still, there is potential in these more traditional fields such as the food sector, transport, etc., as reflected by Lithuania's Smart specialisation priorities and emerging success stories like the BOD Group, Amilina or Rūta.

4. Compared to the policy mix of 2007-2013, the current one pays more attention to encouraging co-operation between science and business. At least five policy instruments[35] provide direct investments for co-operation. Indirect investments are made in innovation promotion services, matchmaking (Inogeb LT) and the development of technology transfer centres. The policy mix also provides a larger variety of instruments and is better balanced in terms of innovator types addressed, the innovation cycle covered, innovation supply-and-demand-side instruments (including a pre-commercial procurement measure), and measures aimed at R&I-based FDI. In addition, a few relevant reforms are under way, fuelled by the Science and Innovation Policy Guidelines proposed by the Lithuania's President.

5. The policy mix for 2014-2020 was expected to focus on exploiting the RIs created for economic R&D results. To achieve this, innovation culture and skills in Lithuanian universities and institutes needed to be urgently developed, and R&I policy coordination had to be improved. From this perspective, current policy framework still suffers from several flaws:

   a. High fragmentation of documents, public agencies, research and HEIs, etc., also lead to over-regulation;

[35] They are: innovation vouchers; joint science-business projects; Intellect. Joint science-business projects; development of competencies of researchers in knowledge-intensive firms; and Inocluster.

b. High fragmentation of R&D infrastructures and their different types (research institutes, valleys, open access centres, competence centres, technology transfer centres, innovation centres, etc.), information asymmetry regarding available R&D services (see point 2b above), and lack of effective knowledge and technology transfer programmes;

c. Lack of co-operation in designing instruments, which does not allow for the creation of synergies;

d. Slow implementation of funding instruments from the 2014-2020 operational period;

e. Specific gaps in the policy mix concerning joint industry-research projects that may discourage institutions from participating in joint industry-research projects, effectively rendering some of the funds devoted to intersectoral cooperation obsolete**.**

f. Over-complicated ESIF regulations and rules (EU and national) leading to lack of easy-access and easy-to-manage instruments.

Conclusions on innovation-oriented FDI

6. Compared to regional competitors, Lithuania is a modest performer in attracting FDI. Furthermore, FDI investments are of a comparatively lower quality, and have not served as a catalyst for Lithuanian sectors to improve their positions in the global value chains (GVC). The position of Lithuania GVC has not improved significantly and the country shows a low 'backward participation' in GVCs. Compared to all Lithuanian companies, on average, foreign-affiliated enterprises established in Lithuania create more jobs, have a higher turnover, invest more per person employed, create more value added at factor cost, and are more productive. However, compared to competitor countries, they do not perform that well. This is especially the case for turnover per enterprise and value added at factor cost per enterprise.

7. From 2010-2015, the majority of FDI (in terms of employment) came into the knowledge-intensive services sector, or more specifically – shared services sector – making Lithuania a regional hub for exported SSC services. However, this may become a risk in the longer term since labour costs are expected to rise significantly in Lithuania. Meanwhile, FDI in the medium-high-technology sector is increasing, but remains over five times lower than that in KIS. FDI in high-technology services is lowest and declining, which is a worrying trend. The highest share of FDI is in financial services activities (except insurance and pension funding), real estate activities, and the manufacture of coke and refined petroleum products, chemicals and (bio)pharmaceuticals.

8. Another trend relates to the low attractiveness of Lithuanian regions as investment locations. Vilnius attracts more than half of the FDI projects,

followed by Kaunas (15 %) and Klaipėda (9 %), leaving the rest of the country with a small share.

9. Lithuania is among the top performers in the region for attracting FDI projects in design, development and testing. However with nine FDI projects in R&D from 2010-2016, the country is below leading competitor countries. According to Create Lithuania (2016), in 2010-2014, the number of R&D projects per million population was 0.7 in Lithuania compared to 34.3 in Ireland. The share of R&D-based FDI projects was 2 % in Lithuania as against 20 % in Ireland (a top performer) during the same period. On a positive note, the number of R&D projects attracted by Invest Lithuania tripled from 2013 to 2016 (from one to three projects per year). There are also positive trends in terms of emerging ICT 'hot spots' in the fields of gaming, cyber security and fintech, while success stories in the life sciences/biotech sector were more evident a few years ago.

10. According to investors, the availability of a highly skilled workforce is the main motive for choosing Lithuania as a location for investment and therefore a key barrier at the same time. Other drivers mentioned by investors include business environment and regulation, domestic market potential, and infrastructure and logistics. Lower costs seem to play a lesser role than might be expected (MCJ Lemagnen analysis based on Financial Times FDI markets, 2017); however, this may also be understated, as the only data available is for public announcements. Nonetheless, there are indications that Lithuania is losing its advantage of being a low-cost country.

11. Given the regulatory environment, restrictiveness towards FDI is not high in Lithuania, being found primarily only in specific sectors (e.g. air transport). In spite of this, regulatory and policy environment has several structural flaws:

a. A relatively high level of labour taxation;

b. Too rigid regulation of labour relations (121st out of 138, according to WEF, 2016);

c. High administrative/regulatory burden (92nd out of 138, according to WEF, 2016);

d. Skills mismatch and diminishing availability of skilled workforce (especially in regions other than Vilnius) play an important role. Lithuania fails to both retain and attract talent. According to the World Competitiveness Index, Lithuania ranks only 106th in retaining talent. Its ability to attract talent is even worse (111th place) (WEF, 2016). A potential shortage of human resources in important fields such as ICT or engineering may force investors to choose other countries;

e. Finally, all the critical issues in the R&I field, such as a lack of coordination or poor working conditions for young researchers, are

resulting in a lack of human resources to deliver R&D services or a lack of open access to RIs. Combined with the lack of availability of the workforce, these issues could hinder further attraction of innovation-oriented FDI, especially 'pure' R&D projects;

f. Other than that, additional improvements, such as better air connectivity between Vilnius and major cities or better economic diplomacy, are also advocated.

12. Recently, innovation-intensive FDI attracted policy attention. Invest Lithuania's Strategy for 2016-2020 sets targets for 2020, among them: 182 FDI projects in high- or medium-value-added sectors, and at least 43 R&D-based FDI projects. This Strategy identifies specific target sectors that overlap to some extent with the country's Smart specialisation priorities. To attract innovation-intensive FDI, three ESIF-funded instruments have been launched: SmartParkas LT (EUR 13 million), Smartinvest LT (EUR 5.8 million) and Smartinvest LT+ (EUR 43.4 million) funding FDI in R&D activities, RI and organisational innovations. In addition, Lithuania provides corporate profit tax incentives for R&D. In the case of investment projects, a reduction of up to 50 % is available for corporate profit tax. Start-up visa was introduced in 2017. *However specific policy instruments may prove ineffective due to weaknesses in the regulatory framework (see above), and there may be challenges with ESIF-funded instruments.* For example, so far, the quality of the project pipeline for Smartinvest LT+ has been low, and the majority of applications have been rejected.

ANNEX 1. LIST OF REFERENCES

BGI Consulting (2015), Europos Sąjungos struktūrinės paramos poveikio žmogiškųjų išteklių plėtrai poveikio vertinimas.

Bureau of Economic and Business Affairs (2016), 2016 Investment Climate Statement, Lithuania.

Create Lithuania (2015), Motyvacinės sistemos savivaldybėms pritraukti privačias investicijas kūrimas. Esamos situacijos analizė.

Create Lithuania (2016a), Pasiūlymai dėl MTEP priemonių užsienio investuotojams tobulinimo.

Create Lithuania (2016b). Pasiūlymai dėl MTEP priemonių užsienio investuotojams tobulinimo. Survey of companies.

Deloitte (2017), Corporate Tax Rates 2017.

ESTEP (2015), 2007-2013 m. ES struktūrinės paramos poveikio Lietuvos konkurencingumo vertinimas, Ministry of Finance.

European Commission (2016a), References to Research and Innovation in the European Semester Country Report 2016. Lithuania, DG Research & Innovation, Brussels.

European Commission (2016b), The 2016 EU Industrial R&D Investment Scoreboard, Joint Research Centre.

Fraunhofer-Gesellschaft (2016), Annual Report 2015. Focus on People.

Golnik, R. (2016), Shared services locations vs. costs: Comparison of four key countries, SSON Analytics.

Invest Lithuania (2015a), Investuok Lietuvoje MTEP strategija ir sumani specializacija.

Invest Lithuania (2015b), We speak fluent business. Let's talk Lithuania.

Invest Lithuania (2016a), Investicinė aplinka: prioritetai ir būtini pokyčiai.

Invest Lithuania (2016b), Reformų gairės konkurencingai Lietuvai.

Invest Lithuania (2016c), Tiesioginių užsienio investicijų (TUI) projektų apžvalga 2015 m.

Invest Lithuania (2016d), Viešosios įstaigos „Investuok Lietuvoje" veiklos ilgalaikė strategija iki 2020 metų.

Invest Lithuania (n.d.), Driving Innovation. We have the right DNA.

Investors' Forum (2016a), Lietuvos investuotojų pasitikėjimo indeksas (7).

Investors' Forum (2016b), Pasiūlymai Lietuvos investicinės aplinkos gerinimui.

Knowledge Economy Forum (2012), Klasterių studija.

LMT (2012), Evaluation of research (arts) activities 2009-2011.

LMT (2015), Evaluation of research (arts) activities 2012-2014.

LVPA (2017), Intelektas. Bendri mokslo-verslo projektai. Evaluation. Presentation of first call results of the instrument.

Martinaitis Ž. et al. (2013), Current strengths and future growth potential in Lithuania's economy. Background discussion paper to support development of Smart Specialisation Strategy in Lithuania.

MCJ Lemangen (2016), Corporate Investment Opportunities in the Nordics and Baltic Sea Region, Executive summary.

MITA (2016a), Klasterizacijos vertinimo ataskaita.

MITA (2016b), Our R&D Competence to Your Business.

MOSTA (2013), Identification of specific research and (sociocultural) development and innovation (RDI) priorities in Lithuania, Proposals for RDI Priorities. Updated and amended report.

MOSTA (2014), Lietuvos mokslinių tyrimų ir eksperimentinės (socialinės, kultūrinės) plėtros (MTEP) ir inovacijų konkrečių prioritetų identifikavimo paslaugos. Prioritetų įgyvendinimo kelrodžiai.

MOSTA (2015), Specialistų kvalifikacijų žemėlapio pirminė analizė.

MOSTA (2016), Lietuvos mokslo ir studijų būklės apžvalga 2016.

MOSTA, LPK (2014), Mokslo ir studijų institucijų bei pasirinktų verslo sektorių gebėjimo bendradarbiauti MTEP srityje tyrimo analizė, Final report.

OECD (2016), Reviews of Innovation Policy: Lithuania 2016, OECD Publishing, Paris. doi: http://dx.doi.org/10.1787/9789264259089-en

OECD FDI Regulatory Restrictiveness Index 2015.

Paliokaitė, A. (2015), Stairway to Excellence Report Lithuania, Institute for Prospective Technological Studies, JRC, DG Research and Innovation, Seville.

Paliokaitė, A., Krūminas, P., Stamenov, B. (2016), RIO Country Report 2015: Lithuania, Joint Research Centre.

Paliokaitė, A., Kubo, K. (2013), DG RTD expert group advising on Smart specialisation development in Lithuania, Final Report.

Paliokaitė, A., Martinaitis, Ž., Sarpong, D. (2016), Implementing Smart Specialisation roadmaps in Lithuania: lost in translation? Technological Forecasting & Social Change 110, 143-152.

Reymen, D., Gerard, M., De Beer, P., Meierkord, A., Paskov, M., Di Stasio, V., Donlevy, V., Atkinson, I., Makulec, A. Famira-Mühlberger, Lutz, H. (2015), Labour Market Shortages in the European Union, European Parliament.

Statistics Lithuania (2014), Development of Innovation Activity 2010-2012.

Statistics Lithuania (2016), Development of Innovation Activity 2012-2014.

Technopolis Group and Ernst and Young (2012), Operational model for R&D infrastructure projects, Report.

Technopolis Group and Ernst and Young (2014), Galutinė Slėnių stebėsenos projekto ataskaita, įskaitant galutinę MTEP infrastruktūros projektų stebėsenos ataskaitą.

UNCTAD (2016), World Investment Report 2016. Annex tables.

Visionary Analytics (2014), High technologies development feasibility study, Ministry of Economy of the Republic of Lithuania, Vilnius.

Visionary Analytics (2015), Support to SMEs - Increasing Research and Innovation in SMEs and SME Development: Work Package 2. Lithuania: Case Study, European Commission DG REGIO, Brussels.

Visionary Analytics (2017), *Ex-post* evaluation of the "Inno-vouchers LT" impact on business R&D expenditure, Final Report. Ministry of Economy of the Republic of Lithuania, Vilnius.

World Economic Forum (2016), The Global Competitiveness Report 2016-2017.

ANNEX 2. WHO IS WHO IN R&D IN LITHUANIA

The mapping of 'who is who' is based on the relative performance of various research organisations. Thus, the best-performing ones with respect to innovation or industry-research collaboration have been selected. In the case of clusters, those that were most active in 2007-2013 instruments were selected.

Institution	Department and position	Name	Contact information
Research and higher education institutions			
Kaunas University of Technology	Director of Centre for Innovation and Business	Edmundas Šalna	edmundas.salna@ktu.lt +370 612 73311
	Vice-Rector for Research and Innovation	Prof Asta Pundzienė	asta.pundziene@ktu.lt +370 37 300 003
	Rector	Prof Petras Baršauskas	petras.barsauskas@ktu.lt +370 37 300 00, 324 040
Vilnius Gediminas Technical University	Rector	Prof Dr Alfonsas Daniūnas	Alfonsas.daniunas@vgtu.lt +370 5 274 5000
	Vice-Rector for Research and Innovation	Prof Antanas Čenys	antanas.cenys@vgtu.lt +370 5 274 5005
	Director of Knowledge and Technology Transfer Department	Vilma Purienė	vilma.puriene@vgtu.lt +370 5 251 2488
Center for Physical Sciences and Technology (FTMC)	Director	Gintaras Valušis	Gintaras.valusis@ftmc.lt +370 5 264 9211
	Head of Department for Technology and Innovation	Marius Vinciūnas	marius.vinciunas@ftmc.lt +370 5 264 9361
	Deputy Director	Nerija Žurauskienė	Nerija.zurauskiene@ftmc.lt +370 5 261 9532
Vilnius University	Rector	Prof Artūras Žukauskas	rector@vu.lt +370-5-2687010
	Vice-Rector for Research	Prof Rimantas Jankauskas	Rimantas.jankauskas@mf.vu.lt +370-5-2687015
	Director of the Research and Innovation Department	Vida Lapinskaitė	vida.lapinskaite@cr.vu.lt +370 5 268 7164
Lithuanian	Rector	Prof Habil Dr	rektoratas@lsmuni.lt

University of Health Sciences		Remigijus Žaliūnas	+370 37 32 72 01
	Vice-Rector	Prof Habil Dr Vaiva Lesauskaitė	vaiva.lesauskaite@lsmuni.lt +370 37 32 72 06
Lithuanian Energy Institute	Director	Dr Sigitas Rimkevičius	Sigitas.Rikevicius@lei.lt +370 37 401924
	Chair of R&D and Innovation Department	Rimantas Levinskas	Rimantas.Levinskas@lei.lt +370 37 401804
Klaipėda University	Rector	Prof Habil Dr Eimutis Juzeliūnas	rektorius@ku.lt +370 46 398 901
Life Sciences Centre	Chair of the Board	Prof Eugenijus Butkus	eugenijus.butkus@chf.vu.lt +370 5 223 4435
Institute of Biotechnology (Vilnius University)	Chief Scientist and Head	Prof Dr Virginijus Šikšnys	siksnys@ibt.lt +370 5 2602108
Science valleys			
Santaka Valley	Administrator	Evelina Školaitė	evelina.skolaite@ktu.lt +370 (37) 300 089
Sunrise Valley	(Sunrise Valley Science and Technology Park)	Laima Kaušpadienė	info@sunrisevalley.lt administracija@sunrisevalley.lt +370 615 47865
Santara Valley	Managing Director	Kristina Mateikienė	kristina.mateikiene@valleysantara.lt +370 611 19217; +370 5 219 52 98
Business and business associations			
Lithuanian Confederation of Industrialists	Executive Director	Giedrė Švedienė	giedre.svediene@lpk.lt +370 5 243 10 66
	Expert in Education, Research and Innovation Unit	Raimundas Balčiūnaitis	Raimundas.Balciunaitis@lpk.lt +370 5 212 61 30
Lithuanian Business Confederation	President	Valdas Sutkus	info@lvk.lt +370 5 212 1111
Lithuanian Private Equity and Venture Capital Association	Chairman of the Board	Arvydas Saročka	info@vca.lt +370 5 255 46713
Engineering Industries Association of	Director	Gintaras Vilda	gintaras.vilda@linpra.lt +370 686 13581

Lithuania			
Infobalt	Project Manager – Innovation	Andrius Plečkaitis	a.pleckaitis@infobalt.lt
Investors' Forum	Executive Director	Rūta Skyrienė	ruta@investorsforum.lt +370 5 275 52 58
Association of Robotics	Director	Edgaras Leichteris	e.leichteris@lic.lt +370 698 04499
Business companies, investors			
ABB	Managing Director	Bo Henriksson	info@lt.abb.com + 370 5 2738 300
Kitron	Managing Director	Mindaugas Šeštokas	Mindaugas.sestokas@kitron.com +370 37 409330
Thermo Fisher Scientific Baltics	Vice-President in the Baltics, General Director	Algimantas Markauskas	info.baltics@thermofisher.com +370 5 239 4203
Telia Lietuva	Chief Executive Officer	Kęstutis Šliužas	+370 5 262 1511
Sicor Biotech	General Manager	Dr Janis Meiksans	info@sicor.lt +370 5 236 0561
Yukon Advanced Optics Worldwide	General Manager	Aliaksandr Alsheuski	aolshevskiy@yukonopticsglobal.com +370 699 36062
Achema	General Director	Ramūnas Miliauskas	sekretoriatas@achema.com +370 349 56237
Altechna	Director	Marius Piliauskas	Marius.piliauskas@altechna.com +370 5 272 5738
Amilina	Director	Edvinas Bernotas	info@amilina.com +370 45 45 45 00
Baltic Solar Energy	General Manager	Vidmantas Janulevičius	info@solitek.eu +370 5 263 8774
Biotechpharma	General Manager	Prof Vladas Algirdas Bumelis	info@biotechpharma.lt
Ekspla	Director	Kęstutis Jasiūnas	ekspla@ekspla.com +370 5 264 96 29
Elinta	Director	Vytautas Jokužis	vytautas.jokuzis@elinta.lt +370 698 23267
Intersurgical	General Manager	Sigitas Žvirblis	info@intersurgical.lt +370 3876 6611
Lifosa	General Manager	Jonas Dastikas	info@lifosa.com +370 347 66 483
Ruptela	General	Andrius Rupšys	info@ruptela.com

	Manager		
Šviesos konversija	Manager	Algirdas Juozapavičius	sales@lightcon.com +370 5 249 1830
Intelligent Communications	Manager	Mantas Vizbaras	info@trafi.com
Barclays Group Operations Limited Lithuania	Director	Justin Eugene Sifferman	+370 5 251 1110
Brolis Semiconductors	Director	Dominykas Vizbaras	dominykas.vizbaras@brolis-semicon.com
Clusters			
Užupis Creative Cluster	President	Marius Pareščius	+370 686 77781
Odontology Innovations Cluster	Director	Renata Gilienė	renata@medgrupe.lt +370 618 58154
Laser and Engineering Technology Cluster	Coordinator	Julius Paužolis	julius.pauzolis@litek.lt +370 5 266 1640
Stem Cell and Regenerational Medicine Innovation Cluster	Coordinator	Justinas Ožiūnas	justinas.oziunas@biotechpharma.lt +370 696 78591
Photovoltaic Technology Cluster	Director	Prof. Algirdas Galdikas	algis.galdikas@protechnology.lt +3705278606
Lithuanian Laser Association	Cluster Manager	Petras Balkevičius	Petras.balkevicius@eksma.eu + 370 5 2729714
Baltic Automotive Components Cluster	Chairman of the Board	Tomas Jaskelevičius	info@bacc.lt +370 650 80617
Lithuanian Plastics Cluster	Coordinator	Gintaras Vilda	Gintaras.vilda@linpra.lt +370 686 13581
Public institutions			
Chancellery of the Government of Lithuania	Chancellor	Milda Dargužaitė	milda.darguzaite@lrv.lt +370 706 63974
Office of the President of the Republic of Lithuania	Adviser to the President	Dr Saulė Mačiukaitė-Žvinienė	saule.maciukaite-zviniene@president.lt +370 706 64131
Ministry of	Deputy	Dr Giedrius	Giedrius.Viliunas@smm.lt

Education and Science	Minister	Viliūnas	+370 5 2191226
	Head of Technology and Innovation Division	Kristina Babelytė-Labanauskė	Kristina.Babelyte-Labanauske@smm.lt +370 5 2191220
	Director of Department of Higher Education, Science and Technology	Dr Albertas Žalys	Albertas.Zalys@smm.lt +370 5 219 1177
Ministry of Economy	Deputy Minister	Lina Sabaitienė	Lina.Sabaitiene@ukmin.lt +370 706 64920
	Deputy Minister (previously worked at Invest Lithuania)	Rugilė Andziukevičiūtė-Buzė	Rugile.Andziukeviciute-Buze@ukmin.lt +370 706 64915
	Director of Innovation Department	Dimitrijus Kucevičius	Dimitrijus.Kucevicius@ukmin.lt +370 706 64669
	Director of Investment and Export Department	Gina Jaugielavičienė	Gina.Jaugielaviciene@ukmin.lt +370 706 64840
Parliament of Lithuania (Seimas)	Head of the Committee of Economics	Virginijus Sinkevičius	Virginijus.Sinkevicius@lrs.lt +370 5 239 6696
	Head of the Committee of Audit	Ingrida Šimonytė	Ingrida.Simonyte@lrs.lt +370 5 239 6978
	Head of the Committee of Education and Science	Eugenijus Jovaiša	Eugenijus.Jovaisa@lrs.lt +370 5 239 6604
Invest Lithuania	Managing Director	Mantas Katinas	mantas.katinas@investlithuania.com +370 5 2627438
	Business Services Team Lead	Laisvis Makulis	laisvis.makulis@investlithuania.com; +370 5 2194313
	Technology Team Lead	Ugnius Ramanauskas	ugnius.ramanauskas@gmail.com +370 5 2649069
Investment and Business Guarantees (INVEGA)	Chief Executive Officer	Audrius Zabotka	audrius.zabotka@invega.lt +370 5 210 7510
Research	**Chairman of**	Prof. Dainius	Dainius.pauza@lmt.lt

Council of Lithuania	**the Council**	Haroldas Pauža	+370 5 261 8531 +370 682 39366
	Director of Science Fund	Aušra Vilutienė	ausra.vilutienie@lmt.lt +370 5 261 1009
Agency for Science, Innovation and Technology (MITA)	**Director**	Kęstutis Šetkus	Kestutis.setkus@mita.lt +370 5 2 644 707
	Head of the R&D&I Programmes and International Cooperation Division	Ričardas Valančiauskas	Ricardas.valanciauskas@mita.lt +370 5 2 127 434
Research and Higher Education Monitoring and Analysis Centre (MOSTA)	Acting Director	Dr Ramojus Reimeris	ramojus.reimeris@mosta.lt +370 5 243 0403
	Analyst	Tadas Juknevičius	tadas.juknevicius@mosta.lt +370 5 243 0403
Other staleholders, experts			
Knowledge Economy Forum	Executive director	Arminas Varanauskas	arminas@zef.lt +3706 18 00519
Lithuanian Innovation Center	Director	Dr Mantas Vilys	m.vilys@lic.lt +370 686 50156
	Project Manager	Dr Artūras Jakubavičius	a.jakubavicius@lic.lt +370 687 36632
Baltic Institute of Advanced Technology	Chief Executive Officer	Dr Tomas Žalandauskas	info@bpti.lt +370 683 87737
LITEK Cluster/FTMC	Expert	Linas Eriksonas	Linas.Eriksonas@ftmc.lt +370 614 10640
Go Vilnius	Director	Darius Udrys	go@vilnius.lt +370 5 262 9660

Note: due to data availability, in some cases contacts of companies are provided rather than specific people

A complete list of open access centres and contact details of their managers is available here: http://www.mita.lt/en/general-information/national-rampd-programmes/open-access-resources-and-services/open-access-rampd-centres/

ANNEX 3. USEFUL STATISTICS

Table 8: HERD funded by business enterprise sector as % of GDP

Country / Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU-28	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	NA
Bulgaria	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	NA
Czech Republic	0	0	0	0	0	0	0.01	0.01	0.02
Denmark	0.01	NA	0.03	0.03	0.03	0.03	0.03	0.02	0.02
Germany	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	NA
Estonia	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.03
Croatia	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
Latvia	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Lithuania	0.07	0.07	0.08	0.06	0.06	0.07	0.09	0.07	0.07
Hungary	0.03	0.03	0.04	0.03	0.03	0.02	0.02	0.02	0.01
Poland	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Romania	0.01	0	0	0	0.01	0.01	0	0	0
Slovenia	0.02	0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.03
Slovakia	0.01	0	0	0	0.01	0.01	0.01	0.01	0.01
Finland	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.03	0.03
Sweden	0.04	NA	0.04	NA	0.03	NA	0.03	NA	NA
Norway	0.02	NA	0.02	NA	0.02	NA	0.02	NA	NA

Source: Eurostat data

Table 9: GOVERD funded by business enterprise sector as % of GDP

Country / Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
EU-28	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	NA
Bulgaria	0.01	0.01	0.01	0.01	0.01	0	0.01	0	NA
Czech Republic	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Denmark	0	NA	0	0	0	0	0	0	0
Germany	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.05	NA
Estonia	0	0	0	0	0	0	0	0	0
Croatia	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Latvia	0.03	0.02	0.02	0.03	0.02	0.03	0.02	0.03	0.03
Lithuania	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Hungary	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.02
Poland	0.03	0.01	0.01	0.02	0.02	0.01	0.01	NA	0.01
Romania	0.02	0.03	0.02	0.03	0.05	0.03	0.03	0.03	0.03
Slovenia	0.05	0.05	0.04	0.05	0.02	0.03	0.03	0.02	0.02
Slovakia	0.02	0.02	0.02	0.02	0.02	0.03	0.01	0.03	0.03
Finland	0.04	0.04	0.05	0.03	0.04	0.03	0.03	0.02	0.02
Sweden	0.01	NA	0.01	NA	0.01	NA	0	NA	NA
Norway	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.03	NA

Source: Eurostat data

Table 10: Enterprises co-operating with universities or other HEIs in 2014 by NACE, percentage of total innovative enterprises

Country / NACE	A	B	C	D	E	F	G	H	I	J	K	L	M	N
EU28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bulgaria	NA	NA	NA	0	0	NA	3.1	5.5	NA	7.9	0	NA	11.6	NA
Czech Republic	NA	24.9	13.1	21.7	14.3	NA	2.6	2.9	NA	13.7	15.4	NA	27.1	NA
Denmark	44.1	41.8	20.5	12.5	25.8	16.0	10.3	6.0	1.4	6.4	8.7	0.0	21.6	5.6
Germany	NA	14.4	16.6	21.4	14.7	NA	NA	10.2	NA	19.6	10.7	NA	NA	NA
Estonia	NA	16.7	14.1	26.3	8.3	NA	NA	2.2	NA	12.2	15.4	NA	NA	NA
Croatia	NA	32.5	9.8	7.4	7.3	16.6	0.5	3.8	4.9	7.9	1.7	NA	14.1	NA
Latvia	NA	NA	7.4	10.7	NA	NA	0.9	4.2	NA	13.8	NA	NA	25.6	NA
Lithuania	NA	10.7	8.5	5.9	6.3	0.4	NA	2.5	NA	22.9	8.6	NA	NA	NA
Hungary	NA	25.0	11.6	4.2	18.9	NA	8.9	9.1	NA	12.2	5.1	NA	32.9	NA
Poland	NA	20.5	12.5	16.9	9.5	NA	5.3	2.5	NA	10.9	2.0	NA	20.9	NA
Romania	NA	NA	12.5	0	NA	NA	10.1	0	NA	13.3	0	NA	22.3	NA
Slovenia	NA	NA	23.6	NA	NA	NA	NA	NA	NA	16.1	NA	NA	35.8	NA
Slovakia	NA	0	13.2	44.8	0	3.2	6.5	12.7	NA	17.2	10.0	NA	22.3	NA
Finland	NA	33.3	28.6	59.4	32.6	NA	NA	9.4	NA	25.6	6.7	NA	NA	NA
Sweden	NA	NA	17.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	21.6	NA

Notes: NACE sector: A – Agriculture, forestry and fishing; B - Mining and quarrying; C – Manufacturing; D – Electricity, gas, steam and air conditioning supply; E – Water supply; sewerage, waste management and remediation activities; F – Construction; G – Wholesale and retail trade; repair of motor vehicles and motorcycles; H – Transportation and storage; I – Accommodation and food service activities; J –Information and communication; K – Financial and insurance activities; L – Real estate activities; M – Professional, scientific and technical activities; N – Administrative and support service activities. Key: red – low cooperation, yellow – medium cooperation, green – high

cooperation, relative to other sectors of a given country. *Source: Eurostat, Community Innovation Survey, 2014*

Table 11: Enterprises co-operating with government, public or private research institutes in 2014 by NACE, percentage of total innovative enterprises

Country / NACE	A	B	C	D	E	F	G	H	I	J	K	L	M	N
EU-28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bulgaria	NA	0	1.3	0	0	NA	NA	NA	NA	3.2	0	NA	7.0	NA
Czech Republic	NA	20.8	5.5	5.7	9.4	NA	2.6	1.4	NA	3.9	16.0	NA	15.0	NA
Denmark	33.7	13.6	10.3	8.3	5.9	5.2	3.8	3.0	0	2.0	1.6	0.0	8.8	3.3
Germany	NA	8.2	12.2	25.2	5.8	NA	NA	1.9	NA	12.0	2.2	NA	NA	NA
Estonia	NA	16.7	6.9	21.1	4.2	NA	NA	2.2	NA	6.8	7.7	NA	NA	NA
Croatia	NA	32.5	6.1	NA	5.9	5.0	NA	NA	4.0	1.8	1.7	NA	7.9	NA
Latvia	NA	NA	4.6	10.7	NA	NA	NA	4.2	NA	10.3	NA	NA	25.6	NA
Lithuania	NA	3.6	6.3	3.9	9.4	0.2	NA	0.2	NA	7.1	11.4	NA	NA	NA
Hungary	NA	12.5	3.3	NA	10.8	NA	3.5	3.8	NA	6.9	1.3	NA	13.5	NA
Poland	NA	23.3	11.0	10.6	7.3	NA	6.0	1.4	NA	5.2	2.2	NA	14.0	NA
Romania	NA	NA	5.7	NA	NA	NA	NA	0	NA	13.6	NA	NA	13.4	NA
Slovenia	NA	NA	16.1	NA	NA	NA	NA	NA	NA	13.7	NA	NA	23.1	NA
Slovakia	NA	0	6.5	10.3	0	6.3	5.4	0	NA	6.0	6.0	NA	6.4	NA
Finland	NA	22.2	24.0	35.9	34.9	NA	NA	4.5	NA	18.3	4.5	NA	NA	NA
Sweden	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes: NACE sector meaning: A – Agriculture, forestry and fishing; B – Mining and quarrying; C – Manufacturing; D – Electricity, gas, steam and air conditioning supply; E – Water supply; sewerage, waste management and remediation activities; F – Construction; G – Wholesale and retail trade; repair of motor vehicles and motorcycles; H – Transportation and storage; I – Accommodation and food service activities; J – Information and communication; K – Financial and insurance activities; L – Real estate activities; M – Professional, scientific and technical activities; N – Administrative and support service activities. Key: red – low cooperation, yellow – medium cooperation, green – high cooperation, relative to other sectors of a given country. *Source: Eurostat, Community Innovation Survey, 2014*

Table 12: Lithuanian global value chain participation index (%), by sector

Sector	1995	2000	2005	2008	2009	2010	2011
Total - all NACE activities	40.37	43.98	41.11	46.1	41.78	44.57	46.34
Agriculture; fishing	20.5	16.93	15.9	25.01	27.04	30.22	31.85
Mining and quarrying	16.37	16	14.49	24.72	23.04	21.64	22.73
Manufacture of food products, beverages and tobacco	25.18	24.09	25.61	35.3	32	37.2	39.37
Manufacture of textiles and textile products; leather and leather products	35.63	35.17	27.2	31.92	27.64	32.3	30.69
Manufacture of wood and wood products, pulp, paper and paper products;	25.96	24.13	21.94	32.67	28.23	31.67	33.32

Sector	1995	2000	2005	2008	2009	2010	2011
publishing and printing							
Manufacture of coke, refined petroleum products and nuclear fuel; chemicals, chemical products and man-made fibres; rubber and plastic products; other non-metallic mineral products	31.94	29.14	22.11	31.62	30.91	27.62	28.76
Manufacture of basic metals and fabricated metal products	41.82	39.75	36.84	40.79	35.81	39.72	37.8
Manufacture of machinery and equipment n.e.c.	38.95	33.93	31.49	38.51	29.53	39.17	37.67
Manufacture of electrical and optical equipment	42.29	39.21	35.28	43.04	35.38	41.17	40.41
Manufacture of transport equipment	32.81	32.43	28.5	33.08	23.61	30.1	36.78
Manufacturing n.e.c.	27.68	26.27	22.84	31.36	26.97	30.49	30.18
Electricity, gas and water supply	26.41	22.05	19.91	38.92	33.91	37.93	37.88
Construction	23.19	20.82	18.01	19.36	19.64	20.14	20.01
Wholesale and retail trade; hotels and restaurants	11.43	10.41	9.51	10.32	8.3	10.29	11.09
Transport, storage and communication	20.42	16.7	15.61	17.51	12.5	13.71	14.62
Financial intermediation	10.12	7.97	9.26	9.17	10.44	10.41	10.27
Real estate, renting and business activities	12.83	10.7	9.72	15.12	10.13	12.04	12.26
Public administration and community services; activities of households	14.39	13.54	12.09	15.16	10.45	12	13.01

Note: Key: red – low participation, yellow – medium participation, green – high participation, relative to other sectors in a given year. *Source: OECD, Eurostat*

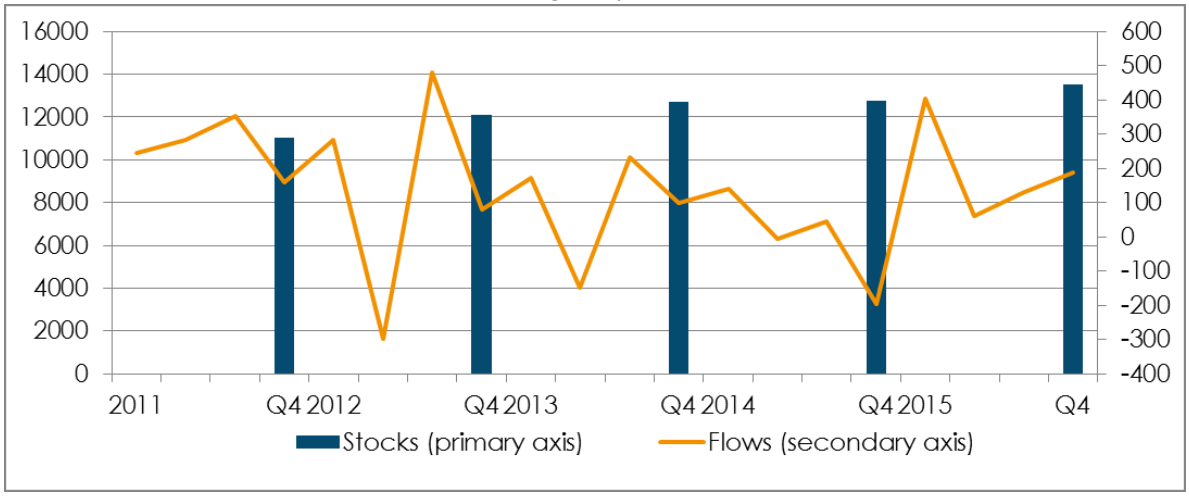
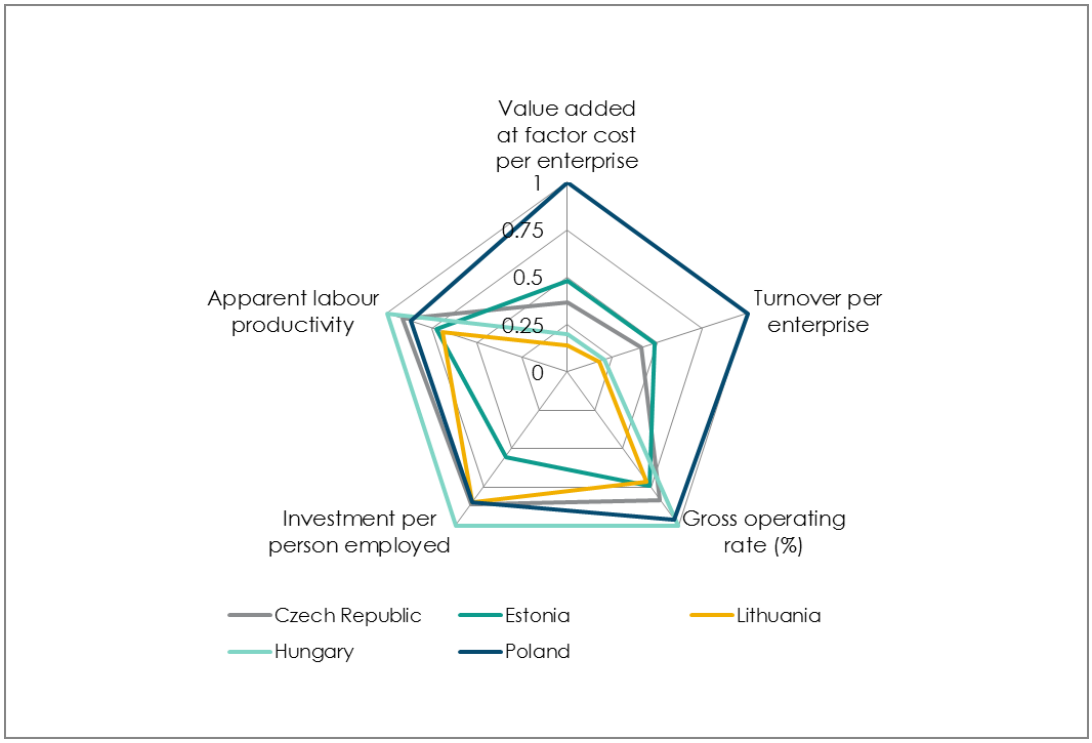
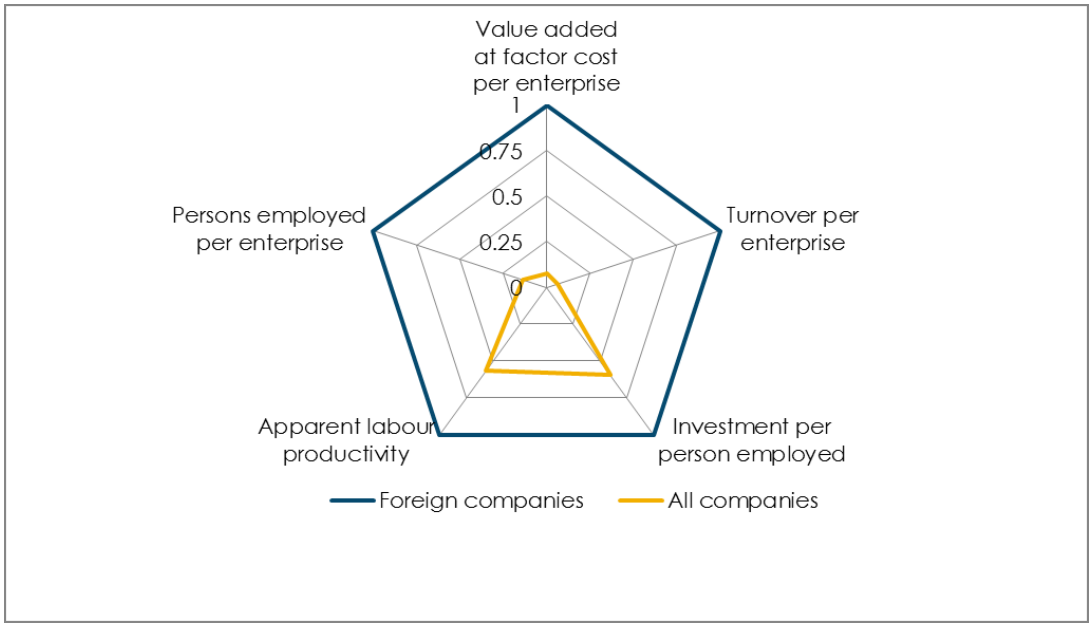


Figure 18: FDI stocks and flows in Lithuania (EUR millions)

Source: Statistics Lithuania, Bank of Lithuania

Figure 19: Statistics of foreign-controlled companies in Lithuania compared to competitors and all Lithuanian companies (2014)





Source: Eurostat, data on total business economy; repair of computers, personal and household goods, except financial and insurance activities

ANNEX 4. DATA ON LITHUANIAN R&D INFRASTRUCTURES

Table 13: Data on open access centres

No.	Open Access Centre	Manager of OAC	Valley	No. of staff (of whom researchers) in 2015	ESIF RI investments 2007-2013, (EUR million)	Related cluster RI projects, total	Income from business 2013-2015 (Lithuanian / foreign) (EUR thousands)
1.	Open Access Centre for Marine Research	Klaipėda University	Marine	55(25)	25.44	–	404.1 / 141.7
2.	National Open Access Scientific Research Center for Future Energy Technologies	Lithuanian Energy Institute	Santaka	181(133)	6.52	Photovoltaic technology cluster EUR 4.54 million	1547.9 / 356.3
3.	Open Access Center of Instrumental Analysis	Vytautas Magnus University	–	19(17)	–	–	2.3 / 0
4.	Micro and Nano Technology Laboratory	Panevėžys Mechatronics Center	–	8(4)	–	–	10.1 / 0
5.	Food Research and Technologies' Open Access Centre	Kaunas University of Technology	Nemunas	24(18)	2.4	Food (fruit and vegetable) cluster EUR 0.19 million	33.8 / 0
6.	National Innovation and Entrepreneurship Centre	Kaunas University of Technology	Santaka	N/A	36.68	Photovoltaic technology cluster; Advanced orthopaedics and rehabilitation means cluster; Odontology innovations cluster; Food (fruit and	3287.0 / 217.4

No.	Open Access Centre	Manager of OAC	Valley	No. of staff (of whom researchers) in 2015	ESIF RI investments 2007-2013, (EUR million)	Related cluster RI projects, total	Income from business 2013-2015 (Lithuanian / foreign) (EUR thousands)
						vegetable) cluster; Laser and engineering technology cluster; Clear World Digital cluster; Banking Cluster LT EUR 10.05 million	
7.	Joint Open Access Center	Baltic Institute of Advanced Technology UAB "Teravil" UAB "Geozondas"	–	2(1)	–	–	189.3 / 0
8.	Centre for the Advanced Pharmaceutical and Health Technologies	Lithuanian University of Health Sciences	Santaka	111(79)	19.58	Stem cell research and regenerative medicine innovation cluster; Complex solutions for health promotion cluster; Advanced orthopaedics and rehabilitation means cluster; Odontology innovations cluster EUR 6.29 million	113.2 / 27.7
9.	Research Centre for	Lithuanian	Nemunas	89(71)	10.1	Food (fruit and	130.3 / 114.5

No.	Open Access Centre	Manager of OAC	Valley	No. of staff (of whom researchers) in 2015	ESIF RI investments 2007-2013, (EUR million)	Related cluster RI projects, total	Income from business 2013-2015 (Lithuanian / foreign) (EUR thousands)
	Animal Nutrition, Health, Biotechnologies and Food	University of Health Sciences				vegetable) cluster EUR 0.19 million	
10.	Centre for the Material of Animal Origin Quality	Lithuanian University of Health Sciences					
11.	Scientific Research Institute Nature Research Centre	Nature Research Center	Santara	14(13)	4.97		39.3 / 0
12.	Civil Engineering Research Centre	Vilnius Gediminas Technical University	Sunrise	59(39)	5.47	–	426.3 / 212.7
13.	Vilnius University Laser Research Centre Facility "Naglis"	Vilnius University		N/A	3.47	Advanced orthopaedics and rehabilitation means cluster; Odontology innovations cluster; Laser and engineering technology cluster; Photovoltaic technology cluster EUR 11.71 million	8.1 / 6.0
14.	Vilnius University Joint Life Science Centre		Santara	43(30)	41.08	Stem cell research and regenerative medicine innovation cluster	194.4 / 500.2

No.	Open Access Centre	Manager of OAC	Valley	No. of staff (of whom researchers) in 2015	ESIF RI investments 2007-2013, (EUR million)	Related cluster RI projects, total	Income from business 2013-2015 (Lithuanian / foreign) (EUR thousands)
						EUR 1.94 million	
15.	Vilnius University Information Technology Research Centre			9(4)	1.56	Clear World Digital cluster; Banking Cluster LT EUR 2.48 million	43.3 / 0
16.	Centre for Innovative Medicine	Institute Centre for Innovative Medicine		89(66)	15.98	Stem cell research and regenerative medicine innovation cluster; Complex solutions for health promotion cluster; Advanced orthopaedics and rehabilitation means cluster; Odontology innovations cluster EUR 6.29 million	70.5 / 0
17.	Open Access Centre for modeling of fruit and vegetables processing technologies	Lithuanian Research Centre for Agriculture and Forestry Institute of Horticulture	Nemunas	12(7)	1.06	Food (fruit and vegetable) cluster EUR 0.19 million	88.1 / 0
18.	Open Access Centre for Agrobiological Research	Lithuanian Research Centre for Agriculture and		38(34)	25.01	Food (fruit and vegetable) cluster EUR 0.19 million	41.6 / 24.8

No.	Open Access Centre	Manager of OAC	Valley	No. of staff (of whom researchers) in 2015	ESIF RI investments 2007-2013, (EUR million)	Related cluster RI projects, total	Income from business 2013-2015 (Lithuanian / foreign) (EUR thousands)
		Forestry					
19.	Open Access Joint Research Centre of Agriculture and Forestry	Aleksandras Stulginskis University Lithuanian Research Centre for Agriculture and Forestry		60(45)			57.0 / 64.8
20.	Open Access Centre of Biosystem engineering, biomass energy and water engineering	Aleksandras Stulginskis University		40(27)		Photovoltaic technology cluster; Food (fruit and vegetable) cluster EUR 4.73 million	195.5 / 1.7
21.	Vilnius University Physical Sciences and Technologies Research Centre	Vilnius University	Sunrise	N/A	69.2	Laser and engineering technology cluster; Photovoltaic technology cluster EUR 6.81 million	129.8 / 227.9
22.	Open Access Centre of Prototype formation and integration	Center for Physical Science and Technology		1(0)		–	0.3 / 0
23.	Open Access Centre of Conversion and Chemical Coatings			N/A		–	0.7 / 0

No.	Open Access Centre	Manager of OAC	Valley	No. of staff (of whom researchers) in 2015	ESIF RI investments 2007-2013, (EUR million)	Related cluster RI projects, total	Income from business 2013-2015 (Lithuanian / foreign) (EUR thousands)
24.	Open Access Center of Electronic Microscopy, X-ray Diffractometry and Spectrometry			14(9)		–	20.5 / 4.6
25.	Open Access Center of Processing Technologies - BALTFAB			2(0)		–	55.1 /0.5

Note: connections with valleys and ESIF funds based on publicly available data. Changes in structures of OACs have taken place and attributions may be corrected by administrating institutions. *Sources: Visionary Analytics (2014); Lietuvos aukštųjų technologijų plėtros galimybių studija; LR ūkio ministerija; MITA; www.esparama.lt; valleys and OACs information*

Table 14: Public and private research infrastructure in Smart specialisation priority areas

Smart specialisation priority area	Priorities	Public R&D infrastructures	Private RI funded by Intellect LT+ in 2007-2013	Cluster RIs by Inocluster LT+
Energy and sustainable environment	Smart systems for energy efficiency, diagnostic, monitoring, metering and management of generators, grids and customers	12 PROs (R&D centres, faculties, laboratories), 3 OAC	1 business RI project, EUR 0.15 million	-
	Energy and fuel production using biomass/waste and waste treatment, storage and disposal	20 PROs, 3 OAC	4 projects, EUR 1.83 million	-
	Technology for the development and use of Smart low-energy buildings – digital construction	4 PROs, 3 OAC	1 project, EUR 0.14 million	-
	Solar energy equipment and technologies for its	13 PROs, 3	1 project, EUR 0.29 million	1 cluster RI

Smart specialisation priority area	Priorities	Public R&D infrastructures	Private RI funded by Intellect LT+ in 2007-2013	Cluster RIs by Inocluster LT+
	use for the production of electricity, heat and cooling	OAC		project, EUR 4.54 million
Health technologies and biotechnologies	Molecular technologies for medicine and biopharmaceutics	14 PROs, 3 OAC	11 projects, EUR 11.77 million	1 project, EUR 1.94 million
	Advanced applied technologies for individual and public health	6 PROs, 3 OAC	2 projects, EUR 1.36 million	1 project, EUR 2.78 million
	Advanced medical engineering for early diagnostics and treatment	4 PROs, 4 OAC	5 projects, EUR 0.7 million	2 projects, EUR 1.57 million
Agro-innovation and food technologies	Sustainable agro-biological resources and safer food	6 PROs, 4 OAC	–	1 project, EUR 0.19 million
	Functional food	2 PROs, 4 OAC, 1 Science and technology park (STP)	2 projects, EUR 0.67 million	1 project, EUR 0.19 million
	Innovative development, improvement and processing of biological raw materials (biorefinery)	4 PROs, 3 OAC	6 projects, EUR 3.69 million	1 project, EUR 0.19 million
New production processes, materials and technologies	Photonic and laser technologies	4 PROs, 3 OAC, 3 STPs	10 projects, EUR 11.92 million	2 projects, EUR 2.37 million
	Functional materials and coatings	14 PROs, 4 OAC	4 projects, EUR 1.22 million	1 project, EUR 1.1 million
	Structural and composite materials	4 PROs, 3 OAC	1 project, EUR 0.49 million	–
	Flexible technological systems for product creation and production	4 PROs, 2 OAC	22 projects, EUR 5.41 million	–
Transport, logistic and information and communication technologies	Smart transport systems and information and communication technologies	4 PROs	2 projects, EUR 0.33 million	–
	Technologies/models for the management of international transport corridors and integration of modes of transport	4 PROs	–	–
	Advanced electronic contents, content development technologies and information interoperability	1 PROs, 2 APC	–	1 project, EUR 1.39 million
	Information and communications technology infrastructure, cloud computing solutions and	3 PROs, 2 OAC, 1 STP	10 projects, EUR 1.19 million	1 project, EUR 1.09 million

Smart specialisation priority area	Priorities	Public R&D infrastructures	Private RI funded by Intellect LT+ in 2007-2013	Cluster RIs by Inocluster LT+
	services			
Inclusive and creative society	Modern self-development technologies and processes	5 PROs	–	–
	Technologies and processes for the development and implementation of breakthrough innovations	3 PROs	–	1 project, EUR 2.29 million

Source: Visionary Analytics (2014); Lietuvos aukštųjų technologijų plėtros galimybių studija. LR ūkio ministerija

ANNEX 5. POLICY INSTRUMENTS RELEVANT FOR RESEARCH-INDUSTRY CO-OPERATION

Instrument	Funds 2014-2020 (EUR million)	Short description	Applicants and partners	Focus on smart spec.	Progress
Direct investments in business-science co-operation					
Innovation vouchers. Ministry of Economy	10.1	Innovation vouchers (up to EUR 5682) for acquiring R&D services or feasibility studies from R&D institutions. Instrument aims at initiating contacts between science and industry. Project duration: up to 9 months. This instrument will also cover industrial PhDs. A voucher worth €16 500 will be provided for 4 years, covering half of the PhD studies costs. The rest will be funded by the collaborating business company. Companies in any sector are eligible, but only PhD studies in the physical, biomedical and technological sciences fields will be funded.	Main applicants: private legal entities Partners: –	Yes	First call announced in 2017
Joint science-business projects. Ministry of Education and Science	35.9	Subsidies for R&D projects implemented by research and HEIs (the main applicant) in co-operation with enterprises (obligatory partner). Aims to promote joint science-business projects. Funding covers joint science-business R&D projects implemented within the scope of the Smart specialisation strategy (from EUR 50 000 to EUR 700 000). Project duration: up to 36 months.	Main applicants: research and HEIs; university hospitals Partners: private legal entities (obligatory); research and HEIs; university hospitals	Yes	On hold
Intellect. Joint business-science projects.	139.0	Grants for business R&D activities (from EUR 50 000 to EUR 1.2 million), initial investment in creation and development of research infrastructure (from EUR 50 000 to EUR 3 million), further modifications are	Main applicants: private legal entities (except research and HEIs); public	Yes	98 projects funded (see Table 3)

Instrument	Funds 2014-2020 (EUR million)	Short description	Applicants and partners	Focus on smart spec.	Progress
Ministry of Economy		likely in future calls. Enterprises are the main applicants, while research and HEIs may be partners, but this is not obligatory. Thus, the instrument mainly aims to increase R&D activities in the private sector. Project duration: up to 36 months if project includes development of infrastructure; up to 24 months if it does not	institutions conducting R&D Partners: private legal entities, research and HEIs		
Development of competencies of researchers in knowledge-intensive firms. Ministry of Education and Science	2.9	Research and HEIs will agree to allow their researchers to work in the business sector for a certain time period. Instrument aims at strengthening research capacities in the private sector, and contacts between science and business. Further information is not available as of February 2017.	Main applicants: SMEs Partners: not yet clear	No	On hold
Inocluster. Ministry of Economy	26.1	Instrument aims at strengthening and better use of clustering through support for exploiting cluster, marketing, co-operation between members of the cluster, attracting new members (from EUR 25 000 to EUR €200 000 for the project duration: up to 24 months)*, developing research infrastructure (from EUR 300 000 to EUR 2.5 million for the project duration up to 36 months)*.	Main applicants: legal entities, managing clusters Partners: –	Yes	Seven projects funded
Facilitation of R&D results commercialisation and	13.0	The instrument aims at increasing the level of commercialisation of R&D results and research internationalisation through: a) supporting commercialisation of R&D results by students and	Main applicants: research and HEIs; private legal entities, which have research and HEIs as	Yes	On hold

Instrument	Funds 2014-2020 (EUR million)	Short description	Applicants and partners	Focus on smart spec.	Progress
internationalisation. Ministry of Education and Science		personnel in research organisations and HEIs by creating spin-offs (up to EUR 20 000), project duration up to 12 months; b) supporting international market-oriented research-industry projects (within the context of EUREKA programme) (up to EUR 300 000), project duration up to 36 months.	founders Partners: research and HEIs; private legal entities, which have research and higher education institutions as founders; private legal entities		
Indirect and other relevant investments					
Facilitating activity of competence centres and technology transfer centres. Ministry of Education and Science	26.1	The instrument aims at: a) strengthening exceptional R&D capabilities in research organisations and HEIs through experimental R&D, consultancy, methodical, technical aid, support for researchers and students to test their ideas which have potential for commercialisation (from EUR 100 000 to EUR 1 million); b) supporting activities of technology transfer centres which should encourage commercialisation and transfer of public R&D results (from EUR 100 000 to EUR 700 000). Project duration: up to 36 months.	Main applicants: research and HEIs Partners: public legal entities operating in research and higher education area	Yes	First call announced in 2017
Inogeb LT. Ministry of Economy	8.7	Funding for a broad range of innovation promotion activities, including technology scouting, consulting on intellectual property rights, partner search, etc.	Main applicants: MITA Partners: public institutions which has the state as a shareholder and whose main activity is innovation consulting and/or support, services for promoting entrepreneurship or business competitiveness; national business	Yes	Three agreements signed EUR 7.26 million

Instrument	Funds 2014-2020 (EUR million)	Short description	Applicants and partners	Focus on smart spec.	Progress
			associative structures unifying regional and structural business associations whose members conduct R&D		
Development of competence centres. Ministry of Education and Science	8.7	The instrument aims at developing activities in competence centres through financing material base for R&D, required for joint industry-research projects (from EUR 200 000 to EUR 1 million). However, there is proposal to merge this measure with facilitation of activity of Competences centres. Project duration: up to 36 months.	Main applicants: research and HEIs Partners: research and HEIs; public institutions which conduct R&D	Yes	On hold
Inopatent. Ministry of Economy	3.0	Funds for patenting (project duration up to 36 months) and design registration (project duration up to 12 months) at the international level (up to EUR 30 000 for single invention or design).	Main applicants: legal entities Partners: –	Yes	On hold
Development of competences of scientists and other researchers. Ministry of Education and Science	43.0	The whole instrument aims at various activities for strengthening capabilities of researchers, including capabilities to commercialise, transfer knowledge, market R&D activities. The main goal is to strengthen quality and quantity of human capital in research.	Main applicants: Research Council of Lithuania; KTU; MITA; LMA; MOSTA Partners:	No	Eight project agreements signed EUR 31.62 million

Instrument	Funds 2014-2020 (EUR million)	Short description	Applicants and partners	Focus on smart spec.	Progress
Development of RDI infrastructure and its integration into European infrastructures. Ministry of Education and Science	188	Support for development of existing research infrastructure, science popularisation infrastructure, and integration of research infrastructure into international networks. This instrument should aim at both ensuring that relevant infrastructure is updated and attractive to business, as well as its internationalisation.	Main applicants: research and higher education institutions; Lithuanian Research Library Consortium; Education Supply Centre; Lithuanian Academy of Sciences Partners: legal entities	Yes	Three agreements signed
Purposive R&D in Smart specialisation areas. Ministry of Education and Science	44.9	The instrument supports research in Smart specialisation areas with the aim of producing results with commercialisation potential.	Main applicants: legal entities operating in research and higher education areas Partners: legal entities operating in research and higher education areas	Yes	First call announced in 2017
Purposive R&D. Ministry of Education and Science	Not fixed	Support for short-term research required for urgent needs of the state. Research topics are selected by ministries or other public institutions. Science-business cooperation is possible, but not obligatory.	Main applicants: research and HEIs Partners: legal entities	No (but focus on national challenges)	15 projects selected for funding
National research programmes. Ministry of Education and	18.2**	Investment in research in specific areas of national importance. These include the following society-relevant topics: a) towards future technologies; b) sustainability of agro, forest and water ecosystems; c) welfare society; d) healthy ageing; and e) modernity in	Main applicants: research and HEIs Partners: legal entities	No (but focus on national challenges)	98 projects selected for funding

Instrument	Funds 2014-2020 (EUR million)	Short description	Applicants and partners	Focus on smart spec.	Progress
Science		Lithuania. Science-business co-operation is possible, but not obligatory, and projects are more likely to focus on fundamental research.			
Pre-commercial procurement LT. Ministry of Economy	29.4	Support for increasing innovation demand through pre-commercial procurement, which requires creation of an innovative product needed for solving relevant economic and societal challenges.	Main applicants: contracting organisations (with consent of managing institution) Partners: contracting organisations In specific procurements, applicants can be legal entities or groups of legal entities, other organisations or their departments	Yes	On hold
Pre-commercial procurement. Ministry of Economy	Not fixed	Support for increasing innovation demand through pre-commercial procurement, unless the project is already funded through instrument Pre-commercial procurement LT. Maximum funds per project is EUR 2 million. Project duration: up to 36 months.	Main applicants: contracting organisations (with consent of managing institution) Partners: contracting organisations In specific procurements, applicants can be legal entities or groups of legal entities, other organisations or their departments	No	Two procurements in 2016

Notes: * – maximum available funds per project depend on smart specialisation priorities; ** – depending on specific programme, funds cover period only until 2017-2019; once mid-term evaluation of programmes has been carried out, funding will be distributed for the remaining period.
Source: compiled by author

ANNEX 6. MAIN TYPES OF INSTITUTIONS RELEVANT FOR SCIENCE-BUSINESS COOPERATION

Table 15: Main institutions relevant for science-business cooperation

Type	Main role	Scope of activities	Users / participants	Results
HEI	Legal entity, whose main activity is to execute studies and related activities, and conduct R&D activities	Providing higher education and carrying out research in all science fields. In relation to science-business cooperation, most importantly, HEIs implement contract research. HEIs also provide licences and transfer of R&D results.	–	Data available in subchapter 1.1.2.
PRO	Legal public entity, whose main activity is to conduct R&D activities	Carrying out research in all science fields. In relation to science-business cooperation, most importantly, PROs implement contract research. PROs also provide licences and transfer of R&D results.	–	Data available in subchapter 1.1.2.
Valley	Potential of R&D, studies and knowledge-intensive business (altogether), usually concentrated in a single territory and having common or related infrastructure, and contributing towards creation of knowledge society and knowledge economy, as well as increasing competitiveness of Lithuania's economy	Valleys are not legal entities so they do not have specific activities per se. However, the following sectors can be distinguished: marine environment and technologies (Marine valley); agrobiotechnology, bioenergy and forestry, food technology, safety and health (Nemunas); sustainable chemistry, biopharmacy, mechatronics, electronics, future energy, IT and telecommunications (Santaka); lasers, light, materials, nanotechnologies, semiconductors, electronics, civil engineering (Saulėtekis); biotechnology, medical technology, molecular medicine, biopharmacy, ecosystems, sustainable development and ICT (Santara).	Research and HEIs, businesses	Due to late implementation of valley projects, it is still difficult to assess their results. For more information see information on OACs which are partly related to valleys (Annex 4)
OAC	Although, the concept of open access centres has changed	Providing access to research infrastructure and related services to external users from both Lithuania and	Owners – research and HEIs; users – research and	Data available in Annex 4

	with open access infrastructure, its main role is providing access to research infrastructure available in institutions to external users	abroad, as well as from private and public sectors. For a list of all OACs, see Annex 4	HEIs, enterprises (both Lithuanian and foreign)	
STP	Physical or virtual space, where enterprises conducting R&D or other innovation activities are established. The main role of STPs is to provide specific services to enterprises, related to innovation	Innovation Promotion Programme 2014-2020 sees STPs as representing business interests in valleys, encouraging cluster development, linking business and science. In addition, STPs aim at attracting new businesses to valleys, including foreign ones, initiating and coordinating joint R&D projects. Concept of STP Development lists the following services STPs may be grouped into: a) innovation support; b) infrastructure services; c) technical and technological services; d) technology partnership; e) innovation management; f) access to finance for innovation services; g) intellectual property management; h) information dissemination; and i) innovation popularisation. Thus, STPs should facilitate technology transfer, creation of links between science and business, etc.	Main users – enterprises, but also research and HEIs (e.g. for partnerships, technology transfer, etc.)	There are 8 STPs, but data on their results is not available
Cluster	A group of enterprises and/or research and higher education institutions and other entities, which aims to increase the effectiveness of its members' economic activities	Co-operation in clusters is based on the principle of partnerships. Although clusters cover many sectors, there are a higher number of them in services than in manufacturing. In addition, cluster research infrastructure acquired with EU funds should be open access to its users.	Physical and legal entities (enterprises, HEIs, PROs, etc.)	Clusters studied by MITA carry out R&D activities but are limited by lack of finance and depend on ESIF funding.

Source: compiled by author, based on relevant legal acts

Getting in touch with the EU

IN PERSON

All over the European Union there are hundreds of Europe Direct Information Centres.
You can find the address of the centre nearest you at: http://europa.eu/contact

ON THE PHONE OR BY E-MAIL

Europe Direct is a service that answers your questions about the European Union.
You can contact this service
– by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
– at the following standard number: +32 22999696 or
– by electronic mail via: http://europa.eu/contact

Finding information about the EU

ONLINE

Information about the European Union in all the official languages of the EU is available on the Europa website at: http://europa.eu

EU PUBLICATIONS

You can download or order free and priced EU publications from EU Bookshop at: http://bookshop.europa.eu. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see http://europa.eu/contact)

EU LAW AND RELATED DOCUMENTS

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex at: http://eur-lex.europa.eu

OPEN DATA FROM THE EU

The EU Open Data Portal (http://data.europa.eu/euodp/en/data) provides access to datasets from the EU. Data can be downloaded and reused for free, both for commercial and non-commercial purposes.

KI-AX-17-009-EN-9

The Horizon 2020 Policy Support Facility (PSF) has been set up by the Directorate-General for Research & Innovation (DG RTD) of the European Commission under the EU Framework Programme for Research & Innovation 'Horizon 2020'. It supports Member States and countries associated to Horizon 2020 in reforming their national science, technology and innovation systems.

This report presents the developments and the current state of affairs in Lithuania regarding two topics: cooperation between the public science base and business, and attraction of innovation-related foreign direct investment (FDI). It includes an overview of the main facts and figures in relation to the two focus areas and of the current public policies, legislations, strategies and/or concrete initiatives/measures related to these topics.

On the topic of science-business cooperation, the report summarises the evidence gathered on this topic; provides an overview of the existing demand for technological services from the business sector and discusses both the current policy framework and the proposed changes regarding science-business cooperation. On the topic of innovation-oriented FDI, the report presents general trends and Lithuania's performance in attracting FDI, discusses drivers and barriers, and summarises the country's FDI policy and reform proposals.

The report provides the background to the PSF Specific Support to Lithuania, conducted in 2017 by an international panel of independent experts.

Studies and reports

Publications Office

doi: 10.2777/496082
ISBN: 978-92-79-69838-5