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Paliokaitė A., Petraitė M., Gonzalez
Verdesoto E.

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Contact information: JRC-B7-NETWORK@ec.europa.eu

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RIO Country Report 2017

The R&I Observatory country report 2017 provides a brief analysis of the R&I system covering the economic context, main actors, funding trends & human resources, policies to address R&I challenges, and R&I in national and regional smart specialisation strategies. Data is from Eurostat, unless otherwise referenced and is correct as at January 2018. Data used from other international sources is also correct to that date. The report provides a state-of-play and analysis of the national level R&I system and its challenges, to support the European Semester.

Summary

Main RDI challenges and policy responses

(i) Addressing skills and talent shortage for R&D and Innovation

Lithuania is lagging behind in innovative and entrepreneurial talent. The issue is twofold: rapid decrease of the young population as a result of the demographic trends and migration. In the technology field, the mismatch between supply and demand of human capital is increasing, e.g. one third of companies in manufacturing industries agree that they lack engineers, technology designers, etc. for their RDI activities.

Policy response: The Lithuanian government initiated a higher education policy reform with the law approved in June 2016. Additional changes were introduced in July 2017 that aimed at regulating and improving the remuneration of researchers, particularly in the early stages of their careers. The liberalisation of the labour code approved in June 2017 aims at more flexible labour relations that should support new types of employment, including virtual workspaces. The February 2017 decision approving the list of professions, which required high professional qualification and which lack workers in Lithuania, includes 27 occupations and makes it easier to employ workers from non-EU countries with the required qualifications.

(ii) Facilitation of R&D commercialisation and technology transfer

Most R&D activities in Lithuania take place within public universities and R&D institutions, dependant on public funding flows. In addition, R&D demand in business is limited to a few companies within few sectors and little attention was given to the development of innovation ecosystems and development of knowledge and technology transfer capabilities in the public and business sectors. As a result, the established R&D infrastructures are not creating the expected impact on the economy.

Policy response: A set of policies to support technology transfer and facilitate R&D investment in business was implemented in 2016. In 2017, the focus has been put on the optimisation of public universities' network plan. The implementation of the smart specialisation strategy using EU structural funds has led to measures to support business R&D and research capability building through collaborative projects, the development of technology transfer centres, innovation vouchers and stimulating university spin-offs with a seed capital fund.

(iii) Improving co-ordination of R&D and innovation policies

Lithuania's RDI system is highly fragmented, both in the private and the public sector. Fragmentation is also high at the policy and governance level. Lack of synergies and overlaps in competence areas of ministries responsible for RDI policy, as well as a high number of lower-level agencies, leads to missed opportunities and wasted efforts. Coordination is also a critical issue for implementing the smart specialisation priorities which are funded from multiple sources.

Policy response: Development and implementation of the smart specialisation programme has increased the levels of co-ordination across public policy bodies and implementing agencies. The level of duplication has been significantly reduced. In 2017 a civil service reform programme has been launched with the aim of introducing lean and efficient public administration processes and significantly cut numbers of duplicating functions. It is expected to improve policy making and co-ordination practices.

(iv) Promoting the growth of innovative companies

Lithuania has established a favourable start-up environment and is constantly improving its efforts to support new venture creation, facilitation and mentoring programmes. However, the rate of surviving start-ups after 3 years is less than 50% and companies in the growth stage face challenges regarding IPR management, funding, including venture capital, rapid market development and human capital acquisition.

Policy response: The policy mix has been strengthened with the launch in August 2017 of the Open Circle Capital (risk capital fund) to support new technology venture creation and scaling up. In addition, internationalisation of SMEs is promoted with a set of measures implemented via Enterprise Lithuania that support market development, product modification, business network development and export activities. FDI measures have been successful in attracting a number of companies to the cities of Vilnius and Kaunas.

Smart Specialisation

On the whole, Lithuania's smart specialisation policy did not undergo significant changes in 2017. Developments only included modification of planned instruments or minor changes to priority action plans. Thus, progress links mainly to the implementation phase. By August 2017, the majority of instruments are being implemented for the first priority "Strengthening R&D and innovation" and the ninth priority "Educating the society and strengthening the potential of human resources" of the Operational Programme 2014-2020. However, the number of contracts signed is relatively low, due to late start and continuing evaluation of proposals. The 2017 progress report indicates that only four¹ out of 20 RDI priorities show the critical mass needed² (MOSTA, MoE, 2017). This is very useful and should guide future policy actions Progress on the implementation of top down instruments (e.g. development of R&D&I infrastructure) is slow.

It is too early to point to any evidence on the impact of the national smart specialisation strategy. However, Lithuania has carried out an interim evaluation of the impact of R&D measures included in the operational programme 2014-2020, which may lead to a revision of the smart specialisation strategy in 2018. It showed that currently the likelihood to reach intended targets is low-medium, notably:

a) it is unlikely that the target of the indicator "business research and development (R&D) expenditure" will be achieved,

¹ These are: Molecular technologies for medicine and biopharmaceutics; Advanced applied technologies for individual and public health; Functional materials and coatings; Photonic and laser technologies.

² Critical mass in this report is measured by No of publications, patents, international publications with foreign co-authors and secured high investments from ESIF.

b) the sufficiency and appropriateness of the policy mix for facilitation of knowledge commercialisation, knowledge transfer and use of research infrastructure is considered to be low-medium and

c) measures aimed at strengthening skills and capacities of researchers are on average relevant but they do not ensure preconditions for attracting high level foreign researchers or Lithuanian researchers working abroad. Furthermore, the allocation of funds for measures aimed at strengthening researchers' skills and capacities is not sufficient.

Foreword

The **R&I Observatory country report 2017** provides a brief analysis of the RDI system covering the economic context, main actors, funding trends & human resources, policies to address RDI challenges, and RDI in national and regional smart specialisation strategies. **Data is from Eurostat, unless otherwise referenced and is correct as at January 2018.** Data used from other international sources is also correct to that date. The report provides a state-of-play and analysis of the national level RDI system and its challenges, to support the European Semester.

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Authors

Agnė Paliokaitė, Visionary Analytics (Vilnius, Lithuania)

Monika Petraitė, Kaunas University of Technology (Kaunas, Lithuania)

Elena González Verdesoto, European Commission, Directorate-General Joint Research Centre, Unit B.7, Knowledge for Finance, Growth & Innovation (Brussels, Belgium)

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1 Economic context for RDI

In 2016 GDP growth reached 2.3%, mainly carried by private consumption, driven by strong wage and employment growth and subdued inflation. According to the European Commission's autumn 2017 forecast (2017a), a recovery in EU funds-driven investment and exports are set to power GDP growth up to 3.8% in 2017.

Employment grew by 2% in 2016, resulting into an unemployment rate of 7.9%, low by historical standards. In 2017, employment is expected to continue growing, although the supply of the labour is likely to decrease (European Commission, 2017a).

The general government surplus is set to revert to a deficit of 0.1% of GDP in 2017, mostly explained by the costs of structural reforms related to labour market and pensions. A set of tax increases and efforts are however expected to offset part of the revenues losses (an increase on non-taxable income and higher spending on pensions and public wages).

According to the European Semester country report (European Commission, 2017b), whereas Lithuania benefitted from high productivity growth up to 2009, these growth rates have dropped since then. One of the potential reasons is the fall in private investment, which has not managed to recover from the crisis and remains well below historical levels. On the other hand, the declining growth rates of productivity can also be attributed to a natural slowing down of the catching up process as the country's productivity level approaches the EU average.

1.1 Structure of the economy

Lithuania's economy mostly relies on services and the traditional sector (low and medium technology manufacturing industry), which forms the backbone of the economy. The knowledge-intensive services sector accounts for 32.8% of total employment (2016). In 2016, value added from knowledge-intensive services was 25.59% and high and medium high-tech manufacturing amounted to 4.07% of total value added (in 2015). In general the largest share of value added is created in services (67.98% in 2016), and manufacturing (18.88% in 2016). These sectors also account for 66.92% and 15.43% of employment respectively.

1.2 Business environment

The business environment in Lithuania is friendly, and the country ranked 16th in the World Bank's Doing Business Index (out of 190 world countries) as of June 2017³, and 40th in the Global Innovation Index 2017. Legislative changes between 2014 and 2016 enabled entrepreneurs to start a business online, establish limited liability companies without minimum capital, etc. However, some barriers remain, such as resolving insolvency. The key venture capital funds available for business in Lithuania are dependent on EU investments, but privately owned funds are also emerging.

In terms of labour regulation, important steps have been taken to make Lithuania's environment more business-friendly. A new, more flexible Labour Code was adopted in July 2017. In February 2017, the government also approved a list of 27 occupations in high-value-added areas, where non-EU workers will have easier access to Lithuania's labour market.

According to the 2016 Small Business Act (SBA) factsheet (European Commission, 2017c), SMEs represent in Lithuania 99.8% of the total number of enterprises (including only "non-financial" businesses and with companies in agriculture, forestry and fisheries excluded). They generated more than 70% of the value added and constituted more than three quarters of total employment. Lithuania scores above the EU average in the principles of entrepreneurship, business environment, responsive administration and

³ Source: <http://www.doingbusiness.org/rankings>

state aid & public procurement. Access to finance is within the EU average and the country is below average in skills and innovation, second chance opportunities and internationalisation.

As far as the digital economy is concerned, according to the European Commission's Digital Economy and Society Index 2017 (DESI)⁴ Lithuania's performance is above average in all dimensions (connectivity, use of internet, integration of digital technology and digital public services) except for human capital, where there was limited progress. According to the European Commission's digital progress report (EDPR, 2017) this is largely due to a drop in the share of STEM graduates and the persisting low share of ICT specialists as a fraction of employed individuals. Improvement in the integration of digital technologies and in digital public services has been significant.

Lithuania has also made significant progress in the area of eco-innovation. Indeed, the Eco-Innovation Index⁵, published by the European Commission, ranks Lithuania in the 17nd place among the 28 Member states in 2017 while the country was in the last place in this index in 2011-2012.

2 Main RDI actors

When it comes to performance and funding, the public sector is predominant in Lithuania's research and development and innovation (RDI) landscape, but the whole RDI system is fragmented (see Figure 1).

Aware of the fragmentation in the research and higher education networks, the Government started in 2017 a process of optimisation. In June, the Parliament approved the plan of the optimisation of the public universities' network.

The private sector still plays a relatively minor role, even if the share of innovative firms is increasing: 40.7% of firms introduced innovations over 2014, compared to 30% in 2010-2012.

The **Ministry of Education and Science** and the **Ministry of Economy** remain the two main bodies responsible for RDI policy, while several agencies distribute funding. The RDI policy remains fragmented, also at academia level, leading to duplications of RDI activities and a lower efficiency (MOSTA, 2015).

The **Strategic Council for Research, Development and Innovation** is responsible for the overall coordination of the RDI policy and its role might be strengthened as it is also responsible for the implementation of the "science and innovation policy reform guidelines" proposed by the President in 2016 and approved by the Parliament. The structure of the Council was updated in July and October 2017 and is now composed by 13 representatives of the government who work in consultation with 12 experts from the academia and business sectors.

The **research and higher education monitoring and analysis centre (MOSTA)** is the main analytical institution, also responsible for the monitoring of the Lithuanian smart specialisation strategy in partnership with the Ministry of Economy. As from January 2017 MOSTA is directly responsible to the Lithuanian Government and serves as the Secretariat for the Strategic Council for RDI.

A formal **Smart Specialisation Coordination Group** has been set up by the Ministry of Education and Science and the Ministry of Economy⁶ It consists of the representatives of relevant ministries and implementing agencies.

Three key strategic documents covering research and innovation are **Lithuania 2030**, the Lithuania Innovation Development Programme 2014-2020⁷, the **National**

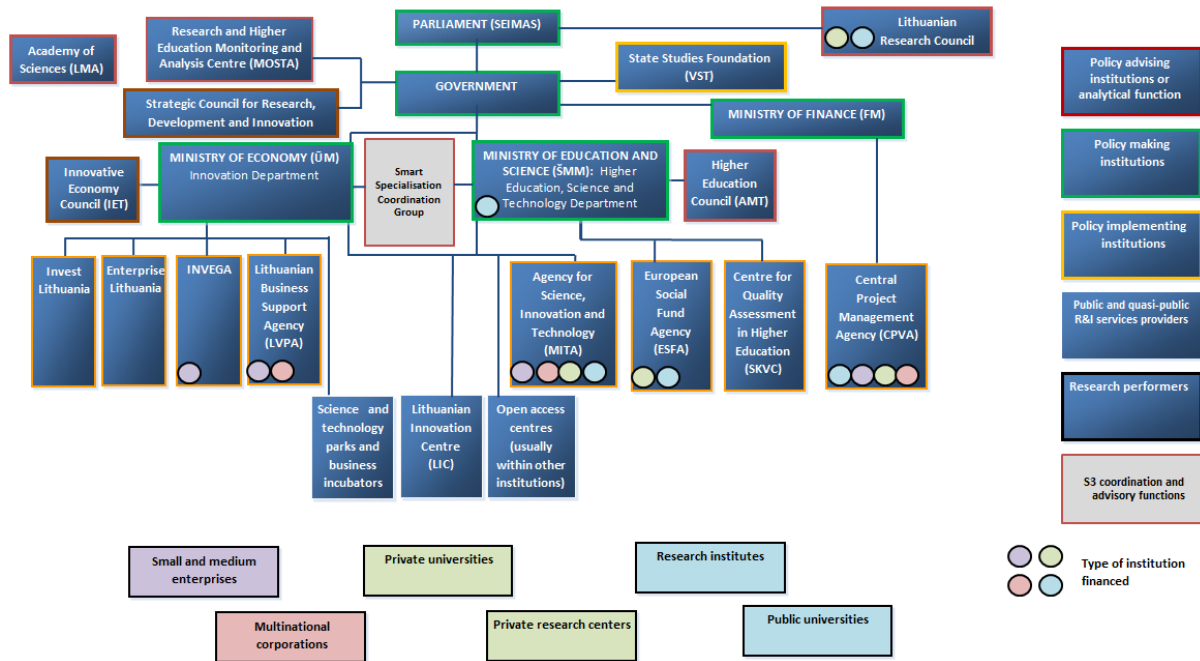
⁴ Source: <https://ec.europa.eu/digital-single-market/en/news/digital-economy-and-society-index-desi-2017>

⁵⁵ https://ec.europa.eu/environment/ecoap/indicators/index_en

⁶ Source: <https://www.e-tar.lt/portal/lt/legalAct/cb9bad50f87b11e39cfacd978b6fd9bb/hSuhTxnNax>

Programme 2014-2020⁸. However, regarding the RDI policy specifically, the two above-mentioned ministries (Education & Science and Economy) issued separate programmes, which can lead to some overlaps. For this reason, in 2017, an initiative to optimize a strategic framework and create one long-term RDI Programme has been launched

Figure 1: Overview of Lithuania's research and innovation system's governance structure (2017)



Source: authors, based on Paliokaitė, González Verdesoto, 2017.

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http://ukmin.lrv.lt/uploads/ukmin/documents/files/Lietuvos%20inovacij%C5%B3%20pl%C4%97tros%20programa_patvirtinta%202013%2012%2018_EN.pdf

⁸ The National Progress Programme for 2014–2020 was approved by Resolution No. 1482 of 28 November 2012 of the Government of the Republic of Lithuania. Sources: <https://www.e-tar.lt/portal/lt/legalAct/TAR.31A566B1512D/OKkwPNbfzS>; <https://rio.jrc.ec.europa.eu/en/library/national-progress-programme-lithuania-period-2014-2020>

3 RDI policies, funding trends and human resources

3.1 Main RDI policy developments in 2017

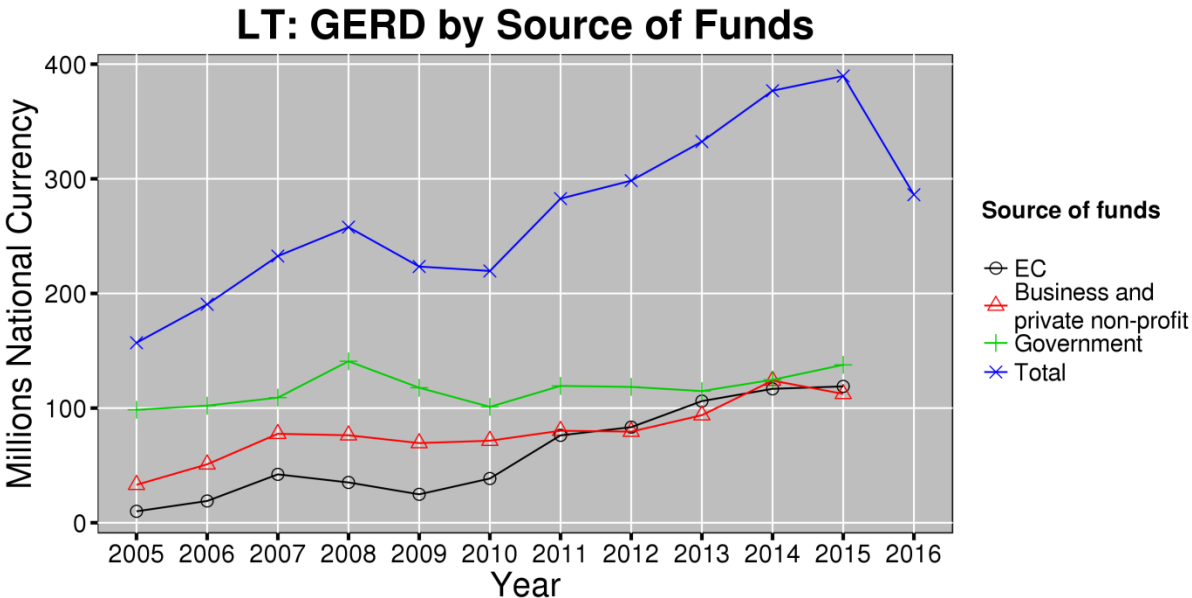
<p><u>Launch of Open Circle Capital</u> (08/2017)</p>	<p>New risk capital fund established by the Ministry of Economy (MoE). It provides capital to SMEs in high technology sectors at the early stages of growth. The estimated size of the fund is €20m (including private contributions).</p>
<p><u>Law on Higher Education and Research</u> (07/2017)</p>	<p>Changes aimed at regulating the remuneration of researchers were adopted. It is expected that this will improve conditions for researchers, especially at the early stage.</p> <p>Although the revised law was passed in 2016, some proposals were made in 2017. These include regulations on: a) Councils of public higher education institutions (HEIs); b) Senates of public HEIs; c) Rectors/Directors of public HEIs; d) Public funding of HEIs based on evaluation of R&D and arts activities; e) Composition of study expenses.</p>
<p>Changes to ESIF-funded R&D instruments (Ministry of Economy instruments, Ministry of Education and Science instruments) (latest version 11/2017)</p>	<p>Funding was re-allocated between different instruments, including those aimed at researchers (in this case, significant funding was transferred from a cancelled measure aiming at independent R&D projects). Other modifications on the implementation of instruments and the amount of funds allocated to different instruments were made.</p>
<p><u>Labour Code of the Republic of Lithuania</u> (06/2017)</p>	<p>The Labour Code was revised to make it more flexible and better suited to the current economic structure and business practices (i.e. new types of contracts).</p>
<p><u>Decision on the approval of the optimisation of public universities' network plan</u> (06/2017) and <u>Government's decision on the approval of measures for implementing the plan of optimisation of the public university network</u> (11/2017)</p>	<p>Parliamentary approval of the plan of the optimisation of public universities' network. The goals of the plan are to concentrate resources, create conditions for higher quality of higher education, decrease irrational duplication of studies and research activities, effective use of funding, and increase international competitiveness of research and studies in Lithuania. While outlining the principles of optimisation, it lacks specificity of the plan originally proposed by the working group. A plan with specific actions was approved by the Government in November, 2017, but needs further approval of the Parliament.</p>
<p><u>Decision on the approval of the list of professions which required high professional qualification and which lack workers in Lithuania</u> (02/2017)</p>	<p>The list includes 27 occupations which require high professional qualifications and makes it easier to employ workers from non-EU countries with these qualifications.</p>

3.2 RDI funding trends

Lithuania is considered a moderate innovator and ranks 16th in the EU Innovation Scoreboard 2017 (European Commission, 2017d), which marks a sharp increase compared to the 24th place in 2016

Lithuania’s GERD has steadily increased over recent years and reached 1.04% of GDP in 2015 but fell to 0.74% in 2016. Lithuania still lags behind the EU28, which is nearly three times as large (2.03% in 2016). Lithuania’s GERD also experiences a period of growth in absolute value, reaching €389.7m in 2015, but fell to €286.1m in 2016. The Lithuanian RDI system still depends significantly on EU investments (see Figure 2), with a higher percentage of foreign sources (34.6% of GERD) than the EU28 average (10.8%) (in 2015).

Figure 2: GERD by source of funds



Source: Eurostat.

3.3 Public allocation of RDI and RDI expenditure

The government provided a third (€137.8m) of total R&D funds in 2015. The majority of government-funded RDI is performed in the higher education sector (73%). The government sector received 25% while the business enterprise sector received only 2%. The Government also channels EU funds. In total, two thirds of R&D expenditures are allocated through government institutions.

The share of government-funded GERD has been in a steady decline since 2008 (from 54.6% to 35.6% of total GERD in 2015). This was driven by an increased reliance on available EU-funds. Thus, there was replacement of funding sources, but RDI funding in the business enterprise sector did not undergo significant changes. It can be therefore stated that structural changes have not taken place and public sector RDI funding distributed through government institutions still dominates the landscape. One of the reasons behind being able to maintain similar levels of RDI funding was the mentioned reliance on the EU funds instead of structural change (Paliokaitė et al., 2016; Paliokaitė, González Verdesoto, 2017).

Publicly funded RDI expenditures are likely to increase during 2017 and in the coming years thanks to the availability of ESIF (EU)-funded RDI instruments. Although the operational period of ESIF covers 2014-2020, many of the competitive calls were launched only in 2016-2017 (see chapter 5).

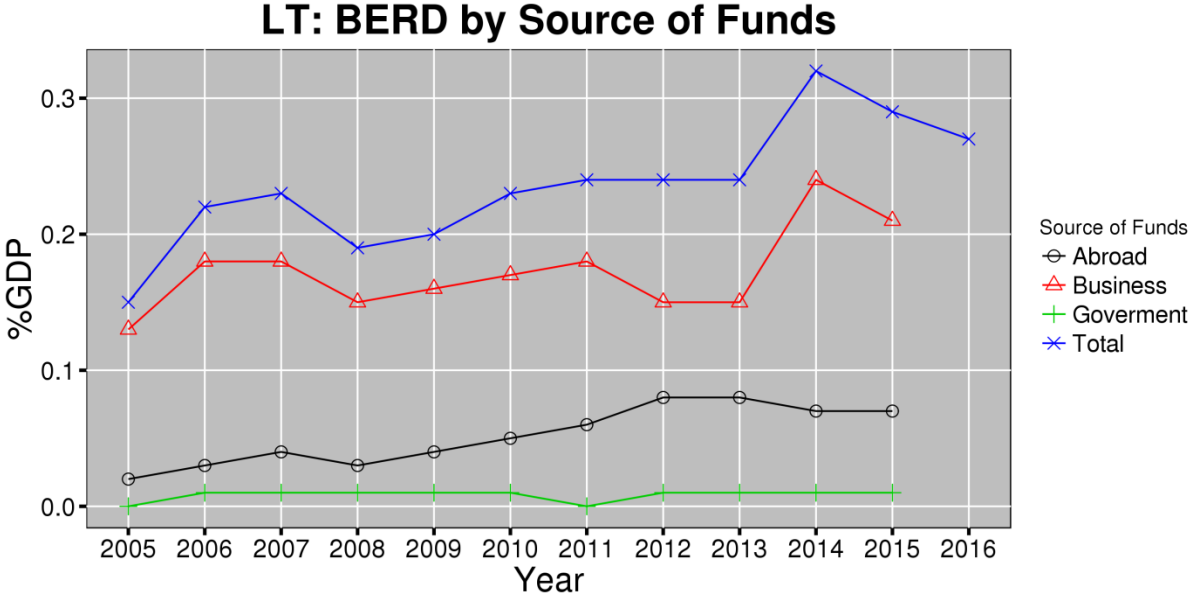
In addition to public funding, Lithuania provides tax-based incentives for companies to invest in RDI. However, corporate profit tax deduction is used rarely and over the period 2009-2013 the usage decreased from 226 companies to 181, representing a decrease from €76.8m to €36.3m (Ivanauskienė, 2014).

3.4 Private RDI expenditure

As indicated by experts (cf. Visionary Analytics, 2017a,b), low expenditure on RDI in the business sector is one of the obstacles to improve Lithuania’s innovation system. Although data for 2014 indicated a noticeable increase in Business Expenditure in Research and Development (BERD), it declined in 2015 and 2016 both as percentage of GDP (from 0.32% to 0.27%) and in absolute value (from €116.3m to €103.5m). No breakthrough has yet happened when it comes to private RDI expenditure. Compared to the EU28 BERD average (1.3% of GDP), Lithuania’s was nearly 5 times lower. In addition, most of the RDI funds provided by enterprises remain within the same sector (68.8%), and although BERD is mostly funded by business, other sectors also play an important role (see Figure 3).

The role of the private non-profit sector in RDI activities is negligent.

Figure 3: BERD by source of funds



Source: Eurostat.

In absolute numbers, the services sector spends more on RDI than manufacturing (€67.0m vs. €37.5m in 2015). The top performing sectors, besides the scientific research and development sector, are professional, scientific and technical activities, ICT (both manufacturing and services), manufacture of metal, electronic and optical products, and manufacture of chemicals.

However, not all BERD is captured by official statistics. A study by MITA indicated that out of 1009 participants, 98% invested in RDI (as quoted in Visionary Analytics, 2017a). Given that the number of enterprises that declare RDI expenditures is low (see tax incentives in section 3.3), there is evidence that many innovative companies do not declare their RDI expenses. This means that a significant share of BERD might not be reflected in statistics.

No explicit data on top-RDI performers in the private sector is available due to data confidentiality and none of the Lithuanian companies were among the top 1000 RDI performers in the EU in 2016 (European Commission, 2016b).

It is however possible to determine which companies have received largest funding for RDI through ESIF (EU-funded) instruments during the operational period 2007-2013, thus, indicating that they might be among the top RDI performers. These were: Biotechpharma (received €13.87m); Soli Tek RDI (€5.78m); Thermo Fisher Scientific Baltics (€5.07m); Intersurgical (€4.24m) and Escolit (€4.17m) (Visionary Analytics, 2017a). While this does not provide evidence that these companies spent the most on RDI overall, the data indicates that they play important role in the Lithuanian RDI system. Soli Tek R&D is active in the energy sector, while the remaining four companies work in the fields of biotechnology and medicine.

The majority of foreign direct investment (FDI) attracted over 2010-2015 went into knowledge-intensive services, predominantly in shared services centres (in total 7,115 jobs planned in projects attracted in 2010-2016, according to Invest Lithuania). FDI in medium-high technology manufacturing sectors is increasing but high-technology manufacturing sectors demonstrate a downwards trend.

Regarding high-value added FDI projects, with nine FDI projects in RDI over 2010-2016, Lithuania is above Latvia and Estonia, but well below most other competitor countries, and the share of RDI projects in the total FDI portfolio is small. FDI is considerably higher in the area of design, development and training, making Lithuania one of the top performers in the region. The majority of DDT projects are implemented in ICT. 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 (Paliokaitė, 2017).

Obstacles to attracting FDI specific to RDI include inadequate conditions for researchers (especially, early-stage) (Visionary Analytics, 2017a,b), which limits the pool of available human resources (also see section 3.3 below) and low accessibility of public RI infrastructure, including lack of a functional database of available services and technologies (Kurk Lietuvai, 2016a,b). Additionally, other more general obstacles, such as air connectivity, labour code rigidity, reform of education system to ensure skills supply, have been identified (Investors' Forum, 2016).

3.5 Supply of RDI human resources

Human capital in RDI is a significant challenge in Lithuania. Low attractiveness of the research career, high emigration rate and other factors are behind this challenge and make it difficult to solve in the near future.

The country has a very high number of higher education institutions, which leads to a fragmented system of tertiary education. At the same time, negative demographic trends lead to a decrease in the number of new students. This is strengthened by a large international student outflow compared to inflow, which puts a further strain on the higher education system. Furthermore, despite an overall high level of tertiary education participation, ensuring equal access and other equity provisions in the higher education are needed (OECD, 2017).

The share of STEM⁹ students in Lithuanian universities rose up to 35-40% and up to 48% in Colleges over 2009-2016 (Paliokaitė, 2017). However, Eurostat data on new graduates in STEM areas shows an 18.3% decline from 2012 to 2015. This can be attributed to the demographic trends that the country faces.

⁹ Fields considered as STEM are: 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.

In order to increase the number of STEAM (science, technology, engineering, arts and mathematics) graduates, the Ministry of Education and Science plans to establish 10 STEAM education centres after having approved a new decree in April 2016. It is not yet clear whether specific policies to encourage female participation in STEAM education will be introduced.

The number of students on the path to become researchers is comparatively low within the EU. The number of doctoral graduates per 1000 population has been more or less stable over the 2012-2015 period (fluctuating between 0.75 and 0.83), but lagged behind the EU average in 2013 (1.07).

Regarding the total number of active researchers, there were 8375 in 2016 (full-time equivalent – FTE) declining from 9075 in 2014. The majority works in the higher education sector (59.6%), followed by the business sector (22.7%) and the government sector (17.6%). Over the period 2009-2014, the number of FTE researchers decreased in the education and government sectors but increased in the business one. However, if taken relative terms the number of researchers per thousand population increased from 5.69 in 2011 to 6.58 in 2014 but then fell to 5.92 in 2015. Nevertheless, these data might be underestimate as many of enterprises developing new products do not declare this activity as RDI activity and do not consider its personnel (engineers and technologists) performing this activity (mainly experimental development activity) as researchers.

The gender ratio in research is balanced. In 2015, 46.9% of researchers were women (FTE). If we look at head-count the share of female researchers is 50.7%, indicating that women are more likely not to be employed full time (on average, 43.6% vs 50.9% of full-time for men).

The share varies per sector, with 30.4% of researchers being women in the business sector and 53.0% in the higher education. Two issues that remain significant: a) women representation depends on the field of science b) women are under-represented in senior academic positions (MOSTA, 2015).

The availability of human capital remains one of the most pressing issues for the Lithuanian economy. Employers face difficulty in finding employees with relevant skills (Reymen et al., 2015). Several weaknesses have been identified:

First, specific sectors with high value added (ICT, manufacturing, transport and logistics, health) face skills shortages (Reymen et al., 2015).

Secondly, high emigration and low birth rate cause a decrease in the labour force. According to Statistics Lithuania, Lithuania's population declined by about 23% with the major part of this trend driven by emigration. At least 680,000 people have emigrated since 1990. Furthermore, many emigrants are working age (72% are 15-44 years old), some highly skilled, which further contributes to the skills shortage.

Thirdly, employers claim that employees lack soft skills (e.g. critical thinking, teamwork, etc.) (MOSTA, 2014; OECD, 2016a), which affects productivity.

Finally, a 2014 study indicates that employers perceive that quality of higher education decreased, although the administrations of HEIs see improvements (MOSTA, 2014b).

An important issue is that Lithuania lacks capacity to attract and maintain local and foreign young researchers. According to MOSTA (2016) there are two main deficiencies with governance of RDI human capital system in Lithuania: a) low salaries for researchers, including in the early stages of career;¹⁰ b) high workload divided among

¹⁰ According to results of MORE II project (report published in 2013), even taking into account purchasing power parity, researchers in Lithuania earned less than 20% of what researchers in countries with highest salaries earned, and is lower than those in Poland (25-30%, depending on career stage), Estonia (35-40%) or the average of EU12 (30-40%) (Idea Consult et al., 2013).

teaching and research, often in several institutions. There is also a lack of specific programmes aimed at intersectoral mobility of researchers.

4 Policies to address innovation challenges¹¹

4.1 Challenge 1: Addressing skills and talent shortage for RDI and Innovation

Description

Lithuania is lagging behind in innovative and entrepreneurial talent at European and global scale. The issue is twofold: rapid decrease in the number of young people as a result of the demographic trend and also the openness of the world's top universities and business careers to any nationality. The estimated number of Lithuanians studying abroad reached 8% of total enrolment in higher education in 2014 (UNESCO), or approx. 11000 – 12000 students, while the European average stands at 3.5%. Given the openness of the economy and international trade integration, the higher levels of international enrolment are positive, however Lithuania is failing to attract and integrate top national and international talent and skilled professionals. The Lithuanian business sector is far from being able to compete in terms of management sophistication, human resource policies and remuneration levels as compared to western companies (OECD, 2016a, Snaebjornsson, 2017), and academia does not meet international standards yet in terms of salaries, working environments, and research careers (MOSTA, 2017). In addition, higher education reform is slow, and existing talent is leaving academia for international and business careers that are not necessarily RDI oriented, especially at post doc and early career stages. Moreover, PhD supply is not sufficient to sustain existing academic activities, nor to ensure business RDI capacity building.

Research indicates that in the technology field, the mismatch is increasing. One third of companies in manufacturing industries agree that they lack engineers, technology designers, etc. for their RDI activities (Paliokaitė et al., 2014). In terms of entrepreneurial talent, Lithuania was able to create a positive environment in starting and developing a business at the early stages, however shortcomings of entrepreneurial growth oriented policies and instruments drives most promising entrepreneurial start-ups out of the country towards more attractive locations in Europe and the US.

Policy response

The Lithuanian government has initiated a higher education policy reform (as indicated in the RIO 2016 report). Although the revised law was passed in 2016, some of the revisions were proposed in 2017. These include regulations on: a) Councils of public higher education institutions (HEIs); b) Senates of public HEIs; c) Rectors/Directors of public HEIs; d) Public funding of HEIs based on evaluation of RDI and arts activities; e) Composition of study expenses. Additional changes were introduced in July 2017 that aimed at regulating the remuneration of researchers. It is expected that this will improve conditions for researchers, especially at the early stage.

The liberalisation of the labour code in June 2017 has been approved aiming at more flexible labour relations that should support new types of employment, including virtual workspaces. The decision on the approval of the list of professions which required high professional qualification and which lack workers in Lithuania was taken in February of 2017 and includes 27 occupations that require high professional qualifications and makes it easier to employ workers from non-EU countries with these qualifications.

¹¹ Besides the innovation challenges, for the preparation of the next Semester Country Reports, examples of successful practices in Member States in 2017 are also of interest – examples may be offered in relevant sections of the report and/or discussed during the Brussels visit.

Remuneration for doctoral students was increased by 25% in 2015 (€394.25 per month for first-year students and €456 for students in later years) and there is a planned 50% increase in minimal research positions' salaries at State universities and research institutes, which however won't have an important impact due the very small starting bases. The reform of the university system is also expected to improve working conditions for researchers. Results of these changes remain to be seen. Still, the remuneration of researchers remains significantly below the EU average.

Assessment

Most of the policy response taken might be defined as an incremental improvement while the level of disruption requires radical change. The policy actions taken – unless radically supported by increased public RDI levels and improved RDI and innovation work and remuneration conditions in public sector – will not have major effects. Today, the estimated growth rate of salaries in the economy stands at 6%, while in academia it remains at 3 % and is not equally distributed.

The autonomy of universities (including decisions on staff policies) will remain, promoting rigidity towards resource optimisation and talent investments unless new regulations and clear reform plan will be imposed. Businesses will continue to face the challenge of talent and STEM skills shortage while facing global competition and not being able to compete for international talent unless higher productivity levels, and the associated salary increases and work conditions improvements will be achieved.

4.2 Challenge 2: Facilitation of RDI commercialisation and technology transfer

Description

The main RDI activities in Lithuania are still taking place within public universities and RDI institutions, dependant on public funding flows. Major RDI infrastructure investments, benefiting from EU funds were also associated with the development of research infrastructures within public universities (i.e. Science and Business valleys). However, relatively weak attention was given to the development of innovation ecosystems and of knowledge and technology transfer capabilities at both public and business sectors.

Science and technology parks, as major technology transfer facilitating agents, still lack efficient interfaces with public RDI infrastructures. Open access centre initiatives within public infrastructures remain at rather embryonic stage where very little collaborative RDI is taking place (see for example Büllinger et al, 2018 and Paliokaitė, 2017). In sum, the established RDI infrastructures are not creating the expected value flow and impact on the economy, and remain mainly at the service of academic research. In addition, RDI in business is limited to a few companies within few sectors, and a large cohort of start-ups remain outside of the access to the existing policy measures due to the lack of research capabilities, intellectual capital, and also experience in RDI driven innovation.

RDI funding flows remain associated with public higher education and RDI institutions, while private RDI is not taking up (with the exception of EU structural funds projects). Only few Lithuanian businesses are capable to compete on the European scale for Innovation in SMEs and FTI support.

Policy response

A set of policies including tax incentives to support technology transfer and facilitate RDI investment in business was implemented since 2010 (see RIO 2016 report). In 2017, the focus has been put on the optimisation of public universities' network plan (06/2017) with Parliamentary approval. The goals of the plan include, concentrating resources, creating conditions for higher quality of higher education, effective use of funding, increasing international competitiveness of research and studies in Lithuania. The implementation of EU SF measures to support business RDI and research capability

building was launched with the first collaborative projects starting. Smart specialisation agendas are tightly associated with ESIF investments that target development of technology transfer centres, inno-vouchers, stimulating university spin-offs (including seed capital funding and collaborative RDI projects).

Assessment

The university sector reform is a main step forward in public RDI capacity building and high level research production. However, it has its own risks, as the universities are increasingly driven towards international rankings and much less concerned about the community impact and local business engagement, especially at SME level. Micro policy measures, like the inno-vouchers, are of limited interest from the public research establishment perspective because of the diminishing volume of the grant as compared to the large scale RDI and collaborative projects. However, this could be changed, if open access RDI processes would be in place and public and private technology transfer capabilities are significantly upgraded. Facilitation of collaborative RDI platforms for SMEs is needed, beyond the dominating narrow approach limited to high tech sectors. Embracing RDI for wider innovation, such as creative industries, social innovation, education and societal health has potential and the current technology transfer structures seem not to be able to address it. Furthermore, a number of reports have recommended implementing the performance- and partnership-based funding model for applied research centres and professionalising cluster initiatives (for detailed recommendations see Büllinger et al, 2018).

4.3 Challenge 3: Improving co-ordination of RDI and innovation policies

Description

Lithuania's RDI system remains highly fragmented, both in the private (e.g. approx. 50 clusters) and the public sector (e.g. large number of higher education and research institutions, over 20 open access centres, 7 science and technology parks, etc). Fragmentation at the level of research performance creates a burden in several ways: a) potential synergies are not achieved due to research being carried out in different institutions with little collaboration; b) overlaps and duplications in research, as well as potential duplications in infrastructures. Fragmentation is also evident at the policy and governance level. Lack of synergies and overlaps in competence areas of ministries responsible for RDI policy, as well as a high number of lower-level agencies, leads to missed opportunities and wasted efforts. Although there are bodies that coordinate policy initiatives (e.g. inter-institutional body for smart specialisation strategy), overall coordination is still lacking (OECD, 2016b; Paliokaitė, 2015; Büllinger et al, 2018).

Coordination is also a critical issue for implementing the smart specialisation priorities, which are funded from multiple sources. In addition, informed policy making is still at the early stages, where very little of research is aimed at understanding of causes and critical factors that shape behaviours and responses to policy incentives ex-ante. The Research Council of Lithuania launched in 2015 a "Welfare society" programme in order to address this issue. However, the co-ordination between research finding and transfer of research results to policy making practices is absent and of ad-hoc type.

Policy response

Development and implementation of the smart specialisation programme has increased the levels of co-ordination across public policy bodies and implementing agencies. The level of duplication has been significantly reduced.

In 2017, the modernization of the RDI public administration system started according to the Plan of Implementation of Governmental Programme. This modernisation includes not only the strengthening the role of Strategic Council for RDI, but also the

consolidation of the legal base of the RDI system, assignment of the leadership of the technology and innovation field to the MoE, consolidation of RDI policy implementing institutions and strategic RDI programmes and other.

The Government Chancellor has launched in 2017 a civil service reform programme with the aim of introducing lean and efficient public administration processes and significantly cut numbers of duplicating functions. The reform of the public institutions implementing RDI policy is foreseen in the Government's programme. The programme is expected to improve policy making and co-ordination practices as well. Previous actions on improving co-ordination also had positive effects (Paliokaitė, González Verdesoto, 2016).

In 2017, a systematic review of all RDI-related programmes has been launched. Under the aegis of a reinforced Strategic RDI council an improvement of the strategic coordination framework has been initiated, in particular by consolidating RDI-related programmes in the light of Science and Innovation Policy Shift Guidelines and creating one long-term RDI Programme. The new Programme with the implementation period till 2030 is foreseen to be approved in 2018.

Assessment

The coordination challenge has improved with recent developments: enhanced cooperation among new ministers, assignment of leadership and responsibility, analytical studies and advice by MOSTA, as well as new multilateral working groups that were set up to look at various policy challenges. The newly formed Strategic RDI Council is in action, and, most importantly, there is less pressure to coordinate policy planning since all the negotiations over ESIF funds have already been completed. The government attitude towards the society engagement in policy implementation is still moderate, the national smart specialisation process being among the few positive examples. So far the relevant parties still need to demonstrate the success in implementing horizontal programmes and the results of recent developments remain to be seen.

Traditional forms of coordination (councils, interest groups etc.) proved to have very little effect for co-ordination improvement over the past two decades in Lithuania. Essential cultural change in policy making and co-ordination is needed. However, societal challenges such as a lack of trust in public governance, civil society development and a high perception of corruption (Global rank 38, Transparency International Index 2017) are preventing changes on a bigger scale and also are dissonant with attempts to improve business and RDI conditions. Inclusive and open innovation culture driven policy making is a core policy co-ordination challenge in Lithuania. Further challenge is to reform the fragmented institutional framework of RDI policy implementation as recommended by OECD (2016b) and Büllinger et al (2018), among others.

4.4 Challenge 4: Promoting growth of innovative companies

Description

Lithuania has established a favourable start-up environment and is constantly improving its efforts on new venture creation, facilitation, and mentorship programmes. The entrepreneurial community features dynamism, proactivity and innovative culture and is clustered around entrepreneurial universities, science and technology parks and also private start up hubs.

However, the rate of surviving start-ups over 3 years is less than 50%. The business acceleration and growth capabilities and relevant processes are absent within public business support infrastructures, no relevant public policies exist. Fragmentation of various measures persists (see Paliokaitė, González, 2016), whereas the focused policy mix would be needed. Companies in the growth stage face IPR, funding, including venture capital, challenges, rapid market development and HR acquisition challenges. As

a result, innovative companies either look for acceleration hubs within other locations or face slow and fluctuating development, with a few exceptional cases of successful and rapid internationalisation, which are however associated with reallocation of companies towards the venture capital locations. The ecosystem is also able to produce so called “hidden champions” (Petraite, Dlugoborskyte, 2017) that operate in small global niche markets, but never achieve significant growth.

This challenge also incorporates the issue of private RDI investment (Paliokaitė, González, 2016), which requires stable growth in innovative international markets that essentially drive the need to innovate (Petraite et al, 2017). Existing exports are dominated by mid – high tech sectors and services, however with the positioning at the lower end of the value chain.

Policy response

The policy mix has responded with a combination of various measures to support RDI in SMEs, new technology venture creation, including the launch of Open Circle Capital in August 2017, a new risk capital fund established by MoE. It provides capital to SMEs in high technology sectors at the early stages of growth. The estimated size of the fund is €20m (including private contributions). In addition, internationalisation of SMEs is promoted with a set of measures implemented via Enterprise Lithuania that support market development, product modification, business network development and export activities. FDI measures, launched with FDI and investment programme in 2014, have been successful in attracting number of companies in Vilnius and Kaunas.

Assessment

Acceleration programmes within a well-integrated policy mix for innovative business acceleration is still needed and individual efforts of S&T parks and other agencies are insufficient. Specific measures to support mentoring and acceleration programmes within relevant infrastructures are critically needed in order to facilitate the rapid growth of promising start ups and innovative companies, as well as to create positive dynamics among existing innovative businesses. Business RDI investment support measures are important standalone measures, however the implemented tax incentive for RDI in enterprises does not give the expected return as there are not many strategic stimuli for RDI because of low value chain network lock-ins, that means that firms are locked in the existing low value chains (Eriksonas et al 2015). There is also a need for customer-oriented approaches to supporting business growth, innovation and cooperation that target individual companies and support them up an innovation ladder (as noted by OECD, 2016b; Visionary Analytics, 2017a; and Büllinger et al., 2018).

5 Focus on RDI in National and Regional Smart Specialisation Strategies

New policy developments

On the whole, Lithuania's smart specialisation policy did not undergo significant changes in 2017. Developments only included modification of planned instruments or minor changes to priority action plans. Thus, progress links mainly to the implementation phase (see below).

Progress on implementation

In 2017, the implementation of national smart specialisation strategy speeded up with more projects that have started and more instruments that have been launched. However, the 2017 progress report indicates that only four¹² out of 20 priorities show the critical mass needed for RDI¹³ (MOSTA, MoE, 2017).

The progress in the implementation of the specific instruments varies, but has at least improved since 2016. By December 2017, the majority of instruments are being implemented (16 out of 18 in the first priority "Strengthening R&D an innovation" and 2 out of relevant 3 in the ninth priority "Educating the Society and strengthening the potential of human resources"). However, the number of contracts signed is relatively low, as many competitive instruments are still evaluating proposals.

Second, in state-planning instruments (e.g. development of RDI infrastructure), project implementation is slow. This increases the risk of lower impact (Visionary Analytics, 2017a,b). With the operational programming period already mid-way through, this slow progress causes concerns. Until December 2017, €124.2m¹⁴ from ESIF were allocated to projects related to smart specialisation, which makes about 18.8% of the total budget (€661m) planned for these instruments (see Figure 4 for detailed overview of the instruments). Figure 4 shows the smart specialisation policy mix (except 9.3.3 instruments which are ESIF-funded but not bound by smart specialisation priorities).

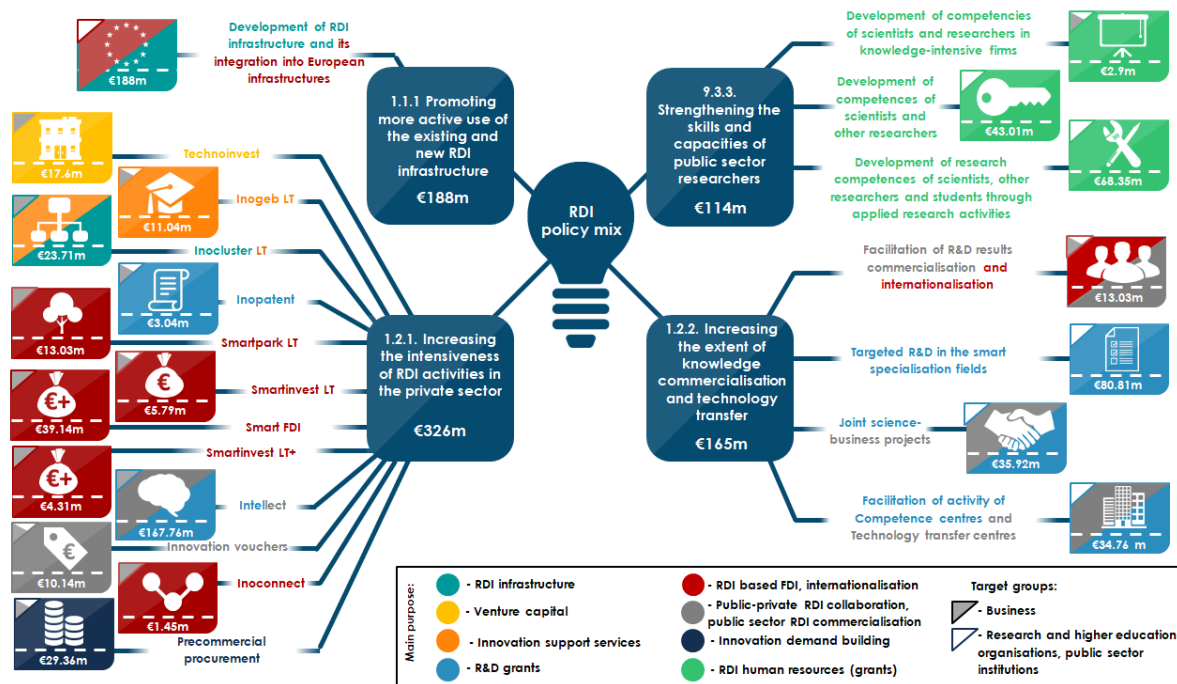
The late start of ESIF-funded instruments might also imply delays in the innovation cycle, i.e. there might not be enough time to move low technology readiness level (TRL) products to instruments funding projects aimed at higher TRLs.

¹² These are: Molecular technologies for medicine and biopharmaceutics; Advanced applied technologies for individual and public health; Functional materials and coatings; Photonic and laser technologies.

¹³ Critical mass in this report is measured by No of publications, patents, international publications with foreign co-authors and secured high investments from ESIF.

¹⁴ The number does not include financial instrument Technoinvest due to the way it is constructed.

Figure 4: RDI policy mix in the Operational Programme 2014-2020



Source: update from Paliokaitė, based on relevant plans of the implementation of the Operational Programme (MoE, MoES). [18-08-2017]

Looking at business RDI projects selected for funding and reflected by MOSTA and MoE (2017) (see Table 1 below), it appears that so far the variety of themes is high. Finally, proposal evaluations in the "Intellect" measure show quality differences with lower scores for transport, logistic and ICT, and Inclusive and creative society priority areas.

Table 1: First applications to "Intellect" instrument based on Smart Specialisation areas

6 priority areas	No. of applications (stage I)	No. of applications (stage II)	No. of funded projects (allocated sum)	Average evaluation score (0-100)
Inclusive and creative society	24	8	8 (€1.93m)	43.9
Energy and a sustainable environment	33	19	9 (€3.72m)	58
Health technologies and biotechnologies	71	43	28 (€12.24m)	61
Transport, logistic and information and communication technologies	54	23	15 (€5.89m)	49.2
New production processes, materials and technologies	73	37	31 (€12.97m)	59.9
Agro-innovation and food technologies	35	15	7 (€1.96m)	54.6
Total	290	145	98	-

Source: Paliokaitė (2017).

Lithuania's smart specialisation strategy includes the participation in thematic Smart Specialisation Platforms. However, the country's involvement is low. Lithuania is a participating region in Smart Grids and Sustainable Buildings partnerships in the area of energy. Agri-Food and Industrial Modernisation partnerships do not involve Lithuania. However, the country also participates in international cooperation networks. Lithuanian institutions take part in the following Interreg Baltic Sea Region projects focused on smart specialisation: GoSmart BSR, LARS, Smart-up BSR and EMPINNO. In the Interreg Europe first call, 10 (out of 40) projects related to research and innovation involve Lithuanian partners.

Monitoring mechanisms and the feedback loop

Monitoring and evaluation of the implementation of the national smart specialisation strategy are carried out by MOSTA and MoE. The first progress report was published in 2017 (MOSTA, LR ūkio ministerija 2017), but there is still limited evidence to analyse. The report also identifies the need for a refined list of indicators and the encoding by theme. The review of the smart specialisation strategy is expected to be carried out in 2018.

Slow implementation of related instruments creates obstacles to successful review and modification of the strategy, since there is relatively little data already available.

Evidence of impact

So far it is too early to point to any evidence on the impact of the national smart specialisation strategy.

However, an interim evaluation of RDI measures included in the operational programme 2014-2020 showed that the likelihood to reach intended targets is low-medium. Although the evaluation found it too early to study impacts in more depth, some relevant conclusions were formulated based on qualitative evaluation methods (Visionary Analytics, 2017a,b):

- It is unlikely that the target of the indicator "business research and development (R&D) expenditure" will be achieved. A systemic approach would be needed to foster business RDI expenditure, including composite measures for start-ups development and fostering transformation of potential innovators. Measures outside EU funds would be necessary (access to risk capital, tax exemptions, etc.) as well as incentives or information to companies about declaring RDI activities.
- The policy mix for facilitation of knowledge commercialisation, knowledge transfer and use of research infrastructure is considered to be low-medium when we look at its sufficiency and appropriateness. A share of planned research infrastructures is not relevant to the business sector and the start of the implementation phase is late. There are significant risks related to the planned RDI collaboration measures. For example, there will be limited demand for funding in Joint science-business projects due to applied state aid rules under which the universities should contribute significantly with their own funds.
- Measures aimed at strengthening skills and capacities of researchers are on average relevant. However, they do not ensure preconditions for attracting high-level foreign researchers or Lithuanian researchers working abroad. Furthermore, allocation of funds for measures aimed at strengthening researchers' skills and capacities is not sufficient.

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Abbreviations

BERD	Business expenditures on research and development / Įmonių išlaidos moksliniams tyrimams ir eksperimentinei plėtrai
ESIF	European structural and investment funds / Europos struktūriniai ir investicijų fondai
EU	European Union / Europos Sąjunga
EU28	All European Union Member States / Visos Europos Sąjungos valstybės nares
<i>FDI</i>	Foreign direct investment / Tiesioginės užsienio investicijos
FTE	Full time equivalent / Pilnos darbo dienos ekvivalentas
GBAORD	Government budget appropriations or outlays on R&D / Valstybės biudžeto asignavimai arba išlaidos moksliniams tyrimams ir eksperimentinei plėtrai
GDP	Gross domestic product / Bendrasis vidaus produktas
GERD	Gross domestic expenditure on research and development / Bendrosios vidaus išlaidos moksliniams tyrimams ir eksperimentinei plėtrai
HEI	Higher education institution / Aukštojo mokslo institucija
ICT	Information and Communication technologies / Informacinės ir ryšių technologijos
MoE	Ministry of Economy / Ūkio ministerija
MoES	Ministry of Education and Science / Švietimo ir mokslo ministerija
MOSTA	Research and higher education monitoring and analysis centre / Mokslo ir studijų stebėsenos ir analizės centras
OECD	Organisation for Economic Co-operation and Development / Ekonominio bendradarbiavimo ir plėtros organizacija
R&D	Research and development / Moksliniai tyrimai ir eksperimentinė plėtra
RDI	Research, development and innovation / Moksliniai tyrimai, eksperimentinė plėtra ir inovacijos
RI	Research infrastructure / Mokslinių tyrimų infrastruktūra
SME	Small and medium size enterprise / Maža ir vidutinė įmonė
STEAM	Science, technology, engineering, arts, maths / Gamtos mokslų, technologijų, inžinerijos ir matematikos tyrimų ir eksperimentinė veikla
STEM	Science, technology, engineering, arts, maths / Gamtos mokslų, technologijų, inžinerijos ir matematikos tyrimų ir eksperimentinė veikla
TRL	Technology readiness level / Technologinės parengties lygis

Factsheet

	2009	2010	2011	2012	2013	2014	2015	2016	2017
GDP per capita (euro per capita)	8500	9000	10300	11200	11800	12500	12900	13500	
Value added of services as share of the total value added (% of total)	69.42	67.61	65.09	64.8	65.98	65.81	66.5	67.98	
Value added of manufacturing as share of the total value added (%)	16.73	18.77	20.37	20.67	19.42	19.19	19.27	18.88	
Employment in manufacturing as share of total employment (%)	15.82	15.37	15.55	15.7	15.43	15.06	15.18	15.43	
Employment in services as share of total employment (%)	64.21	66.62	66.97	66.14	66.08	66.14	65.89	66.92	
Share of Foreign controlled enterprises in the total nb of enterprises (%)	2.39	2.39	2.45	2.21	2.19	2.08			
Labour productivity (Index, 2010=100)	94.2	100	107	109.2	112.5	114.7	114	112.8	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	0.65	0.66	0.67	0.75	0.83	0.83	0.77		
Summary Innovation Index (rank)	23	23	23	23	23	23	22	16	
Innovative enterprises as a share of total number of enterprises (CIS data) (%)				32.9		43.3			
Innovation output indicator (Rank, Intra-EU Comparison)			28	28	28	28			
Turnover from innovation as % of total turnover (Eurostat)		6.6		5.5					
Country position in Doing Business (Ease of doing business index WB)(1=most business-friendly regulations)						21	20	21	16
Ease of getting credit (WB GII) (Rank)						22	27	29	
EC Digital Economy & Society Index (DESI) (Rank)						9	13	12	13
E-Government Development Index Rank		28		29		29		23	
Online availability of public services – Percentage of individuals having interactions with public authorities via Internet (last 12 months)	22	24	29	36	34	41	44	45	
GERD (as % of GDP)	0.83	0.78	0.9	0.89	0.95	1.03	1.04	0.74	
GBAORD (as % of GDP)	0.52	0.42	0.4	0.36	0.36	0.34	0.33	0.32	
R&D funded by GOV (% of GDP)	0.44	0.36	0.38	0.36	0.33	0.34	0.37		
BERD (% of GDP)	0.2	0.23	0.24	0.24	0.24	0.32	0.29	0.27	
Research excellence composite indicator (Rank)	22	21	27	26	27	22			
Percentage of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country		6.41	4.71	3.81	4.33	4.24			
Public-private co-publications per million population	7.85	8.59	9.17	4.33	2.36	1.7	0.68		
World Share of PCT applications	0.02	0.01	0.01	0.02	0.02	0.02	0.02		
Global Innovation Index				40	39	38	36	40	

Data sources: various, including Eurostat, European Commission and International scoreboard data

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