

# IMPROVING EFFECTIVENESS OF LITHUANIA'S INNOVATION POLICY

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# Table of contents

Executive Summary	8
1. Recent economic and innovation performance of Lithuania	13
1.1. Continued catch-up with little structural change	13
1.2. Improved innovation performance with low business R&D expenditure	14
2. Better understanding gaps in STI policy implementation: Policy actions taken after the 2016 OECD Review of Innovation Policy	18
2.1. Policy actions taken in the recommendation areas of the OECD Review of Innovation Policy Lithuania 2016	19
3. Better policy implementation and design in selected key areas: Consolidation of innovation agencies and enhancing Lithuania's STI Council	30
3.1. Introduction	30
3.2. Consolidation of innovation agencies	30
3.3. Enhancing the role and effectiveness of Lithuania's Science, Technology and Innovation Council	36
3.4. Conclusion	41
4. Strengthening Public Procurement of Innovation in Lithuania	43
4.1. Introduction	43
4.2. Building a monitoring system for innovation procurement	43
4.3. Fostering the implementation of innovation procurement	50
4.4. Conclusion	54
5. Mission-oriented innovation policy in Lithuania: challenges and opportunities to address societal challenges	58
5.1. Introduction	58
5.2. Challenges and opportunities for mission-orientation in Lithuania	59
5.3. Options for adopting a MOIP approach in Lithuania	60
5.4. Conclusion	66
6. Support for Industry 4.0 and Artificial Intelligence technology diffusion in Lithuania	69
6.1. Introduction	69
6.2. AI and Industry 4.0: Key observations and policy options for Lithuania	69
6.3. Conclusion	77

## FIGURES

Figure 1.1. Lithuania's GERD by sector of performance (million EUR), 2010-19	16
Figure 3.1. The STI agency landscape in Lithuania so far	31
Figure 3.2. Summary of agency merger options (simplified)	36
Figure 4.1. The different linkages between public procurement and innovation	44
Figure 4.2. Procurement of R&D and innovation based on keywords, CPV codes and PCP data	48
Figure 4.3. Options for establishing a competence centre for innovation procurement	52
Figure 4.4. Possible allocation of roles and coordinating functions among network members	53
Figure 5.1. The balance between ascending and descending dynamics in an innovation system	66
Figure 5.2. Tentative map of MOIP options in Lithuania	67

## TABLES

Table 1.1. Lithuania's GERD by sector of performance and source of funds (million EUR), 2018	16
Table 2.1. Recommendation areas in the OECD Review of Innovation Policy: Lithuania 2016	18
Table 4.1. Measuring innovation procurement – selected examples	47
Table 4.2. Exploratory OECD analysis of potentially innovation-friendly buyers, 2010-20	49
Table 4.3. Recent initiatives and support measures to promote innovation procurement	50
Table 6.1. Main policies for I4.0 and AI technology diffusion in Lithuania	69
Table 6.2. Selected national strategies for Industry 4.0	71

## Improving Effectiveness of Lithuania's Innovation Policy

OECD

### Abstract

*This paper presents the final report of the project “Support to Improve Effectiveness of Lithuania’s Innovation Policy” which summarises the findings, policy options and recommended actions. It has been aimed at providing support to reform efforts of the Government of Lithuania to better deliver existing policies, and develop and implement appropriate new policies, instruments and institutions in selected areas of science, technology and innovation (STI) policy. To this end, the report takes stock of recent developments and policy actions taken in Lithuania’s STI policy since the “OECD Review of Innovation Policy: Lithuania 2016”. Drawing on international good practices it explores the scope for improvement in selected areas of STI policy: a) consolidation of innovation agencies and enhancing Lithuania’s STI Council, b) public procurement of innovation, c) mission-oriented innovation policies, and d) industry 4.0 and artificial intelligence. The project has been aligned with ongoing Lithuanian reform processes, some of which are reflected in the ‘New Generation Lithuania’ plan related to the EU’s Recovery and Resilience Facility.*

**Keywords:** Innovation policy, Governance, Mission-orientation, Public procurement, Industry 4.0, Artificial intelligence

**JEL Codes:** O31, O38, L52

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## Foreword

The project 'Support to Improve Effectiveness on Lithuania's Innovation' Policy was requested by the Lithuanian authorities and supported by the European Commission, DG REFORM under the Structural Reform Support Programme (SRSP) and carried out by the OECD's Directorate for Science, Technology and Innovation. Over the years, Lithuania and the OECD have built a strong record of cooperation on science, technology and innovation (STI), an area which is critical for the country's continued convergence to leading European countries in terms of productivity and income per capita, and for tackling the challenges its economy and society are facing. Already before becoming a full member of the OECD, Lithuania has requested an OECD review of its innovation policy which serves as a reference for this report. However, while the OECD Review of Innovation Policy: Lithuania 2016 provided a comprehensive assessment of Lithuania's innovation system and policy, the OECD-SRSP project and this report focussed on providing support in selected areas of STI policy.

Specifically, this report is focussed on the following areas of STI policy:

- Consolidation of innovation agencies and enhancing Lithuania's STI Council,
- Strengthening Public Procurement of Innovation in Lithuania
- Mission-oriented Innovation Policies in Lithuania: challenges and opportunities to address societal challenges, and
- Support for Industry 4.0 and Artificial Intelligence technology diffusion in Lithuania.

As a background project, a brief update is provided on the development of the Lithuanian economy in recent years (Chapter 1). In addition, a stocktaking of STI policy actions taken with regard to the recommendations of the 2016 OECD Review has been carried out with the support of STRATA (for an overview see Chapter 2). This stocktaking and consultations with STI policy stakeholders informed the selection of two areas of STI policy already addressed in the 2016 OECD Review that required continued policy attention and reform: the consolidation of innovation agencies and enhancing Lithuania's STI Council (see Chapter 3). Both issues are linked to the current policy agenda. Areas of STI policy that have not or only partly been covered in the 2016 OECD Review but have been declared to be of high interest to Lithuania are Public Procurement of Innovation (Chapter 4), Mission-oriented Innovation Policies (Chapter 5) and Industry 4.0 and Artificial Intelligence (Chapter 6).

The OECD-SRSP project included a virtual fact-finding mission in November 2020 which provided a unique opportunity for dialogue and gathering first-hand information and perspectives related to the issues to be addressed in the project. In addition, two virtual workshops – a Stocktaking Workshop and a Stakeholder Workshop (both virtual) – were held in February and June 2021, respectively. These workshops were planned and organised by the OECD project team with the support of STRATA, and included a wide range of Lithuanian policymakers and other actors and stakeholders of the Lithuanian innovation system, including representatives of the business sector, higher education and research institutions as well as invited international experts. The Stocktaking Workshop, held in February 2021, offered a platform for the presentation and discussion of diagnostics and first findings in the selected policy areas and to sharpen the focus of policy issues the project was addressing. The Stakeholder Workshop held in June 2021 provided a platform for presentation and discussion of the finding as well as possible policy options and recommended actions emerging from the project. See Annex A for a list of interview partners and contributors.

The OECD-SRSP project has been closely aligned with Lithuania's STI policy agenda. In the course of the project, numerous consultations and discussions were held with the Lithuanian authorities and other actors and stakeholders. Between the two workshops, between March and the beginning of June 2021, five policy

notes (intermediate reports) – which are summarised in chapters 4-6 of this report – were delivered according to a revised timetable to align the project to the Lithuanian authorities' STI priorities.

The OECD-SRSP project was carried out during a critical phase for the development of Lithuania's science, technology and innovation (STI) policy. During this time, preparations for the next funding period of the European Structural and Investment Funds (ESIF) have been made and national plans developed. In addition, a number of national reform initiatives were ongoing. In December 2020, a new government took office in Lithuania. The Government Programme published at the end of 2020 contains a number of initiatives in the area of STI policy.

At the same time, the impact of the Covid-19 pandemic triggered responses at national and European level, including the creation of the Recovery and Resilience Facility (RRF), the 'centerpiece' of Next Generation EU. The RRF has been designed to mitigate the economic and social impact of the Covid-19 pandemic and make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions. This meant that during the OECD-SRSP project's lifetime, Lithuania – like the other member states of the European Union – was to develop its national Resilience and Recovery Plan (RRP) which has been submitted to the European Commission on 14 May 2021. This plan ('New Generation Lithuania') contains projects proposed for funding through the RRF. In total, Lithuania is set to receive EUR 2.22 billion (fully consisting of grants) over the lifetime of its RRP. The Lithuanian RRP includes a number of initiatives in the area of STI. The OECD-SRSP project has been feeding into the process of development of the Lithuanian RRP's proposals in this area, such as the creation of a single innovation agency, the use of public procurement of innovation and specific options for applying a mission-oriented policy approach in Lithuania's STI policy.



# Executive Summary

## Recent economic and innovation performance and STI policy actions

Lithuania's macroeconomic performance after independence in 1990 has been favourable, characterised by steady growth punctured only by short recessions. Productivity in terms of GDP per hour worked continued to converge to the EU average before and during the Covid-19 pandemic. However, the dynamism shown in macroeconomic indicators and data on the rapid growth of international trade has not been accompanied by significant structural change. Continued effort is needed in various policy areas to improve productivity further to sustain the catch-up process, and to facilitate and nurture structural change towards knowledge-intensive activities. Boosting innovation will be critical in this context.

On a number of indicators, Lithuania has shown improved innovation performance since the mid-2010s. However, challenges persist. Lithuania's research system does not sufficiently attract talent from within or from abroad. Business R&D expenditure is still low. In contrast, non-R&D innovation expenditure (e.g. investment in equipment, acquisition of patents and licensing, etc.) is comparatively high. This constellation may be well suited for an economy in its earlier phases of catching up, but new sources of growth have to be mobilised to maintain high growth as the country moves closer to the technological frontier. Innovation is the most powerful source of sustained growth of income per capita in the long term.

As part of the present study, a stocktaking has been performed of the policy actions taken corresponding to the recommendations of the OECD Review of Innovation Policy: Lithuania 2016. In the area of STI governance important reform efforts remained incomplete or did not deliver the expected results. Two specific areas where continued policy action is clearly needed have been selected for closer examination: First, the consolidation of innovation agencies and second, is the enhancement of the Lithuanian STI Council, which could be made more effective and play a strategic role in transforming Lithuania into a more innovation-driven economy and society.

## Consolidation of innovation agencies and enhancing Lithuania's STI Council

Lithuania has a highly fragmented system of innovation agencies. Consolidation has been on the policy agenda for some time but has not materialised so far. The new government made a fresh attempt at creating a unified Innovation Agency. Three options have been identified and discussed in the OECD Project, feeding into the discussions of the reform process:

**Option 1: A unified Innovation Agency:** This option aims at gathering all innovation-related support functions in a unified Innovation Agency. The guiding principle is to bring together all activities directly related to analysing, preparing and implementing RDI-related initiatives that require expertise in RDI and RDI policy. This would help concentrate expertise and create opportunities for learning, improve the quality of services and facilitate co-ordination and alignment of policy instruments. This might potentially involve relevant parts of Agency for Science, Innovation and Technology (MITA), RDI-related parts of Lithuanian Business Support Agency (LVPA), Enterprise Lithuania (VL) and – subject to agreement of stakeholders – the Lithuanian Innovation Centre (LIC), as well as parts of some other entities.



**Option 2: An extended unified Innovation Agency:** This option extends Option 1 by adding Invest Lithuania (IL) and export-related function of Enterprise Lithuania (VL) to the Innovation Agency. International trade and investment and their promotion play a critical role for Lithuania and could be better linked to innovation policy.

**Option 3: A unified Research and Innovation Agency:** This option is ambitious but holds sufficient potential to be considered as a next step. In some countries (Norway, United Kingdom), this approach has already been pursued. Essentially, a unified research and innovation agency would bring under one roof the unified Innovation Agency (Option 1 or 2) and the Lithuanian Research Council (LMT). For a small country, this configuration could have significant advantages. International trends in technology and growing concerns with regard to societal challenges call for new types of integrated policy initiatives, bundling of instruments and 'hybrid' institutions that extend across the borderlines of research and innovation.

The following presents a list of recommended actions regarding the Innovation Agency:

- Aim at merging all innovation-related support functions in the unified Innovation Agency.
- Keep the new Innovation Agency open to implement and deliver STI programmes and other policy initiatives of all ministries.
- Consider concentrating all general business support functions in a separate business promotion agency and ensure a clear division of tasks.
- Establish close co-operation with Invest Lithuania from the beginning.
- Ensure that the concentration on innovation and related advantages of specialisation are not diminished in an Innovation Agency that also includes some general business promotion functions.
- Ensure that the collaborative relations between the Innovation Agency and a prospective Science Agency and (a reformed) LMT, possibly including the envisaged Science Agency, will be close and dynamic, e.g. in promoting business-science co-operation and the commercialisation of research results, but also in view of the need for close co-operation on societal challenges and the deep economic and societal transitions ahead.
- Redesign and configure the STI agencies in such a way as to facilitate a transition to an integrated Research and Innovation Agency.

Governance and co-ordination has been a persistent challenge for Lithuania's STI policy. Lithuania has approached this issue by establishing a high-level STI Council chaired by the Prime Minister, with a mandate to make proposals to government on priorities, directions and guidelines for STI at national level, the co-ordination of STI policy and strategic management of the STI system, etc. However, the STI Council's success in improving co-operation and reducing fragmentation has been very modest so far. It has not lived up to expectations with regard to the strategic role it needs to play in driving the development of the STI system.

The following presents a list of recommended actions regarding the STI Council:

- Sharpen the STI Council's focus on strategic issues, taking a forward-looking approach.
- Strengthen the Council's role in initiating, supporting and monitoring the implementation of strategic initiatives. Support new types of programmes and the adoption of mission-oriented policies, which could play a pivotal role for co-ordinated action.
- Welcome international members to bring fresh perspectives to the STI Council.
- Making use of temporary thematically oriented working groups. Avoid rigid 'research' or 'innovation' subcommittees that hinder crosscutting solutions.
- Involve the network of STI Officers to be placed in the ministries in the preparation of council meetings and the working groups.

- Establish a well-resourced and independent Secretariat of the STI Council. Locate the Secretariat e.g. at the Prime Minister's or Government Office.
- Ensure effective communication of the STI Council's work. Extend its activity to awareness and information campaigns. Produce, with the support of the Secretariat and external experts, and publish at least one highly visible annual report on the state of Lithuania's STI system and policy.

## Strengthening public procurement of innovation in Lithuania

Innovation has become an additional and important strategic objective pursued by public authorities when making public procurement decisions across a wide range of policy fields. The economic significance of procurement highlights its potential as a demand-side innovation policy tool that may directly or indirectly shape and drive innovation through its funding, demonstration and risk sharing attributes. In Lithuania, public purchases of goods and services amounted to 24.6% of total general government expenditures in 2020, equivalent to 10.7% of GDP. Lithuania recently increased its target for the share of innovation in total public procurement from 5% to 20% as part of the National Progress Plan for 2021-30. While the strategic importance of public procurement as innovation policy tool is recognised, Lithuania still needs to put in place an effective monitoring system to track progress towards its policy target and advance in develop an evidence base around the extent, nature and potential impact of innovation procurement. As highlighted in the OECD team's interviews with national experts and stakeholders, funding and capacity building initiatives – often targeted towards pre-commercial procurement – are well underway but could be consolidated and reinforced with a view to promoting the broader uptake of innovation procurement.

This report offers four overarching and complementary recommendations, supported by examples of relevant practices and mechanisms of support in other OECD countries, with the aim to contribute to Lithuania's strategic goal to spur innovation procurement in Lithuania.

- Clarify relevant concepts and definitions and develop comprehensive guidelines, adopting a definition of public procurement of innovative solutions that comprises multiple degrees of novelty.
- Create an encompassing monitoring system aligned with relevant definitions, updating the current measurement strategy based on the innovation criterion in account of available information sources and measurement approaches and opportunities for upgrading the existing data reporting system.
- Explore ways to identify innovation-oriented buyers as a basis for developing good local examples, creating an award system and customising support services to different types of buyers.
- Create a competence centre to consolidate and reinforce existing support activities, establishing a single and clear access point for information and guidance on innovation procurement and a platform for collaboration and the sharing of knowledge and good practises in this policy area.

## Enhanced adoption of mission-oriented innovation policies

Mission-oriented innovation policies (MOIPs) are co-ordinated packages of policy and regulatory measures tailored specifically to mobilise STI in order to address well-defined objectives related to a societal challenge, in a defined timeframe. These measures possibly span different stages of the innovation cycle from research to demonstration and market deployment, mix supply-push and demand-pull instruments, and cut across various policy fields, sectors and disciplines. Lithuania has recently demonstrated firm interest in this policy approach by commissioning related studies and announcing the launch of three 'Joint Science and Innovation Missions' as part of the national Economic Recovery and Resilience Facility plan.

The OECD Project has identified several options for the adoption of a MOIP approach in Lithuanian STI policy accompanied by recommended actions for each option:

**Option 1: Contribute to the ‘co-creation’ and implementation of EU Horizon Europe’s missions** by involving various actions around communication and mobilisation of actors and networks in one or several of the five EU mission areas that are most relevant to Lithuania. This involves the set-up of mission working groups to mobilise the relevant communities of actors and prepare their contribution to EU missions. Proper coordination of EU missions and national strategies and policies will also be needed.

**Option 2: Define national cross-sectoral missions.** This option consists of defining a few ambitious, inspirational and well-accepted missions and setting up a cross-sectoral funding scheme to support potential solutions across the whole innovation cycle, from research to market deployment. Precise guidance is provided to ensure the successful implementation of the missions planned in the Recovery and Resilience Facility (RRF).

**Option 3: Develop Lithuanian ecosystem-based missions.** This option consists in empowering emerging ecosystems to co-develop and coordinate their own strategic agendas to fulfil specific missions. Following best practices in Nordic countries, Lithuania could develop a dedicated mission-oriented scheme to allow the collective elaboration and implementation of strategic agendas by emerging or established knowledge-based ecosystems in carefully selected priority areas.

**Option 4: The Lithuanian mission-oriented Smart Specialisation Strategy (S3) 2021-27** consists in either making the revised S3 more mission-oriented (more challenge-based and focused, more holistically governed and implemented with a stronger portfolio approach) and/or using the S3 to promote a more mission-oriented approach (including via funding the 4 MOIP options presented above. Relevant parties in Lithuania will need draw on emerging initiatives in various EU regions to strike a better balance between top-down and bottom-up processes; Map and strengthen the connections between the S3 priorities and other national and EU priorities and missions; Systematically seek and exploit synergies between European Structural Investment Funds (ESIF) and Horizon Europe.

These options should be considered as complementary. Synergies between the ‘challenge-led’ (options 2 and 3) and ‘area-based’ (options 3 and 4) should be exploited. It is also essential to involve and strengthen mission-oriented capabilities and awareness in all ministries, beside and in close connection with Ministry of Education, Science and Sports (MoESS) and Ministry of Economy and Innovation (MoEI).

## Artificial Intelligence and Industry 4.0: Key observations and policy options for Lithuania

Policymaking in Lithuania on Industry 4.0 (I4.0) and Artificial Intelligence (AI), at least as concerns diffusion in the business sector, appears to be based on limited evidence. Lithuania could build on the emerging experience of AI survey-development by Eurostat, NSOs and various NGOs. Programme evaluation, focused on impact assessment, could also be strengthened.

Various comparator countries have created dedicated coordinating and monitoring bodies, as well as targeted budget allocations, for their national I4.0 and AI strategies, which have not been present in Lithuania, and from which lessons could be learned.

Attention should be given to the lack of people with machine learning know-how and skills in the broader areas of technology and innovation management. STEM education overall could be improved.

Lithuania operates a wide range of policies and institutions to support I4.0 and AI in the business sector. Given that the supply of programmes is already quite diverse and numerous, consideration should be given to whether some degree of streamlining could be beneficial.

Policymakers could follow the recommendations in OECD (2017) regarding good practice in the design and *modus operandi* of institutions for technology diffusion.<sup>1</sup> Over time, the overall coverage of Lithuania's institutions must ensure that industrial SMEs are not omitted from support. Lithuania should consider developing mechanisms for bridging between AI skills needs in firms and AI expertise in research organisations, such as those in the United Kingdom run by the Digital Catapult and the Turing Institute.

Much of Lithuania's industrial base and AI infrastructure is concentrated around Vilnius. Subnational authorities could take a series of measures to facilitate AI uptake, from helping to inform the local business community about the benefits of AI, to supporting the development of local training programmes.

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<sup>1</sup> OECD (2017), The Next Production Revolution: Implications for Governments and Business, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264271036-en>.

# 1. Recent economic and innovation performance of Lithuania

## 1.1. Continued catch-up with little structural change

After regaining independence in 1990, Lithuania's economy has grown robustly, allowing the country to narrow the productivity gap vis-à-vis the EU average (see below). The process of catching up has made important progress by the time the 2016 OECD Review of Innovation Policy was carried out. The economic advancement of the country has been underpinned by Lithuania's economic reforms, leading to the country's accession to the European Union (EU) in 2004 and to the European Monetary Union (EMU) in 2015. In 2018, Lithuania also became a full member of the OECD. These accessions facilitated the successful integration of the Lithuanian economy in the European market and the world economy.

Lithuania has achieved steady GDP growth since the mid-1990s, with an acceleration of growth ahead of the financial and economic crisis of the late 2000s, which was followed by a swift recovery. During the period in which the 2016 OECD Review (OECD, 2016) was carried out (the mid-2010s), Lithuania's GDP growth was rather sluggish – at least by the standards of a catching-up economy – at 2.0% and 2.5%, respectively in 2015 and 2016, partly due to the uncertainties related to political tensions and sanctions related to the annexation of the Crimean peninsula by the Russian Federation. However, Lithuania's GDP growth picked up again, expanding at an annual rate of 4.3%, 3.9% and 4.3%, respectively, in the three following years. This implied a steadily widening GDP growth differential between Lithuania and the EU27, reaching +2.7 percentage points in 2019. Productivity, as measured by GDP per hour worked, has also grown steadily since the mid-1990, declined in the recession of 2009 to pick up rapidly in its aftermath. Around the mid-2010s – 2014 to 2016 – GDP per hour worked even declined by 0.6 percentage points in total. After 2016, productivity per hour worked improved at a healthy pace (OECD, 2021b) again. Taking a long-term view, GDP per hour worked in Lithuania relative to the EU27 increased from 40% in 1995 to 70% in 2016, and 81% in 2020 (OECD, 2021).

By international standards, the Lithuanian economy has shown remarkable resilience to the pandemic shock, with GDP only mildly declining in 2020 (-0.9%, compared to -6.1% for the EU27). In fact, this was the mildest recession observed among the EU27 countries (with the exception of Ireland, the only EU country that continued to grow in 2020). Government policy has been supportive to contain the impact of the pandemic. External demand has been increasing.<sup>2</sup> In May 2021, the OECD projected a return to pre-pandemic rates of economic growth: Lithuania's GDP is expected to expand by 3.7% and 4% per year, in 2021 and 2022, respectively<sup>3</sup>. Rising real wages and reduced savings accumulated during the pandemic will strengthen domestic demand and reinforced investment is expected support the recovery, as

<sup>2</sup> This included, among other items, demand for "...Lithuanian chemicals for use in COVID-19-related pharmaceutical production elsewhere" (WIIW, 2021).

<sup>3</sup> Similarly, the European Commission's EC Summer 2021 Forecast (July 2021) projects Lithuania's GDP to grow at 3.9% in 2021 and 3.8% in 2022. In its June 2021 forecast, the IMF revised Lithuania's GDP growth upwards, to 4.4% in 2021.

confidence is improving with the rollout of vaccines (OECD, 2021a). While the short-time work scheme helped to contain its rise, unemployment is expected to remain above the pre-pandemic level for some time. As in other countries, increased oil prices and strengthening domestic demand are expected to exert upward pressure on inflation (OECD, 2021a). Fiscal policy is expected to remain supportive to the recovery. In 2022, confidence is set to be strengthening further as the vaccination of the population progresses. Reduced savings from disposable income are likely to prop up consumption, and investment activity will benefit from government programmes and swift implementation of EU-funded projects, including those funded through the Economic Recovery and Resilience Facility. Nevertheless, downside risks remain, including possible further waves of the pandemic (OECD, 2021a).

Lithuania records a high level of trade openness, resulting from a rapid expansion of exports and imports in the post-independence era. However, the composition of exports has changed rather little over the last decade (OECD, 2020). The exports basket is dominated by low-medium technology and resource-intensive goods, and, as far as services are concerned, largely by transportation. Lithuanian exports mostly consist of low-complexity goods. The share of more complex goods in total exports of goods – in the Lithuanian case mostly machinery, equipment (17% in 2019) and vehicles (6%) – remains relatively small, low and medium complexity goods consequently account for the largest share (OECD, 2020). The Economic Complexity Index<sup>4</sup> for Lithuania increased somewhat in the first decade of the millennium, but has changed little over the last decade (2010-19).

To sum up, Lithuania's macroeconomic performance record after independence has been favourable, characterised by steady growth punctured only by short recessions, which could be quickly overcome. However, the dynamism shown in macroeconomic indicators and data on the volume of international trade (exports and imports of goods and services) has not been accompanied so far by significant structural change in the composition of exports. Continued effort needs to be made in various policy areas to further improve productivity to drive a continued catch-up process (EC, 2020) and to facilitate and nurture structural change towards knowledge-intensive activities. Boosting innovation will be critical in this context.

## 1.2. Improved innovation performance with low business R&D expenditure

According to European Innovation Scoreboard (EIS), Lithuania is a moderate innovator (EC, 2021), in terms of the Summary Innovation Index, the country is ranked 18<sup>th</sup> in the overall performance rating of the EIS. It is one of the five countries that witnessed the growth in performance of 25% or more since 2014. In fact, the Summary Innovation Index increased by 31 percentage points for Lithuania, as compared to 12.5 percentage points for the EU on average (EC, 2021).

Lithuania's top three indicators are the 'share of the population with tertiary education', 'development of environment-related technologies' and 'job-to-job mobility of human resources for S&T'. By dimension of indicators, Lithuania performs well on 'Digitalisation' (broadband penetration, people with above basic overall digital skills), 'Innovators' (product innovators, business process innovators; both SMEs) indices and also on 'Environmental sustainability' (air emissions by fine particulate matter, environment-related technologies). Looking at individual indicators, Lithuania is ahead of the EU27 in terms of 'population with tertiary education' (under the 'Human resource' dimension; 201.3% relative to the EU average in 2021)

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<sup>4</sup> The Economic Complexity Index (ECI) measures the complexity of a country's export basket relative to other countries. The measure comprises data on two dimensions: (1) 'diversity', i.e., the number of products that the country is able to export competitively, and (2) the 'ubiquity' of products in the export basket, i.e., the number of countries that are able to export these products competitively as well. Accordingly, countries rank high on economic complexity when they export many goods that are only produced by few other countries. The computation of the ECI uses export data classified according to the Harmonised System (HS-96) at 6-digit level.

and 'non-R&D innovation expenditure' (under the 'Firm investments' dimension; 143.1% relative to the EU average). These two are among the top indicators signalling Lithuanian strengths.

Lithuania has also achieved overall improvement in all dimensions for the period of 2014-21, meaning that the country's position relative to the EU average in terms of EIS has increased from 61.2% in 2014 to 81.8% in 2021.<sup>5</sup> While the changes in respective dimensions are rather moderate, the biggest improvement has been made in terms of SMEs' performance (40.7% in 2014 to 110.4% in 2021). The two indicators under this dimension – product innovators (introduction of new product to the market) and business process innovators (process, marketing and organisational innovation) – more than doubled on average, and in the case of product innovation, the indicator more than quintupled from 2014 to 2021.

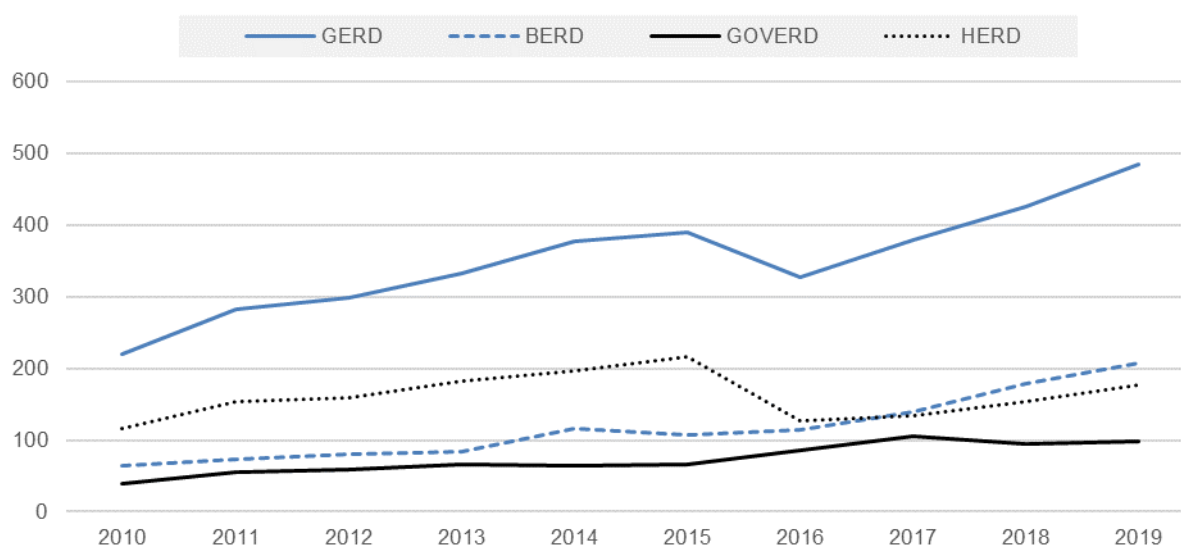
However, Lithuania is lagging by a large margin in indicators such as BERD and innovation expenditures per employee that together define its performance in terms of 'Firm investments' in the EIS. Similarly, although Lithuania has potential strengths in terms of human resources with relatively larger population with higher education, it is below average in other indicators relating to human resources, such as the number of new doctorate graduates in science, technology, engineering and mathematics (STEM) and population involved in lifelong learning. This finding is intricately linked to the low attractiveness of Lithuania's research system as evidenced by low number of international scientific co-publications (80% relative to the EU average), most cited publications (41.5%) and admission of foreign doctorate students (35.7%).

The next two paragraphs provide a closer examination of Lithuania's R&D expenditure and its components. Lithuania's gross domestic expenditure on R&D (GERD) increased from EUR 389.7 million in 2015 to EUR 484 million in 2019 (Figure 1.1). The low level of business expenditure on R&D (BERD) continues to be an important obstacle to Lithuania's development towards an innovative economy. While BERD nearly doubled in nominal terms (from EUR 106.7 million in 2010 to EUR 208.1 million in 2019), it still lags behind comparators even among Central and Eastern European (CEE) countries. Although Lithuania's BERD as a percentage of GDP increased from 0.23% to 0.43% between 2010 and 2019, it still lags far behind Slovenia (1.51%), the Czech Republic (1.2%), Hungary (1.11%) as well as Estonia (0.86%). Lithuania's gap to the OECD average of 1.76% and EU27 average of 1.39% is even larger. In terms of the share of R&D personnel as a percentage of the labour force, Lithuania shows a similar pattern, with little change between 2010 and 2019, in contrast to a number of CEE countries. Government expenditure on R&D (GOVERD) expanded from EUR 38.5 million in 2010 to EUR 99.1 million in 2019) while higher education expenditure on R&D (HERD) increased in the first half of the decade (from EUR 116.5 million in 2010 to EUR 216.4 million in 2015) but declined afterwards to EUR 176.8 million in 2019.

A salient feature of R&D funding in Lithuania is the low share of funding from the business enterprise sector. For some time, the share of business-funded GERD fluctuated around 30%, and picked up only in recent years to reach 38% in 2018. This is still low compared to the OECD and EU average of 62.5% and 57.8%, respectively (Table 1.1). Even among CEE OECD countries, Lithuania has one of the lowest shares of business funding. Only the Czech Republic at 33% and Latvia at 22.3% have shares lower than Lithuania, while others are in the range of 50-60%. In Lithuania, the share of government funding has declined drastically after 2008, from more than half to about one third of GERD in recent years. In contrast, R&D funding from abroad has increased with Lithuania's accession to the EU, accounting one third or more of GERD in the first half of the 2010s (with a peak of 37.1% in 2013). In the funding of government R&D but also of business enterprise R&D, funding from abroad exceeded national government funding. In 2018, funding from abroad amounted to 47.4% of GOVERD and 18.7% of BERD (see Table 1.1).

<sup>5</sup> The total of 32 innovation indicators are grouped into 12 dimensions, which are: Human resources, Attractive research systems, Digitalisation, Finance and support, Firm investment, Use of information technologies, Innovators, Linkages, Intellectual assets, Employment impacts, Sales impacts and Environmental sustainability.



**Figure 1.1. Lithuania's GERD by sector of performance (million EUR), 2010-19**

Source: OECD (2021c), OECD Stat. (database). <https://stats.oecd.org/index.aspx?r=82762#>

**Table 1.1. Lithuania's GERD by sector of performance and source of funds (million EUR), 2018**

Sector of performance	Business Enterprise	Government	Higher education	Total (performance)
Source of funds				
Business enterprise	142 (79.6%)	10.294 (10.9%)	9.825 (6.4%)	162.146 (38%)
Government	2.8 (1.6%)	39.58 (41.7%)	95.766 (62.5%)	138.152 (32.4%)
Higher education	0.1 (0.1%)	0.01 (0.01%)	13.754 (9%)	13.907 (3.3%)
Private non-profit	0.04 (0.02%)	0.016 (0.01%)	0.498 (0.3%)	0.558 (0.13%)
Funds from abroad	33.3 (18.7%)	44.906 (47.4%)	33.341 (21.8%)	111.543 (26.2%)
Total (funding sector)	178.3 (100%)	94.806 (100%)	153.184 (100%)	426.306 (100%)

Note: Retrieved from the latest data available.

Source: OECD (2021). OECD Stat. (database). [https://stats.oecd.org/Index.aspx?DataSetCode=MSTI\\_PUB#](https://stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB#)

Overall, Lithuania has shown better innovation performance since the mid-2010s as evidenced by its comparatively high share of tertiary education attainment of the population, enhanced digitalisation and improved product and business process innovations in SMEs. However, structural challenges persist in both the research and business sector. Lithuania's research system does not sufficiently attract talent from within or from abroad. Business R&D expenditure is still low, despite improvements, while non-R&D innovation expenditure (e.g. investment in equipment, acquisition of patents and licensing, etc.) is comparatively high. This constellation may be well suited for an economy in its earlier phases of catching up but will have to shift as the country moves closer to the technological frontier.

Creating innovation-friendly framework conditions, stimulating business R&D and facilitating structural change towards innovative and knowledge intensive economic activities are major tasks for Lithuania's economic and STI policies. This will imply own funding mechanisms and diminishing reliance on EU funding (Paliokaitė et al., 2018).

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## 2. Better understanding gaps in STI policy implementation: Policy actions taken after the 2016 OECD Review of Innovation Policy

The OECD – SRSP Project Support for Improving Effectiveness of Lithuania's Innovation Policy follows up the OECD Review of Innovation Policy: Lithuania 2016 (hereafter 2016 OECD Review; OECD, 2016). Based on its diagnosis drawing on a wide range of sources, the Review provided a comprehensive assessment of the country's innovation system and policy. In addition, the 2016 Review presented a range of concrete policy recommendations aimed at strengthening Lithuania's research and innovation system and performance, harnessing technological change, boosting economic growth, achieving needed social objectives and creating frameworks and environments conducive to further innovation.

This chapter is dedicated to achieving a better understanding of gaps in STI policy implementation based on a stocktaking of the policy actions undertaken by Lithuania related to the Recommendations (grouped in Recommendation areas; Table 2.1) made in the 2016 OECD Review. Each Recommendation area includes specific Recommendations that target different parts or functions of the Lithuanian STI system. The following section provides a summary of findings regarding actions taken in the respective Recommendation areas.

**Table 2.1. Recommendation areas in the OECD Review of Innovation Policy: Lithuania 2016**

Recommendation area(s)		Keyword(s)
1.	Provide favourable framework conditions for innovation	Framework conditions
2.	Foster the quality of human resources for innovation	Human resources and skills
3.	Improve public governance of the innovation system: agenda-setting, co-ordination and strategic alliance	STI governance
4.	Better balance the policy mix, fostering innovation in the wider business sector	Business innovation
5.	Enhance the performance of the higher education institutions (HEIs)	Higher education system
6.	Support international knowledge linkages	International linkages

Note: A complete list of recommendations for each recommendation area can be found in the Annex of the full report

Source: OECD (2016), OECD Reviews of Innovation Policy: Lithuania 2016, OECD Publishing, Paris.

<http://dx.doi.org/10.1787/9789264259089-en>.

## 2.1. Policy actions taken in the recommendation areas of the OECD Review of Innovation Policy Lithuania 2016<sup>6</sup>

### ***Improve framework conditions and better balance the policy mix for fostering innovation in the wider business sector (Recommendation areas 1 and 4)***

Good framework conditions that are essential for innovation include a mature system of equity and debt finance that would facilitate investment in high-potential growth firms, improved regulatory framework and monitoring of effects on firms of the government-led reform initiatives and public investments (**Recommendation area 1**). The 2016 OECD Review noted that Lithuania has been strengthening its framework conditions for innovation, but pointed at numerous remaining challenges. Since then, a number of policy measures have been taken in this respect.

With the start of the new European Regional Development Fund (ERDF), several funds were designed by the Ministry of Economy and Innovation (MoEI) and implemented mainly by Investment and Business Guarantees (INVEGA) to improve firms' access to finance as pointed out by the 2016 OECD Review. INVEGA, a financial institution owned by MoEI, implements a number of measures to assist SMEs across different growth stages. For instance, the *Co-investment Fund* and *Co-investment Fund II*<sup>7</sup> are venture capital instruments designed for investment in companies with high growth potential, thereby increasing capital availability to new prospective Lithuanian companies. In addition, the *Business Angels Co-investment Fund* intends to finance a diversified portfolio of investments in companies with business angels from seed to development stage. It remains to be seen to what extent firms with high innovation potential are the actual beneficiaries of these funds (thus relating to the innovation focus of such measures) or if they rather serve the more general aim of increasing access to capital. The OECD team's interviews identified business sector concerns that a large number of financial assistance measures are targeting the early stages of business development whereas relatively few address business scale-up. The main venture capital instruments made available to businesses are dependent on EU funds (Angelis et al., 2020).<sup>8</sup>

Furthermore, Lithuania has made progress in terms of setting more business-friendly legal frameworks. The Law on Crowdfunding was adopted in 2016 to establish legal conditions for crowdfunding, crowdfunding operators, terms and conditions for mandatory disclosure of information provided on a crowdfunding platform as well as the maintenance of platforms by their operators. Lithuania has the second highest proportion of rejected loan applications (25% in 2020 up from 24.4% in 2018) which is higher for

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<sup>6</sup> This section takes stock of the policy actions taken in the recommendation areas of the 2016 OECD Review. The presentation was adjusted to take into account the inter-connectedness of some recommendation areas and the subsequent focus of Chapter 3. Specifically, recommendation areas 1 and 4 were gathered under one heading as both are centred on policies directed at business enterprises. The presentation of recommendation area 2 is followed by recommendation area 5, while recommendation area 3 is placed at the end of this section, as it provides a background and a bridge to the subsequent chapter.

<sup>7</sup> See INVEGA. <https://invega.lt/en/business/grow-business/venture-capital/177/baltic-innovation-fund-ii-53>.

<sup>8</sup> The lack of focus on business scale-up is partly due to the institutional constraints that do not encourage the growth of firms (EC, 2020). The share of micro enterprises has been growing steadily since 2004 (while the number of large firms has declined). This trend may have been reinforced by the preferential tax treatment for SMEs in 2010. Setting a threshold for preferential taxation may ease doing business for small firms but create obstacles to the 'growth' of innovative firms as noted in the 2016 OECD Review since the firms can lose incentives to pursue growth to an optimal size.

SMEs.<sup>9</sup> Generally, SMEs perceive bank as reluctant to provide loans, and this law is expected to provide the opportunity for alternative financing and investment for them.

In line with the 2016 OECD Review's recommendation to make bankruptcy procedures more rapid and less costly, a new Law on the Insolvency of Legal Entities (hereinafter Insolvency Law)<sup>10</sup> came into force on 1 January, 2020, replacing the Law on Enterprise Bankruptcy and the Law on Restructuring Enterprises. The new regime has accelerated the initiation and resolution of personal and corporate insolvency proceedings. It also encouraged the parties to turn to dialogue and out-of-court solutions that provide businesses more options than exit, accelerated the court procedures, improved accountability of insolvency administrators and established new supervision rules implying strong self-regulation (OECD, 2020).

Lithuania has also implemented various measures to lower the barriers for the growth of innovative companies. However, challenges remain, in particular relating to the 2016 OECD Review's recommendations on increasing government institutions' capabilities to improve the regulatory framework and monitor the effects that reform initiatives and public investments aimed at addressing infrastructure deficits may have on Lithuanian firms. Lithuania still relies heavily on external funding (mostly from the EU) which is expected to decrease as the country continues to advance economically. There remain significant disparities between the capital Vilnius where most business firms are centred and the peripheral regions (OECD, 2021b). Most public investments are concentrated in Vilnius and other urban regions such as Klaipėda and Kaunas, while key infrastructures are lagging in rural regions.

**Recommendation area 4** relates to the set of dedicated policies that are intended to foster innovation in the wider business sector (and together make up the overall business innovation policy mix). As noted in the 2016 OECD Review, most funding schemes were designed with a focus on fostering research and science-driven innovation, while business R&D and innovation started to receive more attention towards the end of the 2007-13 EU Structural Funds period. To engage more companies in R&D activities, the 2016 OECD Review stressed the necessity of raising awareness of the importance of R&D and innovation, facilitating competence building and absorptive capacities of companies and other measures aimed at increasing the number of companies capable of and willing to engage in R&D and innovation.

Accordingly, Lithuania has introduced a wide array of measures that focus on increasing the share of R&D and innovation performers in the business sector. The most prominent action has been *Intellect. Joint Science-Business Projects* with a budget of EUR 147 million for the 2014-20 period. This measure has been supporting the R&D activities carried out by enterprises with or without partner research institutions. Enterprises or consortia are supported with initial financial resources to create new or expand the existing research, development and innovation (RDI) infrastructures. However, evaluation results regarding the success of this measure are rather mixed since enterprises have remained reluctant to collaborate with researchers on equal terms, and the measure was mostly popular with large companies rather than HEIs or small firms (Angelis et al., 2020). In 2019, this measure was replaced with *EXPERIMENT* (funding volume EUR 153 million), which is still under implementation. Compared to its predecessor, *EXPERIMENT* simplified the document that tests the applying projects' match with S3 priorities<sup>11</sup>, clearly defined the R&D services, and reduced the required financial planning by omitting the requirement of financial projections. Overall, this lowered the entry barrier for Lithuanian firms and facilitated their participation in implementing the Smart Specialisation Strategy (S3).

<sup>9</sup> European Central Bank – Statistical Data Warehouse.

[https://sdw.ecb.europa.eu/quickview.do?sessionId=43722EB79E2FA6FCC71CD88738D8D454?SERIES\\_KEY=258.BLS.Q.LT.ALL.O.E.Z.B3.RA.D.FNET&periodSortOrder=ASC](https://sdw.ecb.europa.eu/quickview.do?sessionId=43722EB79E2FA6FCC71CD88738D8D454?SERIES_KEY=258.BLS.Q.LT.ALL.O.E.Z.B3.RA.D.FNET&periodSortOrder=ASC).

<sup>10</sup> Parliament <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/56df69a293fa11e9aab6d8dd69c6da66>.

<sup>11</sup> According to its objective and scope, the *EXPERIMENT* policy instrument is designed for better implementation of Smart Specialisation Strategy in Lithuania.

Furthermore, most of the policy actions taken in this Recommendation area were designed as competence-building schemes that target enterprises not yet engaged in R&D and innovation, including through awareness-raising measures. *Inospurtas* has been a project implemented under the measure *Inogeb LT* providing the innovation consultancy and support services.<sup>12</sup> The project involves public institutions such as the Lithuanian Innovation Centre (LIC) and Science and Technology Parks (STPs) among whose main role is to the provision of innovation consulting. Financial instruments such as *Early Stage Development Fund I and II* were made available for firms by offering micro, small and medium-sized enterprises expert assistance in identifying innovation technology ideas with commercial potential. These policy actions do not specifically focus on firms that are not yet engaged in RDI activities and rather have wider focus on SMEs that generally lack resources and incentives to engage in such activities.

On the other hand, Lithuania has also shown its commitment to continue developing demand-side policy measures, the most promising being the public procurement of innovation (PPI). The Lithuanian Innovation Development Programme for 2014-20 initially defined a target of 5% for the share of innovation procurement in total public procurement. This target was increased to 20% in the National Progress Plan (NPP) 2021-30. To this end, since 2017 MoEI is implementing the Pre-commercial Procurement LT measure to stimulate the demand for innovation by encouraging public authorities to purchase R&D services. MITA also provides training services and guidance regarding PPI (see Chapter 4. on PPI).<sup>13</sup> However, the number of innovation-based procurements remains fairly low. After reaching a peak of 17 in 2014, the number has gradually decreased to 1 or 2 on average from 2018 to 2020 (STRATA, 2021). This indicates that the measures to stimulate the demand for innovation are still poorly used.

Only a few policy actions have been found that were aimed at fostering collaboration within the business sector (i.e. among firms) and with the research and education sector. The 2016 OECD Review pointed to the need to develop a long-term strategy for the support of collaborative networking arrangements among firms, but no formal public engagement has been noted in this respect that would have generated significant impact. This partly relates to another recommendation on business clusters, which generally appear to lack endogenous strength for innovation apart from the infrastructural developments (e.g. Valleys, STPs, open access centres funded by the EU) achieved in the past. The period of relatively intense clusterisation coincides with the implementation period for the EU Structural Funds (mainly from 2010 to 2015). Currently, there are 46 clusters in operation, among which only a quarter are based on long-term cooperative relationships, whereas some are still in their infancy as groups of business firms and research institutes which are lacking strong interconnections and synergies.<sup>14</sup> In this sense, the 2016 OECD recommendations on business clusters are still valid in that the clusters should not be considered an end in themselves, but rather should be seen as a mechanism, led by industry, that involves and enhances inter-firm co-operation, including with public authorities, universities and research institutes.<sup>15</sup>

### ***Foster the quality of human resources for innovation (Recommendation area 2)***

Skills shortages and mismatches between the outputs of the education system and industrial needs have been identified as a critical barrier to innovation. The 2016 OECD Review provided recommendations to strengthen the human resources base for innovation in order to supply businesses with the skills they need to become more innovative. This would require mapping the skills by Lithuanian companies through dialogues with higher education institutions (HEIs) and business sector, promoting development of

<sup>12</sup> MITA. <https://mita.lrv.lt/en/projects/inospurtas>.

<sup>13</sup> MoEI. <https://eimin.lrv.lt/lt/veiklos-sritys/es-parama-1/2014-2020-m/ikiprekybiniai-pirkimai-lt>.

<sup>14</sup> Klaster LT. <https://klaster.lt/klasteriai/>; MITA counts that 60 clusters are operating in Lithuania according to their study in 2020. See reference below.

<sup>15</sup> See Chapter 5 on Mission-Oriented Innovation Policy (MOIP) in Lithuania for more detail on 'clusterisation' and a potential ecosystem-based MOIP option.



vocational education and training (VET) institutions, and enhancing the performance of students in secondary education in longer term. Also, the 2016 OECD Review calls for attention to the need to foster linkages between Lithuanian researchers and research units abroad as well as to address the challenge of brain drain and to lower barriers for attracting talent from abroad.

Lithuania seems to hold a middle ground in terms of skills mismatch in Europe<sup>16</sup>. However, it still suffers from labour shortage in skills-intensive sectors such as ICT and finance and a surplus in low-or medium-skilled occupations. According to the OECD Skills for Jobs Database, Lithuania faces shortages in workers with competences in areas such as computers and electronics, systems evaluation and analysis and verbal and quantitative abilities (OECD, 2018). In 2019, approximately 41% of employees who graduated from HEIs or VET institutions recorded a mismatch by field of study and/or qualification level (OECD, 2021a). This phenomenon can be attributed to many factors as has been noted by the 2016 OECD Review, i.e., low performance of lower and upper secondary education, inefficient VET system and a lack of talent attraction from abroad.

One of the policy initiatives aimed at strengthening the human resource base for innovation and the supply of businesses with relevant skills was the amendment to the Law on Higher Education and Research in 2018 that clearly defines a level 5 of educational programmes (equivalent to ISCED 5).<sup>17</sup> Before the introduction of level 5 at HEIs, VET schools provided level 5 study programmes that were widely considered ineffective. The new Law states that colleges together with VET schools can provide short-cycle studies after coordination with the Ministry of Education, Science and Sports (MoESS). MoESS will approve the list of qualifications and study branches of which short-cycle studies may be provided in HEIs. Moreover, numerous policy actions have been taken to promote training and professional development of workers at enterprises. These are considered to have strengthened the human resource base for innovation overall.

After the amendment of the Law on Vocational Education and Training in 2019, all VET schools became public institutions that will involve more businesses and municipalities in their education processes. To that end, MoESS approved councils in 47 VET schools and more will follow in the coming years. A council is a collegial school management body, of which business representatives have the possibility to become stakeholders or delegate their employees to be involved in the management process. The Law also calls for the establishment of more efficient VET school network, which led to the adoption of VET School Network Development Plan by MoESS in 2018.<sup>18</sup> Against the backdrop of a shrinking population and increasing need to adjust VET schools to demographic trends, the Plan states that if the number of students at VET institution falls below a critical level, the institution will be restructured and redesigned as departments or subsidiaries of another VET school.

The 2016 OECD Review's recommends to foster linkages between Lithuanian researchers and research units abroad. As expected, the majority of Lithuanian researchers' collaboration with international research communities is largely facilitated through EU programmes. In addition, the Lithuanian Research Council (LMT), the main funding organisation for basic research, takes part in the Baltic Research Programme (with Latvia and Estonia), and manages bilateral research cooperation channels with Belarus, France, Chinese Taipei and Japan in line with the 2016 OECD Review's recommendation to foster Lithuanian engagement in international STI beyond EU programmes.<sup>19</sup>

In summary, a number of issues raised by the recommendations of the 2016 OECD Review still appear relevant for Lithuania's STI policy today. There is evidence that a large proportion of graduates find occupations with low relevance to the tertiary education received, which points at excess qualification of

<sup>16</sup> CEDEFOP. <https://www.cedefop.europa.eu/en/publications-and-resources/data-visualisations/european-skills-index/skills-matching>.

<sup>17</sup> International Standard Classification of Education (ISCE).

<sup>18</sup> Parliament. <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/094a5111345511e884a38848fe3ec9e2?fwid=zaydj60p3>.

<sup>19</sup> LMT. <https://www.lmt.lt/en/research-funding/international-collaborations/814>.



graduates employed in some sectors. Moreover, the culture of business-science cooperation does not have deep roots in Lithuania, except for certain firms based, e.g., on laser research and technology or the life sciences, where the industrial foundations were mainly built by researchers and scientists and linkages have strengthened overtime. Although 'Population with tertiary education' was identified as one of the top-three indicators of Lithuania's strength for innovation on the EIS, the OECD Skills Strategy: Lithuania (hereafter Skills Strategy) noted that the education system does not appear to be sufficiently responsive to evolving labour market demands (OECD, 2021a). The Skills Strategy finds that the funding arrangements and admission policies of HEIs and VET schools could be modified to become more closely linked to labour market needs.

### ***Enhance the performance of Higher Education sector (Recommendation area 5)***

Following the adoption of the Law on Higher Education and Research in 2009, the Lithuanian government initiated various reform initiatives to improve the performance of the higher education sector. These initiatives concern both universities' performance in a narrow sense and strengthening business-science collaboration more broadly. In this regard, specific recommendations of the 2016 OECD Review included the consolidation of the institutional landscape, enhancement of the institutes' research management capabilities (also for international cooperation), creation of technology transfer centres and a systematic international research assessment of Lithuanian research units. Recommendations also addressed the need to better monitor and exploit the advantages of the existing facilities for business-science collaboration such as STPs, Valleys and open access centres.

In 2017, the Lithuanian government launched an integral reform in its HEI system consisting of three pillars: 1) reform of the funding of HEIs, 2) reform of the quality assurance system and 3) university network consolidation (Caturianas and Budraitis, 2019). As regards funding of research, MoESS introduced a two-tier mechanism where 40% of the budget is based on the annual research assessment undertaken by the LMT and 60% through a comparative assessment (benchmarking exercise) conducted every five years by groups of foreign experts. Research funding is allocated to institutions based on the results of the last three years of the annual evaluation and the five-year benchmarking exercise.<sup>20</sup> The interviews carried out by the OECD team indicate that this change has been instrumental for research in the higher education system.

Regarding the second pillar, Lithuania saw an improvement for academic staff as their salaries grew on average twice as fast as the annual wage growth between 2017 and 2018, which potentially contributes to increasing performance.<sup>21</sup> On the third pillar, a Working Group headed by the Minister of MoESS was established. The Working Group prepared the 'Public University Optimisation Plan', which was adopted by Parliament.<sup>22</sup> MoESS is the principal coordinator of the merger process, and Parliament the supervisory body. As of 2021, three cases of merger have been approved by Parliament. However, the actual implementation diverged from what was originally envisioned, and the agenda of university merger seems to have lower saliency on the political agenda. On the other hand, three research institutions – the Center for Physical Sciences and Technology (FTMC), Lithuanian Energy Institute (LEI) and the Lithuanian Research Centre for Agriculture and Forestry's – have been brought together to form a 'first' Research and

<sup>20</sup> LMT. <https://www.lmt.lt/mokslo-kokybe/mokslo-meno-vertinimas/182>.

<sup>21</sup> STRATA (previously MOSTA). <https://strata.gov.lt/lt/renginiai/8-naujienos/532-destytoj-ir-tyrej-atlyginim-augimas-dvigubai-greitesnis-nei-salies-ukyje>.

<sup>22</sup> Lietuvos Respublikos Seimas, Nutarimas Dėl Valstybinių Universitetų Tinklo Optimizavimo Plano Patvirtinimo 2017 m. birželio

29 d. Nr. XIII-533, Vilnius,

<https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/e668d82060b411e7a53b83ca0142260e?jfwid=-2y4hh2gps>.

Technology Organisation (RTO)' in 2019.<sup>23</sup> It remains to be seen to what extent this association of institutions will provide value added and live up to the expectation to increase the visibility of Lithuanian research organisations at the international level. In the meantime, one of the organisations involved, the FTMC, joined the European Association of Research and Technology Organisation (EARTO) which can be considered a positive step forward.<sup>24</sup>

The low level of collaboration between the research community and the business sector has been a long-standing issue in Lithuania. Business-science collaboration does exist but is mostly limited to certain industries or clusters where the ties are inscribed in the history of the research institutions and businesses. Financed by the EU Structural Funds, the Central Project Management Agency (CPVA) implemented a measure to promote centres of excellence and technology transfer centres at research and study institutions. In addition, as noted in the 2016 OECD Review, the key mechanism used in Lithuania to improve the commercialisation of research is the establishment of STPs and local technology centres mainly during the 2007-13 Operational Programme period. However, this upgrading of infrastructures and funding of R&D activities within competence centres did not lead to a qualitative improvement of science institutions' collaborative R&D activities with businesses, and overall the clusters in Lithuania are still in their infancy except for a few traditionally strong industry sectors such as life sciences and laser industries (see recommendation area 4).<sup>25</sup>

To sum up, despite the reform initiatives undertaken, Lithuania still faces numerous challenges in its tertiary education system and a number of recommendations made in the 2016 OECD Review remain valid. The higher education institution is still in need of consolidation. The quality of study in Lithuanian universities remains low, and the empirical evidence on skills mismatches indicates that the education provided does not sufficiently meet industrial needs. Demand for jobs is higher for qualified professionals, which contributes to the skills mismatch in Lithuania that is above the OECD average. This phenomenon is reinforced by the largest difference in education outcomes between core and peripheral regions (OECD, 2020). The remuneration for research positions is still considered generally low among the Lithuanian research community (STRATA, 2020). The financial conditions of HEIs are relatively poor compared to other European countries. In addition, allocated public funds are inefficiently used, with some HEIs spending almost 30% of their budget for administrative purposes. Furthermore, Lithuania has not been successful in international competitive funding programmes such as Horizon 2020 or, at the high end of research and competition, in attracting funds from the European Research Council which has become to be used as an indicator of the quality of research performed.

### ***Foster formation of international knowledge linkage and internationalisation (Recommendation area 6)***

As indicated by the 2016 OECD Review, international linkages are of particular importance for small countries. However, building such linkages requires concerted and strategic efforts and cultivating a high-quality domestic research base (see Recommendation area 5). The latter has been one of the weak elements in the Lithuanian innovation system. In this context, the 2016 OECD Review provided recommendations to further promote participation in European and other international STI programmes, develop a national internationalisation strategy, continue the support measures for internationalisation of the public research system and support institutional capacity building at universities and research centres to enhance internationalisation as an element for their strategies.

<sup>23</sup> RTO Lithuania. <https://rtolithuania.com/>.

<sup>24</sup> EARTO. <https://www.earto.eu/earto-network-welcomes-2-new-members-ftmc-lithuania-and-inti-argentina/>.

<sup>25</sup> See Chapter 5 on Mission-Oriented Innovation Policy (MOIP) in Lithuania for more detail about 'clusterisation' and a potential ecosystem-based MOIP option for Lithuania.

This requires long-term commitment of not only the research community but the entire innovation system. In fact, participation in European programmes represent much of the international activity of Lithuania. The participation rate in European programmes is increasing and the success rate (in terms of the number of participations)<sup>26</sup> of 13% in Horizon 2020 is similar to the EU28 average of 12%. Also, Lithuania's performance in terms of EU net contributions has improved in Horizon 2020 compared to its predecessor, FP7.<sup>27</sup> However, compared to its European peers, Lithuania is ranked low in terms of number of participation and share of funds received.<sup>28</sup> This can be attributed to multiple factors including Lithuanian research institutes' low visibility at EU level with the exception of a few institutes such as the Lithuanian Energy Institute (LEI) or the Centre for Physical Sciences and Technology (FTMC). Low visibility overall can be attributed to small scale, a lack of strategic management capabilities needed to develop a strong activities and profiles and inefficiencies in administration within universities and research institutes. These issues have already been raised in the 2016 OECD Review, but despite some developments in the right direction (see e.g. regarding the RTO area above), there remains much scope for improvement.

Regarding the recommendation to promote participation in European and other international STI programmes by allocating more resources, the Lithuanian Research Development and Innovation Liaison Office in Brussels (hereafter the LINO Office) based at the Permanent Representation of Lithuania to the EU started activities in 2017. The LINO Office aims to integrate Lithuanian researchers into international research projects, thereby strengthening European research cooperation. The Office strives to collect information via various channels including interactions with science attachés and other liaison offices, but its activities appear to be limited by a lack of staff. For instance, the Office does not have enough human resources to address specific themes of the Framework Programmes, which – together with other factors – limits Lithuanian researchers' participation.

The 2016 OECD Review also recommended the development of overarching national internationalisation strategy that involves all relevant ministries and stakeholders to ensure alignment of the internationalisation strategies of individual STI actors. During the EU Structural Funds period 2014-20, STRATA in partnership with the MoESS initiated a project 'Creating a map of international cooperation in science' which is currently under preparation. While the aim is to create a map of cooperation in science that will help identify the potential of Lithuanian R&D and innovation in international context, specifically by providing recommendations, tools, methodologies and indicators, it is said to lack systematic approach and overlaps exist with other policy measures.

One interesting new development in this regard is the intended creation of a Science Agency as part of LMT. This new agency is envisaged to assemble under its roof – among other things – the national contact points (NCPs) for Horizon Europe, which so far have been separately managed by LMT and MITA. Although information about this new initiative is scarce, this initiative could contribute to increasing awareness and participation of Lithuanian research and innovation actors in Horizon Europe. Success would still require simultaneous efforts in the research community as well as the business sector.

Overall, most recommendations proposed in the 2016 OECD Review remain valid. A strong focus on internationalisation has to be a key strategic dimension of the STI policy of small, catching-up economies.

<sup>26</sup> Ratio of all funded projects and project proposals (%) starting from the start of Horizon 2020 in 2014. Data retrieved in July 2021; LMT. <https://www.lmt.lt/lt/moksliniu-tyrimu-finansavimo-instrumentai/programa-horizontas-2020/lietuvos-dalyvavimo-horizonte-2020-statistika/351>.

<sup>27</sup> The net EU contribution for Horizon 2020 was EUR 90 million compared to EUR 55 million for FP7.

<sup>28</sup> Lithuania is ranked 26th according to the number of participations, 27th according to the funds received; LMT <https://www.lmt.lt/lt/moksliniu-tyrimu-finansavimo-instrumentai/programa-horizontas-2020/lietuvos-dalyvavimo-horizonte-2020-statistika/351>.

### ***Improve the STI governance system (Recommendation area 3)***

The 2016 OECD Review acknowledged that Lithuania has made progress in developing its R&D and innovation policy governance, primarily through the implementation of Research and Innovation Strategies for Smart Specialisation (RIS3; hereafter S3). However, the STI governance system in place had some difficulties to implement the S3 successfully. This was mainly due to a lack of co-ordination among government institutions and fragmentation of support schemes. The 2016 OECD Review called for an integral enhancement of the overall STI governance structure as well as a sound review of STI-related programmes, the establishment of principles for policy evaluation at practical level, and the consolidation of innovation agencies, which would involve institutional restructuring with potentially far-reaching impact. Lithuania's STI governance continues to be an area that requires high policy attention. Two key areas – enhancement of the role of STI Council and consolidation of the innovation agencies – are discussed in depth in the following Chapter 3.

The Law on Technologies and Innovation adopted in 2018 – together with the Law on Higher Education and Research – is considered to have shaped the Lithuanian STI governance system in important ways. The Law stipulates that the MoEI becomes the central ministry in charge of innovation policy making, and MoEI was provided with means to attract more investments from the private sector. The Law is currently being amended. The law also defined the role of the Science, Technology and Innovation Council (Article 10) in its current form, and an agency as being authorised by the government to perform functions related to STI policy implementation (Article 14). Overall, the Laws were aimed to create an institutional setting that is more conducive to research, innovation and higher education. However, a high degree of fragmentation persists in Lithuania's institutional landscape for STI, mainly – but not exclusively – between MoEI and MoESS. A strict division of responsibilities for innovation and research and a less pronounced emphasis and practice of bridging and facilitating interactions may hinder the interactions across institutional and disciplinary borders needed in 21<sup>st</sup> century innovation STI systems and policies.

Overall, reform efforts have not resulted in a significant improvement of Lithuania's STI governance system, and challenges related to high-level, strategic governance, coordination and cooperation across policy areas, government ministries and agencies remain to this date. Against this backdrop, the new government that came into office in 2020 launched several policy initiatives to advance the innovation reform started earlier. The NPP 2021-30 introduced 'innovation and creativity' as one of the three main 'horizontal principles'. It acknowledges innovation to be of a cross-cutting nature, linking public and private actors. The principle is reflected in the NDPs prepared by the ministries.<sup>29</sup> These principles form the basis for the 10 Strategic Goals (SGs) established under the NPP. Among them SG 1 pertains directly to the development of the STI system.<sup>30</sup> It calls for an integral transformation of the Lithuanian innovation system by providing highly qualified scientists, strengthening the entrepreneurial and knowledge transfer capacities of research and study institutions to encouraging digital transformation of industry.

The new Government Programme adopted at the end of 2020 is based on the principles and SGs of the NPP. The Programme consists of 12 'Missions' that are aimed at modernising Lithuania's society and economy. Mission 1 (led by MoESS) is dedicated to "Equal start positions for all people of Lithuania" and includes project on "World-class Science" (with measures regarding the salaries of researchers, research internationalisation, mission-oriented research, innovation programmes, etc.). Mission 5 is specifically dedicated to building a 'High value-added economy' specified by several projects including 'A vibrant innovation ecosystem'. The latter addresses the need for institutional change, that is, adaptation of a network of state institutions in order to complete the innovation reform. The Government Programme foresees that this would result in an enhanced functioning of MoEI and the establishment of a unified Innovation Agency. Concurrently, the Innovation Promotion Fund was established at the end of 2020. Its

<sup>29</sup> The two main NDPs related to innovation are prepared by MoEI ('Competitiveness Programme') and MoESS ('Science Programme'). NDPs have not been made public at the time of writing.

<sup>30</sup> The remaining 9 SGs contain innovation components as well (in line with the horizontality principle).

aim is to ensure effective financing of R&D and innovation activities and contribute to their development. This new Fund is potentially composed of allocations from the state budget, EU funds and other sources) and the implementing agency. It is foreseen that once it is created, the new Innovation Agency will take over the role as its implementing agency from INVEGA.

In spring 2021, the New Generation Lithuania – Economic Recovery and Resilience Measure 2021-26 (hereafter the Lithuanian Recovery and Resilience Plan, RRP) was adopted and submitted to the European Commission.<sup>31</sup> The RRP has seven focus areas (components), including the one that addresses the innovation agenda ('innovation and science'). Building on the NPP and Government Programme, the RRP announces the establishment of an Innovation Agency and a Science Agency with the former having more focus on the business sector and the later on education and research. The model for the new Innovation Agency is presented in some more detail, than the planned Science Agency.<sup>32</sup> Furthermore, the Innovation Promotion Fund is planned to be expanded, and a network of science officers to be established to strengthen relevant expertise in the ministries, cooperation between the public authorities, and communication with the science and business sectors on matters of STI.

As part of the RRP, three 'Joint Science and Innovation Missions' have been set up for the three Smart Specialisation areas (i.e. advanced manufacturing, health technology / biotechnology and ICT).<sup>33</sup> In 2019, the S3 Coordination Group has decided to reduce the number of previously seven priorities of the S3 to aforementioned three to increase wider participation of Lithuanian stakeholders and focus on those economic sectors with the highest potential (STRATA, 2018). The missions aligned with the three S3 priorities will be carried out in the form of research-industry partnerships, and they will be addressing the societal challenges the Lithuanian society is facing (see Chapter 5. for five options to adopt mission-orientation in Lithuanian STI policy). In the coming period, MoEI will become responsible for the implementation of S3, and measures for the implementation of S3 objectives will be provided by the National Development Programmes (NDP) coordinated by the MoEI and the MoESS. The MoESS will be responsible for inter-ministerial coordination through the Smart Specialisation Coordination Group (under MoESS).

The Law on Strategic Management<sup>34</sup> was adopted in 2020 with the aim to develop a result-oriented strategic management system by integrating the – so far fragmented – processes of strategic planning (at both national and regional level). The Law aims government programmes of various levels are effectively implemented, monitored and evaluated. Since the lack of complementarity and interaction between and among different strategies and government-funded programmes has been considered a critical issue for Lithuania's STI policy, this Law potentially constitutes a step forward towards building a common and logical strategic planning system that encompasses all policies including those on STI.

Overall, there exists notable political commitment to STI reform, and Lithuania has made some progress in this area over time. But reform has been difficult to implement in a number of cases. For instance, the Agency for Science, Innovation and Technology (MITA) was created in 2010 with the aim to improve horizontal co-ordination across ministries and agencies. The intended consolidation of the innovation agencies foreseen during the last legislation period did not come to fruition as planned, and the agency landscape remained fragmented, as observed in the 2016 OECD Review and can be observed today. The ongoing reform of the agency landscape (the creation of a unified Innovation Agency as well as a Science

<sup>31</sup> Ministry of Finance. <https://finmin.lrv.lt/lt/es-ir-kitos-investicijos/naujos-kartos-lietuva>.

<sup>32</sup> The model for the new Innovation Agency was consulted with the OECD throughout the progress of this project. See Chapter 3 for more in depth discussion.

<sup>33</sup> In 2019, the S3 Coordination Group has decided to reduce the number of previously seven priorities of the S3 to aforementioned three to increase wider participation of Lithuanian stakeholders and focus on those economic sectors with the highest potential (STRATA, 2018).

<sup>34</sup> In Lithuanian, *strateginio valdymo įstatymas*; the Parliament. <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/90386d20bab711ea9a12d0dada3ca61b/>

Agency, possibly within LMT) is an opportunity to bring about a more effective and efficient agency system for innovation and science. The present OECD-SRSP project has been engaged in providing analysis and international experience for a renewed attempt to overcome fragmentation. The 2016 OECD Review's recommendations also noted that Lithuania should consider launching a systemic review of all STI-related programmes and that this review could be initiated and overseen by the STI Council. Such a review, which would be very useful to better adjust and manage the portfolio of STI policy instruments, has not been carried out so far. More generally, the STI Council, despite its relatively strong mandate it has been given in the Law on Technologies and Innovation, has been largely inactive in taking strategic initiatives to shape the future of Lithuania's innovation system and boost its performance. There is a need to renew and enhance the effectiveness of the STI Council (see Chapter 3. ) which could play an critical role in turning Lithuania into an innovation-driven economy.

STI governance is an area that needs and is receiving continued high policy attention in Lithuania but where scope remains for major improvements. The following Chapter deals in depth with two issues on the current STI agenda: specific ways to enhance the role and operations of the STI Council and the consolidation of the innovation agencies.

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# 3. Better policy implementation and design in selected key areas: Consolidation of innovation agencies and enhancing Lithuania's STI Council

## 3.1. Introduction

Various studies – including the 2016 OECD Review – have identified the need of reform of different aspects of Lithuania's STI system and policy. One area that stands out as deserving continued attention owing to their importance for the overall performance of the innovation system is the Recommendation area 3 (STI governance, see Chapter 2. ). In addition, a stocktaking of policy actions taken in recent years in areas corresponding to the recommendations of the 2016 OECD Review indicated that with regard to STI governance, some important previous reform efforts have remained incomplete or did not deliver the expected results. Two of the specific areas where a need for continued policy action clearly persists have been selected for this chapter: First, the consolidation of innovation agencies that was part of the previous 'innovation reform' and has been taken up by the new government for implementation. The second, also taken up by the government, is the enhancement of the Lithuanian STI Council, which could potentially become more effective and play a strategic role in transforming Lithuania into an innovation-driven economy and society and tackling the challenges ahead.

## 3.2. Consolidation of innovation agencies

The fragmentation of innovation agency landscape is a long-standing concern in Lithuania. Attempts towards defragmentation were initiated by the previous government but finally did not materialise. The new Government Programme announced at the end of 2020 calls for an improvement of the institutional network, which would result in an enhanced functioning of MoEI and the establishment of a unified Innovation Agency. More recently, the Lithuanian RRP developed in the context of the Economic Recovery and Resilience Facility contains specific models for the newly created innovation agency taking into consideration the options presented by the OECD project team in the context of this SRSP project.

### ***STI policy implementing agencies in Lithuania: the current landscape***

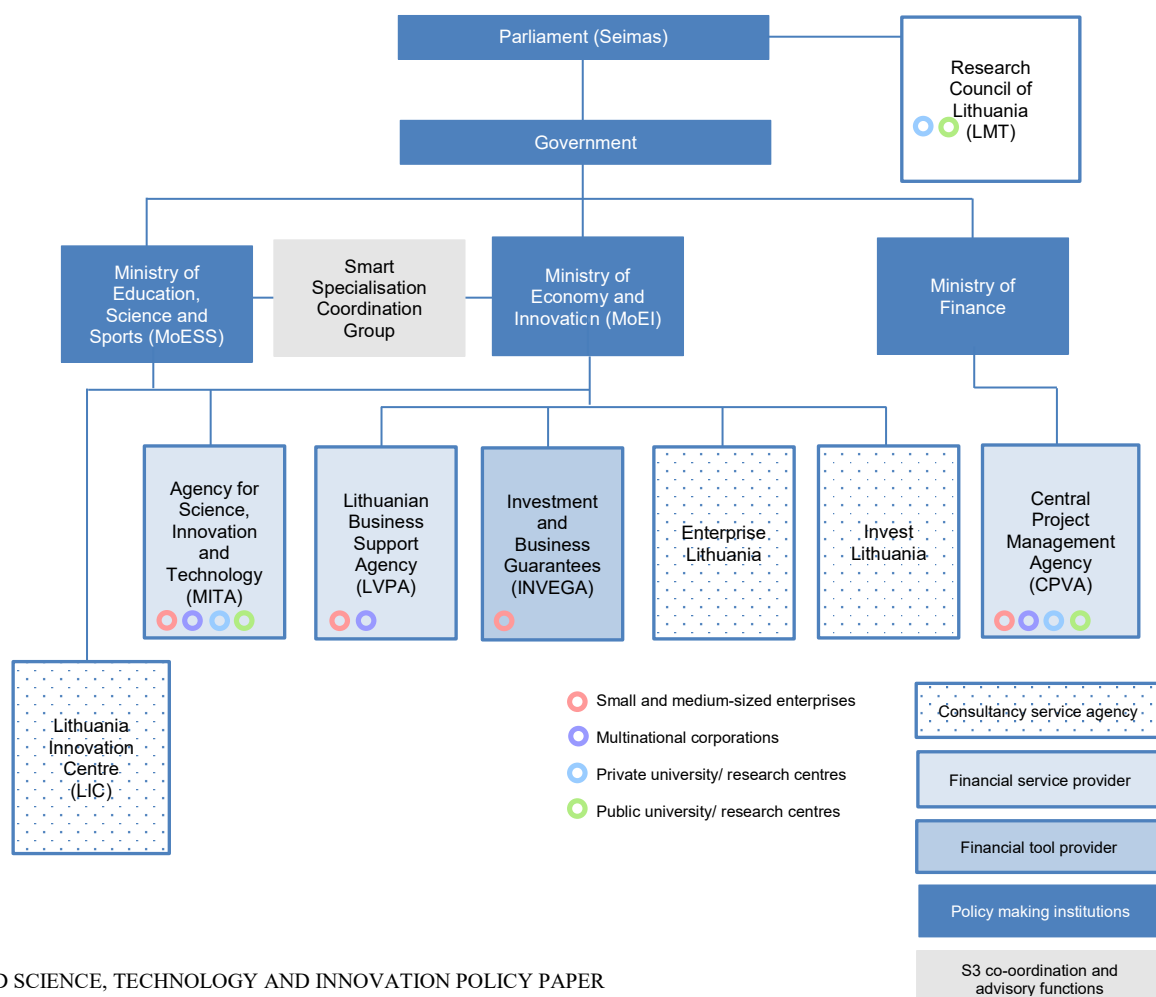
MoEI and MoESS, together with the Ministry of Finance (MoF) as well as the Government Office – are the main governmental actors in the area of STI in Lithuania. At the implementation level, there are currently six agencies, one limited liability company and the Lithuanian Research Council (Figure 3.1). As regards ownership of the six agencies, MoEI and MoESS have jointly owned MITA so far, while the Lithuanian Business Support Agency (LVPA), Enterprise Lithuania (VL) and Invest Lithuania (IL) are all exclusively

subordinate to MoEI. The LMT is not 'owned' by any of the ministries but reports directly to Parliament. INVEGA differs organisationally from the others as it is organised as a limited liability company owned by MoEI. The Lithuanian Innovation Centre (LIC) in turn is a quasi-public agency that has a unique ownership structure where MoEI, MoESS and the Lithuanian Confederation of Industrialists (LPK) jointly own the agency.

In terms of the scope of their activities and the innovation components / functions within, only MITA and LIC are entirely committed to STI-related activities. Agencies or financial institutions such as LVPA, VL, IL, CPVA and INVEGA do perform activities in the field of STI, but their respective roles are partial or in some cases even marginal for various reasons. This is because LVPA, VL, IL and INVEGA provide general business support services that are not necessarily designed for supporting innovation, and CPVA under the MoF has a wider scope of activities since it is the main agency which implements EU-financed programmes and projects on national infrastructures.

The current Lithuanian STI agency landscape is of relatively recent origin, and has been evolving and expanding significantly in the first two decades of the millennium. Only in after a redesign in 2007, has LMT, established in 1991, acquired its current status as an agency providing competitive funding for research in addition to its advisory role (European Science Foundation, 2014; OECD, 2016), and MITA was created just a decade ago, in 2010 as an innovation agency under MoEI and MoESS. In contrast, major STI funding agencies in leading European countries were created half a century ago or even earlier, around the time of World War II.

Figure 3.1. The STI agency landscape in Lithuania so far



Source: OECD (2016); Paliokaitė A., Petraitė M. and E. Gonzalez Verdesoto (2018).

Note: MITA functions as both 'financial service provider' and 'consultancy service agency'. It is categorised as 'financial service provider' given its relatively larger role as the former.

### ***Summary diagnostics***

Taking a summary point of view, Lithuania's STI funding system is characterised by the following salient features:

Lithuania's innovation funding system is highly fragmented as indicated by the country's innovation agency landscape (Figure 3.1) and overlaps exist between these agencies. Partly this is the result of a fragmented STI system governance and a lack of co-operation and co-ordination between ministries.

- A lack of inter-ministerial co-ordination is not the only cause of fragmentation, however. The majority of innovation agencies are under the MoEI, and MITA is jointly overseen by MoEI and MoESS. This means that MoEI on its own has a comparatively large number of agencies.
- While new agencies have been created in Lithuania, a number of European countries have consolidated their respective landscape of innovation agencies in the recent past (e.g. Austria, Denmark, Finland, the United Kingdom), in response to new needs and previous fragmentation.
- Cost and a lack of critical mass and human resources for STI are challenges for Lithuania. An effective and efficient set of funding institutions and policy instruments helps to address them.
- Currently, a large part of STI-related funding comes from European sources. Additional national funding is needed for developing the Lithuanian STI system, and an adequate set of modern agencies to handle corresponding STI programmes and initiatives and allocate the funds efficiently.

### ***Rationales for merger***

For a small country such as Lithuania, with comparatively low expenditure on R&D and innovation, the efficient use of resources is particularly important. There are a number of sound rationales for merger of STI agencies, including the following:

- Achieving economies of scale that are important to achieve but hard to realise in small countries.
- Improving service quality through specialisation and learning.
- Enhancing capacity building and offering stronger incentives and better career opportunities for skilled agency staff.
- Providing a powerful source and platform for experimentation and policy learning through the establishment of a strong unified innovation agency.
- Improving policy co-ordination. A strong and diversified consolidated STI agency can contribute to better co-ordination of policies and the mix of policy instruments applied.

A caveat is nevertheless warranted here. While there are well-established rationales for merger and potential gains may be high, it depends on the ways the new institutions are designed and how mergers are carried out in practice, if this potential can be fully realised. There are a number of options for agency merger, corresponding to different motivations and levels of aspiration. In the following, three options for creating a new unified agency are discussed:

### ***Option 1: A unified Innovation Agency***

This option would strive to gather all innovation-related support (at minimum for technological and R&D-based innovation) in one unified Innovation Agency. In particular, referring to currently existing agencies, this could involve relevant parts of MITA, the STI-related parts of LVPA, Enterprise Lithuania, LIC, subject to agreement of stakeholders, (in the longer term) Invest Lithuania and (to the extent legally and technically

possible) INVEGA and possibly some STI-related activities/functions of CVPA.<sup>35</sup> The guiding principle here should be to integrate in a new, unified Innovation Agency all activities directly related to analysing, preparing and implementing STI-related initiatives that require expertise in STI and STI policy. This would help concentrate expertise and create opportunities for further learning within this new organisation, improve the quality of services and create opportunities for co-ordination and alignment of policy instruments and delivery within the organisation. LIC is a special case and could, with the agreement of the stakeholders, continue to exist as a service provider outside the Innovation Agency or be part of it. INVEGA has a special status as a development organisation.

### *Recommended actions in implementing Option 1*

The following presents a list of recommended actions for this Option:

- Remain open to take on the implementation and delivery of STI programmes and other policy initiatives from all ministries.
- Set up an integrated support that spans across the whole innovation cycle from research to market deployment (see Chapter 5. on Mission-oriented Innovation Policy).
- Concentrate general business support measures in a separate business promotion agency.
- Ensure a clear division of labour between the general business promotion and services agency and Innovation Agency and avoid overlap between their functions.
- Establish a close co-operation from the beginning and on a routine base with Invest Lithuania and the general business promotion agency.
- Use the Innovation Promotion Fund to increase business access to capital, e.g. complementing the risk capital facility for start-ups, and gradually reduce dependence on European funding.

### ***Option 2: an extended unified Innovation Agency***

Option 2 consists of an extended version (Figure 3.2) of Option 1 by adding Invest Lithuania (IL) and export-related function of Enterprise Lithuania (VL) to the Innovation Agency of Option 1. The 2016 OECD Review also noted that the Lithuanian economy could potentially benefit from technology learning and spill-over via global interactions such as international trade and FDI. Lithuania has made significant achievements in trade performance. In 2019, Lithuania was in 64<sup>th</sup> position as regards total exports and the 32<sup>nd</sup> most complex economy out of 157 countries according to the Economic Complexity Index (Observatory of Economic Complexity, 2021).<sup>36</sup> Lithuania has also become an increasingly attractive destination for technology companies and firms in some industries of high value added.

### *Recommended actions in implementing Option 2*

The following presents a list of recommended actions for this Option:

- Ensure that that the concentration and advantages of specialisation on issues of innovation are not weakened in a configuration that includes general business promotion functions.
- Fully realise the potential gains that multinational enterprises can bring in terms of technology transfer to domestic firms and their integration into global value chains.
- Ensure that the collaborative relations and between the Innovation Agency and the prospective Science Agency and LMT will be close and dynamic, especially in promoting business-science co-

<sup>35</sup> As regards the latter, the OECD team does not currently have sufficient information to assess the situation in detail. We are aware that the CVPA spends a substantial amount of financial resources on STI-related initiatives, although this represents a relatively small share of the total amount of financial resources this agency is handling.

<sup>36</sup> See Chapter 1 for a description of the Economic Complexity Index.

operation and the commercialisation of research results, but also in view of the need for close co-operation on societal challenges and the deep economic and societal transitions ahead.

***Option 3 (long-term): A Unified Research and Innovation Agency***

Finally, a third option for the longer term. Even if this option may not be considered feasible at the current stage, it holds a potential that makes it worthy to be considered for the future. In some countries this future has already become (at least partly) reality. Essentially, a unified research and innovation agency would consist of bringing under one roof the unified Innovation Agency (Option 1) and the LMT (possibly in the new form as indicated in Box 3.1). Option 3 may therefore be considered as a future extension of Option 1. For a small country, in particular, this configuration could have significant advantages. A successful international example that could serve as inspiration is the Research Council of Norway.

### Box 3.1. Recent and ongoing developments regarding innovation agency reform

#### ***Creation of the Innovation Agency on the basis of Enterprise Lithuania (VL)***

According to MoEI and the RRF Plan, the Innovation Agency will be based on VL and integrate the innovation functions of MITA and LVPA. INVEGA, due to its specific status as a financial institution, will not be affected by the consolidation, and Invest Lithuania will be gradually integrated in the future, potentially by 2025. The merger of LIC is not foreseen.

The new model set out by the Lithuanian government largely coincides with Options 1 and 2 above. The main difference seems to be that the latter draw a stricter dividing line between STI-related functions and general business support that would rather be allocated to a dedicated business promotion agency, as other countries have done. When including general business support functions in the Innovation Agency special care needs to be taken that the focus and impact of the Innovation Agency is not diminished and its mission blurred.

#### ***Establishment of Science Agency and reform of LMT***

In response to the planned reorganisation of MITA and the transfer of some of its functions to the new Innovation Agency, MoESS has been considering to create its own Science Agency. In this context, MITA may change its legal status from budgetary institution to public institution, the details of the creation of the Science Agency remain to be decided, however.

According to MoESS, there is a chance that the Science Agency may be created as an internal department or operational unit of the LMT. The relevant functions previously carried out by MITA will be integrated into Science Agency, which would expand the scope of its operations (as part of LMT) of facilitating knowledge transfer and promoting business-science collaboration. The new Science Agency will also be in charge of creation and co-ordination of network of science and innovation officers (see Box 3.2).

This may imply significant change in the governance of LMT and this institution's unique relation to Parliament. In the end, the creation of Innovation Agency and Science Agency inside LMT might result in a more clearly structured 'binary model' of Research and Innovation funding concentrated in two "Agencies", potentially enabling a more effective STI policymaking in Lithuania. The co-operation between these "Agencies" will be critical for their combined systemic effectiveness.

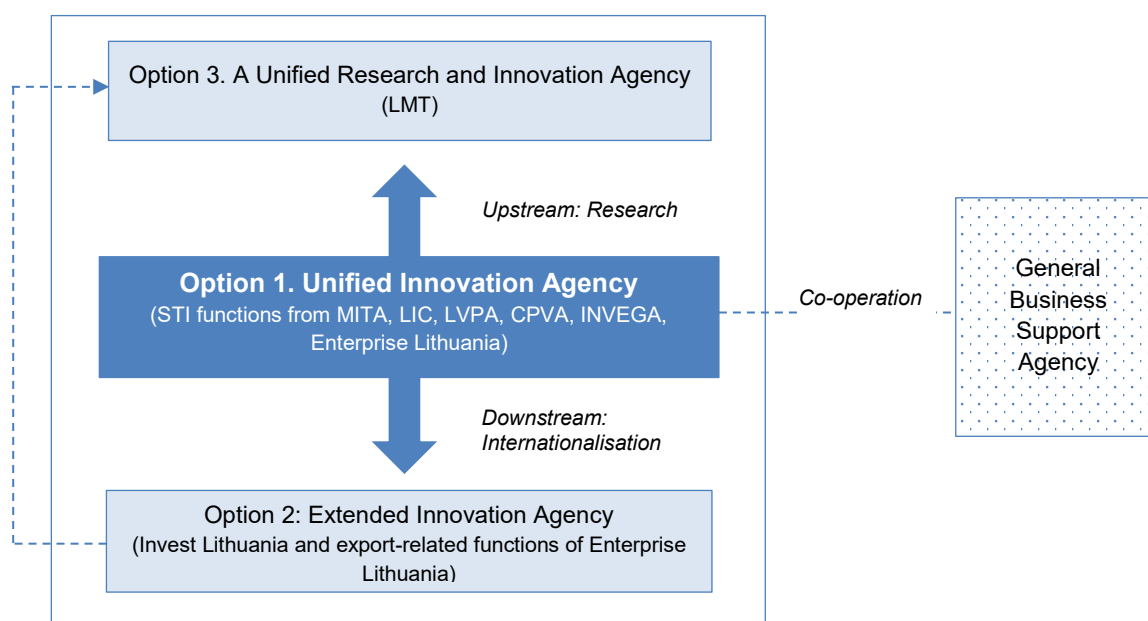
Source: MoEI and MoESS.

### *Recommended actions in implementing Option 3*

The following presents the recommended action for this Option:

- In the ongoing reform process, redesign and configure the STI agencies in such a way as to facilitate a (future) transition to an integrated Research and Innovation Agency. New international trends in technology and growing concerns with regard to societal challenges. These developments call for new types of integrated policy initiatives, bundling of instruments and "hybrid" institutions that increasingly extend across the borderlines between "research" and "innovation".

Figure 3.2. Summary of agency merger options (simplified)



Source: OECD.

### 3.3. Enhancing the role and effectiveness of Lithuania's Science, Technology and Innovation Council

#### *STI councils in an international perspective*

In many OECD countries, STI councils have become a core institution of STI governance at national level. Depending on their mandate, STI councils may provide direction, facilitate the co-ordination of policies and major actors in the research and innovation system, and monitor the advancement of STI strategies, priorities and major reform projects to make their country's STI system and policy fit for the challenges ahead. As discussed below, the role of STI councils has been evolving and will continue to develop in view of the needs to act on major societal challenges and profound transformations of the economy and society.

In establishing or reforming an STI council, governments have to make important upfront choices regarding the role and mandate they wish to assign to this institution, its structure and composition, the resources it commands etc. International comparative studies (OECD, 2009 and Schwaag Serger et al., 2015) suggest that the STI councils reviewed could be categorised into four different types of model:

- A joint planning model (Japan), where the government uses the council as a kind of virtual "horizontal ministry of innovation", much as engineering companies build project teams by bringing together people across different disciplines.
- A co-ordination model (Chile, Finland, Netherlands, to some extent and temporarily also Austria), where the intention is that the council should communicate horizontally across ministry responsibilities so as to align policies in support of innovation, without this alignment always being binding.
- An advice model (Canada, Ireland, the Netherlands' AWT, Switzerland, United Kingdom), where the council proactively or reactively provides (non-binding) advice to government on research and innovation policy matters.



- A “platform for inter-action” model, where the council lacks a clear mandate or substantial resources, e.g. to plan and co-ordinate policy but functions more as a “sounding board”.

Both the planning and co-ordination models require significant commitment of ministers in terms of time as well as their willingness across the political and institutional spectre to treat research and innovation as permanently central dimension of government policy (OECD, 2009). It is not by coincidence that the planning type of council is mostly found in East Asian countries. The ways and degree of anchoring of councils in government also differs widely. In both the planning and the co-ordination models, ministers are often members of the council. Ministers take also part in advisory type councils (in some cases as non-voting members). With the rise of innovation in countries' agendas, STI councils have become frequently chaired by the Prime Minister.

STI Councils have been astonishingly successful in terms of the speed of their international proliferation in recent decades. According to an OECD Survey in 2017, 31 out of 35 OECD countries had an STI Council (Borowiecki and Paunov, 2018). Between 2010 and 2017, the number of councils nearly doubled. Some countries (e.g. Austria and Germany) operate several councils. Among OECD countries only Ireland, Italy, New Zealand and Norway did not have an STI Council at the time. Ireland and New Zealand had a Chief Scientific Adviser in the Anglo-Saxon tradition, while Norway follows a pronounced “sector principle” with strong line ministries and comparatively little formal co-ordination between them, while the Research Council of Norway (RCN) plays a unique “second-tier” co-ordination role at agency level.

While STI Councils have been flourishing and proliferating, their actual success and impact have been mixed. A number of them have – at least for an important period of time – evidently been successful and highly valued institutions of their respective national STI governance system. The Finnish Council, currently called the Research and Innovation Council (RIC), and even more so its predecessor, the Science and Technology Policy Council, have been widely perceived as instrumental to Finland's rise to a leading knowledge-based economy. It provided inspiration and has been emulated in many countries across the world. However, quite a few of these institutions in other countries did not come to play as significant a role as expected, and some of them even began to resemble empty shells that hardly showed any activity despite being formally anchored at the highest level of government.

### ***Factors of success of STI Councils***

Uneven performance raises the question of what are key factors of success for STI councils. This is a difficult question and requires detailed study of the respective council and the specific environment it is operating in. One of the few international comparative studies of STI councils (Schwaag Serger et al., 2015) identifies a number of factors that contribute – in various combinations with one another – to a council's impact on innovation policy and performance. These include:

- A mandate, composition and anchoring at top political level to give legitimacy.
- A focus that is relevant and anchored in the national context – taking a broad perspective on innovation and a systemic approach.
- A mandate, governmental anchoring and composition that fosters receptiveness and willingness on behalf of government to receive and act upon advice.
- A focus/approach and composition which acknowledges the increasing internationalisation of research and innovation to avoid the council (and STI policy) becoming inward-looking; and
- Resources (budget and staff) that allow the council to produce or commission relevant analysis and engage in forward-looking activities.

### ***The Lithuanian STI Council***

As various studies have shown, co-ordination has been a persistent challenge in Lithuania's STI system and policy. Most countries are facing such issues (in federally structured countries the co-ordination between levels of government becomes more prominent) – albeit to varying degrees – and they seem to be rather deep-seated in Lithuania. Like other countries, Lithuania attempted to approach this issue by establishing council structures. At the beginning, there was a council under the MoESS and MoEI that was primarily operating as a platform for the co-ordination of the implementation of the Lithuanian Valleys concept, rather than STI policy in general. In 2014, the council formally became a Government Commission responsible for research, development and innovation policy implementation. As a next step in this evolution, the Law on Technologies and Innovation (Article 10) that came into force in January 2019, defined the STI Council as “advisory body on STI policy” with a mandate to make proposals to government on priorities, directions and guidelines for STI at national level, for improvement of the structure and main characteristics of the STI system, the co-ordination and implementation of STI policy and strategic management of the STI system, etc. The STI Council consists of 12 Ministers (including the Prime Minister as chair and the Ministers of MoEI and MoESS as Vice Chairs) and 8 representatives from business and academia.

The Law on Technologies and Innovation mandates the STI Council to come forward with proposals of strategic and systemic significance. Referring to the categorisation of STI councils into the four types presented above, it seems fair to say that the Lithuanian STI Council is indeed more of the advice model type, although it is not an expert council. It has not gone far in the strategic and co-ordination domain, focusing on major innovation reform efforts and advancing and monitoring progress in cross-government strategic initiatives. In practice, the STI Council has at times been acting as a platform for the adoption of routine projects (e.g. large-scale pre-commercial procurement), etc. An examination of the success factors for STI councils outlined above indicates that some of these factors have not or to an insufficient degree been in place in the case of the Lithuanian STI Council. Arguably, there are unresolved issues around the STI Council's focus, the approach to internationalisation, resources and staff to produce and commission analysis and engage in forward-looking activities.

Overall, the STI Council's success in improving co-operation and reducing fragmentation of the STI system and policy has been very modest. Past attempts to achieve better co-ordination between ministries – notably MoEI and MoESS – were prone to erosion. A lack of horizontal co-operation and co-ordination continues to result in duplication of efforts and overlaps in terms of competences despite an overall scarcity of resources. To some extent, the lack of horizontal co-operation contributes also to the fragmentation of the STI agency landscape. While a lack of co-operation and co-ordination between ministries in charge of STI prevails, current trends point to the opposite, as will be argued in the following section.

### ***Summary diagnostics***

Main diagnostics on the STI Council are the following:

- Overall, the STI Council is widely seen as not having lived up to expectations, in particular with regard to fulfilling a strategic and co-ordinating role in driving the development of the Lithuanian research and innovation system.
- It is widely held that the STI Council's orientation is too general and would benefit from a stronger focus and a forward-looking approach in confronting future challenges and realising new opportunities for Lithuania by means of STI.
- While the innovation reform remained incomplete and the STI system is found to remain fragmented, societal challenges and transitions call for mission-oriented policies and generate new needs for policy development and co-ordination across different policy areas and disciplines.

- Current Secretariat resources of the STI Council are extremely scarce, severely limiting the Council's range of activities, communication and credibility.
- STI-related capacities in ministries are modest, especially in line ministries other than the core science and innovation-related ones.

The profile, scope and demands on STI councils are evolving over time. The extension of the remit of councils from science and technology to (technical and non-technical) innovation has led to changes in their scope and composition. Today, the need to draw on STI to address societal challenges (such as climate change, demographic trends, etc.) and other profound transformations (digitalisation, energy transitions etc.) calls for strategic direction, new, crosscutting approaches and involvement of a wider range of actors. These new requirements are challenging for STI councils in various regards. First by putting problems of co-ordination in even sharper focus than before, second by advancing the trend towards multi-layered governance and third by the enormous challenges related to information needs and the presence of uncertainty. For STI councils this will imply, among other things, efforts for strengthening their information base, the application of forward-looking approaches (such as foresight techniques), but also outreach to new stakeholder groups, improved communication with society etc. This will also require changes in their modes of operation (see the recommended actions below).

### Box 3.2. Supporting the functions of STI Council through a network of STI Officers

The NPP Objectives foresee the establishment of a “network of scientific officers” that is expected to be funded by the Economic Recovery and Resilience Facility, RRF (Lithuanian Government, 2021). In view of the potential role of these officers, “science and innovation” or “STI” Officers may be a more appropriate designation, which also sends a signal on which kind of profile is required for assignment. The latter will be used in the following.

The STI Officer network could contribute to the enhancement of the STI Council by establishing STI and related policy expertise successively in line ministries, thereby opening channels of communication in and among ministries and with external communities. It could also play a role in supporting the preparation of STI Council's meeting agendas, working groups etc. The success of such a network depends on the specific institutional arrangements. While the STI Officers are firmly installed in their respective ministry, crosscutting issues could be discussed in meetings chaired by a network co-ordinator who could in turn be placed in a high-level, crosscutting government body such as the Government Office. It would seem commendable to keep the system simple and assign the co-ordinator a clearly defined role in the overall architecture, especially as concerns the relation to the STI Council.

Several countries have established networks of science (and engineering) officers or advisers for better policy communication. For instance, the RITA programme in Estonia was initiated in 2015 and as part of the programme, scientific adviser positions were created at the Ministries and the Government Office (12 advisers in 10 ministries). Their role within ministry is to advise ministries on R&D issues and develop plans. They also act as interlocutors for inter-ministerial R&D projects, in interactions with scientists and for international cooperation.

Source: Government Office of Lithuania and MoESS.

### ***Recommended actions regarding the Lithuanian STI Council***

The following presents four sets of recommended actions:

*Sharpen the focus on strategic issues, initiate and monitor strategic initiatives*

- Sharpen the strategic focus and forward-looking approach of the STI Council and its capacity to take up new challenges and opportunities.
- In particular, strengthen the STI Council's role in initiating and supporting strategic reform initiatives and strengthen its role in oversight and monitoring progress in implementation.
- Welcome international members to the STI Council to bring new perspectives and expertise to the Lithuanian context. STI Councils in other countries are benefitting from such arrangements.
- Support new types of programmes and the adoption of mission-oriented policies, which could play a pivotal role for joint action involving ministries, agencies, research institutions, businesses, etc.
- Consider inviting project directors to present critical challenge areas that cut across several ministries and related missions. Consider taking on a role of oversight and monitoring.<sup>37</sup>

*Adapt the Council's mode of operation*

- Strengthen focus and increase agility by making use of temporary, thematically oriented working groups (e.g. on themes of central importance, e.g. 'skills', or on important missions) across ministries, STI institutions and disciplines. Avoid rigid 'research' or 'innovation' subcommittees that hinder crosscutting solutions.
- Involve the network of STI Officers to be installed in the ministries can play in the preparation of Council meetings and in working groups. The network can become a key element in both strengthening the STI Council and nurturing inter-ministerial information flows, and co-operation.
- Consider meetings of the STI Council with working group leaders, e.g. once or twice a year at a "STI Summit" devoted to the presentation of conclusions and related policy initiatives.
- Invite leading international experts as members of these working groups.

*Provide a strong Secretariat infrastructure for the Council*

- Establish a strong, well-resourced and independent Secretariat of the STI Council following international good practice. To fulfil its role, the Secretariat has to have sufficient "absorptive capacities" to effectively monitor ongoing national and international work on STI indicators, assess, interpret and guide STI-related analysis and translate and apply this work to the national policy context.
- Locate the Council Secretariat e.g. at the Prime Minister's or Government Office.

*Strengthen the Council's communication*

- With the support of a strengthened Secretariat, ensure effective communication of the STI Council's work vis-à-vis the STI community and the wider public.
- Extend the activity of the STI Council to awareness and information campaigns highlighting major achievements and opportunities for Lithuanian STI.
- Publish, with the support of the Secretariat and external experts, at least one high-level annual Council report on the state and recent development of the Lithuanian research and innovation system. Good-practice international examples exist.
- Consider periodical review / evaluation of the STI Council's work.

<sup>37</sup> The mission-oriented approach could be applied in promising industrial sectors, e.g. the laser industry, life sciences and clean energy as identified in the interviews of the OECD project team. For further understanding of applying the mission-oriented policy approach, see Chapter 5 of this report.

### 3.4. Conclusion

Building on a diagnostic of the current situation, the chapter offers options and recommended actions as an input for the ongoing reform effort regarding the merger of innovation agencies into a single unified Innovation Agency, related attempts concerning the creation of a Science Agency in connection with LMT and a reform of the Lithuanian STI Council to make this institution more effective and better equipped to provide co-ordination and strategic guidance for the development of the Lithuania's innovation system. Interim results of this project have been used in the process of developing the Next Generation Lithuania plan in the context of the EU Recovery and Resilience Facility.

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# 4. Strengthening Public Procurement of Innovation in Lithuania

## 4.1. Introduction

The 2010 OECD Innovation Strategy and subsequent update (OECD, 2015a) indicate that demand-side innovation policies, including policies that involve the purchase of goods or services that represent innovations (hereinafter “innovation procurement”), were gaining ground in OECD countries and beyond. The economic significance of procurement highlights its potential as a demand-side innovation policy tool that may directly or indirectly shape and drive innovation through its funding, demonstration and risk sharing attributes. In Lithuania, public purchases of goods and services amounted to 24.6% of total general government expenditures in 2020, equivalent to 10.7% of GDP (OECD, 2021).

The measurement of innovation procurement and consolidation of existing capacity building efforts through the creation of a competence centre represent two priority areas of work that were identified through discussions with national experts and stakeholders as part of the OECD fact-finding mission and project workshops. This chapter describes the OECD findings and outlines some overarching recommendations in each area of work, together with examples of relevant practices in other OECD countries

## 4.2. Building a monitoring system for innovation procurement

Lithuania recently started to build up experiences in the field of innovation procurement, primarily in the pre-commercial procurement (PCP) segment. At the time of reporting, 17 PCP projects are in progress and one PCP project (LBChain) was already successfully completed. Lithuania has also made some first experiences with PPIs through the [Santaros project](#), co-financed through the EU COSME programme. However, comprehensive evidence on the extent of innovation procurement through both traditional and innovation-oriented procurement procedures (e.g. innovation partnership) in Lithuania is still lacking.

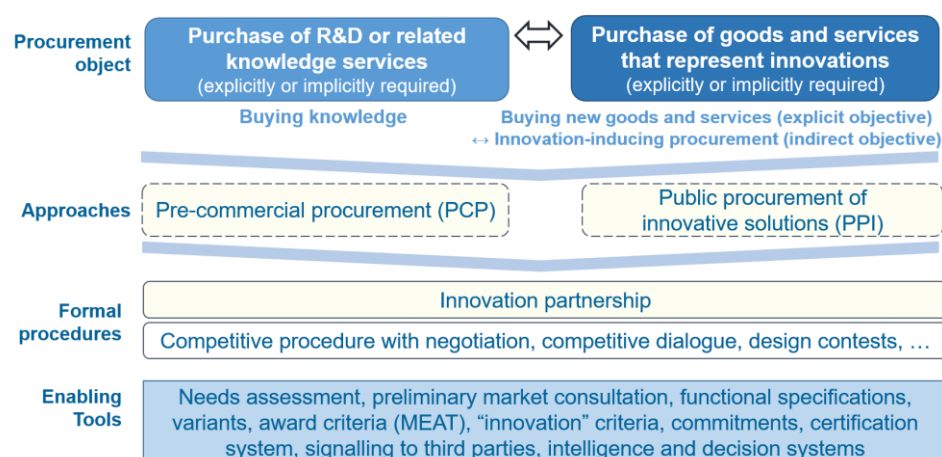
Several ambiguities arise in identifying innovation in procurement practice. Innovations arising or expected to arise as the result of procurement practice can represent different degrees of novelty (i.e. which party perceives the novelty, namely seller or buyer), in contrast to what benchmark (local, national or global markets) as well as the nature of novelty. The broad concept and definition of innovation is laid out in the Oslo Manual (OECD/Eurostat, 2018), and while this applies to all sectors, it is mostly operationalised in a business, supply oriented context. Novelty is not the only critical dimension in the definition of innovation, with knowledge, uncertainty and implementation into products available to final users and processes deployed within organisations. To be defined as innovations, solutions have to be implemented.

Different types of innovation may be object of policy interest and object of measurement. In the context of procurement, either firms or public authorities with development input from firms can introduce innovations. Assessing the innovative nature of public purchases requires knowledge of technologies and available market solutions and may not be straightforward, especially for public buyers. Based on common and



agreed concepts and definitions, a monitoring system can help reduce uncertainties in procurement practice, highlighting the different ways in which public procurers can purchase innovative solutions within the legal framework. As Figure 4.1 illustrates, innovation procurement<sup>38</sup> relates to the purchase of innovative solutions, either explicitly or implicitly required as part of procurement contracts, and may in some cases build upon additional research and development input for suppliers to be able to meet public sector needs.

**Figure 4.1. The different linkages between public procurement and innovation**



Note: In addition to these terms, the term "innovative procurement" can refer to an attribute of the procurement process rather than the object of procurement. This term belongs under the category of process innovations within government and the broader public sector, but examples could arise in synchronicity with the purchase of innovative solutions, as in the case of a first time adoption of new procedures and enabling tools with that particular objective.

Source: OECD.

Pre-commercial procurement (PCP) and public procurement of innovative solutions (PPI) are approaches available to EU procurers, but are not the only way to procure R&D or innovations, which can occur during innovation partnerships or may be procured using traditional procurement procedures.<sup>39</sup> Competitive procedure with negotiation, competitive dialogue and design contests, for instance, are procedures that are considered innovation-oriented (EC, 2018). Moreover, procurers have various tools that can help encourage innovation such as preliminary market consultations, functional specifications (Edquist and Zabala-Iturriagagoitia, 2020), variants, MEAT award criteria (most economically advantageous tender) and innovation criteria. A system that captures these different linkages between public procurement and innovation facilitates the development of indicators that reflect the extent of R&D and innovation procurement (outcome) and the degree to which procurement is carried out in a way that encourages innovation (intention). These two types of indicators are conceptually linked and can be both of interest.

### ***Definitions, targets and measurement in Lithuania***

The Law on Technologies and Innovation introduced a first official definition of innovation procurement in Lithuania in 2018 in reference to an ambiguously named "innovative public procurement" ("Inovatyvus viešasis pirkimas"), placing emphasis on the "technical specification for it to include requirements that

<sup>38</sup> In line with the European Commission guidance on innovation procurement (EC, 2018), this chapter adopts a wide ranging perspective and uses the overarching term "innovation procurement" in reference to public purchases of innovative solutions and public purchases of R&D services that may give rise to innovations.

<sup>39</sup> For a definition of PCPs, PPIs and innovation partnerships, see EC (2007a), EC (2007b), EC (2014) and EC (2018).

ensure that the contracting authority acquires innovative products" (Box 4.1) but making no direct reference as to which type of procurement procedures and purchases (e.g. R&D services) fall within the scope of this definition. The NPP for 2021-30 in turn specified a 20% target for "innovative public procurement", defined as the sum of "innovative public procurement, PCPs, state orders for R&D and innovation activities". While this definition is broader in scope, several elements require clarification, such as the use of "innovative procurement" as overarching concept versus element in the said definition.

#### Box 4.1. Definitions and targets of innovation procurement in Lithuania

##### **Law on Technologies and Innovation, 2018, definition for "Inovatyvus viešasis pirkimas":**

„...the contracting authority, when defining the object to be procured in the technical specification, includes requirements that ensure (it) acquires innovative products... in accordance with the procedures that provide the preconditions and incentives for suppliers to offer and supply the innovative products”.

##### **National Progress Plan, 2021–2030, definition for 20% target:**

Innovative public procurement: „innovative public procurement, pre-commercial procurement, state orders for R&D and innovation activities as the share of total public procurement”.

Note: Key excerpts translated to English by the OECD Secretariat.  
Source: OECD.

Over the past decade, a number of countries considered the adoption of targets as a possible mechanism for encouraging contracting authorities to promote innovation while pursuing their primary goals (OECD, 2016). Lithuania's target of 20% (previously 5%) is on the higher end compared to Finland (10%, 5% prior to 2020), Belgium (3%), Italy (3%), the Netherlands (2.5%), France (2%) or Austria (2%) – countries that set such targets on a temporary or permanent basis. These targets – in most cases indicative and non-binding – are not necessarily directly comparable, varying in their scope and the definition of innovation procurement.<sup>40</sup> Several countries surveyed public buyers with a view to measuring the latter (Table 4.1).<sup>41</sup>

Lithuania's monitoring strategy is based on information collected in the procedural reports (Atn1, Atn2) by the public procurement office (VPT). In these reports, public buyers specify whether they applied an innovation criterion during the procurement procedure. There is currently no direct guidance on how this innovation criterion should be applied, no cross-validation of this classification or proof of the actual purchase of an innovative solution. Existing VPT statistics indicate that the value of public procurements with innovation criterion is very low, well below 1% in all years but 2012. Based on this project's analysis of VPT procurement data and interviews of selected public buyers<sup>42</sup>, it appears that some tagged purchases (e.g. plumbing supplies, school catering services) may not necessarily involve the acquisition of innovative solutions, while other purchases of innovative solutions may simply not have been marked due to lack of guidance on how to apply the innovation criterion, which may have resulted in excessive caution or fear of making a mistake that the relevant officials could be held responsible for.

Overall, the interviews with national stakeholders and public buyers carried out as part of the OECD fact-finding and consultative missions, coupled with the analysis of policy documents and legislation, pointed

<sup>40</sup> Some targets apply only to central purchasing bodies (NLD, FRA) or purchases from innovative SMEs (FRA) or apply at regional level (BEL, ITA). They may also cover innovative purchasing methods (BEL) or green procurement (ITA).

<sup>41</sup> Based on these pilot surveys, the share of innovation procurement was estimated at 3% in Austria (2013), 5% in Finland (2018), 2-6% in the Netherlands (2010-13), and 12-15% in Germany (2016).

<sup>42</sup> Bank of Lithuania, Lithuanian Airports, Lithuanian Railways, Vilnius University, Vilnius University Santaros Hospital.

out to a number of areas of improvement for the development of a well-functioning system for the monitoring of innovation procurement in Lithuania:

- The concept of innovation procurement is broad and not well defined, and there is no common understanding of how different components of innovation procurement (PCP, PPI, innovation partnerships) differ from one another. Relevant concepts and terms are used interchangeably.
- The official definitions (Law on Technologies and Innovation, NPP 2021-30) differ in scope, i.e. in the innovation procurement elements that they cover. Several elements in the definition of NPP also require clarification.
- The official definition of innovation procurement is not well aligned with the existing measurement strategy based on VPT statistics that rely on the use of an innovation criterion, one possible indicator of whether public procurement is carried out in an innovation-friendly manner. Based on this information alone, no conclusion can be drawn about the purchase of innovative solutions.
- A monitoring system can capture various linkages between public procurement and innovation in order to yield insights into the extent of innovation and innovation-friendly procurement. Lithuania still has to build up an extended monitoring system, capturing the ways in which public procurement encourages innovation (intention and outcome), and define its intended purposes.

### ***Recommended actions for building a monitoring system***

The following presents some recommended actions for building a monitoring system for innovation procurement in Lithuania. While 81% of OECD countries have developed strategies or policies to support innovative goods and services through public procurement, only 39.4% of OECD countries are measuring the results of their support to innovative goods and services through public procurement (OECD, 2017). This chapter highlights examples of existing measurement practices in OECD countries in this area.

#### *Clarify relevant concepts and definitions and develop comprehensive guidelines*

A review and possible update of existing definitions of innovation procurement (Law on Technologies and Innovation, NPP 2021-30) would be a first and important step in establishing a common understanding of the relevant concepts and definitions among stakeholders in Lithuania. As there is currently no unambiguous statistical definition of innovation procurement (OECD, 2016), Lithuania could consider – as other OECD countries – to develop a definition for public purchases of innovative solutions in line with its intended use (e.g. guidance, funding, measurement) and Lithuania's strategic goals, building upon the R&D and innovation concepts in the STI measurement frameworks (OECD, 2015b, OECD/Eurostat, 2018) and relevant definitions in EU legislation and guidance (EC, 2014 and 2018).

The degree of novelty (procurer vs. market) to be applied in defining innovative solutions would depend on the specific public user setting and Lithuania's strategic goals (e.g. demand creation, innovations diffusion or public sector modernisation). For example, solutions that are new to procurers (even if not new to the market) would be innovations of interest if the policy priority is public sector modernisation, but less so if the primary strategic goal is to create demand for novel solutions in the Lithuania market. Lithuanian policy makers may thus consider to apply a definition that comprises multiple levels, i.e. degrees of novelty, adapted as appropriate depending on the intended usage. A flexible definition of innovative solutions would capture a broader variety of relevant scenarios compared to one universal definition. Similar considerations were covered in a [study](#) issued by the Finnish Government (Valovirta et al., 2017). While the final proposition excluded purchases that are new only to public buyers, the subsequent surveys of public buyers in Finland were designed to cover novelty to the procurer and to the market, providing interesting complementary insights into both aspects to policy makers (KEINO, 2019a and b, 2021b).

Following a clarification of relevant concepts and definitions, Lithuania may further consider to develop comprehensive guidelines that capture all elements of innovation procurement, distinguishing between the

purchase of R&D services and innovative solutions (outcome) and innovation-oriented procedures (intention). Existing guidelines (MoEI, 2014; MITA, 2017; LIC, 2020) tend to focus on selected components of innovation procurement such as PCPs and PPIs. A number of OECD countries - e.g. Germany (KOINNO, 2017), the Netherlands (PIANOo, 2014) and Finland (KEINO, 2014) - have already issued guidelines that capture both innovation and innovation-oriented procurement. This more encompassing approach promotes procurement of innovations through the adoption of innovation-friendly procedures and tools. The OECD interviews of public buyers highlighted the need for more practical guidance (e.g. step-by-step guides) on relevant procedures and tools and the application of the procurement legislation.

*Create an encompassing monitoring system aligned with relevant definitions*

Building upon a more comprehensive and clear description of relevant concepts and definitions, Lithuania may consider to develop a more encompassing monitoring system that captures both innovation and innovation-friendly procurement and leverages several sources of information, complementing the existing VPT statistics based on the innovation criterion. This would imply an extension of the existing measurement strategy based on the innovation criterion proposed in the NPP 2021-30, in order to align it with the updated definition and current policy target for innovation procurement.

A monitoring system can exploit various sources of information to derive indicators that reflect the extent of R&D and innovation procurement (outcome) and those that provide a measure of the innovation-orientation of procurement (intention). Table 4.1 provides a non-exhaustive overview of different approaches that selected OECD countries and studies take in measuring innovation procurement, ranging from the analysis of procurement data (type of procedure, product code and text analysis of contract descriptions), surveys of public buyers to the establishment of a certification system for certified innovative solutions. The use of innovation-oriented procedures (competitive dialogue, competitive procedure with negotiation) and tools such as the use of award criteria (MEAT vs. price criteria) or use of an innovation criterion in turn provides insights into the extent to which public procurement is carried out in an innovation friendly way.

**Table 4.1. Measuring innovation procurement – selected examples**

Innovation procurement (“outcome”)		Data availability (LTU)
Procedure (PCP, innovation partnership)	Innovation partnership: European Union (DG GROW, 2020)	Procedural reports; PCP – LVPA data
Product code (e.g. R&D)	R&D: OECD (OECD, 2016), EC (DG CONNECT, 2020 and 2021), USA (Congressional Research Service, 2018; NSF, 2020)	Procedural reports
Certification	Korea (OECD, 2017), Austria (IÖB-Innovationsplattform)	-
Survey of public buyers	Finland (KEINO, 2019a and b, 2021b), Germany (KOINNO & FoRMöB, 2016), Austria (Statistics Austria, 2017), Estonia (Jaakson, 2017)	-
Text analysis	OECD (OECD, 2016), EC (DG CONNECT, 2020 and 2021)	Procedural reports
Innovation-friendly procurement (“intention”)		Data availability (LTU)
Procedure	Netherlands (PIANOo, 2017), Finland (KEINO, 2019a and b)	Procedural reports
Award criteria	Netherlands (PIANOo, 2017), Finland (KEINO, 2019a and b)	Procedural reports
Innovation criterion	Lithuania (VPT, 2020), Germany (Czarnitzki et al., 2020), Slovakia (DG CONNECT, 2020 and 2021)	Procedural reports
Market consultation	Netherlands (PIANOo, 2017), Finland (KEINO, 2019a and b)	Market consultation notices
Functional requirements	Netherlands (PIANOo, 2017)	-
Variants	Netherlands (PIANOo, 2017)	Contract notices

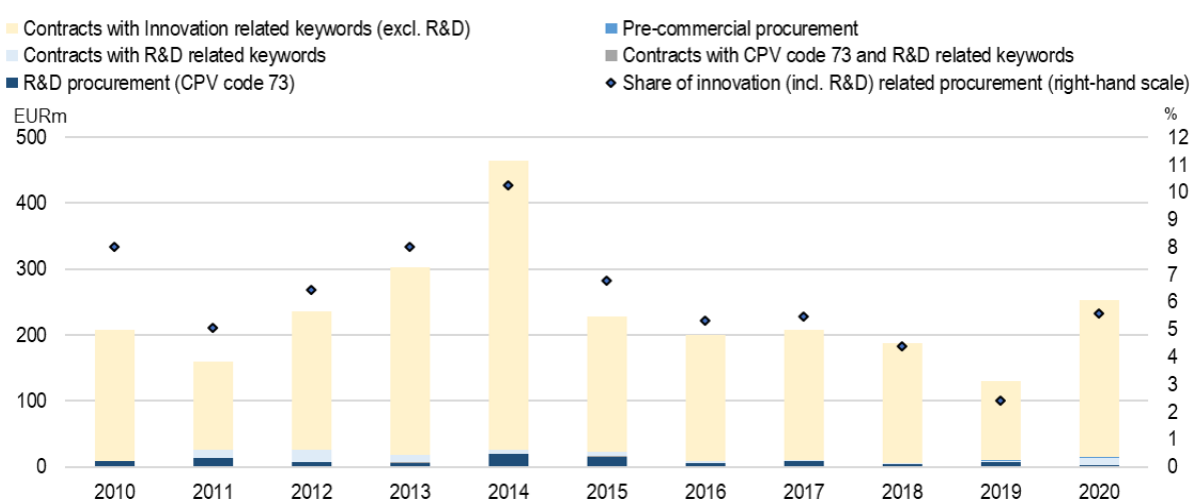
Source: OECD.

Based on the LVPA and VPT procurement data currently available, Lithuania is able to exploit information on PCP funding, R&D product codes and contract descriptions to derive exploratory indicators that reflect

the possible magnitude of innovation procurement. Product codes specify the object of purchase and are typically included in administrative procurement databases. The EU developed the Common Procurement Vocabulary (CPV) to describe the subject of public contracts and contain a dedicated code for procurement of R&D services (73). While some R&D contracts might not be captured (false negative) due to coding errors or incomplete data coverage (e.g. due to reporting thresholds or exemptions, e.g. PCPs), some of the tagged R&D contracts might not necessarily reflect R&D (false positive) as defined in the OECD Frascati Manual (OECD, 2015b)<sup>43</sup>. Despite these possible limitations, such codes may represent the only available source for deriving a proxy measure of R&D procurement. Text analyses, exploiting the information in contract descriptions, can additionally help identify possible R&D and innovation related procurement. They may rely on keyword searches (OECD, 2016) or national process language techniques (DG CONNECT, 2020 and 2021) but are often bound by the length of the contract descriptions and availability of relevant data across countries (OECD, 2016).

Figure 4.2 presents an experimental indicator of innovation related procurement in Lithuania for the period 2010-20, leveraging PCP funding data, CPV codes and contract descriptions that contain selected R&D and innovation related keyword tokens. Expert reviews of contract descriptions represent one possible way to cross-validate the quality of the exploratory text analysis based on keyword tokens. Such follow-up reviews may be limited to a random sample of procurement contracts, and can help establish a training data set with validated innovation related procurement actions that can provide the basis for more advanced semantic analyses based on natural language processing techniques.

**Figure 4.2. Procurement of R&D and innovation based on keywords, CPV codes and PCP data**



Note: For contracts with R&D and innovation related keywords, figures refer to international and simplified procurement contracts with a contract description (93%), for R&D procurement, they refer to contracts with CPV code 73 (with or without contract description), and for pre-commercial-procurement, figures indicate payments made by the public (national and EU) for PCP projects through the "Pre-commercial procurement LT" measure. Not all payments are R&D related, i.e. up to 10% of funding can be used for administrative activities. Contracts with innovation related keywords contain at least one R&D related keyword ("moksl + tyrim" (scien + research), "eksperiment + pletr" (experiment + develop), mtep (R&D equivalent) or one of the following terms in the contract description: "moksl" (scien), "technolog" (technolog), "inova" (innova), "modern" (modern), "pokyt" (chang), "tobulin" (improv), "prototip" (prototyp), "pazang" (advanc). All text descriptions were transformed to lower case.

Source: OECD analysis based on VPT and LVPA data.

As Figure 4.2 shows, the share of R&D related procurement (PCPs, contracts with CPV code 73, contracts with R&D related keyword tokens) stays below 1% during the 2010-20 period, while the share of total

<sup>43</sup> The United States (Congressional Research Service, 2018; NSF, 2020) revised its PSC classification to align the existing R&D codes with the Frascati definition of R&D and simplify the code structure.



innovation related procurement (including innovation related keyword tokens) in total international and simplified procurement varies from 2% to 10% (average 6%). This estimate, while not too far off from the recent estimate of DG CONNECT (2020) for Lithuania in 2018 (7.6%), should be seen as an upper bound for the possible magnitude of innovation procurement, requiring further cross-validation by experts and a more advanced semantic analysis using natural processing language techniques.

Effective monitoring and measurement strategies cannot be developed without a well-functioning information system that collects data alongside the different stages of the procurement process. With the envisaged modernisation of the central public procurement system (SAULE IS), Lithuania would have the opportunity to further improve and expand the current data collection processes that provide the basis for monitoring innovation and other forms strategic procurement in Lithuania. This may entail revising existing and introducing new data fields to more fully capture the innovative nature of public purchases among other questions of policy interest, in addition to developing more comprehensive guidelines on the use of product codes and innovation criterion to improve the extent and accuracy of data reporting.

### *Explore ways to identify innovation-friendly buyers*

Lithuania may also consider to explore information on the use of innovation-friendly procurement procedures to identify innovation-friendly buyers. For instance, the Czech Republic developed an index ("[Zindex](#)") and the Netherlands a [list](#) of top 10 'innovation-friendly buyers' that reflect the use of innovation-friendly procedures and tools. The analysis of innovation-friendly buyers can provide the basis for developing an award system that recognises public buyers' efforts in encouraging innovation, and set the foundation for identifying and developing good local examples. Furthermore, such analysis can provide the basis for establishing focus groups for certain types of tenders, as implemented in the Netherlands, or for differentiating and targeting support services to specific type of buyers. The KEINO competence centre for sustainable and innovative procurement in Finland, for instance, targets its more resource-intensive and high-impact support services (e.g. buyer groups, coaching) to procurement frontrunners (KEINO, 2021). Finally, an analysis of innovation-friendly buys can also provide insights into the linkages between innovation, green and other forms of strategic procurement (e.g. SME procurement) and the scope for supporting these through a unified competence centre.

**Table 4.2. Exploratory OECD analysis of potentially innovation-friendly buyers, 2010-20**

Rank	PCP projects	R&D code	Innovation criterion	MEAT criteria	Innovation-friendly procedures
1	Bank of Lithuania (1st PCP finished)	Ministry of Agriculture (23%)	Vilnius university (75%)	ESO (11%)	Lithuanian Railways (23%)
2	VU Santaros Hospital (2 in progress)	Environmental Protection Agency (11%)	Lithuanian Road Administration (10%)	Lithuanian Railways (9%)	Klaipėdos Nafta (13%)
3	Kaunas city municipality (2 in progress)	Lithuanian Road Administration (8%)	Consumer Rights Protection Authority (3%)	Lithuanian Road Administration (9%)	ESO (12%)
4	ESO (2 in progress)	Ministry of Environment (8%)	Lithuanian Hydrometeorological Service (3%)	Klaipėdos Nafta (6%)	Vilniaus kogeneracinė jėgainė (8%)
5	General Žemaitis Military Academy (1 in progress)	Livestock productivity control (7%)	Center of Excellence of the Healthcare and Pharmacy Specialists (2%)	Kaunas city municipality (5%)	LITGRID (5%)

Note: The analysis is limited to international and simplified procurement in the period 2010-20. This table lists: 1) the 1<sup>st</sup> finished PCP, entities with 2 PCPs and the largest PCP in value; top 5 buyers in 2) R&D procurement (CPV code 73), 3) procurement with innovation criterion, 4) procurement using a MEAT criterion and 5) usage of innovation-friendly procedures (competitive dialogue, competitive procedure with negotiation). The names of public buyers were translated by the OECD Secretariat for demonstration purposes. Some buyers may have changed their names or ceased to exist since their procurement actions were recorded for the period 2010-2020.

Source: OECD analysis based on VPT and LVPA data.

Table 4.2 presents the results from an exploratory OECD analysis of innovation-friendly buyers in Lithuania, displaying their value share in each category and ranking in terms of use of innovation friendly procedures, MEAT criteria and participation in PCPs. This basic framework for identifying innovation-friendly buyers may be further refined, e.g. by considering additional criteria (e.g. use of market consultations, functional specifications), other strategic goals (e.g. green or energy efficiency related criteria) or applying weights that Lithuanian stakeholders attach to different selection criteria.

### 4.3. Fostering the implementation of innovation procurement

#### *Innovation procurement in Lithuania: key stakeholders and support mechanisms*

Various institutions support the uptake of innovation procurement through policy development and implementation, capacity building, funding, and the compilation of procurement data and statistics. At ministerial level, the innovation and procurement policy legislation is developed by the MoEI in account of the policy objectives set by the Government of Lithuania under advice of the STI Council. On the implementation level, there are four agencies: MITA, LVPA, LIC, and VPT. At the time of reporting, Lithuania is considering to integrate the STI functions of MITA, LVPA and LIC in a single, Unified Innovation Agency. This includes the innovation procurement-related functions of LIC, MITA and LVPA which in the case of MITA and LVPA focus primarily on pre-commercial procurement of R&D (exempted from reporting under EU Procurement Directives).

Table 4.3 summarises various initiatives taken by the involved institutions to promote the uptake of innovation procurement in Lithuania in recent years, be it through financial support or capacity building.

**Table 4.3. Recent initiatives and support measures to promote innovation procurement**

Type of support	Initiative
Funding	2014-20 ESIF support: “ <b>Pre-Commercial Procurement LT</b> ” measure administered by LVPA to fund PCPs (budget: EUR 15.5 million); <b>GovTech</b> – recent smaller scale initiative to finance innovations in public sector.
Mentoring	PCP-focused consulting by MITA and LIC (“ <b>InoSpurtas</b> ” measure, budget: EUR 0.376 million).
Training	<b>OECD – VPT collaboration</b> : “Training of trainers” in 2018; pilot sessions led by newly trained specialists in 2019. <b>MITA – JERA consulting</b> : two sessions in 2020 on PPI.
One-stop shop	<b>Inopirkimai.lt</b> discontinued in 2019. Separate portals provide information: (i) MITA - pre-commercial procurement; (ii) MoEI - innovative public procurement; (iii) VPT- statistics
Guidelines	<b>MoEI</b> (2014); <b>MITA</b> (2017); <b>LIC</b> (2020).
Incentives	<b>MoEI</b> assigned an award for most innovative public procurement in 2020.
International cooperation	<b>MITA</b> : EU Mutual Learning Exercise (2017-18); Procure2Innovate member since 2018; iProcureNet (2019-24); TAFTIE conference organisation (2018). <b>LIC</b> : iBuy Interreg Europe partner (2018-22).

Source: OECD.

While a number of capacity building initiatives are well underway (Table 4.3), as also highlighted in the OECD interviews and discussions with national experts, stakeholders and public buyers, a consolidation and possible expansion of existing support activities would be a crucial element in promoting the broader implementation of innovation procurement in Lithuania.

- The innovation procurement system in Lithuania is highly fragmented, visible in the multitude of individual support initiatives carried out by different institutions, and reflected in the complex and lengthy PCP approval process, involving up to four institutions (MITA, MoEI, LVPA and STI Council).
- Lithuania still has to assign key responsibilities in the promotion of innovation procurement beyond PCPs. The institution responsible for promoting innovation procurement, including PPIs and



innovation partnerships, and providing consulting services to procurers has yet to be nominated. This includes raising awareness and providing practical assistance in the use of innovation-friendly procurement procedures and tools in order to facilitate public procurement of innovative solutions.

- Both non-financial and financial support (largely EU funds) is targeted at PCPs, although recent initiative (GovTech) aims to cover purchases of innovations. Risk-averse public buyers do not have the relevant budget, incentives or competencies to carry out innovation procurement on their own.
- Lithuania has completed its first PCP project and made some first experiences with PPIs. While certain public buyers may cooperate and share knowledge informally, there is currently no formal platform, which would allow public buyers to collaborate and share good practices.

### ***Recommended action for promoting the uptake of innovation procurement***

The following presents some possible options for consolidating and reinforcing the existing support services through the creation a competence centre for innovation procurement in Lithuania. These options have been derived based on the input provided by national experts and stakeholders as part of the OECD fact-finding mission, and stocktaking and stakeholder workshop, coupled with a review of existing competence centre models in OECD countries.

#### *Consolidate existing support activities through the creation of a competence centre*

In response to the strategic importance of innovation procurement, a number of OECD countries have established a competence centre for innovation procurement in recent years with a view to strengthening the efficiency of existing support services, establishing a single access point for guidance and best practices, and creating a platform for collaboration and knowledge sharing. Providing practical and financial assistance, a competence centre can encourage the broader implementation of innovation procurement and help foster innovation-oriented procurement practices across all policy fields.

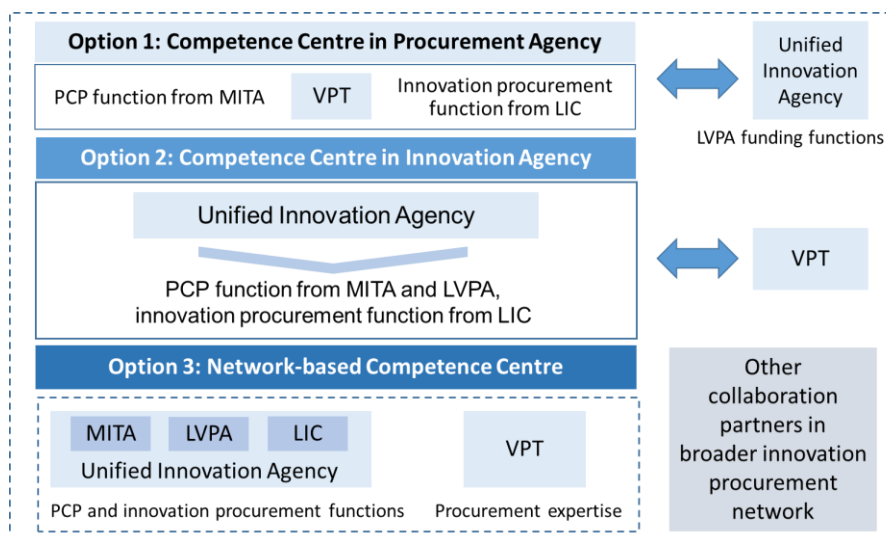
Four types of organisational models are common – the creation of a competence centre for innovation procurement as part of a: (1) public procurement agency (e.g. [Austria](#), [Sweden](#)); (2) expert (non-profit) organisation (e.g. [Germany](#)); (3) government agency with STI functions (e.g. [the Netherlands](#), [Estonia](#)); and 4) a network of government agencies with STI and procurement functions (e.g. [Finland](#)). Some competence centres rely on a unified model and cover both innovation and sustainable procurement (e.g. Finland, Netherlands and Sweden). A common feature of these centres is also the broad collaboration network that they can leverage in supporting innovation procurement. This includes national STI funding and research institutions and experts in procurement law and management among others.

The allocation of personnel and financial resources and definition of responsibilities and roles are key elements in designing a competence centre (Procure2Innovate, 2020). The competence centres in the EU Procure2Innovate network have on average between 4 and 6 staff members (FTE: full-time equivalent) and a median annual budget of EUR 6 million (Procure2Innovate, 2020). Data available for selected OECD countries point to some variation in the size of the competence centre staff force, ranging from 2.5 FTE in Estonia to 36 staff members (including part-time staff) in the Netherlands. Similarly, annual budgets differ, e.g. EUR 1.2 million for KOINNO in Germany and EUR 2 million for KEINO in Finland.

Figure 4.3 highlights three options for establishing a competence centre for innovation procurement in Lithuania that provides practical and/or financial assistance to innovation procurement more broadly, i.e. pre-commercial procurement falls within the scope of activity independent of the organisational model. An overarching approach in support of innovation procurement could help Lithuania exploit synergies in its capacity building efforts, in particular as the different elements of innovation procurement are inherently related and can also be combined at times (e.g. PCP and PPI). All three options further rely on the collaboration between VPT as provider of methodological guidance on various procurement related aspects, and the Unified Innovation Agency, which is envisaged to take on the innovation procurement

related functions from MITA, LVPA and LIC, creating operational synergies in the PCP funding approval process. The three models account in principle also for VPTs' efforts to launch a competence centre for sustainable procurement in September 2021. This would create the possibility of establishing a unified competence centre for sustainable and innovation procurement in the case of Option 1, whereas in Options 2 and 3, the competence centres for innovation and sustainable procurement would collaborate as separate entities with one another, facilitating the promotion of strategic procurement more broadly.

**Figure 4.3. Options for establishing a competence centre for innovation procurement**



Source: OECD.

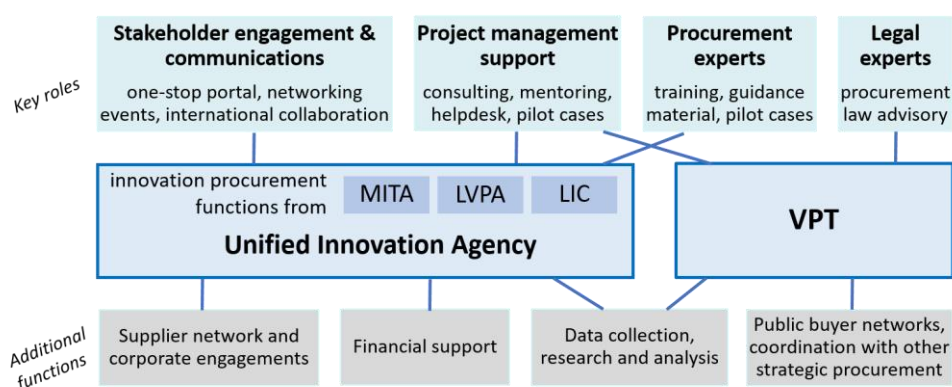
**Option 1** considers gathering all innovation procurement related support activities within the national procurement agency. Austria, operating its PPPI Service Centre as part of the Federal Purchasing body, relies on such a model, for instance. In Lithuania, this would imply integrating all non-financial support functions within VPT. LVPA's financing role for PCPs would remain with the Unified Innovation Agency and possibly extend to cover other forms of innovation procurement (e.g. PPIs). The main question would be how to further strengthen and expand VPT's experience and expertise in capacity building activities that relate to innovation procurement, including PCPs, which – exempted from procurement directives –, fall outside VPT's area of responsibility. For the integration of the innovation procurement and PCP related capacity building functions from LIC and MITA, both to be integrated into the future Unified Innovation Agency, different scenarios can be envisaged, ranging from the actual integration of staff members to the establishment of a cooperation agreement. In the latter arrangement, the newly created Innovation agency would be in charge of the PCP approval process and contribute to PCP capacity building efforts, while VPT would focus on capacity building for innovation procurement more broadly. The ultimate allocation of tasks may change over time as the VPT competence centre further develops its own STI functions through international networking, collaboration and knowledge sharing with other competence centres in this field.

**Option 2** focuses on the development of a competence centre for innovation procurement as part of a government agency that has STI functions. The Netherlands, for example, apply this model, operating the PIANOo competence as part of the Netherlands Enterprise Agency. In the case of Lithuania, the competence centre could be placed within the future Unified innovation agency that has incorporated the innovation procurement functions from MITA, LVPA and LIC. In this constellation, the competence centre would collaborate with VPT in order to complement its activity in supporting innovation procurement more broadly (i.e. beyond PCP). Methodological guidance on various procurement aspects, including innovation partnerships, innovation-oriented procedures and tools, as well as PPIs fall in principle within VPT's area

of responsibility. VPT's existing training sessions for public procurers in strategic procurement could also become a joint initiative and create a link between the activities of VPT's competence centre for sustainable procurement and the future Innovation Agency's competence centre for innovation procurement.

**Option 3** explores the possibility of creating a network-based competence centre, allowing the current actors in innovation procurement system in Lithuania to bring in the expertise in their area of specialisation without any direct changes in the institutional set-up. This network-based model has been adopted by Finland, for instance, where the KEINO competence centre for sustainable and innovative public procurement operates as a network of six institutions, each of which had established experiences in innovation procurement and/or expertise in sustainability and innovation prior to the creation of the KEINO competence centre. In the Lithuanian context, this would imply that the institutions in the Lithuanian innovation procurement system would maintain their current core functions and innovation procurement related activities but carry them out in a more coordinated manner, in addition to taking on some additional coordination functions. The Unified Innovation agency would thus focus on aspects such as training, events, international collaboration and funding, while VPT would focus on legal and administrative aspects, including methodological guidance, as well as the compilation of procurement statistics. Figure 4.4 provides an overview of the possible allocation of roles and coordinating functions for the two network members.

**Figure 4.4. Possible allocation of roles and coordinating functions among network members**



Source: OECD.

VPT's participation in the network based competence centre for innovation procurement would automatically facilitate a collaboration with VPT's competence centre for sustainable procurement. A cooperation with LMT is also envisaged in relation to R&D state orders. Further cooperation could also be envisaged with other institutions in the broader innovation procurement network, such as the Central Procurement Organisation, which could contribute to other competence centres functions such as the procurement of innovative solutions in a centralised manner.

The ultimate choice of competence centre model and scope of collaboration network depends on the motivation and levels of aspiration (e.g. breadth of competence centre service portfolio). In the current setting of the planned innovation agency merger, a competence centre network (Option 3) appears to be the most suitable and preferred option among Lithuanian stakeholders for Lithuania to provide an overarching support to innovation procurement through both capacity building and funding. This option would leverage the complementary functions and expertise of VPT and the future Innovation Agency and rely on a coordinated and direct engagement of both parties.

## 4.4. Conclusion

Innovation procurement carries an important significance as a demand-side innovation policy tool in Lithuania. Guided by interviews with Lithuanian stakeholders, this Chapter focuses on two priority areas: the monitoring of innovation procurement and consolidation of existing support activities through the creation of competence centre. Following an overview and diagnosis of Lithuania's current measurement and capacity building efforts, this chapter offers four overarching recommendations, supported by examples of relevant practices and mechanisms of support in other OECD countries, with the aim to contribute to Lithuania's strategic goal to promote the uptake of innovation procurement in Lithuania:

1. **Clarify relevant concepts and definitions and develop comprehensive guidelines**, adopting a flexible definition of public procurement of innovative solutions that reflects Lithuania's strategic goals and comprises multiple degrees of novelty, adapted as appropriate depending on the intended use.
2. **Create an encompassing monitoring system aligned with relevant definitions**, updating the current measurement strategy based on the innovation criterion in account of available sources of information and measurement approaches and opportunities for further enhancing the monitoring system through the modernisation of the central public procurement system SAULE IS.
3. **Explore ways to identify innovation-friendly buyers**, leveraging existing information on public buyers' use of innovation-oriented procurement procedures and tools. This could contribute to the promotion of innovation procurement in Lithuania via the identification of good local examples, the creation of an award system and customisation of support services to different types of buyers.
4. **Create a competence centre to consolidate and reinforce existing support activities**, with a view to establishing a single and clear access point for information and guidance on innovation procurement and a platform for national and international collaboration and the sharing of knowledge, experiences and good practices in innovation procurement.

These four recommendations are complementary and interrelated in nature. Clear concepts and definitions provide the basis for establishing a well-functioning monitoring system. However, they are also important for the creation of a competence centre, both in defining its responsibilities and functions and supporting its services, be it the development of guidance material, financing of eligible projects or development of local pilot cases in collaboration with innovation-oriented buyers. A competence centre, providing practical and financial assistance, can encourage the broader implementation of innovation procurement and help foster innovation-oriented procurement practices across all policy fields. With an effective monitoring system in place, Lithuania would in turn be in the position to identify the contributions of the envisaged competence centre, track progress towards its policy target and advance in developing an evidence base to better understand the extent, nature and potential impact of innovation procurement.

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# 5. Mission-oriented innovation policy in Lithuania: challenges and opportunities to address societal challenges

## 5.1. Introduction

Mission-oriented innovation policies (MOIPs) are co-ordinated packages of policy and regulatory measures tailored specifically to mobilise science, technology and innovation in order to address well-defined objectives related to a societal challenge, in a defined timeframe. These measures possibly span different stages of the innovation cycle from research to demonstration and market deployment, mix supply-push and demand-pull instruments, and cut across various policy fields, sectors and disciplines.<sup>44</sup>

Faced with the dual imperative of both responding to mounting societal challenges while strengthening – if not increasing – national growth and jobs in an ever-more global competition, a number of countries have started experimenting with this type of systemic policy. This process needs to be carefully managed as it most often occurs in national STI systems characterised by weak directionality, lack of holistic co-ordination and a fragmented policy mix, which were inherited from decades of 'traditional' STI policies. Lithuania is no exception to this and several recent studies highlight similar limitations.

While highlighting the challenges of implementing such directional and systemic policy approach, the OECD project on mission-oriented innovation policies (Larrue, 2021) also provides some overarching messages that are important for Lithuania:

- all countries, regardless of their initial conditions (notably their level of resources, their ability to set priorities, to govern holistically STI policies, etc.), can initiate such policy approach through experimentation, learning and gradual improvements towards stronger orientation, better coordination and more effective implementation. MOIPs are not restricted to countries with mature and well-endowed systems of innovation;
- no country starts from a blank page. MOIPs build on each country's existing structures, institutions and capabilities. Adopting an MOIP approach does not involve an overhaul of the underpinning national innovation system. Such policy evolves and is nurtured gradually as the country unfolds its 'mission-oriented policy trajectory'. This requires continuous reforms, stability, agility and reflexivity to 'adapt, adopt and learn'.

<sup>44</sup> This module builds upon the results of the OECD project on mission-oriented innovation policies (see Larrue, 2021).

Lithuania has recently demonstrated a firm interest in this policy approach, through the commissioning of related studies (notably Angelis et al., 2020; and this study) and by making several policy commitments in the context of the Lithuanian RRP (Government of Lithuania, 2021).

Against this backdrop, this module first assesses the challenges and opportunities of the adoption of a mission-oriented innovation policy approach in Lithuania and identifies four relevant options to do so.

## 5.2. Challenges and opportunities for mission-orientation in Lithuania

The assessment of the factors that foster or impede the adoption of a MOIP approach in Lithuania involves investigating three main questions, related respectively to the national institutional setting for strategic orientation, policy coordination and policy implementation.

### ***1. Can Lithuania engage a wide array of public and private STI actors to set directions in order to achieve particular objectives of national importance?***

The Lithuania governance system holds some features that are conducive to mission-orientation, notably the ability to set clear priorities and targets, with mid- to long-term deadlines, as it is the case notably in the Lithuania 2030 (Lithuania's Progress Strategy)<sup>45</sup> and the NPP for 2021-30<sup>46</sup>. The latter is an integrated whole-of-government strategic framework, which represents relatively significant improvement compared to the previous period. Efforts will be devoted to making the strategic plans of all ministries as well as the Smart specialisation strategy should be consistent with this overarching plan.

Moreover, an increasing number of priorities and objectives relate to the imperative to address societal challenges such as climate change. However, despite some improvement, some of the long-standing weaknesses of strategic orientation in Lithuania, which have been previously pointed out in numerous reports and evaluations, are still prominent: lack of a single national authoritative strategic document with a clear set of priorities for research and innovation; not active and powerful high-level STI council (see Chapter 3. ); unstable list of priorities; weak or unclear connections between strategic priorities, policy measures and budget allocation.

The first Smart Specialisation Strategy (S3) 2014-20 has somewhat alleviated some of these issues, by setting clear priority fields for innovation. Furthermore, as in most other Central and Eastern Europe, it has been instrumental in engaging a wide array of stakeholders to set priorities that guide the allocation of European Structural Investment Funds (ESIF). However, S3s remain largely bottom-up and questions remains as to whether they can lend themselves to a mission-oriented policy approach (see Option 4).

### ***2. How Lithuania coordinates STI policies across policy fields, communities and sectors?***

The lack of coordination in the STI policy arena is a long-standing issue in Lithuania. It has been documented in several reports in the last decade and demonstrated, for instance, in the design and implementation of some key initiatives such as the Valleys Programme and the deployment of STPs and incubators. The difficulty to coordinate the numerous agencies with responsibilities pertaining to the STI area can be also seen as further evidence. The introduction of ESIF funds has been beneficial to holistic STI policy coordination in Lithuania, in particular since the launch of the S3, co-chaired by the MoEI and MoESS. However, a more detailed review of practices shows that this coordination consisted mainly in the sharing of a common funding source, rather than in aligning plans and implementing collective actions.

<sup>45</sup> In Lithuanian '*Lietuvos pažangos strategija Lietuva 2030*'.

<sup>46</sup> In Lithuanian: '*Nacionalinis Pažangos Planas 2021-2030*'.

Due to the systemic nature of societal challenges, the need for policy coordination has now expanded toward sectoral ministries. The plan to appoint STI Officers (see also Chapter 3. ) in all relevant ministries is a new initiative that might mark a step change with regard to the involvement of and coordination with sectoral ministries. In connections with each other and the MoESS and MoEI, this network of key resources should help build awareness around and diffuse innovation in their respective ministries.

### ***3. How Lithuania implements specific STI policies and programmes that match to a greater or lesser extent the features of MOIPs?***

Lithuania has several schemes to support various research and innovation support functions for different types of beneficiaries, most of them being financed with EU structural funds. To date, none of them come close to the definition of mission-oriented programmes and schemes.

The National Research Programmes (NRPs)<sup>47</sup>, such as the one on Healthy ageing (2015-21), support research in specific areas. However, they are for the most part generated and implemented bottom-up by researchers without strong strategic guidance nor connection to firms and potential users. Each programme hosts a set of separate small research projects that have been selected and funded through thematic competitive calls.

More generally, the research and especially, innovation policy landscapes are fragmented with little integration of individual measures in meaningful, cross-cutting and larger scale initiatives. There is a lack of interconnection between different policy support measures to support activities of different public and private organisations at different stages of the innovation chain (currently often funded by different agencies).

In relation to this policy landscape, but also more fundamentally to the characteristics of the Lithuanian industry structure, innovation policy in Lithuania mainly supports incremental product and process improvements in individual firms, rather than disruptive innovation initiatives implemented through public-private partnerships.

## **5.3. Options for adopting a MOIP approach in Lithuania**

### ***Option 1. The Lithuanian contribution to EU Horizon Europe's missions***

#### *The basics of this option*

Due to the small size of the Lithuanian economy and the relatively limited amount of funding the country can dedicate to research and innovation, in particular, when it comes to larger initiatives, the contribution to EU's Horizon Europe five missions<sup>48</sup> is an attractive option. In cooperation with international partners, Lithuanian actors could engage in more ambitious initiatives with higher visibility and impact that would be feasible on a national scale. There are however significant roadblocks on the way towards EU missions. First of all, the participation in missions might be very selective, which has in the past deterred participation of Lithuanian actors in Framework Programmes (FPs), more attracted by Structural Funds. The perceived complexity of the mission implementation and governance, along with the uncertainty with regards to what the mission will really consist of at the end of the current 'preparatory phase', is also a factor that is detrimental to engagement.

<sup>47</sup> In Lithuanian '*Nacionalinės mokslo programos*'.

<sup>48</sup> Adaptation to climate change including societal transformation; Cancer; Climate-neutral and smart cities; Healthy oceans, seas, coastal and inland waters; Soil health and food.

Out of the 5 mission areas defined by the EC, the 'cancer', 'soil' and 'smart cities' missions were mentioned as most relevant to interviewees. However, to date, there has been little systematic and formal initiatives to prepare for Lithuania's future involvement in EU missions (beside some actions from some ministries, agencies and from the Lithuanian Research Development and Innovation Liaison Office in Brussels (LINO)).

Several EU countries have started more or less formal initiatives to form or mobilise networks in relevant areas. For example, Austria has chosen a voluntary approach to participate in the EU mission co-creation, building on enhanced coordination among national institutions and with EU missions. Interesting international initiatives are also being launched in Norway, Germany or Spain, with the creation of dedicated task forces and working groups for all or specific EU missions.

### *Potential actions to be taken*

Necessary actions should be taken to (i) share information and align plans of the different policy bodies when relevant to the EU missions; (ii) build networks in relevant areas – raising awareness, creating channels of interaction for exchanging information on EU missions and relevant national initiatives, and collecting, integrating and analysing dispersed information on missions. In each of these dimensions, it is essential to expand beyond the realm of research and innovation *stricto sensu*. It is for instance critical to enlist sectoral ministries around the missions.

## **Box 5.1. Recommended actions to prepare the Lithuanian contribution to EU Horizon Europe's missions**

<p><b>1.1 Set up informal and flexible mission working groups gathering representatives of the relevant communities of actors to mobilise them and prepare their contribution to EU missions</b></p> <p>The informal and flexible working mission groups should gather representatives of the different communities of public and private actors relevant to each mission area. MoESS and MoEI should be represented, as well as the concerned sectoral ministries (transport, environment, agriculture, energy, etc.). Once appointed the STI Officers should be involved in these groups. The relevant RTOs could play an important role as they often have significant FP experience (and therefore international networks).</p> <p>The informal mandate of these groups, at this stage, should be to (non exhaustive list):</p> <ul style="list-style-type: none"> <li>• collect and disseminate information on EU missions, as they develop;</li> <li>• identify and exchange information on national initiatives that are relevant to the missions (not least the three RRF missions);</li> <li>• identify or establish appropriate direct or indirect channels to connect to Mission Boards and EC staff (in particular the mission managers and their teams deputies in the different DGs);</li> <li>• on this basis, gradually align plans to develop some common proposals that could be communicated to the Mission Board and the EC 'mission staff'</li> </ul> <p>The informal mission working groups should be fed with an up-to-date inventory of activities relevant to each EU mission. This could be done through a dedicated baseline study or rely upon the knowledge and networks of the members of the mission working groups. This task should use the EU Mission Board reports and implementation plans, which provide a significant amount of information on what is the main thrusts of mission activities.</p>
<p><b>1.2. Ensure appropriate coordination of the EU mission areas with the national strategies and policies</b></p> <p>A first step toward effective coordination is to map EU missions areas (as well as their different components and, when available, concrete missions) with the priorities of the different national strategies. These include notably the priorities and national missions of the RRP and that of the revised Smart Specialisation Strategy. When available, the MoEI and MoESS Development Programmes<sup>49</sup> should be also included in this mapping exercise, as well as the sectoral strategies and plans (for instance those related to specific eco-systems). Once the points of convergence, overlaps and complementarities between these strategies, policies and plans are identified, a second step consists in ensuring channels of interaction between the different decision makers in charge. The mission working groups could play an important role in that regard. It is essential that this mapping is not limited to strategies and plans led by or focused upon research and innovation. Relevant initiatives in the transport and energy areas for instance should be included.</p>

<sup>49</sup> In Lithuanian '*Plėtros programos*'.

## **Option 2. National cross-sectoral missions**

### *The basics of this option*

This option consists in defining a few ambitious, inspirational and well-accepted missions and setting up a wide-ranging, cross-sectoral mission-oriented funding scheme to support potential solutions across the whole innovation cycle, from research to market deployment. This option is already planned as part of the RRP that includes provisions for three 'Joint Science and Innovation Missions' set up in the three 2021-2027 Smart Specialisations areas<sup>50</sup>, co-funded by ESIF and RRF funds. These missions will take the form of research-industry partnerships that undertake interdisciplinary and intersectoral cooperation to achieve specific missions related to the most pressing and relevant societal challenges.

Furthermore, Joint Science and Innovation Missions will be mandated by the new Law on Technologies and Innovation that is currently being amended. According to the OECD interview, the discussion is being held among Lithuanian policy makers that this Law would envision a creation of two research and innovation programmes, 'mission-based innovation programme'<sup>51</sup> and 'competition-based research and innovation programme'<sup>52</sup>. The mission-based innovation programme would include the aforementioned Joint Science and Innovation Missions.<sup>53</sup> Selected public research and innovation institutions and private sector actors would be mobilised purposefully to develop solutions to achieve each of the missions. Although the Law has not been adopted yet, the mission-based programme is foreseen to be interministerial, including some relevant sectoral ministries, and would be jointly governed by MoEI and MoESS. As regards the competitive research programme, institutions authorised by the Government under the Law, mostly ministries, would be given funding to do experimental research in their responsible fields.

Mission-oriented funding schemes gather the portfolios of policy instruments of different agencies, hence alleviating the aforementioned fragmentation of the STI policy mix. They also allows inserting the demand dimension early in the research and innovation process and accelerating developments. This option can therefore be an alternative or a preliminary step to the merger of some of these agencies (see Chapter 3. ) where agencies are still separate entities and the scheme operates in practice as a one-stop-shop vis-a-vis the applicants. While it has a narrower scope, one of the comparative advantages of this option is that it does not involve heavy structural change. It can even be seen as a first step towards a merger or a way to accompany a merger since silos can persist within merged organisations: collaboration between the agencies facilitates the creation of a common vision and language and allows building trust. Examples of such mission-oriented challenge-led scheme are Pilot-E in Norway in the area of emission free and energy saving solutions (positively evaluated in 2021).<sup>54</sup> The example of the Science Foundation Ireland's challenge-based research funding, where the challenges are co-defined by various stakeholders and stage-gate funding is applied, could also be instrumental to devise a process appropriate to the Lithuanian context.<sup>55</sup>

### *Potential actions to be taken*

The three Joint Science and Innovation Missions planned in the RRP could be a key opportunity to set up a holistic (cross-ministerial and/or inter-agency) mission-oriented scheme in order to support innovation projects throughout the different stages of the innovation process.

<sup>50</sup> In Lithuanian '*Bendros mokslo ir inovacijų misijos Šumanios specializacijos srityse*'.

<sup>51</sup> In Lithuanian '*Misijomis grįsta mokslo ir inovacijų programa*'

<sup>52</sup> In Lithuanian '*Konkursinė mokslo ir inovacijų programa*'

<sup>53</sup> To avoid confusion, the name 'Joint Science and Technology Missions' is used in the following part of the report.

<sup>54</sup> See <https://www.enova.no/pilot-e/>.

<sup>55</sup> See <https://www.sfi.ie/challenges/>.

## Box 5.2. Recommended actions to prepare the national cross-sectoral missions

### 2.1. Devise a process to co-create the ambitious objectives to be addressed by the each of the three Joint Science and Innovation Missions as cross-sectoral programmes and design and adopt holistic governance and implementation processes inspired by mission-oriented policy good practices

The Joint Science and Innovation Missions addressing bold and legitimate societal and economic challenges should be driven toward clear objectives, gather research and industry partners, have light but dedicated governance structure (possibly at the level of each challenge/mission), embed the demand dimension early in the process, maintain linkages between projects, etc.

Some more guidance is provided below, along the three main dimensions of mission-orientation:

- **Orientation** - In order to enhance the legitimacy and buy-in of each of the missions, an array of stakeholders should be mobilised to collectively identify the societal challenges and define the corresponding bold and measurable mission objectives, and the strategic agenda to guide activities towards these objectives.
  - Clear and ambitious (but realistic) missions related to legitimate and well-identified challenges with strong societal and economic relevance and timeline to achieve them. These goals should be developed through consultations with public and private actors within and outside the STI arena;
  - High level of political endorsement to increase the legitimacy of the missions;
  - Co-definition of each of the missions' strategic agendas/roadmaps
- **Coordination** - It is necessary to enhance the coordination between MoESS, MoEI, sectoral ministries and relevant agencies (including the LMT). For instance, joint steering groups could be set up for each mission. The groups would include representatives from the public and private sectors, academia and industry.
  - At the level of the 'mission-based innovation programme', set up of a dedicated interministerial structure of governance. The STI Council, possibly supported by STI Officers, could be instrumental to support interministerial coordination of the three missions and support learning and exchange of good practices between missions;
  - At the level of each of the three missions, a smaller size group allows the coordination of activities of each mission. It includes relevant public authorities and some representatives of the public and private sector partners;
  - At the level of the mission-based innovation programme', a small and agile team of staff originating from the relevant agencies to operate the scheme, headed by an experienced manager (possibly paid by different ministries/agencies);
- **Implementation** - the programmes should implement project portfolio management practices, with an overall roadmap or strategic agenda linking together the different projects and supporting their interactions. The programme should allow for the support of project demonstration stages, based on partnerships between the project partners, public authorities (including local administrations that can use their public procurement power), regulators and various stakeholders.
  - Clear mandate of agencies to support the consortia with their respective instrument portfolio (including public procurement and other demand-side support instruments);
  - Integration of the application, selection, funding and management of projects so that it appears as a one-stop-shop to project participants;
  - Linkages with the relevant EU Mission Board, Mission Assembly and dedicated EC staff (via the national mission working groups proposed in Option 1);
  - A dedicated multiyear budget and stage-gate mechanisms to manage the progress of projects throughout the stages of the innovation chain.
  - When relevant, ensure linkages between projects aiming to resolve the same challenge;
  - Stage-gate mechanisms to monitor the progress of projects through the innovation cycle
  - Support to consortia of several organisations (universities and/or RTOs, business companies, users including in administrations via PPI);
  - Coverage of an extended spectrum of project needs from applied research to market deployment and when relevant support to internationalisation.

### Option 3. The ecosystem-based MOIPs

#### *The basics of this option*

This option consists in supporting ecosystem dynamics using a mission-oriented approach. The aim of such schemes is to allow stronger directionality and legitimacy of collective action by delegating responsibilities to develop and coordinate the definition of strategic agendas in selected areas to the relevant community or ecosystems of public and private stakeholders.

This ecosystem-based approach usually requires at least two preconditions: 1) consensual development of strategic agendas that rely, at least to a certain extent, on established communities; and 2) 'hands-on' way of intervention from the state in galvanising the interest and participation of relevant actors.



These initiatives usually follow a two-stage process: (i) The Ministries or implementing agencies initiate the process with a 'call for strategic agenda proposals'. They however only provide neutral support by establishing the framework conditions for developing the strategic agendas, playing the role of broker or 'ecosystem architect' all along the process. Responding to the call, groups of actors from businesses, academia and public sector jointly define and submit to public authorities their strategic agendas. (ii) the state and the organised ecosystems cooperate to implement, monitor and update the selected innovation agendas. Under guidance of public authorities, they set their own governance structure adapted to each strategic agenda.

Relevant initiatives are found most often in Nordic countries.<sup>56</sup>

### *Potential actions to be taken*

Lithuania has several industry ecosystems (e.g. clean energy, life sciences and laser), some being still nascent, which could use a mission-oriented policy approach to support their development.

## **Box 5.3. Recommended actions to prepare the ecosystem-based MOIPs**

### **3.1 Develop a dedicated mission-oriented scheme to allow the collective elaboration and implementation of strategic agendas by emerging or established knowledge-based ecosystems in carefully selected priority areas**

Taking inspiration from the Nordic mission-oriented ecosystem initiatives, and adapting it to the specificities of the Lithuanian policy and economic landscape, the scheme would support the collective elaboration of strategic agendas by emerging or established ecosystems. The state would cooperate with the ecosystems and support the implementation of these agendas by ecosystem actors. The agendas should be integrated, i.e. covering the whole innovation chain and different dimensions of ecosystem development (human resources, infrastructure, etc.).

Such schemes require strong strategic and management capabilities in the public bodies managing it, as well as very good knowledge of the technologies, businesses and markets relevant to each priority areas. Public officers with strong leadership and previous experience in the priority areas are needed. While they are not leading the development of the agendas themselves, their strong connections with the underlying communities of actors and also their understanding of the strategies and challenges are prerequisites in playing adequately their role as facilitators.

The other necessary conditions for success are:

- A multiyear government commitment that provides a long-term perspective ;
- Careful monitoring and evaluation through an effective stage-gate approach;
- Involvement of and close interactions between ministry and agency levels. The role of agencies should not be confined to execution and management;
- An interministerial structure of governance for the scheme;
- Dedicated structure of governance at the level of each (selected) emerging ecosystem. The empowerment of the actors is an essential condition for success;
- An integrated coverage of the needs of nascent ecosystems (R&D infrastructures, collaborative innovative projects, platform operations, communication and interaction, etc.). The scheme should use various policy instruments to support the ecosystems (i.e. not only funding R&D and innovation, but also skill development and international activities).
- Building on existing structures as much as possible to avoid increasing the fragmentation in these areas.

When relevant, the ecosystem strategic agendas should indicate how they could contribute to the three RRP missions.

## **Option 4. A mission-oriented Smart Specialisation Strategy 2021-27**

### *The basics of this option*

This option consists in either: 1) emphasising mission-oriented aspects in the design and implementation of the S3, i.e., making it more challenge-based and focused, more holistically governed and implemented with a stronger portfolio approach; and/or 2) using the S3 to promote a more mission-oriented approach (including via the funding of the other four MOIP options presented in the report).

Making the S3 more mission-oriented is in line with the international call for a better balance of bottom-up and top-down approaches in S3. The new strategies are expected to abide by a 'dual directionality'

<sup>56</sup> See for instance the Swedish Strategic Innovation Programmes (<https://www.vinnova.se/en/m/strategic-innovation-programmes/>) and the Danish 'Green missions' (<https://innovationsfonden.dk/en/programmes/green-missions>).



principle: on the one hand, new S3s would still be place-based and address the localised needs and regional market opportunities; on the other hand, by addressing clearly identified societal challenges, the new S3s would contribute to attaining global goals and accelerating regional and national sustainable transitions.

Several experimental initiatives are ongoing, such as Catalonia's Smart Specialisation strategy (RIS3CAT) and Wallonia's Strategic Innovation Areas where multiple stakeholder partnerships in all S3 priority areas are formed to facilitate strategy's implementation (see Marinelli, Fernandez and Pontitakis, 2021).<sup>57</sup>

### *Potential actions to be taken*

The actions presented below aim to strengthen the mission-orientation principles in the design and implementation of the Lithuanian S3. As previously mentioned, the S3 will also be very instrumental to financially support mission-oriented initiatives as presented in the three other options.

## **Box 5.4. Recommended actions to strengthen the mission-orientation principles in the design and implementation of the Lithuanian Smart specialisation strategy**

<b>Actions to make the Lithuanian S3 more mission-oriented</b>	
<b>4.1. Engage a collective process for identifying opportunities to strike a better balance between top-down and bottom-up processes and practices to implement the revised S3</b>	
The mission-oriented approach offers several directions for improvements in the implementation of the S3 in each of the three 2021-27 priorities by:	
(i)	Strengthening directionality towards orientations that have been co-created with stakeholders, within each of the three priorities or transversal to the three priorities. Some of these orientations could take the form of specific challenges (covering only part of the priority) defined with clear targets and deadlines for achieving them. A challenge-driven approach would be instrumental in clearly communicating the objectives and expectations that R&I activities should address. Furthermore, it would foster creativity and inclusiveness, since addressing a societal challenge requires interdisciplinary and inter-sectoral efforts of multiple teams. This also echoes the view of some stakeholders that the current priorities are too focused on specific technologies;
(ii)	Adopting more inclusive and multilevel governance, for instance, by establishing quadruple helix platforms (academia – industry – public authorities – stakeholders and citizen) at the level of priorities or sub-priorities;
(iii)	Ensuring greater synergies between instruments and the use of project portfolio practices to reach objectives. This involves stronger coordination between policy makers and governance at the level of objectives, not specific measure and individual project. The newly announced Smart Specialisation coordinators will be very instrumental to take on these tasks during the whole programming period.
(iv)	More strategic and hands-on (less administrative and paper-based) management and monitoring of funded activities.
<b>Actions to use the S3 to support mission-oriented initiatives</b>	
<b>4.2 Map and strengthen the connections between the S3 priorities and other EU national and EU priorities and missions.</b>	
This action should be implemented in conjunction with action 1.3. While the S3 has not set any priorities directly related to the Green Deal or any societal challenge, the 3 priorities are transversal and pervasive, in particular advanced manufacturing and ICT, but also biotechnology. They therefore have potential to contribute to national (those announced in the RRF) and EU missions (and other EU initiatives). This map will be a first step towards connecting the diverse initiatives. It will also be very useful to have a clear view of synergies and funding opportunities. While it is not desirable to align all missions and priorities, it is important to identify possible connections (including common elements) and ensure linkages, when relevant.	
<b>4.3 Systematically seek and exploit synergies between ESIF and Horizon Europe</b>	
The different ways to enhance synergies between ESIF and Horizon Europe are:	

<sup>57</sup> See Marinelli, Fernandez and Pontitakis, (2021); <https://s3platform-legacy.jrc.ec.europa.eu/sdgs-in-catalonia>; and <https://economie.wallonie.be/sites/default/files/S3%20Wallonia%20general%20presentation.pdf>

- Combine Horizon Europe and ESIF contributions to support some projects in order to achieve greater impact and efficiency (and possibly cover different type of costs. For instance, ESIF funding for infrastructure support and large equipment costs);
- Use successively Horizon Europe and ESIF contributions to support projects that build on each other or to fund different stages of project development (for instance ESIF taking over for later commercialisation stage);
- Use Horizon Europe and ESIF contributions in parallel to support complementary projects or mutually supportive activities;
- Use ESIF to support unsuccessful but high quality (e.g., evaluated above threshold) project proposals to Horizon Europe (Seal of Excellence-type of scheme).

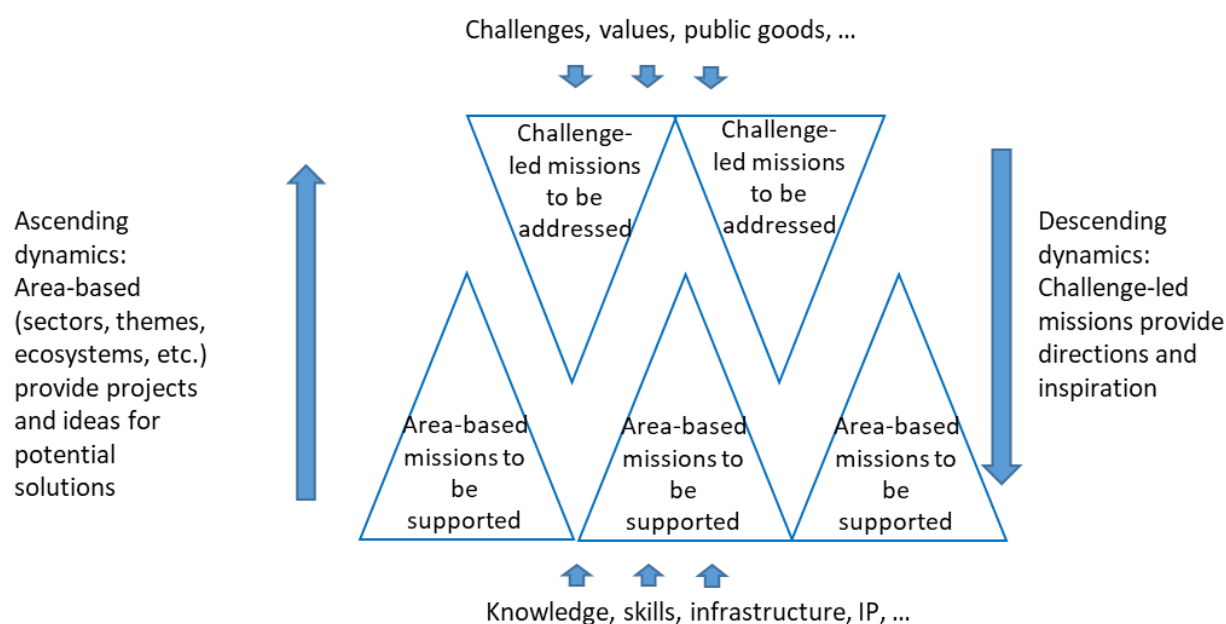
This type of synergies could be especially useful for larger and more ambitious initiatives such as those expected in the context of mission-oriented policies. There are great variations in the way and extent to which countries and regions have allocated ESIF to facilitate the access to Framework Programmes. Some have been successful at doing it and provide interesting best practices for many others. Despite a strong EU policy mandate for maximising synergies, working in silos continues to be the norm (Puukka, 2018).

## 5.4. Conclusion

This section proposes a tentative scenario for the promotion of a mission-oriented innovation policy in Lithuania, based on the four options presented in this module.

These options should be considered as complementary. In particular, synergies between the 'challenge-led' missions (Options 1 and 2) and 'area-based' missions (Options 3 and 4, as well as other initiatives that aim to strengthen themes, sectors, ecosystems, clusters, etc.) should be exploited. As shown in the Figure 5.1, the 'descending' challenges and missions set the strategic orientations and provide incentives for collective action across silos. The various 'ascending' public and private organisations pertaining to different areas provide projects and ideas as potential solutions to address the challenges and missions. Specific support is needed to ensure the proper development of capabilities and infrastructure of these areas to address missions and, more generally respond to needs, contribute to growth and jobs.

**Figure 5.1. The balance between ascending and descending dynamics in an innovation system**



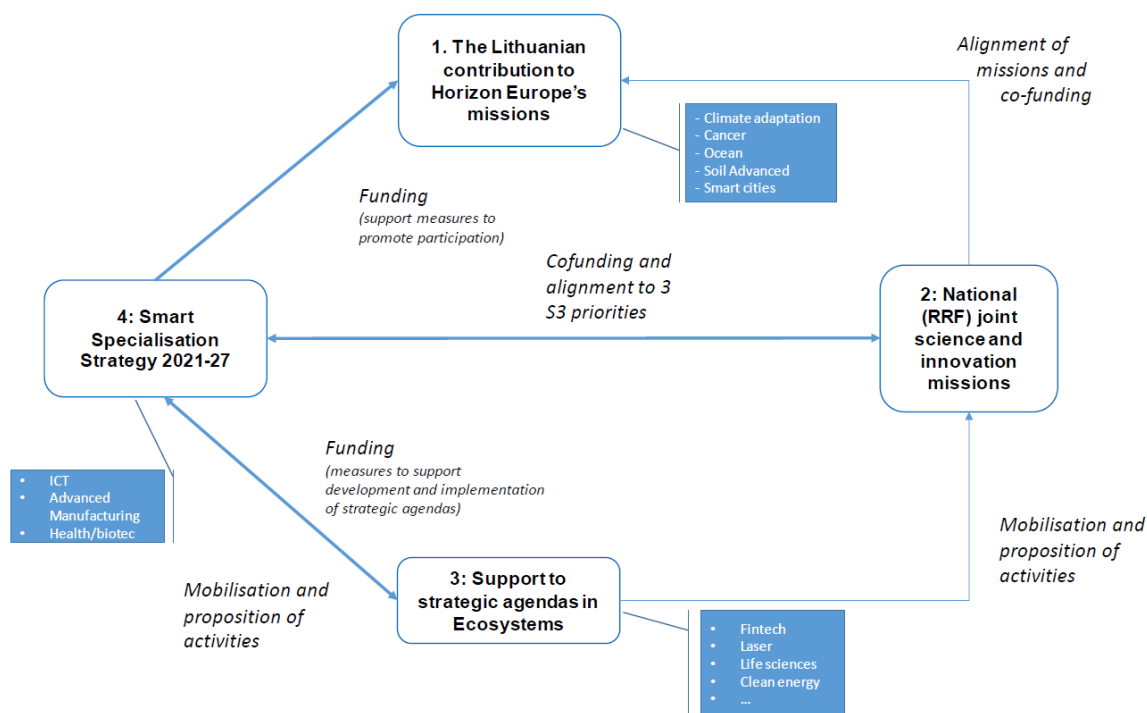
Source: OECD.

Two key questions therefore relate to:

- (i) what initiatives and measures should be challenge-led or area-based? The EU missions (Option 1) and RRP missions (Option 2) are on-going challenge-led missions. The S3 priorities (Option 4) and ecosystems (Option 3) are key pillars for policies that aim to develop skills and infrastructure in areas where Lithuania has specific strengths (supported by three competence centers announced in the RRP Plan). While they can be improved to benefit from some good practices stemming from mission-oriented policies, their support need not be fully driven towards missions.
- (ii) how to connect the challenge-led or area-based initiatives? There are several possible points of connection: for instance the strategic agendas defined by ecosystems should stipulate their possible contributions to the national (RRP) and EU missions; the RRP missions are positioned in the three S3 priorities; the ESIF funding in the three S3 priorities will be mobilised to fund ecosystems and several actions relevant to other options; the national science and innovation advisers will also be key to maintain linkages between different initiatives (e.g. as part of the dedicated EU mission working groups; to support the STI Council that could supervise the RRF missions, etc.).

In view of the above, a tentative scenario for the adoption of a mission-oriented policy, combining different options proposed in this report is proposed in Figure 5.2).

**Figure 5.2. Tentative map of MOIP options in Lithuania**



Source: OECD.

This scenario will not work if it is restricted to the STI policy bodies and their traditional partners and beneficiaries. It is therefore essential to strengthen capabilities and awareness in all ministries, beside and in close connection with MoESS and MoEI.

### Box 5.5. Recommended action to support the cross-ministerial coordination of mission-oriented policy initiatives

#### 5.1 Create and support a network of STI Officers in order to STI activities in sectoral ministries and support missions

A network of STI Officers is part of the government plan and should be funded through RRF. These officers should not only be appointed and positioned in sectoral ministries. They should be connected to each other and embedded in the mission framework, with a clear and formal role to play in their coordination and implementation. The Estonian RITA programme provides valuable insights on the role played by scientific advisers for capacity building in sectoral ministries, raises awareness on and appetite for STI issues in these institutions, improves interministerial coordination and supports large strategic interministerial (i.e. mission-oriented) projects.

As it stands, the planned STI officers will be positioned under the Horizon Acceleration Programme. It is essential to ensure that their actions expand far beyond the Horizon Europe and play an important role in all Lithuanian mission-oriented initiatives and related activities.

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# 6. Support for Industry 4.0 and Artificial Intelligence technology diffusion in Lithuania

## 6.1. Introduction

Artificial intelligence (AI) can increase productivity in manufacturing in many ways. It can reduce machine downtime when intelligent systems predict maintenance needs; accelerate industrial research; support workforce training; help manage supply-chains and even makes zero-defect production possible in some industries. However, even in the most advanced economies, the diffusion of AI and other digital technologies in manufacturing is limited and slow.

This chapter aims to give operational advice relevant to programmes and policies in Lithuania for Industry 4.0 (I4.0), including AI in industry. In particular, and drawing from experiences from across OECD member countries, it provides insights on how such programmes and policies can be designed, implemented, monitored and evaluated.

## 6.2. AI and Industry 4.0: Key observations and policy options for Lithuania

### *Main policies in Lithuania for I4.0 and AI diffusion*

Table 6.1 lists the 12 main policy initiatives in Lithuania specifically designed to promote the diffusion of I4.0 and AI technologies. For each policy, the table indicates the types of instruments used, their timeline (i.e. start and end date), budget and responsible organisation. Six main types of policy instrument can be identified: (i) National strategies, agendas and plans; (ii) Centres of excellence grants; (iii) Technology extension and business advisory services; (iv) Grants for business R&D and innovation; (v) Scholarships for higher education and vocational training; and, (vi) Networking and collaborative platforms.

**Table 6.1. Main policies for I4.0 and AI technology diffusion in Lithuania**

Policy initiative name	Type(s) of instrument	Timeline	Budget, EUR	Responsible organisation
<a href="#">Lithuanian Industry Digitisation Roadmap</a>	National strategy, agenda and plans	2019-2030	N.A.	MoEI
Roadmap for the Integration of the Lithuanian Industry into European Value Chains	National strategy, agenda and plans	2021-	N.A.	MoEI

	Roadmap for Lithuania's Industrial Transition to a Circular Economy	National strategy, agenda and plans	2021-	N.A.	MoEI
	<a href="#">Digital Innovation Hubs</a>	Centres of excellence grants (emphasising demonstration)	2020	17.6 million	MoEI, LVPA
	<a href="#">European Digital Innovation Hubs</a>	Centres of excellence grants (emphasising demonstration)	2022-2027	1-2 million per year (EU funds)	MoEI, LVPA MITA
	Promotion of automation of production processes and the introduction of digitization technologies for industrial SMEs (industrial digitization)	Technology extension and business advisory services	2022-2027	75 million	MoEI
	<a href="#">Industry 4.0 Lab</a>	Technology extension and business advisory services (emphasising demonstration and the circular economy)	2022-2025	3.5 million	MoEI
	<a href="#">Industrial Digitization LT</a>	Technology extension and business advisory services Grants for business R&D and innovation	2019-2022	110.56 million	MoEI, LVPA
	<a href="#">Smart InoTech for Industry</a>	Grants for business R&D and innovation	2019-2022	2 million	MITA LIC
	<a href="#">Targeted Scholarships for STEAM</a>	Scholarships for higher education and vocational training	2021-	10 million (in 2021 only)	MoESS
	<a href="#">Industry 4.0 Platform</a>	Networking and collaborative platforms	2016-	N.A.	MoEI
AI-specific	<a href="#">Lithuanian Artificial Intelligence Strategy</a>	National strategy, agenda and plan	2019-	N.A.	MoEI
	<a href="#">LT.AI</a>	Information services and access to datasets Equity financing Grants for business R&D and innovation	2020-2021	17 million	MITA
	<a href="#">AI BOOST Accelerator</a>	Technology extension and business advisory services	2021-	N.A.	MITA

Source: EC-OECD (2021), STIP Compass, <https://stip.oecd.org>; LIC and InTechCentras (2020).

### **General observations on Lithuania's strategic direction in Industry 4.0 and AI**

Lithuania has a large industrial base relative to GDP. Lithuanian industry is gradually increasing its ability to manufacture higher-value added products. The regulatory environment is conducive, foreign start-ups are growing in number, more firms are becoming technology developers rather than just users, and the infrastructure for digital connectivity is well developed. An overarching strategic framework for I4.0 technologies and AI in manufacturing is provided by the Lithuanian Industry Digitisation Roadmap and the Lithuanian Artificial Intelligence Strategy.

#### *The level of generality in the strategy framework*

The *Roadmap* is well informed and is the result of an extensive consultation process. However, as a roadmap, the document is somewhat generic. The MoEI has now prepared an implementation plan that



includes milestones and key performance indicators, signed by multiple Ministries in May 2020. This may serve to overcome some of the drawbacks associated with excessive generality in a strategy framework.

High levels of generality in national AI strategies is not unique, and many similar national frameworks follow a comparable model to Lithuania's. However, national strategies will generally serve to better orient nation-wide policies, programmes and institutions if they are built from explicit analysis of specific local circumstances, so it is worth considering some country cases where more specific objectives were incorporated from the start of strategy formulation. One example which might be examined by Lithuanian policymakers (with a view to possible future iterations of overarching goals), is Hungary's national AI strategy. Another is the Dutch Digitisation Strategy.

Viewed against practices in a set of relevant comparator countries, the rather generic nature of the *Lithuanian Industry Digitisation Roadmap* and the *Lithuanian Artificial Intelligence Strategy* may be part of the reason why arrangements for strategy follow-up and coordination have been relatively limited in Lithuania, both for Industry 4.0 (Table 6.2) and AI (although this may change under the May 2020 agreement on a cross-Ministry implementation plan referred to above). For example, Table 6.2 shows that various comparator countries have created dedicated coordinating and monitoring bodies, as well as targeted budget allocations, which have not been present in Lithuania.

**Table 6.2. Selected national strategies for Industry 4.0**

Country	Timeline	Yearly budget, EUR	Strategy follow-up mechanism(s)	Degree of coordination in implementing strategy
<a href="#">Finland</a>	2019-2023	-	Periodic monitoring and/or evaluation of progress	Medium: Public bodies are expected to plan activities based on strategy
<a href="#">Germany</a>	First introduced in 2011	100M-500M	Dedicated coordinating/monitoring public body	High: Strategy provides recommendations to public bodies which they have to adopt or reject via formal procedures
<a href="#">Korea</a>	2018-2022	Not applicable	Action plan Dedicated budget allocations Periodic monitoring and/or evaluation of progress	Medium: Public bodies are expected to plan activities based on strategy
<a href="#">Lithuania</a>	2019-2030	20M-50M	Action plan Dedicated budget allocations	Medium: Public bodies are expected to plan activities based on strategy
<a href="#">Netherlands</a>	2019-	5M-20M	Action plan Dedicated budget allocations Periodic monitoring and/or evaluation of progress Dedicated coordinating/monitoring public body	Medium: Public bodies are expected to plan activities based on strategy
<a href="#">Slovakia</a>	2019-2022	-	Action plan	Low: Strategy communicated to public bodies

Source: EC-OECD (2021), STIP Compass, <https://stip.oecd.org>.

### *The evidence base for Lithuanian policymaking*

Overall, policymaking in Lithuania on I4.0 and AI, at least as concerns diffusion in the business sector, appears to be based on limited data, for instance deriving from survey evidence. National statistical offices (NSOs) and supra-national statistical agencies – in particular Eurostat – have been working to develop and include modules of AI-related questions into established surveys of business innovation, R&D and ICT use. Accordingly, without the need to incur significant expense in developing a new survey instrument,

Lithuania could build on the emerging survey-development experience of Eurostat, NSOs and NGOs such as Germany's Leibniz Centre for European Economic Research (ZEW) (<https://www.zew.de/>). Beyond survey work, a series of structured case studies would be helpful, examining how firms experience the policy environment, what they understand as regards the opportunities that I4.0 and AI afford, and assessing their primary technology adoption constraints.

### *Institutional streamlining*

Lithuania operates a wide range of policies and institutions to support I4.0 and AI in the business sector. Various interviewees held that there is some uncertainty about which institutions have lead responsibilities on AI. Multi-institutional collaboration in the I4.0 Platform was praised, but some felt the Platform itself needs to be more active.

Over time, in many countries, with the introduction of new policy initiatives, the number of support schemes available to businesses easily proliferates, creating a complex and potentially confusing landscape for start-ups and SMEs. It is not possible to determine, without further assessment, whether the number of schemes in Lithuania is excessive, or whether and how synergies might be improved. However, given that the supply of programmes is already quite diverse and numerous, consideration should be given to whether some degree of streamlining could be beneficial. Measures of this sort have been undertaken in a number of countries. One way of bringing about a streamlining might be to create an inventory system that allows policy makers to see the benefits that individual SMEs receive from the different programmes, thereby indicating if there is significant overlap between programmes.

### ***Diffusion challenges in connection with AI in manufacturing***

As with other digital technologies, and across OECD countries, there is limited adoption to date of AI among manufacturers and business more generally. Relative to other I4.0 technologies, particular obstacles exist in expanding the adoption of AI in manufacturing. Recognition of the nature of these obstacles is important because it should inform the design of services aimed at accelerating adoption. These obstacles to adoption of AI include:

**Uncertainty:** AI projects involve a degree of experimentation, with no guarantee of success.

**Required accuracy:** Manufacturers have greater accuracy requirements for AI systems than firms in most other sectors.

**Complementary investments:** Connecting data silos, and getting machines to communicate seamlessly, may require additional investments in ICT.

**Skills and data:** AI skills are everywhere scarce. Even leading technology companies often have high vacancy rates for roles requiring AI skills.

All Lithuanian interviewees consulted during this project highlighted the presence of critical skills constraints. Among the main observations were that: Lithuania has highly skilled data analysts, but lacks people with machine learning know-how and experience in applying machine learning in different manufacturing functions; no university prepares the number of needed experts, even though there are some courses on data and AI; manufacturers and other businesses also need more people with complementary skills and experience in the broader areas of technology and innovation management; despite a range of initiatives, STEM education overall could be improved.

### ***Lessons learned from international experience relevant to Lithuania***

The overall context of uncertainty, required accuracy, need for ancillary investments and skills shortages described in the preceding section highlights the possible roles for public, or public-private, initiatives and institutions to help accelerate technology diffusion. Lithuania has implemented many of the types of

policies, and developed many of the same sorts of institutions, seen in other OECD countries. What follows provides a set of insights from across OECD countries about good-practice in *implementation* of such policies and in the *modus operandi* of such institutions. The topics addressed cover: the operation of institutions for technology diffusion; policies and programmes for skills development; data policies; computing infrastructure; addressing possible hardware constraints facing AI start-ups; linking research and manufacturing; promoting AI uptake in subnational regions; and, programme and policy evaluation.

AI in manufacturing raises particular issues of digital connectivity. Fibre-optic cable is of particular importance for high-speed connectivity that can facilitate the use of advanced digital technologies in manufacturing. In 2019 Lithuania had the third highest number fibre-based broadband connections as a percentage of total broadband connections in the OECD area, behind only Korea and Japan (OECD, 2020). No interviewees consulted for this report considered connectivity issues problematic.

### *Institutions for technology diffusion*

All OECD countries operate institutions, policies and programmes with technology diffusion goals. These include universities, professional societies, knowledge exchange instruments (such as innovation vouchers), bodies that provide technical outreach to firms (such as the United States' Manufacturing Extension Partnership programme), applied technology centres (such as Germany's Fraunhofer Institutes), and technology-oriented business services (such as Canada's Industrial Research Assistance Program).

Various countries have developed programmes specially aimed at increasing the use of AI in manufacturing. For example, the AI Accelerator, initiated by Finland's Ministry of Economy and Employment, together with Technology Industries of Finland, spurs AI use in SMEs. Germany's AI Strategy includes support for SMEs and start-ups through AI trainers in Mittelstand 4.0 Excellence Centres.

Over time it would be important to review the overall coverage of Lithuania's institutions to ensure that industrial SMEs are not omitted from support (various interviewees held that much of the current public support for AI is relevant to Fintech primarily).

Lithuania possesses many institutions and programmes for technology diffusion. Institutions for technology diffusion can be effective if suitably designed, incentivised and resourced. In a synthesis of experience worldwide, Shapira and Youtie (2017) identify the main policy and operational considerations, which should be reflected, where relevant, in the *modus operandi* of Lithuania's institutions:

- Small firms tend to use digital technologies – even mature technologies such as cloud computing – much less frequently than larger firms. It is important to systematise key information for SMEs. Germany's Industry 4.0 initiative, for example, has documented over 300 uses cases of applications of digital industrial technologies (<https://www.plattform-i40.de>). The United Kingdom's 2017 Mayfield Commission led to the creation of an online self-assessment tool. It gives firms a benchmark against best practice, with guidelines on supporting actions (<https://app2.bethebusiness.com/dashboard>).
- Information provided through such initiatives should also include AI. For reasons described earlier, public efforts at technology diffusion could help by providing information on expected ROIs – or the ranges thereof - and how they were calculated. Sweden has established an initiative to this end under its Robot Accelerator Program.
- Because the skills to absorb information are usually scarce in SMEs, simply providing information on technology is not enough. Providing signposts to reliable sources of SME-specific expertise can help. As part of its SMEs Go Digital Programme, Singapore's TechDepot provides a list of preapproved digital technology and service solutions suited to SMEs (<https://www.imda.gov.sg/>).

- Technology diffusion institutions need realistic goals and time horizons. Introducing new ways to integrate and diffuse technology takes time, patience and experimentation. Yet many governments want quick and riskless results.
- The aims of technology diffusion institutions must align with their operational realities. If AI has special importance among other technologies, then it might be inappropriate for diffusion institutions to prioritise revenue generation – and the imperative of becoming self-funded – in their funding model. Furthermore, a common problem is to focus on disseminating the most advanced technology, when many enterprises do not fully use even current technologies. With AI, for example, companies often need to implement basic steps in organising the data they have, before anything else (many SMEs in Lithuania use old-fashioned databases, with data not being stored in the cloud or available in Hadoop).

### *Developing the right skills*

The availability of suitable skills is the main determinant of firms' ability to adopt and innovate with new technologies. Finland plans to create new AI Bachelor's and Master's programmes and courses on AI and to promote incentives and training for teachers to use AI in their courses. Many AI strategies also include incentives to retain and attract foreign nationals with AI skills. With large numbers of Lithuanians living abroad – reportedly including many with data science skills – such programmes merit attention.

Some countries are rapidly developing curricula relevant to robotics (The People's Republic of China, for instance, is developing robotics education tailored to primary schools). Robotics engineering programmes could be embedded in high school curricula.

Each year, in all countries, inflows to the labour force from initial education represent only a small percentage of the numbers of people in work, who in turn will bear much of the cost of adjustment to AI and I4.0 technologies. Both considerations underscore the importance of workforce training. Business and government must cooperate to design training schemes – such as conversion courses in AI for those already in work – with public authorities ensuring the reliability of training certification. Singapore has also developed apprenticeship programs to allow graduate students to learn from AI experts in leading companies in Singapore.

Tooling U-SME – an American non-profit organisation owned by the Society of Manufacturing Engineers – provides comprehensive online industrial manufacturing training and apprenticeships (<https://www.toolingu.com>). A key for policymakers is to ensure that such programmes include curricula that encompass up-to-date uses of industrial AI.

Not all forms of relevant training need to focus on AI and code. Much AI in industry exists in robots. Not all robot-related jobs are programming or software jobs. Many concern hardware. Training could help to open such jobs to workers who possess mechanical skills taught in vocational courses. Many of the necessary skills do not require a 4-year degree. Shorter courses could help, especially if delivered at scale. An example is the intensive 12-week Rockwell programme, in the United States, that provides certification as instrumentation, control and automation technicians. Italy also introduced a tax credit aimed at supporting the training of employees in Industry 4.0 technologies.

### *Skills bridging for AI*

Many industrial firms generate a great deal of data but might not have the skills in-house to extract value from the data. In addition, manufacturers are generally product-led, and might have a limited corporate tradition of data analysis (sectors such as finance and marketing have used data analytics for longer). Even large industrial firms can fail to exploit the value in their data.

However, external sources of expertise – including AI start-ups, universities and other institutions – could create value from data held by manufacturers. Skills-bridging programmes can help, such as those run in

the United Kingdom by the Digital Catapult and the Turing Institute (bringing together large businesses, academic researchers and start-ups in collaborative problem-solving challenges around data and digital technologies). Interviewees indicated that no such programme is available in Lithuania (although there have been exchanges to similar ends between firms and universities).

### *Computing infrastructures*

Several countries allocate high-performance computing (HPC) resources to aid AI-related applications and R&D. Some are setting up HPCs designed for AI and give financial support to develop national HPC infrastructure. Box 1 describes steps governments can take to expand access to HPC for manufacturers.

#### **Box 6.1. Getting HPC into advanced manufacturing: Possible policy actions**

- Raise awareness of industrial use cases, with quantification of their costs and benefits.
- Develop a one-stop source of HPC services and advice for SMEs and other industrial users.
- Provide low-cost, or free, limited experimental use of HPC for SMEs, with a view to demonstrating the technical and commercial implications of the technology.
- Establish online software libraries/clearing houses to help disseminate innovative HPC software to a wider industrial base.
- Engage academia and industry in the co-design of new hardware and software, as has been done in European projects such as Mont-Blanc (<http://montblancproject.eu/>).

Source: European Commission (2016).

### *Resolving hardware and related skills constraints for AI applications in new and young firms*

AI-based start-ups are a channel for technology diffusion, the generation of new business models and, in some cases, the supply of new services for industry. AI entrepreneurs might have the knowledge and financial resources to develop a proof-of-concept for a business. However, they may lack the necessary hardware-related expertise and hardware resources to build a viable AI company. To help address such issues, the United Kingdom's Digital Catapult runs the Machine Intelligence Garage programme. It works with industry partners such as GPU manufacturer NVidia and Google Cloud Platform. Together, they give early-stage AI businesses access to computing power and technical expertise.

### *Linking research and manufacturing*

A large part of national AI strategies focuses on R&D. OECD (2017) examines emerging features of industrial research institutions, all of which are relevant to developing AI for, and transferring AI to, manufacturing. Many such institutions and practices operate in Lithuania, and it is beyond the scope of this chapter to assess their overall or individual efficacy. However, the bullet points that follow distil good *implementation practices* from international experience:

- Government-funded research institutions and programmes should be free to combine the right partners and facilities to address challenges of scale-up and inter-disciplinarity (some manufacturing R&D challenges may need expertise and insight not only from engineers and industrial researchers, but also designers, suppliers, equipment suppliers, shop floor technicians, and users).

- New government-funded manufacturing R&D institutions, programmes and initiatives need to be able to provide innovation support functions beyond basic R&D (e.g. prototype demonstration, training, supply chain development and test-beds).
- Public funding of AI often goes to public laboratories engaged in long-term research projects, whereas the needs of most SMEs have much shorter time horizons and should also be met.
- Policy can help laboratories working on applied industrial research with financial support and help ease the initial phases of their work (for instance with seed funding, sponsored hiring programs out of university labs, and R&D residency grants). Governments can also use proactive marketing strategies that connect laboratories with SMEs, for instance giving no-cost invitations to events and providing mentions in public communications (Bergeret, 2020).

Developing linkages and partnerships between manufacturing R&D stakeholders is also helpful. This reflects the scale and complexity of innovation challenges in advanced manufacturing. Through its Plattform Lernende Systeme (Learning Systems Platform), Germany's Federal Ministry of Education and Research brings together expertise from science, industry and society in a forum for exchange and co-operation on technological, economic and societal challenges around AI research and use.

### *AI and subnational regions*

Much of Lithuania's industrial base and AI infrastructure is concentrated around Vilnius. Geographic concentration of AI skills and capacity is marked in most countries for which there is evidence. Castro (2018) makes proposals and offers rationales for a series of measures that subnational authorities could consider, as follows:

- Help inform the local business community about the benefits of AI, for instance through regular networking events or by sponsoring "AI awareness" events, all tailored to needs and opportunities most relevant to locally prevalent industries.
- Support the development of local training programmes. Because it will be difficult for many cities and regions to attract the most skilled AI workers, it makes sense to focus on developing locally available talent. State and local governments could create partnerships with local educational institutions to develop AI certification or apprenticeship programmes oriented to the specific needs of local businesses.
- Many leading-edge applications of AI will be used in high-tech companies that often cluster in more affluent cities and regions. Accordingly, local and regional governments could focus on training workers for more generic (and numerous) applications of AI in business.
- Stimulate local AI adoption, in part by having the government become an early adopter. For example, without requiring significant expertise, governments could use commercial off-the-shelf AI products, such as virtual assistants, or systems that help match job seekers with job openings.

### *Programme and policy evaluation*

Without reliable metrics and data on the impact of public support, policymakers have no basis for decisions on whether to maintain, scale up or scale down their initiatives around AI. More evidence could be created in Lithuania on the impacts of the I4.0 and AI policies already in place. Warwick and Nolan (2014) set out some key considerations on evaluation of industrial policies, all of which apply to public schemes for AI in manufacturing. These include: choose the right evaluation metrics; consider mandating evaluations when public funding is involved; insist on the development of data and evaluation strategies as a pre-requisite for the commencement of programmes; commit to transparency and early publication of evaluation findings and their (anonymised) underlying data; and, ensure mechanisms for policy learning from evaluation findings.



### 6.3. Conclusion

Using I4.0 and AI in manufacturing, and other areas of production, is an important topic for Lithuania owing to the large share of the industrial sector in the country's GDP. This chapter has distilled operational advice – from across OECD countries – relevant to programmes and policies in Lithuania for I4.0 and AI in industry. The points of focus have been guided by interviews with Lithuanian government officials and business and technology experts. The concentration on technology diffusion reflects one of the main challenges affecting all OECD countries, and is especially important for a country such as Lithuania which is primarily a user of I4.0 and AI technologies, rather than a developer.

The chapter offers a number of overarching suggestions concerning the benefits that might be had from increasing specificity in the overall strategy framework, including developing achievement milestones. Suggestions are also offered in connection with possible strengthening of the evidence base for policy, and possible streamlining of the overall set of programme and policy initiatives. Attention is given to lessons learned from across OECD countries relevant to programme and policy implementation in Lithuania. The topics addressed include the *modus operandi* of institutions for technology diffusion; priorities in skills development; computing infrastructure and access to computing hardware for AI-related start-ups; linking research and manufacturing; the diffusion of AI in firms in lagging regions; and, good practices in programme and policy evaluation.

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## Annex A.

### List of interview partners and contributors (by Chapter and in alphabetical order)<sup>58</sup>

#### Chapter 3. Better policy implementation and design in key selected areas: Consolidation of innovation agencies and enhancing Lithuania's STI Council

Name	Institution	Position
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<sup>58</sup> Information on the interviewee's affiliation and position is based on the time when interviews took place.

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Tomas Andrejauskas	Lithuanian Biotechnology Association	President

**International experts**

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Silvia Schwaag Serger	Lund University, Sweden	Professor
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#### Chapter 4. Support for Public Procurement of Innovation in Lithuania

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## Chapter 5. Mission-oriented Innovation Policy in Lithuania: challenges and opportunities to address societal challenges

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## Chapter 6. Support for Industry 4.0 and Artificial Intelligence technology diffusion in Lithuania

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Marius Kvedaravicius	InTechCentras	Innovation Project Manager/ Head of sales
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Tomas Blazauskas	Kaunas University of Technology	Head of Department
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Gintaras Valinčius	Vilnius University Life Sciences Center	Director
Rūta Petrauskaitė	Vytautas Magnus University	Professor of linguistics, Department of Lithuanian Language
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