Baseline study: Lithuania

Innovation policy mix for Advance Manufacturing

Orkestra – Basque Institute of Competitiveness
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1. Introduction

This report has been elaborated as part of Manumix Interreg, a project that aims at strengthening and improving the effectiveness and efficiency of innovation policy-mixes for Advance Manufacturing (AM) at regional level through evaluation. The project is developed in partnership by governments and institutions in the Basque Country, Lithuania, Piedmont and Wales. Specifically, the consortium of the project is composed by the Basque Government, MOSTA – Lithuanian Higher Education Monitoring and Analysis Centre, FinPiemonte and Welsh Government.

The first phase of the project includes the development of a baseline study to analyse the innovation policy mix of partner regions, its governance and evaluation practices. One report has been developed for each region, as well a general comparative study. These documents have been elaborated by Orkestra with active collaboration and involvement of partner regions, by providing the core information that is summarized in the baselines studies. The studies have been elaborated based on secondary sources, interviews with partner regions representatives and/or other stakeholders, a survey filled by policymakers and a survey filled by beneficiaries of programs (in Piedmont and Basque Country). In the case of Basque Country, an additional workshop with beneficiaries has been carried out.

This report presents the main features of the innovation policy mix for AM in Lithuania. As the report presents, Lithuania's AM strategy is focused on the development of technologies that aim at increasing Lithuania's productivity levels and transiting to more knowledge intensive activities, among others through improving business-research collaboration. To that end, several policy instruments addressed at business, research institutions and the linkages between both compose the innovation policy mix. The specific policy mix selected for Manumix is mainly targeted at research institutions and aim at technology transfer and commersialisation of research results. Evaluation exercises of individual instruments and RIS3 strategy that have already started in Lithuania will provide the basis for policy learning, assessing the adequacy of these instruments and the policy mix in general in achieving the goals of this and other priorities.

The report is structured as follows. Section 2 presents a general overview of the regional innovation and institutional context. Section 3 defines the scope and challenges of Lithuanian's AM strategy and Section 4 provides an overview of its governance. Section 5 delves into the innovation policy mix for AM and the selected policy-mix for Manumix. Section 6 withdraws evaluation practices for AM strategy and the policy-mix. Finally, Section 7 concludes with a summary.

2. Regional context

Lithuania is a country located in the north area of Europe and it is considered one of the Baltic states, situated at the southeast of the Baltic sea. The country has become a Republic in 1990, after a restoration of independence process, since then it began the implementation of some governmental measures mainly with a more neoliberal orientation (MOSTA, 2016). It was in 2004, after its inclusion in the European Union (EU) and the adoption of some European standards for economic development, that this orientation has changed. For instance, by including the process of strategic planning and definition of priorities to guide the country's development path, generating changes in the innovation system related to governance and allocation of resources in science, technology and innovation, among others (*Ibid;* OECD, 2016). The country is considered as a state-region by the European administrative system and became member of the Eurozone in 2015 (Reimeris, 2016).

Regarding economic performance, Lithuanian economic structure has experimented a shift since 1990 to 2010 from traditional sectors (eg. Agriculture, mining) towards service industries which had a positive effect on productivity growth as the economic activities started applying modern technologies in its processes. In terms of trade, statistics on exports show the predominance of low and medium-high-technology industries, related more to traditional sectors. The country's top exports are refined petroleum (16%), furniture (4%), polyacetals (2.3%), wheat (2.3%) and nitrogenous fertilisers (1.4%). Moreover, the level of economic complexity of Lithuanian exports has increased over time but remains very low in comparison to its peers in EU. According to the Economic Complexity Index (2015)[1], Lithuania is the 36th most complex economy among 141 countries and according to the OECD (2016) the Export Specialisation Index indicates it has built comparative advantages in trade with the EU in the next industries: food, drink and tobacco products, raw materials, mineral fuels and related materials, and other manufactured goods.

It is recognized that even though there are still gaps to reduce (eg. GDP per capita, productivity), the country has evolved in terms of catching-up in relation to EU and OECD countries average. In terms of productivity growth, the country still faces some challenges, thus, improving country's innovation capability substantially is a requirement (OECD, 2016). Manufacturing has been the main contributor during the last 15 years for productivity growth. From 2000 to 2010, average productivity growth in manufacturing was 8.6% while the economy average was 5.6%, however it has slowed down during 2010-2015, more than the whole economy (European Commission, 2017). Moreover, Lithuania has not experimented a significant structural change between 2010 and 2015 which reinforces the need to build the economic development path towards a more knowledge-intensive growth model.

The promotion of a smart growth model is precisely the main goal of the Lithuanian multifund Operational Programme (OP), which gathers EU investment funds aimed at Lithuania's economic and social development. The Programme stablished 10 funding priorities, namely (1) strengthening RD; (2) promoting information society; (3) promoting competitiveness of SME's; (4) promoting energy efficiency and renewable energy; (5) environment, sustainability and adaptation to climate change; (6) developing sustainable transport and energy infrastructures; (7) promoting quality employment and labor mobility (8) promoting social inclusion and combating poverty; (9) improving the education system; and (10) improving quality and efficiency of public administration. Through them, it is expected to reduce the gap between Lithuania's and EU average level of development.

Some economic and innovation features are presented in the next table:

[1] http://atlas.media.mit.edu/en/rankings/country/2015/

Table 1. Economic and innovation features

Indicator	Lithuania		European average (2016)
	2011	2016	
Real GDP per capita (EUR per inhabitant)	9,800	12,000	26,900
GDP per capita in PPS (EU28 = 100)	66	75 (2015)	100 (2015)
Real GDP growth rate volume (% change on previous period)	6%	2.30%	1.90%
Research and development expenditure all sectors (% GDP)	0.90%	1.04% (2015) (p)	2.03% (2015) (p)
Research and development expenditure business enterprise sector (% GDP)	0.24%	0.28% (2015) (p)	1.3% (2015) (p)
Research and development expenditure government sector (% GDP)	0.18%	0.18% (2015)	0.24% (2015) (p)
Research and development expenditure higher education sector (% GDP)	0.49%	0.58% (2015)	0.47% (2015) (p)

Source: Eurostat. Own elaboration (p)=provisional

Concerning innovation development, according to Regional Innovation Scoreboard 2017, Lithuania is considered a Moderate innovator, which has increased its performance in the last 7 years. Some relative strengths in comparison to EU are related to the innovation-friendly environment (eg. broadband penetration), human resources (eg. Population with tertiary education), and linkages (eg. Private co-funding of public R&D expenditures and innovative SMEs collaborating with others). Relative weaknesses are in sales impacts (eg. knowledge-intensive services exports and medium and high tech product exports), attractive research systems (eg. foreign doctorate students and most cited publications), and Intellectual assets (eg. Design applications and PCT patent applications).

Lithuania has 39th position in the pillar Innovation of the Global Competitiveness Index 2016-2017 (World Economic Forum). However, it has lower positions in other pillars such as: Market size (77), Financial market development (60), Labour market efficiency (59), Institutions (51), among others (Figure 1). So that, some basic and efficiency factors are still a challenge for the country. Moreover, according to Reimeris (2016), one relevant issue to overcome for Lithuania is its public sector efficiency and governance (accountability, political stability, government effectiveness, rule of law, corruption, etc). This is reinforced by Lithuanian performance in the European Quality of Government Index (EQI) (2013) where it has the 179th position among 206 European regions.

Figure 1. Lithuania performance in competitiveness and innovation 2016-2017

Source: World Economic Forum. Global Competitiveness Index 2016-2017

Regarding, innovation policy, MOSTA (2016) acknowledges that Lithuania had no clear policy focus on innovation before Research and Innovation Smart Specialisation Strategy (RIS3). Resources coming from EU structural funds have been the main source of STI support and they were divided among different public entities with their own priorities so there has not been an integrated strategy developed. Thus, during 2002-2007 some attempts to design a STI policy were implemented but with not clear focus so the effects were blurred as a result of the weakness of the institutional capacity to build up the evidence base for strategy at that moment. Policies were developed top-down with almost no involvement of stakeholders (OECD, 2016).

During 2007-2013, the programming was mainly focused on supporting R&D infrastructure by designing and implementing five Integrated Science, Studies and Business Centers (Valleys) with the objective to generate geographical concentrations of scientific research, studies and knowledge economy clusters in: (i) laser technologies, material science and nanoengineering, electronics and organic electronics and civil engineering; (ii) biotechnology, molecular medicine and biopharmacy, and research of ecosystems and sustainable environments, including Information and communications technologies (ICT); (iii) sustainable chemistry and biopharmacy, mechatronics and related technologies, future energy and the environment, engineering, and ICT; (iv) agrobiotechnology, bioenergy and forestry, and safe and healthy food technologies, and; (v) marine environment and marine technologies. These projects were implemented by universities and research institutes. These actions were additional to other plans fostering STI development like the Economy Promotion Plan 2009-10 (Ministry of Economy) and the Lithuanian Innovation Strategy 2010-20. Several measures were implemented to address coordination problems in the national innovation system as the creation of the Agency for Science, Innovation and Technology (MITA) in 2010.

After a process of two years which included the involvement and participation of a wide range of actors (bottom-up), in April 2014, the Government approved the programme of smart specialisation[2] and ordered the Ministry of Education and Science (MoES) and the Ministry of Economy (MoE) to create the co-ordination group (composed by representatives of public sector, firms and scientific sector) and to prepare roadmaps and implementation plans. RIS3 was a requirement of European Commission and related to potential finance from EU Structural Funds 2014-20. The main goal of the strategy is "to increase the impact of high value added, knowledge intensive and highly-qualified-labour-intensive economic activities on the GDP and structural changes of the economy by means of the R&D and innovation decisions". It specifically has two objectives: (i) create innovative technologies, products, processes and/or methods and, using the outputs of these activities, respond to global trends and long-term national challenges; (ii) increase competitiveness of Lithuanian legal entities and their opportunities for establishing in global markets–commercialization of knowledge created in the implementation of the R&D and innovation priorities as well as knowledge created in developing the R&D and innovation priority areas otherwise and using the unique synergy arising from the collaboration of science and businesses, economic entities and other public and private sector entities. The RIS3 strategy has 6 priorities and 20 sub-priorities (Table 2), which are further developed in specific actions plans designed for each of them.

[2] "Resolution on the approval of the Programme on the implementation of the Priority areas of research and (socio-cultural) development and innovation (Smart Specialisation) and their Priorities"

Table 2. Lithuanian RIS3 priorities and subpriorities

1.	**Energy and sustainable environment**
•	Smart systems for energy efficiency, diagnostic, monitoring, metering and management of generators, grids and customers;
•	Energy and fuel production using biomass/waste and waste treatment, storage and disposal;
•	Technology for the development and use of smart low-energy buildings – digital construction;
•	Solar energy equipment and technologies for its use to produce electricity, heat and cooling.
2.	**Inclusive and creative society.**
•	Modern self-development technologies and processes;
•	Technologies and processes for the development and implementation of breakthrough innovations.
3.	**Agricultural innovation and food technologies.**
•	Sustainable agro-biological resources and safer food;
•	Functional food;
•	Innovative development, improvement and processing of biological raw materials (biorefinery).
4.	**New production processes, materials and technologies.**
•	photonic and laser technologies;
•	functional materials and coatings;
•	structural and composite materials;
•	flexible technological systems for product development and fabrication.
5.	**Health technologies and biotechnologies.**
•	Molecular technologies for medicine and biopharmaceutics;
•	Advanced applied technologies for individual and public health;
•	Advanced medical engineering for early diagnostics and treatment.
6.	**Transport, logistics and information and communication technologies (ICT).**
•	Smart transport systems and information and communication technologies;
•	Technologies/models for the management of international transport corridors and integration of modes of transport;
•	Advanced electronic contents, content development technologies and information interoperability;
•	Information and communications technology infrastructure, cloud computing solutions and services.

Source: Own elaboration based on "Resolution on the approval of the Programme on the implementation of the Priority areas of research and (socio-cultural) development and innovation (Smart Specialisation) and their Priorities"

In terms of innovation policy, general challenges and recommendations have been pointed out by OECD (2016) as part of a peer review process and by the by European Commission in the country's Report 2017:

- The country shows strengths in education and human capital development. For instance, 97% of high school graduates have IT skills (MOSTA, 2016), 91% of inhabitants have secondary education and 53% higher education (Reimeris, 2016). However, skill mismatch still appears to be high among educational offer and business demand which is worsen by the fact that working population is decreasing. This could be improved by spreading information and communication systems on skills needed and encouraging cooperation between higher education institutions (HEIs) and business to include it later into the tertiary educational offer. Other possible actions suggested are related to strengthening and extending measures promoting the development of the vocational education and training (VET) and attracting foreign human talent.

- Despite the efforts in research and innovation policy as well as strengthening innovation governance system, both still show challenges. Fragmentation of policies and lack of coordination among main actors in STI domain, as ministries in the strategic level is needed to be overcome (MoE and MoES). Moreover, further efforts will be needed to enhance co-ordination at operational levels since the existence of a diversity of agencies responsible of implementing instruments and programmes, thus, the access for firms and actors to these supports are difficult. This also affects the monitoring and evaluation processes in the system in order to improve the policy-mix. In the current Research and Innovation Strategies for Smart Specialisation (RIS3) context, some spaces for coordination have been created like the Strategic Council Research Development and Innovation (SMIT) which needs to continue being reinforced to foster its relevant role in shaping the policy. Governance of innovation policy, RIS3 and Advanced Manufacturing will be more analysed in Section 4.
- In terms of R&D investment, as shown in Table 1, public investment in R&D has been important, however R&D expenditure coming from the business sector is still low in comparison to EU average. Moreover, the funded public research institutions have performed poorly in terms of generating scientific and innovation outputs. Thus, important efforts need to be made for improving public resources allocation in a competitive manner and fostering collaboration between science and business.
- Regarding the policy mix, a strong attention has been paid on research and science driven innovation and developing infrastructures supporting R&D and innovation. However, new instruments should be oriented towards strengthening firms' innovation capabilities in a larger range, focusing on other kinds of innovation like organisational and market-oriented innovation and reaching a wider spectrum of firms like SMEs. Some shifts in this aspect have been made in the EU structural fund 2014-2020.
- Limited availability of access to finance for R&D activities is a constraint for innovation in Lithuania. Thus, resources from the European structural and investment funds have been the main sources for research and innovation projects. These sources need to be fostered in order to attract venture capital or other sources of innovation financing.

To conclude, main features of regional context are summarized in Table 3.

Table 3. Features of regional context

Degree of general regional autonomy and innovation policy	Full autonomy on innovation policy design and implementation. However, it has a strong dependence on EU funds.
Set-up of regional governance system	Highly national centered governance system with low role of other territorial levels in innovation policy. Fragmented system composed of several ministries, funding, advisory and implementing agencies.
Nature of the process of RIS3 development	Bottom up and participatory process developed through wide stakeholder involvement.

Source: own elaboration

3. What is Advanced Manufacturing in regional context?

Advanced manufacturing corresponds in Lithuania to the priority area "New production processes, materials and technologies". The priority aims at responding to two competitiveness challenges that Lithuania faces: (1) a lack of business and research, intersectoral and international partnership in knowledge and technology generation and implementation and (2) Lithuania's businesses low productivity levels and "lack of advanced technologies and innovative processes, products and services".

Indeed, as acknowledged in the RIS3 plan, Lithuanian's businesses have relied their competitiveness on low costs and have lost competitive advantage in the context of strong global competition and rapid technological change. The industry has increased productivity but it has been based on employment reduction, not on innovation. Moreover, most industry is focused on products and services of less valuable parts of value chains and high-tech industry does not have a high share. Besides, there is scientific capacity in Lithuanian's research and higher education system which is relevant for AM that is underused by businesses.

Thus, the development of the AM priority should contribute to tackling the following specific challenges (i) the underused scientific capacity and a lack of collaboration between business and science (ii) the low productivity of Lithuania's businesses; (3) a lack of advanced technologies, innovative processes, products and services (iv) the need to increase the supply chain's efficiency by reducing costs; (v) the need to increase supply chain's efficiency and synchronization in order to ensure flexibility; (vi) a shift from mass production to mass adaptation; (vii) the need to shift to more profitable parts of the value added chain, focusing on international markets, on offering and increasing the share of high-technology industry.

The priority, like the other RIS3 priorities, is not focused on sectors but aimed at developing cross-sectoral specific technologies (Reimeris, 2016). AM strategy concretely includes the implementation of the following RDI priorities and thematic areas:

Table 4. Advanced Manufacturing RD priorities and thematic areas

New production processes, materials and technologies.
• photonic and laser technologies - Coherent light sources and their components - Laser Materials and Processing Technology - Long-distance and middle-range infrared emitters and detectors - Spectrally functionalized semiconductor light sources • functional materials and coatings; - Functional layers, nanostructures and forming coatings and surface treatment tech. - Materials and technology of organic electronics and optoelectronics - The physical effects of measurement and material recognition technology - Photo and electronically active layers and derivatives • structural and composite materials; - Exclusive properties and composite construction materials and constructions - Energy-efficient construction and composite materials - Polymer composites and their return processing technology - Innovative and balanced design solutions and modeling techniques • flexible technological systems for product development and fabrication. - Virtual product development technologies - The use of materials and resources saving technologies - Robotic manufacturing technology - Intelligent process management systems

Source: own elaboration based on information from www.sumani2020.lt

Laser Technologies have over three decades of tradition in Lithuania and the 10% of the global scientific laser market. There is a business base of around 40 SME, which is increasing with the creation of spin offs and new businesses. Moreover, its potential receptive sector (production of computer, electronic and optical products) gathers around 116 businesses more.

As for functional materials and coatings, Lithuania has a strong research potential and recognition in semiconductor physics, material science and nanotechnology specifically in the fields of metal corrosion, microbiological degradation of materials, nanostructured surface structures and electro-catalysis. Besides, there has been some previous business-science collaboration that has resulted in successful product development in this field. In addition, around 20 knowledge-intensive companies operate in Lithuania in this market, which is forecasted to increase. Some materials produced by Lithuanian's businesses are already sold to global leaders.

On the other hand, the thematic field of Functional materials and coatings is not only seen as relevant for modernisation of economic fabric but also as a way of fostering Lithuanian's energy independence through the promotion of low-energy buildings. Lithuania has around 50 companies producing structural and composite materials and potential users of such innovations include around 500 companies in a wide spectrum of activities such and paper, rubber and plastics production, waste collection and construction. The construction sector has a relatively high weight in Lithuania's economy and exports and demand of products related to this priority are growing and are expected to increase.

Lastly, flexible technology systems is a broad priority which includes flexible product development systems, resource-efficient technologies such as tools for smart stamping, casting and cutting, processes automation and networks and systems integration solutions. The priority has around 100 potential users.

Besides the business base and potential users of innovations envisaged through AM priority development, all the four thematic priorities have relevant clusters and association that support their potential development through business and science collaboration, as illustrated in Table 5. Likewise, the scientific potential of activities related to the thematic priorities is relatively strong, and it is partly based on capacities developed previously through the Valleys.

Table 5. Planned use, relevant stakeholders and research centres for AM priority development

AM thematic priority	Clusters and associations related or involved	Main Research centers related to activities of the priority	Use of RDI thematic areas
Photonic and laser technologies	• Laser engineering and technology cluster • Lithuanian Association of lasers • Advanced lighting technology developers' association.	• Vilnius University Laser Research Centre (international access laser complex Naglis) • National natural science and technology research centre, (light and laser technology).	• High power laser systems and components • Visualization and Detection System • Laser materials processing equipment • Scientific research equipment • Laser technology industry • Technological equipment production • Medicine and Diagnostics • Energy-saving lighting systems • Plant cultivation of artificial lighting conditions • Disinfection and harmful substances detection
Functional materials and coatings	• Photovoltaic Technology and Business Association • Photovoltaics Technology Cluster • Plastics and New Materials Cluster • Space Association.	• National Centre for Physical and Technology Sciences (semiconductor physics, electronics, materials science)	• Visualization and Detection System • photovoltaics industry • Precision mechanics industry • Displays, signs and markers production • Protection against harmful environmental factors in the system

			• Environmental Monitoring • electronics • chemical industry • Lighting production
Structural and composite materials	• Smart Technology Cluster • Plastics and New Material Cluster. • MONAK, New Generation Science and Business Cluster • Secondary Raw Material Processing Technology Production and R&D Promotion Cluster • Thermal Insulation Innovation Cluster	• -Civil Engineering Research Centre at Vilnius Gediminas Technical University • National Centre of Physical and Technology Sciences • - National Marine Science and Technology Centre being established in Klaipeda University (for researching marine structure reliability).	• Energy-efficient building materials • Reinforced concrete production • Partitions industry • Woodworking industry • Lightweight constructions • Rubber and plastic products • textiles • Orthopedic products •
Flexible technological systems for product development and fabrication	• Smart Technologies Cluster • Laser and Engineering Technology Cluster • Lithuanian Laser Association, Association of Photovoltaic Technologies and Businesses • Lithuanian Engineering Industries Association (LINPRA).	• Science and Technology Centre • Technological Business Incubator of Kaunas University of Technology (mechanics and computer engineering) • National Centre of Physical Sciences and Technology (electric, electronics, and measurement engineering) • Centre for Physical Sciences and Technology. •	• Multi-purpose machines and mechanical equipment manufacturing • Power generation, transmission and distribution • Agriculture and food production • Motor, including electric and hybrid and other vehicles Production • Telecommunications Engineering Systems & Products • Health care, rehabilitation and sports preparations • Water, air or other gas supply and treatment • Chemical products • Household and professional appliances, tools and products • Electronic devices and components manufacturing • Woodworking, furniture and paper production • Environmental monitoring and protection

Source: own elaboration based on thematic priorities' Action Plans and information from www.sumani2020.lt

As mentioned previously, some of the AM thematic priorities, such as laser technologies, have been national priorities prior to the definition of the RIS3 strategy and were covered by several funding schemes before the RIS3 was defined. For instance, the High Technology Programme that was launched in 2006 aimed at supporting high-technology industry and focused on the priority areas of biotechnology, mechatronics, laser technologies, information technologies, nanotechnologies and electronics (OECD, 2016).

Yet, as acknowledged in the action plans that draft the development of the AM thematic priorities, although significant efforts have been made during the 2007-2013 EU funds periods on supporting R&D activities related to these priorities the volume of commercialization and its impact in national economy is still low and remain a challenge. Thus, the support of these priorities aims at filling this gap.

In order to address the challenges described above, actions plans have been drafted for each of the thematic priorities under the AM strategy, which frame different policy measures aimed at different objectives focused on the need for the modernisation of Lithuania's industries. Such measures, as it will be described in Sections 4 and 5, are developed by different ministries and agencies involved in the design and implementation of specific instruments that materialize the AM strategy.

To conclude, the AM strategy in Lithuania looks for contributing to the promotion of a more knowledge-intensive growth model through the use of its underused scientific capacity and the

promotion of cross-sectoral technologies that aims at tackling challenges that affect several industries and sectors of the economy, such as the low productivity and efficiency, lack of modernization and the predominance of firms that are located in low value-added parts of value chains.

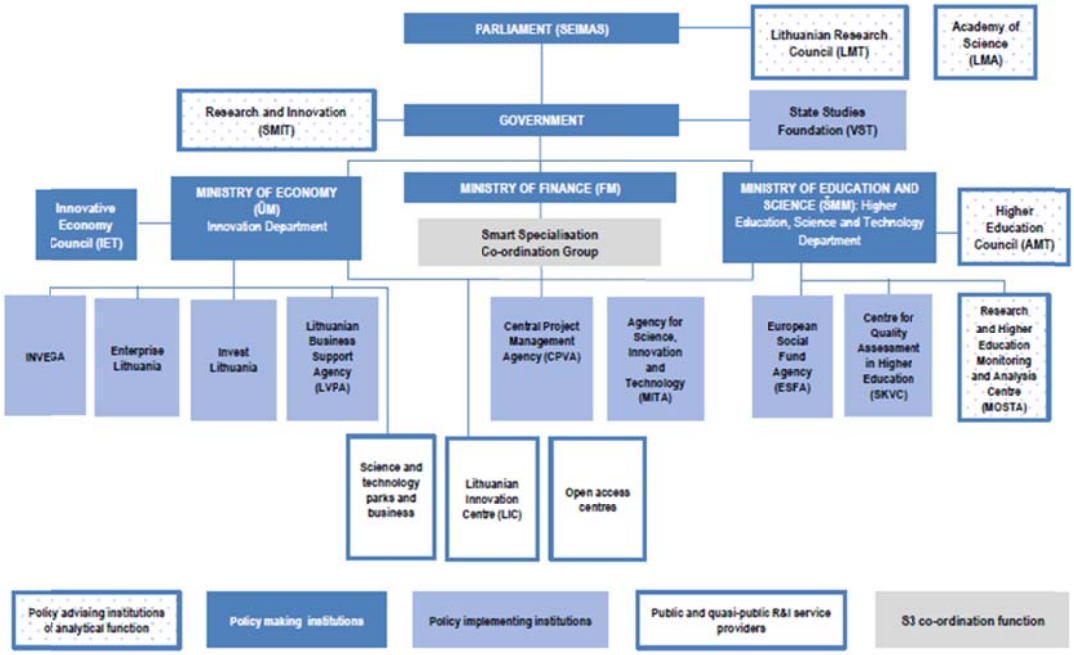
4. Governance of Advance Manufacturing Strategy

General context: innovation policy governance

The governance of innovation policy in Lithuania is complex since there are two ministries and several bodies involved in the design and implementation of policies (see Figure 2). Several reports (i.e. OECD 2016; Reimeris 2016; MOSTA 2016) agree that the fragmentation of innovation policy between a large amount of small scale agencies and their lack of clear role definition and coordination constitute a weakness to be addressed.

However, improvements have been made as mentioned previously through the creation of coordination bodies – i.e. the Strategic Council for Research and Innovation and the Smart Specialisation Coordination Group. Likewise, there is a consensus among the different studies that the process of Smart Specialisation has been a good step towards the decentralization of governance in terms of stakeholder involvement.

Figure 2. Structure of R&D and HE policy institutions in Lithuania



Source: OECD , 2016

As for the functioning of the system, in general terms legislative documents provide the policy framework which stablish the distribution of R&I funding and broad policy orientation (Paliokaite et al., 2016). Ministry of Economy (MoE) and Ministry of Education and Sciences (MoES) are the two main policy forming institutions in innovation, the first related to innovation policy and the second to research policy. Both ministries, as shown in Figure 2, have several implementation and funding agencies. The five main agencies in funding research and innovation are the Agency for Science, Innovation and Technology (MITA), European Social Fund Agency (ESFA), Research Council of Lithuania (LMT) and Central Project Management Agency (CVPA), and there are several bodies that play and advisory role.

The funding bodies serve to different types of institutions, some with more specific focus on one kind (INVEGA), others with a broader scope (MITA). More detail about the role and functions of each of the institutions or coordinating bodies are included in Table 6.

Table 6. Roles of innovation policy institutions in Lithuania

Institution	Main function and activities
Policy institutions linked to the Parliament	
Research Council of Lithuania (LTM)	Advisory body to the Parliament and Government on issues of research and researcher training. Research policy and legislation. Research funding, Evaluation of research performance International representation on science.
Lithuanian Academy of Science (LAS)	Association of scientists that provides advice to all bodies and agencies on research and higher education, culture, social development, economy, environmental protection, health care and technology.
Policy institutions linked to the Government	
Strategic Council for Research and Innovation (SMIT)	Main R&I Council and horizontal policy coordination mechanism. Stablished in 2013, chaired by Prime Minister and constituted by 25 members main ministries, agencies, research institutions and universities, business representatives and independent experts.
State Studies Foundation	A state budgetary institution, which administers financial support for students.
Policy institutions linked to the Ministry of Economy	
Lithuanian Business Support Agency	Administration of EU funds allocated to business support programmes (including those of R&D and innovation activities and infrastructure in the business sector).
Enterprise Lithuania	Support to SME, startups and promotion of exports.
Invest Lithuania	Foreign investment promotion: attraction, advise to foreign companies, management indirect public innovation support measures linked to export promotion and FDI.
INVEGA	Implementation and administration of support measures for SME: micro-loans, financial engineering, entrepreneurship promotion and financial support measures.
Policy institutions related to Ministry of Education and Science	
Higher Education Council (AMT)	Analysis and evaluation of the Lithuanian higher education development strategy, advising the Ministry of Education and Science, submitting proposals regarding the development of higher education and improvement of its quality.
European Social Fund Agency (ESFA)	Administration of EU Social Fund aid and Improvement of capacities of R&I performers: implementation of measures for development of human resources for ST and industry.
Centre for Quality Assessment in HE	Institution that makes quality evaluation and accreditation of higher education system.
Research and Higher Education Monitoring and Analysis Centre (MOSTA)	Providing recommendations on the development of the national research, higher education systems, also innovation policy; monitoring and analysis of the research and higher education systems, innovation policies; participation in development and implementation of research, higher education and innovation policies.
Inter-ministry policy institutions and bodies (MoES, MoE)	
Smart Specialisation Co-ordination Group	Coordination of Smart Specialisation strategy implementation (see next section).
Central Project Management Agency (CPVA)	Financing of public R&D infrastructure projects: administrating of large-scale investments in the development of research infrastructure; administrating international cooperation programmes (EEA Grants, Lithuania-Swiss cooperation, etc.).
Agency for Science, Innovation and Technology (MITA)	Fostering business and science cooperation; creation of a friendly environment for business, that needs innovation; administration of several measures and programmes for innovation activities in private and public sectors, specially R&D collaboration.

Source: own elaboration based on Paliokaite et al., 2016, OECD 2016 and Reimeris, 2016.

Governance and management of Smart Specialisation Strategy

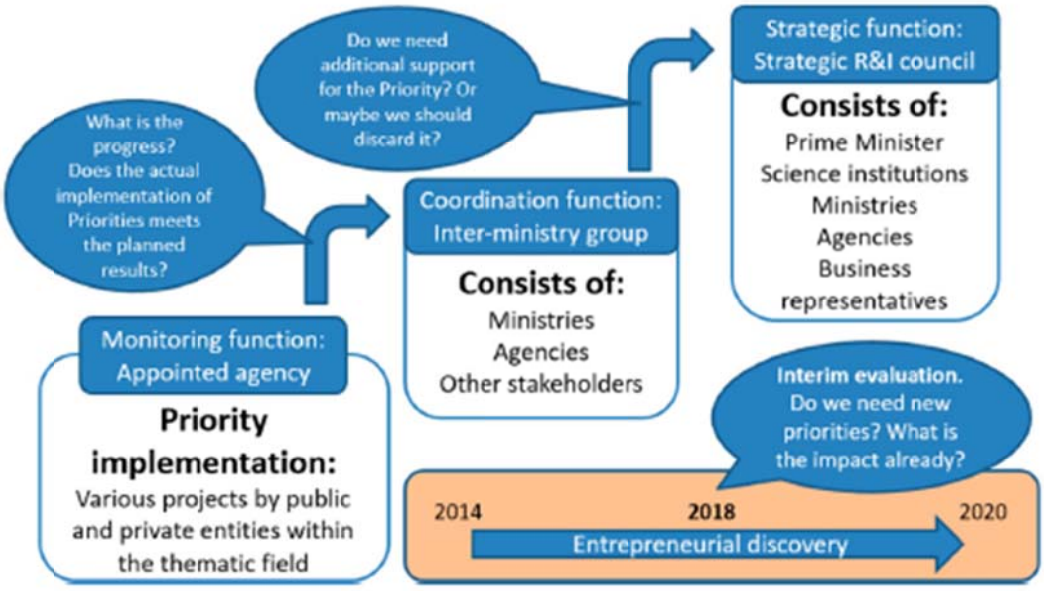
Advance Manufacturing does not have specific governance arrangements, and thus, it is embedded in the governance mechanisms of the RIS3 strategy.

The main coordinating body for the implementation of the RIS3 is the Coordination Group, which was stablished in 2014. The composition, specific functions, group organization, procedures and responsibilities are ruled by Order by Ministry of Education and Science No V576/4409 dated 2014. The Group is composed of the President's Cabinet, government, ministries of Economy and Education and Science, LMT, LVPA, MITA, MOSTA and university and business representatives. The role of the Coordination Group, which meets ad hoc based on specific issues, is the supervision of the strategy development and implementation, making decisions on financing and instruments. It is coordinated by an external Secretariat and is organized by open discussion and voting for each decision.

The creation of this group is considered to be a positive step towards the coordination and dialogue between ministries, agencies and stakeholders (OECD Review, 2016; Reimeris 2016). Moreover, according to Reimeris (2016) the Group has gone beyond their initial role focused on RIS3 and they discuss broader issues related to R&I system generally, functioning in a more "agile and lean" way than the Strategic Council for Research and Innovation, which is the main horizontal coordinating mechanism of the innovation ecosystem.

The governance of RIS3 is illustrated in Figure 3. The strategic role corresponds to the Strategic Council of Research and Innovation, which is chaired by Prime Minister and constituted by 25 government members, university, research and business stakeholders. The Council is responsible for the development of RDI priority areas. On the other hand, the ministries and their agencies are responsible for the implementation of concrete measures that are included in the action plans of each of the thematic priorities, which fund projects developed by other actors. Finally, the Coordination Group supervises the development of the implementation, and the monitoring function is divided between MOSTA and the Ministry of Economy, as it will be described in Section 6.

Figure 3. Governance of Smart specialisation implementation



Source: Reimeris, 2016

To summarize, the AM strategy in Lithuania does not have its own governance, but is embedded in the governance of the RIS3 strategy. The design, implementation and evaluation of RIS3 involves several institutions, since innovation policies in Lithuania are divided between several ministries and agencies. In addition, an inclusive governance model has been created that involves several stakeholders in both strategic and implementation roles. Although coordination between ministries and agencies remains a challenge, the governance mechanisms created for RIS3 should facilitate the coordination between innovation instruments as well as the development of the AM strategy.

5. Innovation policy-mix for Advanced Manufacturing

Lithuania does not have a specific policy mix for Advance Manufacturing. All the innovation policies and instruments of the government are horizontal. However, most instruments incorporate the contribution to RIS3 priorities among the evaluation criteria (non-restrictive). In fact, this is the most usual way to materialize the RIS3 in the regions (Gianelle et al.,2016). Moreover, some instruments do have specific budget assigned for each of the priorities, and thus, part of the budget is specifically devoted to AM priorities.

Most instruments, which are shown in detail in Table 7, are still in early stage and some of them have not been launched yet. The process of launching the instruments has still challenges to overcome since it is taking longer than usual mainly due to administrative burdens. For instance, the first instruments launched by responsible ministries took more than six months after the RIS3 strategy was approved in mid-2015 (Reimeris, 2016).

Some general features can be highlighted about the Lithuanian general innovation policy mix for Advance Manufacturing:

(1) The policy mix has a strong dependence on European Funds, since they are mostly fully funded by them.
(2) There is a mix of instruments that are targeted to demand side and to offer side, with an equilibrated mix of instruments focused at business and at research institutions. Several instruments have the goal of fostering science-business collaboration, which is one of the main challenges of innovation in general, and Advance Manufacturing in particular.
(3) The instruments cover a high range of Technology Readiness Level (TRL), ranging from basic research to commercialization of R&D results.
(4) The mix is predominated by direct economic instruments (grants). However, there are also financial instruments and projects promoted by the State.

Table 7. Instruments for Advance Manufacturing

Policy Instrument	Objective	Eligible participants	Eligible activities	Year of launch	Overall budget	Selection*
Intellect. Science-business cooperation projects	Financing high-value business R&D projects	1) private entities excluding science and education entities 2) in some occasions public entities, if engaged in R&D; excluding entities of science and education	1) R&D activities, 2) Initial business investments in developing and/or expanding the R&I infrastructural capacities, and if it is not publicly accessible, 3) Certification of new products or technologies and related activities	2017, launched	139 M	PBC
Innovation vouchers	Financing low-value business R&D projects	Private organizations	1) vouchers for technical feasibility studies, 2) vouchers for early-stage R&D projects	2017, launched	10 M	PBC
Innopatent	Facilitation and funding in patenting activities	Private organizations	1) International patenting, 2) international design registration	Not launched	3 M	CPS
Smartinvest LT+	Encouraging FDI in R&D and R&D capacity development	A private organization established by a foreign investor (company), which is directly controlled by a foreign company or investor	1) Direct foreign investments into R&D activities, 2) Direct foreign investments, which establishes or expands company's R&I infrastructure	2017, launched	43 M	PBC
Technoinvest	Financial support for companies, that need financing for kick-off of R&D activities.	Companies, which are active or are planning to start R&I activities in the priority fields of Lithuanian RIS3	Realization of the financial measures targeted to startups, spin-offs and other companies, which engage or are planning to engage in R&I activities in the priority fields of the Lithuanian RIS3	2017, launched	17,6M	FM
Commercialization and internationalization of R&D results	Helps researchers and students to commercialize ideas and bring financial benefits to institutions of science and education.	1) Institutions of science and education, 2) private entities, among which stakeholders are institutions of science and education	1) Commercialization of R&D results, ideas, and financial support to innovative start-ups and spin-off companies, 2) Internationalization of R&D activities	Not launched	13 M	PBC
Promotion of activities of centres of competence and centres for innovation and technology transfer I	Addresses knowledge and technology transfer activities in research and higher Education institutions	Universities Research and technology centers Centers of competence	promotion of activities of centres for innovation and technology transfer	2017 launched	14,5M	PBC
	Support for researchers and students in identification and promotion of ideas with commercial potential.	SMES + Big companies Research and higher education institutions University hospitals	promotion of activities of centres of competition	2017, launched	23,1M	PBC
Prie-selling purchases LT (Ikiprekybiniai pirkimai LT)	Increasing the demand (and funds) for R&I production	Purchasing organizations, which have the action approved that it corresponds with the instrument's requirements	An encouragement of innovations by executing a purchasing of a product (process, service, materials, etc.), which is not yet existent in the market or exists, but requires an improvement. The product has to address socio-economic societal challenges.	Not launched	29,4M	PSP

Policy Instrument	Objective	Eligible participants	Eligible activities	Year of launch	Overall budget	Selection*
Prie-selling purchases LT (Ikiprekybiniai pirkimai LT)	Increasing the demand (and funds) for R&I production	Purchasing organizations, which have the action approved that it corresponds with the instrument's requirements	An encouragement of innovations by executing a purchasing of a product (process, service, materials, etc.), which is not yet existent in the market or exists, but requires an improvement. The product has to address the socio-economic societal challenges.	Not launched	29,4M	PSP
Expansion of the competence centers	Development and improvement of the infrastructure to provide better material base for the development of competences	Institutions of science and education	An expansion of the R&D material base for science-business cooperation in the institutions of science and education (the creation and expansion of the infrastructure of the competence centers)	Not launched		PBC
Inogeb LT	To build MITA's capacity in facilitating R&D related activities of the supported organizations	Agency for Science, Innovation and Technology (MITA)	Mainstreaming the innovations and facilitation of cooperation, communication, etc.	2017 launched	8,7M	PSP
Smartparkas LT	Establishing and supporting the economic free zones	1) organizations controlled by city municipalities, 2) industry parks and free economic zones, 3) economic entities, controlled by the state	1) investment into infrastructure of industry parks and free economic zones, where companies engage in the R&I activities, 2) marketing operations of the industry parks and free economic zones	2017 launched	13M	PSP
Smart FDI	Encouraging FDI in R&D and R&D capacity development	A private organization established by a foreign investor (company), which is directly controlled by a foreign company or investor	1) Direct foreign investments into R&D activities, 2) Direct foreign investments, which establishes or expands company's R&I infrastructure	Not launched		CPS
Inoklaster LT	Supporting and developing clusters	Organizations managing clusters	1) cluster management and maintenance, 2) investment to develop cluster infrastructure	2016 launched	26M	PBC
InoConnect	Capacity building in international participation and experience	1) privately-owned organizations, 2) public organizations (science and technology parks, cluster coordinators)	Participation in the events international R&D initiatives	2017 launched	1,4M	CPS
Purposive scientific research in the field of smart specialization	Helps high-level groups of researchers, scientists from abroad, parallel laboratories to develop the research aimed at developing the results relevant to R & D activities, which could then be commercialized.	1) Institutions of science and education, 2) University hospitals	(1) the research carried out by high-level groups of researchers, (2) the attraction of scientists from abroad to carry out research, also (3) the R & D activities of parallel laboratories, aimed at developing the results relevant to R & D activities, which could then be commercialized	2017		PBC

Source: provided by MOSTA

*Selection criteria:
PBC – Project based competition / CPS - Continuous project selection / PSP – Planning of the state projects / FM - Financial measures

Instrument-mix selected for the Manumix project

The policy mix selected for the Manumix project is composed by the following instruments:

Table 8. Lithuania's Policy-mix for Manumix

	No. 01.2.2-CPVA-K-703 Promotion of Activities of Centres of Competence and Centres for Innovation and Technology Transfer, which is divided in two types of calls:
(I)	promotion for innovation and tech. transfer action
(II)	promotion of activities of centres of competence
(III)	No. 01.2.2-MITA-K-702 Commercialization of R&D
(IV)	No. 01.2.2-LMT-K-718. Purposive scientific research in the field of smart specialization

Source: own elaboration

The last instrument has been included as the result of reflections made within the first stakeholder meeting hold after the analysis of the policy mix had been already carried out. For this reason, the reminder of the report focuses only in the first three instruments. However, the fourth instrument will be incorporated to further analysis, learnings and actions taken through the project.

The instruments are fully funded by ERDF fund and they are included in Priority 1 Axes of the Operation Programme "Strengthening Research and Development and Innovation". This priority aims at "promoting, in a comprehensive manner, effective transfer of knowledge important for the development of new products and the commercialization of RDI results in business-science and other (including international) partnerships; (…) and encouraging higher education institutions to be more active in commercializing RDI results".

The instruments included in the selected policy mix for Manumix, which are shown in more detail in Table 9, share the following characteristics:

- They are horizontal instruments, not specific for AM. However, they are targeted to the development of RIS3 priority areas, and they do have some funding assigned to AM priority area, which is established in the selection criteria of projects funded by these programmes.
- The instruments are mainly focused on research entities and universities.
- The three are direct instruments, that is, grants.
- The instruments try to cover higher TRL, 3 to 9.

Table 9. Objectives, beneficiaries, financed activities, budget and year of launch of the instrument mix

Policy Instrument	Objective	Eligible participants	Eligible activities	Budget	Launch year
Promotion of act. of centres of competence and centres for innovation and technology transfer (I)	The instrument addresses knowledge and technology transfer activities in research and higher Education institutions	1) research and higher education institutions, 2) university hospitals	Funding of staff, its competence development, international and domestic training, various functions of technology transfer. Briefly, hires and trains staff for the tech transfer tasks.	14,5 M	2017
Promotion of act. of centres of competence and centres for innovation and technology transfer (II)	Support for researchers and students in identification and promotion of their ideas with commercial potential.	1) research and higher education institutions, 2) university hospitals	expenses related to consultancy provisions: tech transfer coordination, invention exploration, management, marketing, commercialization, etc. Briefly, supports framing a business plan.	11,6 M	2017
Commercialization of R&D (III)	Helps researchers and students to commercialize their ideas and bring financial benefits to the institutions of science and education.	1) institutions of science and education, 2) private entities with science and education stakeholders	The instrument's goal is to facilitate development of a R&D results from the idea to prototype manufacturing; the instrument covers idea development, R&D, creation of prototypes, testing, and pre-final manufacturing.	10,1 M	Not launched

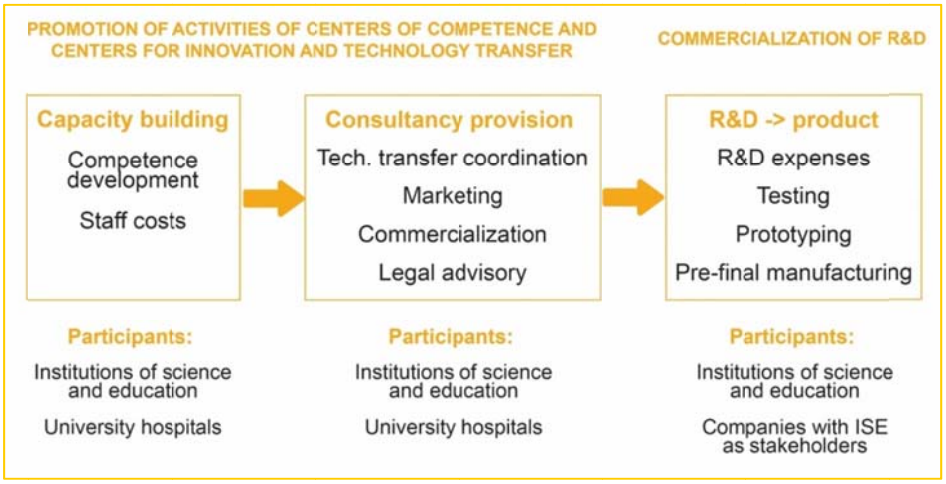
Source: provided by MOSTA

Interactions

The instruments of the policy mix have different and complementary objectives. Two of the instruments aim at fostering technology transfer by different means: the first one, by enabling capacity building of institutions of science and education, the second one by financing consultancy provision. The third instrument addresses mid to late stages of TRL and finances activities to foster commercialization of results.

Hence, the policy mix selected addresses quite broadly some of the main challenges of AM, such as incrementing technology transfer from HIE institutions, commercialization of research outputs and use of scientific infrastructure.

Figure 4. Activities and beneficiaries of the policy mix (presented my MOSTA in Learning Journey, May 2017)

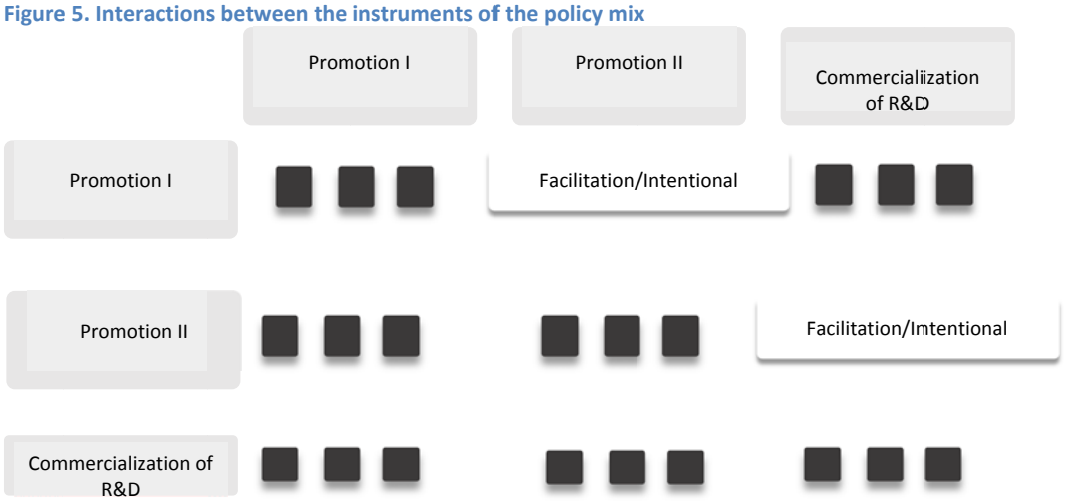


Source: presentation made by MOSTA in Learning Journey, May 2017

The policy mix has been designed intentionally in order to foster interactions between the instruments, specifically a facilitation type of relationship. Facilitation refers to the relationship of two instruments in which the results of one instruments enable the other instrument to function better (Taeihagh et al., 2013).

The interactions between the instruments of the selected policy mix for Manumix are illustrated in Figure 5.

Figure 5. Interactions between the instruments of the policy mix



Source: own elaboration

As we can observe, the instrument Promotion of Activities of centers of competence and centers of innovation and technology transfer (Instrument I) facilitates the functioning of the instrument Promotion of Activities of centers of competence and centers of innovation and technology transfer (Instrument II). That is, instrument I finances capacity building that allow to foster potential R&D activities that may be commercialized. Results of instrument II, that is, activities with commercial potential could be benefited from the Instrument Commercialization of R&D (Instrument III), which is aimed at measures to commercialize the R&D output.

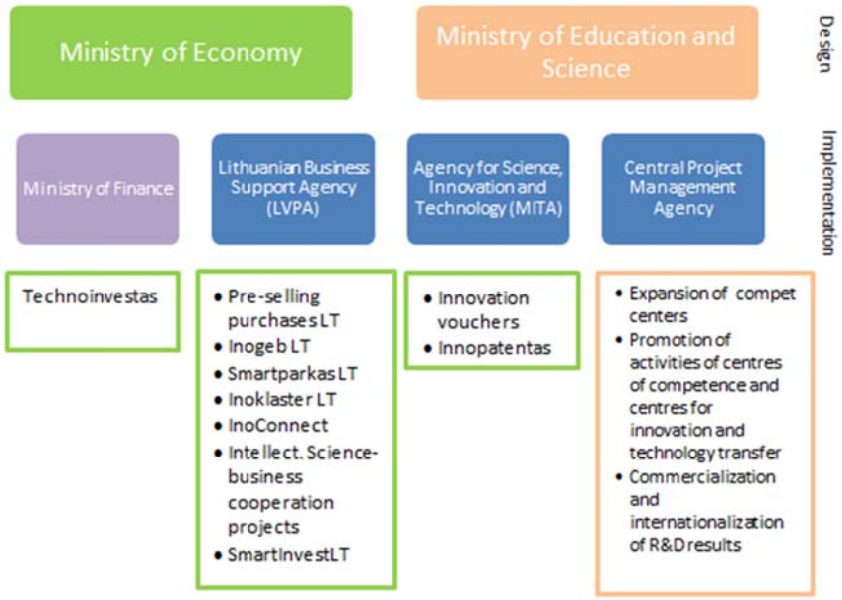
Nevertheless, it must be mentioned that these interactions respond to the design rationale stablished in the Manumix policy mix. So that, once the instruments have been implemented it is still a future task to assess how these interactions work in practice from the beneficiaries' point of view or rationale in order to choose the best mix that fits their needs.

Governance of the policy mix

There is not any specific governance arrangement stablished for each of the priorities within the RIS3 or specific instruments. Hence, the general governance of the policy mix is embedded in governance of RIS3 explained in Section 4.

The implementation of the AM priority area involves two ministries and several agencies that are in charge of the support measures and policy instruments, as shown in Figure 6.

Figure 6. Public institutions involved in design and implementation of AM policy mix



Source: own elaboration based on information provided by MOSTA

The three instruments of the policy mix of Manumix project are administered by Central Project Management Agency, an inter-ministerial agency. Two ministries are involved in the design process. The Ministry of Education and Science makes the design of the instrument with participation of stakeholders and a joint committee that approves the selection criteria for the instruments. The Ministry of Finance approves and provides the funding for the instruments. Evaluation is carried out by several different organizations, as illustrated in Table 10.

Table 10. Overview of governance of instruments of the Manumix policy mix

Stages	Respons.	Brief description of the process	Other stakeholders involved
Design of individual instruments	MoES	Ministry of Education and Science frames priorities, goals, actions, perspective applicant groups, etc. in discussion with several stakeholders. Selection criteria are approved by a joint committee of various public and social partners. Ministry of Finance approves and provides funding.	Ministry of Finance Several stakeholders Joint committee of various public and social partners
Implementation	CPVA	CPVA manages the administration of the calls	
Evaluation of individual instruments	CPVA	Individual instruments are evaluated by CPVA with the help of external experts. Besides, instruments will be evaluated as part of RIS3 evaluation, by MOSTA and MoE and MoF.	Help of external experts; MOSTA; Ministry of Economy; Ministry of Finance
Coordination/management of the innovation policy-mix	RIS3 Council	Program managers have regular meetings. Besides, as part of RIS3 strategy, overall coordination is made by the RIS3 council	Those involved in RIS3· management and monitoring

Source: own elaboration

6. Evaluation practices and management

The monitoring and evaluation of R&D has taken relevant steps in the last few years in Lithuania, especially in regard to smart specialisation strategy (Paliokaite et al., 2016; OECD Review, 2016). Mostly based on MOSTA, the country has designed an evaluation system that includes monitoring exercises and ex-post evaluation through a range of types of analysis such as impact analysis, foresight exercises, and output indicators. The specific evaluation procedure for RIS3 strategy and each of the thematic priorities is ruled and detailed in governmental Order "Procedure for monitoring the development of the priority areas of research and (socio-cultural) development and innovation (smart specialisation) and the implementation of their priorities and for promoting collaboration between businesses and science and study institutions" of 2014. Main features and types of evaluation presented in the order are illustrated in Figure 7.

The evaluation of RIS3 strategy and thematic priorities is divided between MOSTA and the Ministry of Economy. There are mid-term and final evaluation terms planned, in which, results of funded projects and individual instruments, their efficiency, outputs of thematic priorities, economic impact of priorities and the strategy will be evaluated. Each of the 20 thematic priorities of RIS3 strategy (4 priorities belonging to AM) and the instruments related to them have their own set indicators established for mid-term and final evaluation. Examples of such have been included in the Appendix 2 and Appendix 3 of this report.

On the other hand, evaluation is conceived as a policy learning strategy that goes beyond accountability purposes, since it includes mechanisms for the introduction of evaluation results in the policymaking process. Specifically, the results of evaluation are reported to the Smart Coordination Group who has the role of assessing the progress and suggest changes in case targets are not being achieved.

Besides, evaluation results are widely disseminated in Lithuania. Monitoring of allocation of funds and degree of implementation of individual instruments is open to the public on the web page devoted to the Operational Programme. Besides, MOSTA carries out evaluation reports that are published and presented in seminars to stakeholders.

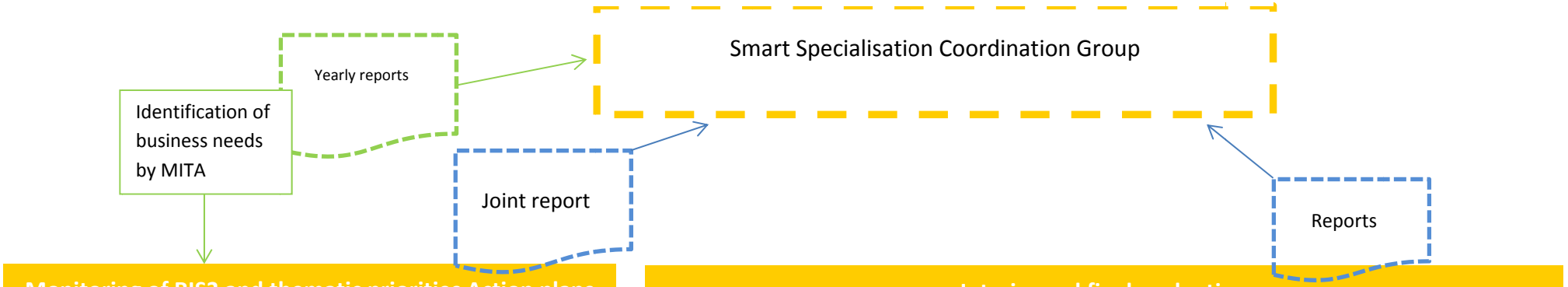
To conclude, although Lithuanian RIS3 has stablished a detailed evaluation system, as regards to the Manumix policy mix, and more generally, to AM policy mix, evaluation of interactions and synergies of instruments and measuring long term socio-economic impact may be highlighted as challenges of the evaluation system, as well as how to efficiently and timely incorporate results in the policy making process.

Table 11. Overview of evaluation activities covered for individual instruments, AM priorities and RIS3

Scope of evaluation	Purpose	Ex-ante evaluation	Monitoring	Ex-post evaluation
Individual instruments of the policy mix	Accountability Learning	Made by Ministry of Finance and thematic Ministries *The ex-ante evaluation includes strategic programming documents, country infrastructure, sectoral priorities and trends(forecast, case studies, surveys, panel discussions)*	Made by Ministry of Finance and thematic Ministries *Monitoring implementation and efficiency of operational programmes' priorities and policy instruments*	Made by Ministry of Finance and thematic Ministries *Progress and impact assessments towards result, outputs, impact of operational and sectoral programmes, policy instruments*
Thematic priorities of AM Strategy – RIS3		Coordinated by MOSTA; obligated by Ministry of Economy and Ministry of Education and Science *It was a complex process based on extensive studies, expert panels and stakeholder involvement to define priorities*	Made by MOSTA and Ministry of Economy *There are biannual reports on progress and the achievement of planned results: evaluation of output, results, implementation degree and efficiency, and context*	Made by MOSTA and Ministry of Economy *Progress and impact assessments towards result, outputs and impact of priorities/strategy*

Source: provided by MOSTA

Figure 7. Activities in evaluation of RIS3 strategy



Monitoring of RIS3 and thematic priorities Action plans

MOSTA	Ministry of Economy
Analysis of: • information on the **implementation** of projects and RDI policy measures research situation • **efficiency** of measures of individual priorities or a combination of such measures provided in the RDI priority action plans;	• **implementation** of projects financed by the MoE • situation of the **national economy** in relation to the RDI impact; • **efficiency** of the RDI policy measures and/or a combination • changes in the development of the **economic sectors** as well as obstacles to the development;

MOSTA & Ministry of Economy

- **impact** of implementation priorities **on sectors** of the economy;
- development and trends of science and technologies and in the factors of social, economic and other environments that can affect the RIS3
- **impact of the implementation of the study and RDI policy measures on the implementation of the RDI priorities**;
- ministerial plans for the announcement of calls for proposals to ensure **timely implementation**.

Interim and final evaluation

Interim Assessment (2018)	MOSTA + MoE	Final Assessment (2020)

Assessment ACTION PLANS

- **Determine progress** of and opportunities for the implementation of RDI priority (according to **achievement of targets**
- **Asses: (1)** results of **implementation measures** under the RDI priority action plan; (2) the **results of the projects** implemented thereunder
- **determine the RDI priority potential for further development** (based on info of technology development and trends and socio-economic developments)

Evaluation/Impact of EACH ACTION PLAN

- **RDI** priority implementation status **(achievement of targets)**
- **assess the** impact **of the implementation of the RDI priority** action plan on the implementation of the relevant RDI priority**,** development **of the relevant RDI** priority area**,** RDI development**, and** competitiveness **of the economy.**

Impact of All Priorities in RDI and Competitiveness

- Final result of the achievement RIS3 strategic goal, objectives and tasks
- **economic impact** of RIS3;
- assess the **impact** of the RIS3 **on the response to the key social and economic challenges**.

Source: own elaboration based on Lithuanian Government order

7. Conclusions

Lithuanian Advanced Manufacturing Strategy is focused on the development of technologies that will address main challenges that Lithuania currently faces, namely Lithuania's business low productivity levels and a shortage of business – research collaboration for generation and implementation of technology. More specific challenges include increasing the innovation output, widening the scope of measures towards new enterprises, and incrementing the use of scientific infrastructure, technology transfer from HIE institutions and commercialization of research outputs.

The AM strategy is focused in four thematic priorities that have the potential for transforming several existing sectors in Lithuania's industrial fabric. The priorities are: (1) photonic and laser technologies; (2) functional materials and coatings; (3) structural and composite materials; (4) flexible technological systems for product development and fabrication.

The development of thematic priorities is materialized in a set of horizontal policy measures and instruments that are not exclusive for any thematic priority. However, there is some verticalization of the instruments since some of them have specific budget for AM priorities and most of them include RIS3 priorities in the selection criteria.

The general policy mix is composed of mainly economic instruments and direct grants. They are directed both to businesses and to research, education and scientific institutions. The mix also includes other instruments aimed at improving the linkages of the system, such as clusters and technology parks. Several instruments address the challenge of improving business-science collaboration and technology transfer.

Precisely, the instrument mix selected for Manumix is framed under the improvement of linkages between science and business. Three[3] instruments have been selected, that specifically focused on research institutions and competence centers aim at improving the capacities of such institutions in technology transfer and commercialization of R&D results. From a design rationale, they have a facilitation type of interaction. Combinations from beneficiaries' perspective cannot be assessed since the instruments have been recently launched, in 2017.

Indeed, there has been a delay in launching all instruments due to coordination and governance issues. This constitutes a weakness since there has been a quite long period with no funding for innovation. The instruments of the policy mix are designed by the Ministry of Education and Science and implemented by one agency among the many existing implementing institutions in Lithuania.

Although it is too early to assess evaluation practices of the policy mix and the RIS3 in general, there is a quite comprehensive evaluation system organized both at instrument level and especially at RIS3 and thematic priority levels. Evaluation includes a wide range of activities covering output, result, monitoring and context evaluation trough quantitative and qualitative methods. Evaluation results are envisaged to be included in the decision-making process with learning and policy reorientation purposes. However, evaluation of the interactions of the policy mix is still a challenge; a challenge that Lithuania shares with many other regions.

[3] Once the analysis of the three instruments was carried a new instrument was included in the policy mix for Manumix Project. Although this report does not include such instrument in the analysis, it will be incorporated for the learning process

List of government documents

Operational Programme:

- Operational programme for the European Union funds' investments in 2014-2020

Smart specialization strategy:

- Approving the priority areas of research and (socio-cultural) development and innovation development (smart specialization). 14 october 2013, no 951
- Resolution on the approval of the programme on the implementation of the priority areas of research and (socio-cultural) development and innovation (smart specialisation) and their priorities. 30 april 2014 no 411

Advanced Manufacturing Strategy:

- Action Plan for the Priority "Photonic and laser technologies" OF the PRIORITY AREA of Research and (Socio-Cultural) Development and Innovation (Smart Specialisation) and their Priorities "New production processes, materials and technologies. Approved by Order No. V-133/4-88 of the Minister of Education and Science and the Minister of Economy and Science of the Repubic of Lithuania of 20 February 2014.
- Action Plan of priority "Functional materials and coatings" of "new production processes, materials and technologies" research and (socio-cultural) development and innovation development priority area. Approved by Order No. V-133/4-88 of the Minister of Education and Science and the Minister of Economy and Science of the Repubic of Lithuania of 20 February 2014.
- Action plan of the priority structural and composite materials of the priority area of new production processes, materials and technologies of the research and (socio–cultural) development and innovation (smart specialisation). Approved by Order No. V-133/4-88 of the Minister of Education and Science and the Minister of Economy and Science of the Repubic of Lithuania of 20 February 2014.
- Action Plan of the priority "Flexible technology systems in product development and production" of the priority area of research and experimental (socio-cultural) development and innovation (smart specialization) "new manufacturing processes, materials and technologies". Approved by Order No. V-133/4-88 of the Minister of Education and Science and the Minister of Economy and Science of the Repubic of Lithuania of 20 February 2014.

RIS3 evaluation:

- Order concerning approval of the procedure for monitoring the development of the priority areas of research and (socio-cultural) development and innovation (smart specialisation) and the implementation of their priorities and for promoting collaboration between businesses and science and study institutions. 15 december 2014 no v-1218/4-911

RIS3 Coordination Group:

- Order: research and experimental (social, cultural) development and innovation development priorities coordinating the implementation of constitution and its rules of procedure approval 2014. 20 june. No no. V576/4409

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Appendixes

Appendix 1. Evaluation Criteria of the RIS3 programme

Objective	Evaluation criterion	Value of criterion			Responsible institution
		baseline (year))	2017	2020	
Strategic objective of the Programme					
Increase the impact of high value added, knowledge-intensive and highly-qualified-labour-intensive economic activities on the GDP and structural changes of the economy by means of the RDI decisions	total expenditure for R&D (as a % of GDP)	0.9 (2012)	1.2	1.9	Ministry of Education and Science of the Republic of Lithuania ('MoES')
	business expenditure for R&D (as a % of GDP)	0.24 (2012)	0.5	0.9	Ministry of the Economy of the Republic of Lithuania ('MoE')
Objectives of the Programme					
1. Create innovative technologies, products, processes and/or methods and, using the outputs of these activities, respond to global trends and long-term national challenges	share of turnover from new products' sale on the market and in the entity as part of total business turnover (as % of total turnover)	6.64 (2010)	10	14	MoE
	share of small and medium-sized businesses introducing new products and processes (as a % of all SMEs)	21.39 (2010)	30	40	MoE
	employment in knowledge-intensive sectors (%)	9 (2010)	11	13.6	MoE, MoES
2. Increase competitiveness of Lithuania's legal entities and their opportunities for establishing in global markets – commercialisation of knowledge created in the implementation of the RDI Priorities as well as knowledge created in developing the RDI Priority Areas otherwise and using the unique synergy arising from the collaboration of science and businesses, economic entities and other public and private sector entities	impact of advanced and moderately advanced technology products on the trade balance (export/import, %)	- 0.85 (2012)	0	1	MoE
	export of knowledge-intensive services (as a % of total exports)	12.5 (2012)	24	37	MoE
	revenues of high education and research institutions from intellectual activities (as a % of total revenues)	no data	0.1	0.2	MoES

Appendix 2. Evaluation criteria for Action Plan Photonic and Laser Technologies (adapted from Action Plan)

Actions and measures	**Evaluation criteria for actions and measures**	**Values of criteria**	
		2018	**2023**
1 action. To establish and introduce on the market new technologies, products, processes, methods:	Established prototypes (concepts) of products, services or processes within 3 years after implementation of the project (pcs.)	**35**	**79**
1.1 measure. Joint academic and business projects, contributing to the implementation of the smart specialization	Number of joint projects by business and research and study institutions (pcs.)	4	10
	Number of certified products (pcs.)	1	3
1.2 measure. Support for the establishment and development of a company's R & DI infrastructure and for development of DI activities (,,Intelektas LT")			
1.3 measure. Support for RDI of the enterprises in submitting innovation vouchers ("Innovation voucher ") to			

the interstate network.			
1.4 measure. Support for international patenting processes of inventions and designs (“InoPatentas LT “)			
1.5. Support for certification of new products and technologies and for performance of tests in labs and in real conditions (”Inosertifikavimas“)			
2 action. To promote development of spin-off businesses, high potential companies:	New companies, which received investments within 3 years after project implementation (pcs.)	**1**	**2**
2.1 measure. Support for providing advisory services of innovations ("Inogeb LT")	Number of companies, receiving financial support of some other kind than subsidies (pcs.)	1	3
2.2 measure. Support for companies, performing RDI, by financial means ("Technostartas LT", "Koinvest")			
3 action. To promote clustering, integration to the international value - adding networks and investments to SR & ED and innovations:	New members of the cluster within 3 years since the commencement of the project implementation (pcs.)	**1**	**2**
	Private investments raised for the RDI area in accordance with the trends of smart specialization within 3 years after the Project implementation (thous. Euro)	**42 353***	**95 295***
3.1 measure. Support for the cluster operation (”InoKlaster LT“)	Number of legally binding deals with international partners (pcs.)	4	10
3.2 measure. Support to participate in international RDI initiatives (”InoConnect LT “)			
3.3 measure. Support for investments into the cluster (”InoKlaster LT+ “)			
3.4 measure. Support for attracting direct foreign investments in the area of RDI ("Smartinvest LT")			
3.5 measure. Support for direct foreign investment in the area of RDI ("SmartInvest LT+")			
4 action. To promote cooperation between research and business, transfer of knowledge and technology, aiming at commercializing SR & ED results:	Orders of business R&D, under execution by Research and study institutions (thous. Euro)	**524**	**704**
	Intellectual activity performance income, gained by the Research and study institutions (thous. Euro)	**6,1**	**7,9**
4.1 measure. Creation and development of the material basis for joint research and business projects in scientific and educational institutions (creation and development of the infrastructure for excellence centres)	Patent applications (pcs.) Doctoral studies, performed together with business entities, (Number of doctoral students)	3 1	10 2
4.2 measure. Support for implementation of the R&D activities, performed by the centres of excellence.			
4.3 measure. Implementation of the market –oriented education and business projects through the interstate network.			
4.4 measure. Promotion of commercialization of R&D performance results in research and study institutions.			
5 action. To strengthen the potential of research and study institutions and the capacity to establish and commercialize knowledge and to prepare specialists:	External users from foreign research and educational institutions, Lithuanian and foreign business enterprises, using updated open-access research infrastructure (funds received from these users (thous. Euro)	**81**	**105**
	Number of publications in frequently cited scientific periodicals (pcs.)	**241**	**277**
5.1 to 5.22 measures	Number of researchers, working on the improved base of the research infrastructure. (full-time equivalents) Number of new spin-off companies in the research and education institutions (pcs.)	70 0	92 2

Appendix 3. Monitoring indicators for Instruments of Manumix policy mix

Instrument: Promotion of act. of centres of competence and centres for innovation and technology transfer (I and II)

Source: http://www.esinvesticijos.lt/lt/patvirtintos_priemones/kompetencijos-centru-ir-inovaciju-ir-technologiju-perdavimo-centru-veiklos-skatinimas. Accessed in 2017/05/29

The monitoring indicator code	Monitoring Indicator	Unit of measurement	The intermediate value in 2018. 31 December	Final value 2023. 31 December
RS304	"Entity to finance higher education and research institutions in R & D expenditure of the total cost"	interest	5	7
PS305	"Investments have received higher education and research institutions submitted patent applications"	Number	0	5
PS396	"Implementation of R & D projects"	Number	0	15
PN737	"Investments have received higher education and research institutions of the financial agreements with companies increase in value"	Number	0	20
PN741	"Investments have received university hospitals in the patent application"	Number	0	2

Instrument: Commersialization of R&D results

Source: http://www.esinvesticijos.lt/lt/patvirtintos_priemones/mtep-rezultatu-komercinimo-ir-tarptautiskumo-skatinimas. Accessed in 2017/05/29

The monitoring indicator code	Monitoring Indicator	Unit of measurement	The intermediate value in 2018. 31 December	Final value 2023. 31 December
RS304	"Entity to finance higher education and research institutions in R & D expenditure of the total cost"	interest	5	7
PB205	"New companies receiving investments, the number of"	Companies	10	70
PB226	"List of cooperating with research institutions, the number of"	Companies	12	40
PS305	"Investments have received higher education and research institutions submitted patent applications"	Number	0	5
PS396	"Implementation of R & D projects"	Number	6	40