ERAWATCH COUNTRY REPORTS 2010: Lithuania

ERAWATCH Network – Public Policy and Management Institute

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Executive Summary

Lithuania is a small single region country with less than 0.7% of the total EU27 population. The country's economy, which had grown strongly since 2002, experienced the European Union's second-worst recession in 2009. GDP per capita fell by 15% in 2009 and stood 64% below the EU27 average. Unemployment has risen sharply up to 18.3% in the second quarter of 2010. The economy contracted once again in the first quarter of 2010 after the closure of the country's only nuclear power plant, but the rest of the year showed early signs of recovery.

The 14 universities form the backbone of the Lithuanian research system, while the majority of governmental research institutes merged with these universities in 2009-2010. Public funding for research has increased more than three fold since 1995; however it fell by 14% in 2009. Lithuania's gross domestic expenditure on R&D was 0.84% of GDP, well below the EU27 average. The higher education sector is the main R&D performer with 0.64% of GERD/GDP and 56.6% of total R&D in 2009, while the investments of the business enterprise sector remained as low as 0.2% of GDP. The stable low-medium tech dominated structure of private knowledge demand, low numbers of newly born knowledge-intensive companies and low rate of entrepreneurship in general make it difficult to reach the national commitment to the 2% target, especially on the private side. Knowledge and technology intensive sectors remain small and the extent of their development does not indicate that Lithuania is getting closer to the EU average in this field.

Since joining the EU in 2003 RTDI policy has rapidly grown in importance. The breakthrough was achieved when the Government reached agreement to invest a significant amount of funding (10% of the total SF for 2007-2013) in research. A versatile mix of new policy instruments and competitive research programmes was planned; most of investments started in 2010. Moreover, the Government put emphasis on the interlinkages of the knowledge triangle policies by approving the broad-based Lithuanian Innovation Strategy 2010-2020 and by establishing the Science, Technology and Innovation Agency. The policy mix in place for promoting private investments in R&D has not developed much since 2009, except for the introduction of the 'innovation voucher' scheme. The Government's ability to strengthen the budget for research and innovation remains constrained by the State budget crisis.

Lithuania is among EU27 leaders in producing tertiary education graduates, including those with science and technology education. Nevertheless, the country lags substantially behind both the leading and the catching up EU27 countries with regard to the capacity to produce and commercialise knowledge. The number of patents in Lithuania is not sufficient even in view of the level of its economic development. Weak effectiveness of the research system gave impetus for the extensive research and higher education sector reform with a re-focus on research and studies quality. The reform gained acceleration in 2009-2010: student vouchers, performance based research funding and peer review based external evaluation of research institutes were introduced; network of research institutes optimised; HEIs gained full autonomy, and the governance of HEIs is under reform.

Knowledge Triangle

Despite the policy mix contributes to significant resource increases in public R&D, the extent of leverage on private R&D might be limited and insufficient. The majority of funds are either targeted at public R&D capacity and excellence (at least 40% of total investments), or focus on the increase of private R&D in existing innovative companies. Hence, the 'supporting the winners' strategy is implemented, which does not fully correspond to the existing structural barriers to private R&D investments, such as limited share of knowledge intensive companies in the economy. Moreover, the government had paid little attention to the creation and facilitation of innovative markets, including those within existing governmental investment programmes that target energy, health care, and other important sectors. Limitations of the policy mix might hamper achievement of the BERD/GDP targets. The following table gives a short assessment of the interaction between different policies in place in the knowledge triangle.

Effectiveness of the knowledge triangle policies in Lithuania

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	• More emphasis on performance based funding and increased share of competitive funding. • Introduction of external evaluation and self-assessment of research institutes. • Reduced fragmentation of the public research system by optimisation of research institutes network.	• Increased emphasis on research performance and increased share of competitive funding will in the medium term increase the quality of research. • Lack of co-ordination between research and innovation governance systems. • Lack of government policy on cross-border research collaboration and internationalisation of research. • Lithuanian research system remains to a large extent closed to other ERA countries and third countries.
Innovation policy	• Broad-based Lithuanian Innovation Strategy 2010-2020 and its Action Plan for 2010-2013 map the RTDI policy mix and establish Government's commitment and priority to promotion of innovations, put emphasis on interaction of knowledge triangle policies. • Newly established Science, Technology and Innovation Agency aims at reducing the fragmentation of research and innovation support system at the medium term period. • Introduction of 'innovation vouchers' scheme.	• LIS 2010-2020 introduces systematic approach towards innovation promotion. Versatile innovation policy mix secured for 2007-2013; focusing also on non-technological innovations. • Funding for fostering HEI-industry linkages and cluster policies is not substantial enough. • The policy mix focuses on supporting 'the winners', too little emphasis on firms not yet engaged in R&D, spin-offs and fostering entrepreneurship in general. • Imbalance of innovation supply and demand side measures, limited use of public procurement as a driver for innovation. • Fragmentation of innovation and research support system and poor inter-departmental coordination remains a problem.

	Recent policy changes	Assessment of strengths and weaknesses
Education policy	• HEIs governance reform (e.g. the power of the boards increased). • Increased autonomy of HEIs to use their assets, determine salaries of researchers etc. • Recommendations on IP policies and strategies at HEIs introduced.	• Introduction of quasi-market instruments, autonomy of universities and governance reform are expected to lead to better market demand and supply match and increased quality of studies. • Lack of support for building strategic capacities at universities, including training and guidance in setting knowledge transfer policies and KTOs.
Other policies	• FDI policies increasingly focused on attracting mobile R&D investment (at least two major R&D investments generated in 2009-2010 in ICT and biotechnologies).	• Business climate remains largely unfavourable for private RTDI investments. Economic policy does not favour fostering of entrepreneurship. The impact of RTDI policy can only be enhanced if framework conditions for RTDI activities are significantly improved.

European Research Area

Lithuania broadly supports the aims of the Lisbon Agenda and this is reflected in the development of Lithuanian policies. However, ERA-related policies have not attracted higher attention over the last years. Government policy towards trans-national collaboration, internationalisation of science and opening the national research system to researchers from other countries is underdeveloped. Joint design and coordination of policies remain low on the political agenda. Furthermore, the country's involvement in existing international infrastructures is vague. Lack of policy attention to opening up the national research programmes stems from the need to first address the national problems related to unattractive researchers' careers and limited research capacity. A mix of measures under the 'Researchers Career' Programme addresses those issues. Concrete policy measures and regulations to promote attractiveness for non-national researchers are rare. In 2010 the Lithuanian Research Council started implementing the Global Grant Scheme, which is for the first time available to non-national world class researchers. Substantial funding (about €400m) is also secured for building world-class research infrastructures; first funds were allocated to the research centres in 2010.

The following table gives a short assessment of the national policies/measures supporting the strategic ERA objectives.

Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
1	Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers	• No policy changes. Policy attention is focusing on the implementation of a framework for researcher careers via the 'Researchers Careers' Programme, funded by SF. Implementation of a versatile mix of measures started in 2010.	• Adequate supply for science & engineering, however the quality of graduates does not fully match market demand. • Overall unattractive working conditions for researchers: low salaries, low access to world-class equipment, however a substantial amount of national and SF funding will be invested towards improvement of the working conditions of researchers in 2010-2015.
2	Increase public support for research	• Public budget for R&D decreased by 14% in 2009	• Low levels of R&D expenditure, also affected by the crisis and delayed implementation of the SF.
3	Increase European coordination and integration of research funding	• No policy changes.	• Government strategy on trans-national collaboration and coordination of research remains weak.
4	Enhance research capacity across Europe	• Bulk of measures, including the NCPs, JRPs and Programmes for science 'valleys' are approved, implementation started in 2010.	• Government places investment in the public research infrastructure and research capacity at the core of national policy for research and innovation development.
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	• No policy changes. Implementation of previously approved measures started. Some €400m will be invested in national RIs in five year period	• Government funding ensured for developing world-class research infrastructures. However, over-reliance on SF funding makes maintenance and further development of RIs post-2013 periods questionable
6	Strengthen research institutions, including notably universities	• The Law on research and studies grants full autonomy to universities since 2010, and strengthens the power of the Board comprised of socio-economic partners. • Methodology on evaluating research performance (2010) provides guidelines on peer-review and performance indicator based evaluation of research results and quality, and embeds performance based research funding. • Methodology for external evaluation and self-assessment of research institutes presented.	• Higher education and research reform, that puts stronger emphasis on research and studies quality, increases the share of competitive funding and introduces performance based funding, will positively affect the quality of studies and research. • Closer involvement of stakeholders in the governance of HEIs will ensure better match of skills supply and market demand.

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
7	Improve framework conditions for private investment in R&D	• No positive policy changes.	• Framework conditions for private investment in R&D remain average. Tax incentives for R&D are applied since 2008; however business climate remains relatively unfavourable, especially because of the recession and strict fiscal policy. Lack of investment in capital in domestic companies results in the low level of R&D investment in capital
8	Promote public-private cooperation and knowledge transfer	• Introduction of innovation vouchers scheme. • Commitment to fostering R&D collaboration and knowledge transfer in LIS 2010-2020.	• Funding secured to foster public-private knowledge transfer and R&D collaboration, but its share in the total share of resources allocated for R&D and innovation is relatively limited (8%), and implementation is delayed. • Third mission is not a high priority for Lithuanian HEIs; limited priority to knowledge transfer at HEIs strategies; few KTOs operating.
9	Enhance knowledge circulation across Europe and beyond	• Global Grant scheme by Lithuanian Research Council is *de jure* open to non-national researchers.	• Most of the research funding programmes remain closed to researchers located outside Lithuania; the one scheme available does not allow non-nationals to carry out research in their home country.
10	Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world	• No policy changes.	• Lithuania's policy towards international cooperation in research remains underdeveloped; this issue is low on political agenda.
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	• No policy changes.	• Lithuania's engagement in joint design of policies and programmes is vague.
12	Develop and sustain excellence and overall quality of European research	• More focus on funding world class research projects and on attracting high quality international researchers (in the Global Grant scheme).	• Impressive investments are secured for national RIs and excellence in research. However Lithuanian research system remains extremely closed.

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
13	Promote structural change and specialisation towards a more knowledge - intensive economy	• New Lithuanian Innovation Strategy 2010-2020 approved by Government decree represents a strong signal of intent to create a knowledge based economy in Lithuania.	• Lithuanian Government has committed to put STI agenda at the core of economic renewal. So far most attention is on strengthening of the public research system.
14	Mobilise research to address major societal challenges and contribute to sustainable development	• National research programmes on future energy and climate change approved and budget for 3 years secured.	• Number of research priorities (12 NCPs approved) remains too broad for a small country like Lithuania. • Instruments (like foresight) for identifying knowledge demand drivers and setting clear national R&D priorities are not applied.
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	• Several SF measures are directly addressing this issue (especially the interest of the younger generation in science).	• Numbers of graduates in science and technology fields remain high. • State puts even more emphasis on attracting young graduates to start research career.

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1 Introduction

The main objective of the ERAWATCH Analytical Country Reports 2010 is to characterise and assess the evolution of the national policy mixes in the perspective of the Lisbon goals and of the 2020, post-Lisbon Strategy. The assessment will focus on the national R&D investments targets, the efficiency and effectiveness of national policies and investments into R&D, the articulation between research, education and innovation, and on the realisation and better governance of ERA. In doing this, the 15 objectives of the ERA 2020 are articulated.

The report builds on the 2009 report streamlining the structure and updating the 2009 policy assessment in the domains of human resource mobilisation, knowledge demand, knowledge production and science-industry knowledge circulation. The information related to the four ERA pillars covered in the 2009 report is also updated and it is extended in order to cover all six ERA pillars and address the corresponding objectives derived from ERA 2020 Vision.

Given the latest developments, the 2010 Country Report has a stronger focus on the link between research and innovation, reflecting the increased focus of innovation in the policy agenda. The report is not aimed to cover innovation per se, but rather the **'interlinkage'** between research and innovation, in terms of their wider governance and policy mix.

2 Performance of the national research and innovation system and assessment of recent policy changes

The aim of this chapter is to assess the performance of the national research system, the **'interlinkages'** between research and innovation systems, in terms of their wider governance and policy and the changes that have occurred in 2009 and 2010 in national policy mixes in the perspective of the Lisbon goals. The analysis builds upon elements in the ERAWATCH Country Report 2009, by updating and extending the 2009 policy assessment in the domains of resource mobilisation, knowledge demand, knowledge production and science-industry knowledge circulation. Each section identifies the main societal challenges addressed by the national research and innovation system and assesses the policy measures that address these challenges. The relevant objectives derived from ERA 2020 Vision are articulated in the assessment.

2.1 Structure of the national research and innovation system and its governance

Lithuania with 3.35m inhabitants (less than 0.7% of the EU population)[1] is one of the smallest EU member states. The country's economy faced a severe economic downturn in 2008-2010. GDP per capita fell by 17% in 2009 to €7,900 per inhabitant (€23,600 per inhabitant in the EU27). The unemployment rate increased significantly

[1] If not referenced otherwise, all quantitative indicators are based on Eurostat data.

from 5.8% in 2008 to 18.3% in the second quarter of 2010 (data of the Lithuanian Statistics Department (LSD)). R&D intensity (measured as a percentage of GDP) increased to 0.84% in 2009 (data of LSD), which was still significantly below the EU average of 1.9% in 2008. This share has been increasing for many years. However, annual investment in R&D actually fell by 15% and amounted to €221.6m in 2009. Since the new Government took office in 2008, the RTDI policy and its governance structure has been changing dramatically, with the ongoing public administration reform at the national level, and higher education and research reform at the sectoral level.

Main actors and institutions in research governance

The Lithuanian research and innovation policy governance structure is based on the dual ministry model, with the Ministry of Economy (MoE) responsible for innovation policy, and the Ministry of Education and Science (MoES) responsible for higher education and R&D policy. At the highest level, Lithuanian research and innovation policy is set by the Lithuanian Seimas (Parliament) and the Government of Lithuania. Since 2005, the Science, Technology, and Innovation Commission chaired by the Prime Minister *de jure* operated as the main inter-departmental coordination body. The Commission was heavily criticised as being inactive and has *de facto* stopped its operation since the formation of the new Government in 2008.

The Ministry of Economy is the principal institution involved in shaping policy for the promotion of innovation and SME development. In 2009, its structure underwent major reorganisation. Firstly, the new Ministry of Energy was established on the basis of the existing department within the MoE in order to implement the tasks related to national energy sector reform after the closing of the Ignalina nuclear power station in 2010. Secondly, in order to place higher emphasis on the promotion of innovation, the Department of Innovation and Knowledge Economy was set up in 2009. The Ministry of Education and Science deals with research excellence in the public science sector and is responsible for the development of highly-skilled human resources for R&D and innovation. Nevertheless, the main responsibility for corporate R&D lies with the MoE, as part of the Innovation and Competitiveness Programme. Both ministries are now mutually responsible for governing the research and innovation system and coordinating high scale investment programmes (coordination is mostly on informal basis, but quite effective at policy implementation level). Furthermore, the Ministry of Finance also plays a major role in allocating funding for national research programmes.

There are several *policy advising institutions* active in the higher education and research policy field. The Lithuanian Research Council (LRC) serves as an advisory body to the Seimas and the Government. Changes to the legal base in 2008 gave the LRC the status of a permanently functioning agency responsible for the competitive funding of research programmes. The Research and Higher Education Monitoring and Analysis Centre (RHEMAC) is an analytical and advisory body to the Ministry of Education and Science. An advisory body, the Higher Education Council, was established in 2009 and is formed of acknowledged representatives from the research and business communities, approved by the Minister of Education and Science.

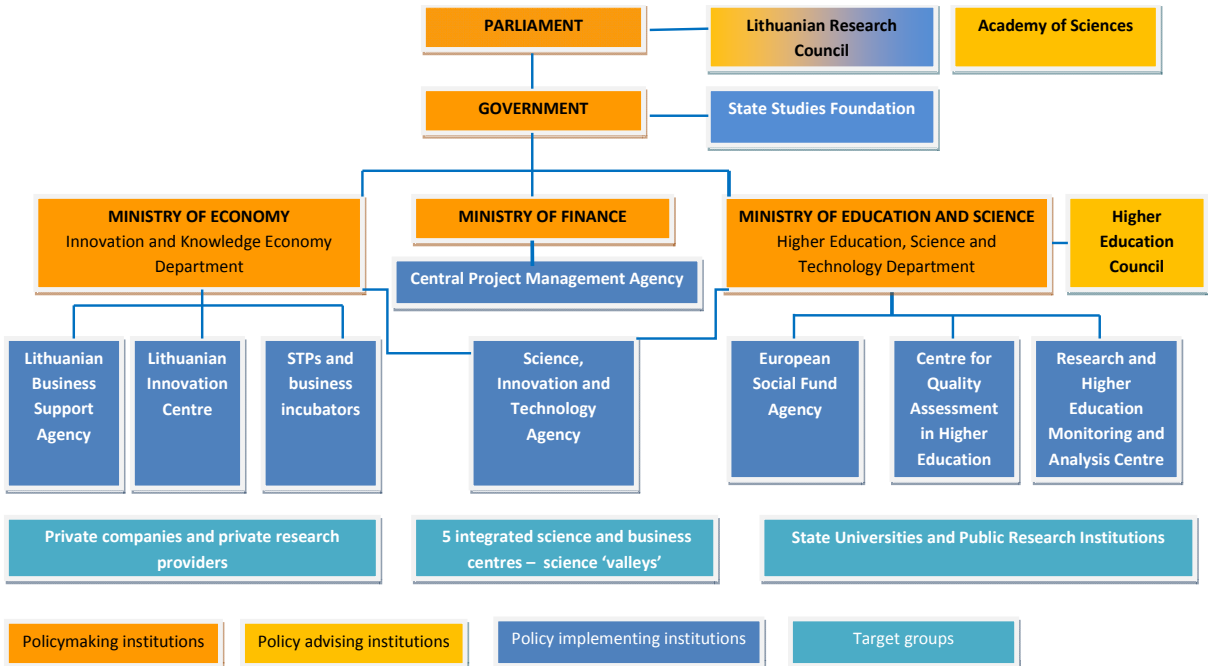
As for *policy implementing institutions,* LRC is the central funding agency for fundamental research, complementing the institutional funding for basic research with project-type funding. The State Studies Foundation (SSF, since 2010, previously called the Lithuanian State Science and Studies Foundation) is the main institution

dealing with study loans. The development of human resources falls under two agencies: the Lithuanian Centre for Quality Assessment in Higher Education (LCQAHE) and the European Social Fund Agency (ESFA). The first deals with quality assurance and higher education standards. ESFA supports, coordinates and administers EU SF aid and implements measures assigned to the MoES in the development of human resources for science, technology and industry.

Lithuanian innovation and corporate R&D policy is implemented by establishments of the MoE, the main one of which is the Lithuanian Business Support Agency (LBSA), responsible for the implementation of national and EU SF based business support programmes, including innovation and R&D in the business sector. The Lithuanian Innovation Centre (LIC) provides qualified support to Lithuanian business and research institutions, industry, and SMEs in the field of innovation and technology transfer. Administration of certain high scale investments programmes related to the development of research infrastructures is the responsibility of the Central Project Management Agency under the Ministry of Finance.

Previous assessments of the institutional framework of research and innovation governance focused on two main aspects: fragmentation and lack of clear-cut separation of functions and responsibilities, and lack of inter-institutional coordination (PPMI, 2009a). With the aim of reducing fragmentation, the Government established the Science, Innovation and Technology Agency (SITA) in early 2010 on the basis of the previously existing Agency for International Science and Technology Development Programmes (AISDP). Functions related to the administration of competitive funding programmes for basic R&D were transferred to the Lithuanian Research Council. The idea is to gradually transfer the administration of the applied R&D and innovation funding programmes to SITA. The Board of SITA is comprised of both ministries responsible for innovation and research.

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



Source: developed by the author

To summarise, steps were taken to reduce the fragmentation of the research and innovation governance system and to strengthen the synergies of knowledge triangle policies. However, core weaknesses of the institutional framework remain unsolved:

- There is no institution that could coordinate the RTDI governance process at the policy design level and provide analytical and advisory support in the innovation policy field (i.e. similar to the LRC but on innovation issues). Coordination of policy design as well as ex post policy evaluation are the weakest parts of the RTDI policy cycle.
- Having a large number of RTDI policy implementing institutions (LBSA, LIC, SITA, CPMA, LRC, SSF, ESFA, not to mention other agencies indirectly related to the implementation of RTDI policy) does not lead to effective implementation due to segmentation of functions, vaguely defined roles, and the institutional weakness of the administrative core (in the case of both ministries). The objective to further develop SITA is constrained by the lack of financial and administrative resources. The current decision of the Government remains to postpone the development of SITA until 2013.

The institutional role of regions in research governance

At its current development stage, Lithuanian regions and municipalities do not play a role in research governance.

Main research performer groups

The main *public research performers* are concentrated in the higher education system, performing 52.7% of the total R&D in 2009 (LSD data). Fragmentation of the public research system was minimised after implementation of the higher education and research reform. Prior to the reform, 45 state research institutes and 15 state universities operated. In 2010, 14 research institutes were integrated into the universities, four were liquidated, and the rest were merged into five major research centres. In total, six new state research institutions were set up, including the State Health University.

The *government sector* performed 23.6% of the total R&D in 2009 (LSD data). Unlike the innovation leading countries, the *business enterprise sector* is not a leading research performer in Lithuania. The share of business R&D in total R&D expenditures reached 23.7% in 2009, which means that the share of BERD decreases (as compared to 28% in 2006). Total intramural R&D expenditure by the business sector shrank by 8% in 2008.

The government sector funding accounted for the biggest share of R&D expenditure (54%) by the source of funds in 2009. The business enterprise sector accounted for 21%, foreign funds – for 13.1%, higher education and non-profit sectors – for 11.6%, and the non-profit sector contributed by only 0.3% (LSD data).

2.2 Resource mobilisation

Since 2000, Europe has made evident progress towards ERA but at the same time it is clear that Europe's overall position in research has not improved, especially regarding R&D intensity, which remains too low. The lower R&D spending in the EU is mainly a result of lower levels of private investment. Europe needs to focus on the impact and composition of research spending and to improve the conditions for private sector R&D investments.

This section assesses the progress towards national R&D targets, with particular focus on private R&D and of recent policy measures and governance changes and the status of key existing measures, taking into account recent government budget data. The need for adequate human resources for R&D has been identified as a key challenge since the launch of the Lisbon Strategy in 2000. Hence, the assessment includes also the human resources for R&D. Main assessment criteria are the degree of compliance with national targets and the coherence of policy objectives and policy instruments.

2.2.1 Resource provision for research activities

Progress towards national R&D investment goals

The authorities have re-committed in 2008 to achieving the 2% GERD/GDP and 1% BERD/GDP targets before 2010 in the National Lisbon Strategy Implementation Programme 2008-2010. It is obvious that available R&D investments are not sufficient to meet the targets set. In 2009 investments in research suffered a decline – according to Lithuanian statistic sources, public investments in R&D (by public higher education and general government sectors) dropped by 15 percent. However due to the shrinking value of GDP the GERD/GDP value increased in 2009.

Table 1: Lithuania's Gross Expenditure on Research and Development, 2000-2009

	2000	2002	2004	2006	2008	2009
GERD/GDP EU27	1.74%	1.76%	1.73%	1.76%	1.77%	-
GERD/GDP Lithuania	0.59%	0.66%	0.75%	0.79%	0.80%	0.84%
BERD/GDP EU27	1.11%	1.11%	1.09%	1.11%	1.12%	-
BERD/GDP Lithuania	0.13%	0.11%	0.16%	0.22%	0.19%	0.20%

Source: Lithuanian Statistics Department, 2010

The Lithuania's gross expenditure on R&D vis-à-vis the EU27 over the period 2000-2009 is presented in Table 3. The data indicate that the current level of gross expenditure on R&D in Lithuania is still substantially below EU levels.

The decline in R&D investments over 2008-2009 is, *first of all*, a result of the economic and financial crisis, and *secondly*, of the related national budget cut-offs. The economic crisis also influenced the re-allocation of €150m from the SF R&D measures to measures aimed at providing business loans.

Thirdly, delayed implementation of the EU SF programmes contributed to shrinking R&D expenditures in 2009. The average figure for the allocation of the SF funds was only 6-8% of the funds secured for the 2007-2013 period. The fact that most research activity is funded by the SF allocations also raises a concern about budgetary consequences after the post 2013 period. Lithuanian research organisations have not yet become effective in obtaining research funding from international sources, and investment on the part of business in research remains negligible.

Securing long-term investments in R&D and main funding instruments

The legal framework for prioritising and budgeting public investments in RTDI is embedded in three strategic documents: the National Lisbon Strategy

Implementation Programme 2008-2010 published in 2008, the Lithuanian Strategy on the use of the EU Assistance for 2007-2013 published in 2007, and the Lithuanian Innovation Strategy for 2010-2020 (LIS) published in 2010. LIS 2010-2020 sets four broad objectives: 1) to accelerate Lithuania's integration into the global market ('Lithuania without borders'); 2) to educate a creative and innovative society; 3) to develop broad-based innovation; 4) to implement a systematic approach to innovation. A workgroup formed of representatives from 12 ministries developed a LIS Action Plan for 2010-2013 that was approved in October 2010. However, opponents note that the Strategy was developed in a hurry, not following the good practice principles of stakeholder involvement; was not based on a thorough analysis of the innovation; the objectives are too broad, the structure of objectives and results is fuzzy and does not allow a predictable policy framework (PPMI, 2010b).

Further it is worth mentioning that a discussion of stakeholders was initiated in 2010 concerning investments in R&D in the post-2013 period. The Prime Minister invited experts, business and academic representatives to join the State Progress Council which is to mobilise the community in mapping Lithuania's route for the near future and to build its vision 'Lithuania 2030'. The State Progress Council will distil all the collected visionary ideas, which will later become the solid base for 'Lithuania 2030' - the broad-based agreement on the long-term development of the country. In addition, in 2010 the Research and Higher Education Monitoring and Analysis Centre (RHEMAC) started a process of facilitating foresight-based development of the long term vision for Lithuanian research and higher education.

Assistance from the Structural Funds for the programming period 2007-2013 as well as the institutional 'block' funding for research remain two main R&D funding instruments. Two SF operational programmes are relevant for research funding: the 'Operational Programme for Economic Growth' (45.7% of the total EU SF resources, or €3.1b EUR, of which €340m will directly target long-term investments in public R&D; and about €192m will aim at private R&D), and the 'Operational Programme for the Development of Human Resources' (13.8% of the total SF funds, or €935m EUR, of which €118m is secured for the national Researchers Careers Programme). With significant delays most of the measures were launched in 2009 or in the first two quarters of 2010. The funds allocated for research and innovation-related measures over 2009-2010 varied from 1.5% (or €252.3m EUR for public research infrastructures) to 80% (or about €550m EUR for venture capital and business loans) of total funds foreseen for a seven year period. The framework of RDTI policy mix funded by SF 2007-2013 is presented in the Annex 1 to this Report.

SF has contributed to the increased share of competitive research funding as announced by the MoES in autumn 2010. The ratio of basic funding to competitive funding is now 60/40 and the State has committed to achieving 50/50 by 2011. While seeking to balance 'block' R&D funding schemes, a competitive funding model for R&D was introduced through the national research programmes, under the framework of the two above-mentioned OPs and administered by the LRC (for more detailed description see ERAWATCH Network, 2009). These programmes are a unique example of joint programming in Lithuania. Each one of them contains a mix of SF measures aimed at strengthening priority research sectors from the knowledge triangle perspective.

In 2010, the MoES introduced the new Methodology for allocating 'block' funding for public research that puts more pressure on quality and outputs of research. Half of the allocated funds now depend on the number of researchers employed, and half on

the results achieved (bibliometric indicators and peer review based evaluation applied). Funding for long-term R&D programmes is approved for three years; after three years the results will be evaluated. Another novelty in institutional research funding is separation of funding by six research fields: social sciences, humanities, art, natural, medical and health sciences, and technology sciences. A higher proportion of funding is allocated for applied sciences as an attempt to foster collaboration of PROs with the business sector. The importance of peer review in evaluation of achieved scientific results while deciding on the amount of 'block' funding was increased.

The new measures launched in the reported period from 2009 to 2010 mostly reflect the actual start of the implementation of the OPs for the EU SF implementation cycle 2007 to 2013. The only exception is the introduction of the 'innovation vouchers' in the cross field between research and innovation. The pilot measure of €0.3m was introduced by the MoE and SITA in summer of 2010; funds were distributed in less than a month – obviously, there is a high demand for this type of assistance in the innovation system.

Mechanisms to build mutual trust between science and society and main societal challenges

Several SF 2007-2013 funded measures are designed to increase creativity and innovation culture, as well as to build mutual trust between science and society: 'The creation of the National Open Source Scientific Communication Centre'; 'Improvement of knowledge about science and technologies among pupils and youth and support to equal rights in science'; as well as 'Creation of infrastructure aimed at the improvement and dissemination of knowledge about R&D, technologies and innovations'. Specifically, the objective of the measure 'Improvement of knowledge about science and technologies among pupils and youth and support to equal rights in science' is to create and implement a young research talents mapping system and to implement the concept of equal rights in science. The specific activities supported are: development of easily accessible information systems; teacher – young researcher mentoring; support for talented pupils interested in science; and supporting equal rights in science.

2.2.2 Evolution of national policy mix geared towards the national R&D investment targets

Barriers and risks for attaining the 1% BERD/GDP target

Available statistics demonstrate a decline of BERD in absolute numbers since 2007 in Lithuania (see 2.2.1). The main challenges with regard to business R&D tend to be related to the structure of private R&D demand and to limits of the increase in absorptive capacity in industry. The structure of the Lithuanian economy is dominated by low-tech and medium-tech industries. The total number of SMEs conducting their own R&D on a permanent basis has been stagnating; the rate of new born firms in general is very low. Therefore, despite Lithuania produces high numbers of human resources in science and technology, including PhD holders, only a small number of people with doctorates are employed in the business sector. The low absorptive capacity in industry on one hand, and poor career perspectives in the public research system on the other, guarantee that new third-level graduates either emigrate or end up working in positions not related to research.

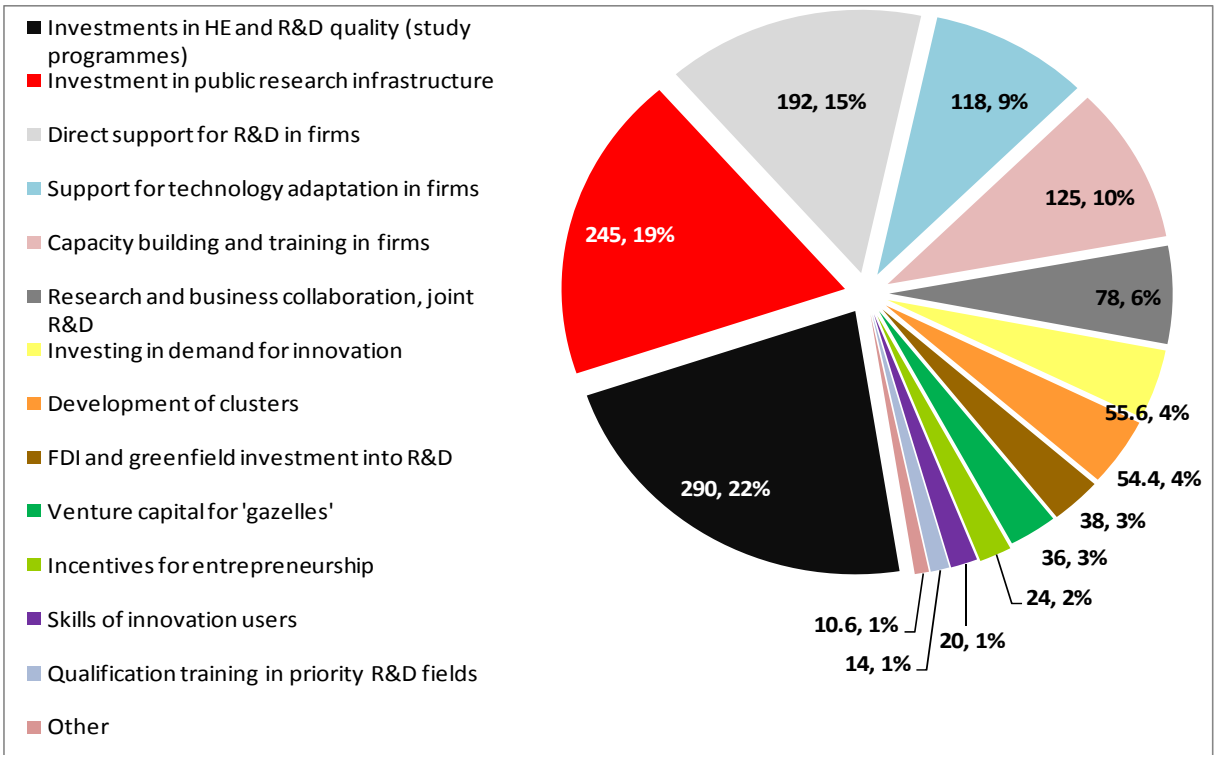
So far, Lithuania has failed to restructure the economy and increase the absorptive capacity in industry. The country is lagging behind other EU countries in attracting knowledge-intensive FDI. Implementation of measures foreseen (development of Greenfield sites and introduction of a set of financial and tax incentives) did not yet have the expected effect due to the unfortunate concurrence with the global economic crisis. Most importantly, Lithuania fails to increase the propensity to create and develop knowledge intensive companies. The numbers of newly established companies are low and decreasing. The State applies a mix of measures including direct support to companies already carrying out R&D as well as indirect support such as tax incentives. However, the same circle of innovative companies keeps on benefiting from direct State support for research (PPMI, 2010b). There are almost no specific incentives such as tax advantages or the availability of early-stage venture capital for entrepreneurs or young innovative firms.

Moreover, the crisis increased the 'competition' between the existing measures of direct support. Due to the high administrative load while preparing the application and implementing projects, businesses choose measures that guarantee 'fast cash' (i.e. direct investment in new production technologies instead of support for long-term R&D or collaboration projects). While the latter examples might be temporary effects of the recession, several studies (PPMI, 2010a; INNO-Policy TrendChart, 2009) criticise the current research and innovation policy mix as being focused on innovation supply side measures only and neglecting the need to foster innovation demand.

Policy Mixes towards increased private R&D investment

The ERAWATCH Country report for Lithuania in 2009 provided a characterisation of the national policy and instrument mix chosen to foster public and private R&D investment according to the six 'routes'. Instead of updating the overview, assessment of the balance and efficiency of the current policy mix is provided here. Analysis of State investments in R&D and innovation secured for the period from 2007 to 2013 allow concluding that the current research and innovation policy mix is mostly designed to follow two routes: *firstly*, to increase R&D in the public sector; and *secondly*, to stimulate greater R&D investment in R&D performing firms. At the highest level of policy objectives, these are two main policy objectives related to R&D, together with the need to stimulate firms that do not yet perform R&D and to foster collaboration between business and science. For implementing the objectives, a set of policy measures is planned (see Figure 2).

Figure 2: Lithuanian research and innovation policy measures 2007-2013; €m, % of total resources allocated



Source: adapted by the author from PPMI, 2010b

The major share of funds secured for research and innovation is oriented towards development of public research capacity – about 40% of the funds are aimed at strengthening the research infrastructure and quality of public sector research (see Figure 2). The rest of the funds are allocated for a set of other objectives, such as fostering R&D in firms (15%), increasing business productivity by supporting acquisition of new technology (Leader LT, 9%), increasing collaboration between various actors in the innovation system, etc. Direct support grants dominate the types of support funding (94% of measures are applying grants schemes)[2].

Lithuania's RTDI policy mix corresponds to the policy mix of a 'catching up country' (Tsipuri et.al, 2009) with dominance of support to the public research system and the rest of the direct support funds being spread over a vast number of funding priorities. However, it has several major weaknesses. *First of all*, it seems that certain objectives that were put high on policy agenda, such as stimulating firms that do not yet perform R&D and fostering collaboration between business and academia, were not granted sufficient resources for achieving any significant effect on the innovation system. The highest proportion of funds aimed directly at fostering R&D activity in business (i.e. measures Idea LT, Intellect LT, Intellect Lt+) is allocated for 'supporting the winners'. Few specific measures are in place to stimulate R&D investment by non-R&D performing firms or those that are in a process of starting a company. This approach neglects the fact that the current structure of the economy does not host

[2] Subsidised loans, guarantees and venture capital schemes (€274m) are not included here as they are not directly linked to R&D. A number of measures supporting non-R&D innovations, such as E-business LT for development of e-business solutions, New Opportunities-LT for new export markets and business support systems (approximately €30m each), and Process-LT for management innovations (€14.5m) are also excluded. Tax incentives are applied to foster business investment in R&D since the end of 2008; however no statistics are available for 2009 and 2010.

too many innovative R&D performing companies. The evidence available confirms that support for RTDI is absorbed by only a meagre part of the Lithuanian economy.

Various long and medium term documents claim that strengthening of public-private collaboration becomes a cornerstone of policy mix. However, the amount of direct support allocated to R&D collaboration and clusters (i.e. measures Inocluster LT, Inocluster LT+, 'Innovation Vouchers') is fairly limited as compared to other measures. It constitutes no more than 6% of all SF and national support allocated to R&D (including plans to spend €3m over the period 2010-2013 for 'Innovation vouchers' introduced by the MoE in 2010, for which the national funding is not yet secured). Lack of a critical mass of support for R&D collaboration between business and academia might constrain development of private investment in R&D in the future.

Secondly, the current policy mix (both in terms of policy priorities and funding) does not fully reflect the structural weaknesses of Lithuanian research and innovation system summarised at the beginning of this Chapter. There is a lack of policy priority given to fostering entrepreneurship and establishment of new indigenous R&D performing firms. The entrepreneurial behaviours in society are especially needed when employment is dropping, and new job creation is hardly feasible in the next five years by the existing enterprises as a result of the economic downturn. A set of SF-funded measures can be directly or indirectly attributed to the role of fostering new business creation: 'Assistant 1' (€6.7m; aims at improving business services provision); 'Assistant 2' (€17.4m; supports development of new art and/or business incubators); and 'Assistant 3' (aims at attraction of FDI into knowledge-intensive business, among other objectives). However, funds allocated are not available directly to the primary target group (entrepreneurs), most is invested in infrastructure. Specific funding for provision of packages of quality services or direct support to the companies (tenants of technology incubators) is not secured. In general, most of recent studies (e.g. PPMIb, 2010) criticise RTDI promotion policy for lacking well developed 'soft' innovation promotion services in place. Hence, budget too modest to leverage establishment of new indigenous R&D performing firms or attracting R&D-performing firms from abroad is a result of insufficient policy attention to these important issues. *Finally*, as concluded by the INNO-Policy TrendChart in 2009 and the two recent studies on RTDI policy and governance in Lithuania, ordered by the Knowledge Economy Forum in 2009 and the Prime Minister's Office in 2010, the core weakness of the Lithuanian innovation support system relates to the lack of a market- and demand-driven policy approach. This approach manifests itself in the absence of market incentives and public procurement for innovation in the strategically important economy sectors (e.g. energy, waste management, health care, etc.). The heavy reliance of the national innovation policy on EU SF funds builds an imbalance between the public support (supply) and market formation (innovation-demand) policies. While strengthening the public sector and innovation support institutions, the government had paid little attention to the creation and facilitation of innovative markets and fostering innovation culture in the society. The proactive policy approach towards the formation of demand and markets for innovation is especially relevant in the times of economic downturn, when markets are weak. For example, Lithuania has a unique opportunity to form a pool of innovative enterprises while combining the energy sector investments following the shutting down of the Ignalina nuclear power plant in 2010 with the proactive market regulations. However, until now, the energy market remains monopolised, which significantly limits the distribution of energy from new sources. Thus, a large pool of opportunities runs the risk of remaining

unexploited (INNO-Policy TrendChart Report, 2009). Development of demand for innovation is a complex and risky task for the government, which is constrained by the need to balance the budget.

The LIS 2010-2020 foresees a range of feasibility studies in the period 2010-2013 on how to foster demand in certain areas (e.g. for electromobiles), however the Strategy misses the aim to foster innovation markets and innovation demand in it's intervention logic. In the middle of 2009 the Law on Public Procurement in Lithuania implemented provisions of EC Public Procurement directives allowing contracting authorities to procure innovative products, services or works through a competitive dialogue procedure; to describe a wanted product through functional specification, desired performance; to offer the possibility of alternative proposals, preliminary contracts, thus supporting innovation through public procurement (INNO-Policy TrendChart, 2009). Furthermore, promoting innovations through public procurement is among the measures of the Lithuanian Innovation Strategy Action Plan for 2010-2013. Improvement of the public procurement system strategy for 2009-2013 is under way, with the primary tasks for 2009-2010 being to collect, synthesise and spread information about innovative public procurement in Lithuania (including: regulations, realisation and examples of good practice in other countries).

Other policies that affect R&D investment

The global economic and financial crisis has further aggravated the prospects for economic recovery, and access to capital has become even more difficult. The regulatory environment was characterised by frequent and unpredictable changes over the last couple of years, the administrative and tax burdens are high after recent changes to company tax policy. The new Government that took office in 2008 has set up a workgroup to reduce the 'red tape' for business, but has not yet come up with any innovative solutions. All in all, current framework conditions are not favourable for long-term and high-risk activities, such as RTDI.

There are no specific financial or fiscal incentives for starting a business, except for the measure 'Development of Entrepreneurial Skills' (€14.5m) of the Ministry of Security and Labour. On the other hand, firms can access the set of measures aimed at the improvement of business access to finance that consist of a variety of tools. The 'Controlling fund' aims to improve SME access to external funding sources (micro crediting up to €25,000; venture capital fund investments; guarantees for SME financial obligations), while 'Partial compensation of SME credit interests' (budget of both is €274m) aims to ease the burden of financial obligations by partially compensating investment credit interests for SMEs and to support the development of enterprises. An Economic Recovery Plan was also launched in late 2008 by the Government, aimed at restoring market stability and providing greater access to capital for business. In the course of implementation of the so called 'crisis' plan, some €150m were re-allocated from the science 'valleys' measures to the venture capital funds.

2.2.3 Providing qualified human resources

Human resources for research are an issue of strategic importance for Lithuania. On the one hand, over the past five years, human resources have been one of the main drivers of the improvement in research and innovation performance, in particular as a result of the strong growth in S&T and SSH doctorate graduates (14.8% in 2008), above the EU27 average (INNO-Policy TrendChart, 2009). The youth enrolment rate is well above the EU average, and the share of S&T graduates is among the largest

in Europe. Human resources in science and technology as a share of the labour force between the ages of 25-64 constituted 41.7% in 2009, slightly above the EU27 average (40.1%). Lithuania ranks among the top EU performers in terms of student enrolment rates. On the other hand, the Lithuanian higher education system has been intensely and for a long time criticised for its low performance in terms of the quality of qualifications. The low quality of studies facilitated the brain drain of skilled young people, i.e. those secondary school graduates with good marks often choose studies abroad for getting better education and thus better prospects in the labour market.

Articulation of education policies within the knowledge triangle

A mixture of policies over the period 2008-2010 has responded to the challenges of increasing the quality of studies as well as to tackling the attractiveness of the researcher's career. The ongoing research and higher education policy reform is the most important event in the education sector since 2008. The main goal of the reform is to create favourable conditions for fair competition among the universities and colleges, and to reduce the state regulation to a minimum. The first results of the funding reform are to be evaluated in 2011-2012. The main elements of the reform addressing the issues above are:

- Student vouchers were introduced to increase the competition among public (and private) universities. The majority of state funding for studies is allocated to the universities and colleges in the form of 'student vouchers', which are awarded to the students, based on their tertiary education graduation exams. After being awarded the 'vouchers', students maintain state funding for the entire course of their selected programme. Students can take this 'voucher' to any university or college of their choice – whether it is a public or a private one. If upon enrolling a student is dissatisfied with the programme, they can take the national scholarship elsewhere. Prior to the start of the reform, each state HEI had a pre-determined quota of state-funded students for each programme that did not change year to year. State funding for universities and colleges (vocational training institutions) was allocated based on the number of programmes they provided and the number of students they could accommodate, and not on the quality of the studies. Private schools were not entitled to receive the financial assistance from the state in any form. It is expected that in order to attract more students and 'student vouchers'(,) HEIs will be encouraged to put more emphasis on the quality of their study programmes. In September 2009, over 20,000 'vouchers' were distributed to first year students based on their tertiary education graduation results. Over 11,500 university students and 9,000 college students received 'student vouchers'. For that purpose €14.8m have been allocated from the state budget for the university studies (up from €10.3m in 2008) and €5.6m for colleges (up from €4.8m in 2008). In September 2010, only 9,680 university students received 'student vouchers'.
- In addition, by introducing significant changes in the state funding system, the government aimed to ensure that everyone who is willing and capable to study has access to higher education. For that purpose, a new student loan system is being introduced. With the start of the reform in September 2008, students are able to draw over €28.96m/year in loans under favourable terms to cover their tuition fees or living expenses. In comparison, only €5.7m in student loans were provided by the state in 2008.

- Re-focus on the quality of study programmes by strengthening the peer review element and by involving students in the evaluation of study programmes;
- Widely dispersed research resources were concentrated by optimising the network of research institutes;
- Overall, principles of the new public management were introduced in research and HE governance, by giving autonomy to the HEIs and leaving them at the 'arm's length' control, with emphasis on performance evaluation (e.g. external evaluation of the research institutes every six years).

A versatile knowledge triangle policies mix is ensured by the measures and incentives of the EU structural assistance Operational Programmes for 2007-2013. The quality of higher education is tackled by the 'National Programme for Studies' (€211.7m). Some €40m will be allocated for the construction of the new study infrastructure or for the renewal of the existing one, as well as for renewal of the research and higher education programmes. In order to ensure the long-term accumulation of human resources for R&D, for the programming period of 2007-2013, a national 'Researchers Careers' programme (RCP)' schedules a variety of actions. For example, such actions like the attraction of the highly-skilled researchers, funding short-term visits of the researchers from abroad, the researcher mobility between science and industry, etc. The Lithuanian Research Council started implementing several RCP's measures in 2010. It is worth mentioning here that for the first time researchers in Lithuania (as individuals) can apply for:

- *Postdoctoral Fellowships,* which aim to involve doctoral studies graduates (PhDs) from Lithuania and abroad in research activities;
- *The Global Grant Scheme* for research projects, aimed at young or experienced foreign researchers working abroad not less than 3 years; and young or experienced researchers working in Lithuania.

The improvement of research qualifications, competences, and building of scientific databases are targeted by a separate group of measures in RCP (€105.7m). The Research Council of Lithuania also implements the *Students Research scheme*, which aims to encourage academically-minded young people to take an interest in research, demonstrate the prospects of the researcher profession and career and provide an opportunity for students from different regions and HEIs in Lithuania to familiarise themselves with the research carried out in well-known groups of scientists. Business enterprises can also take part in this scheme.

Opportunities for job-training in private companies are facilitated by the Ministry of Social Security and Labour – some €95m from the measure 'The Improvement of Human Resources in Enterprises' will be dedicated for this purpose. RCP also provides funding for State assistance for employment of highly-qualified staff and researchers (€9.1m). A researcher can be employed for three years and his/her salary might be compensated by the State.

Main societal challenges

While the supply of science, maths and engineering graduates is sufficient and above the EU average, the quality of studies is low as mentioned above. The policy mix tackling issues on the quality of studies and ensuring a sufficient supply of graduates is in place. Steps have also been taken to strengthen the vocational training system. Experts have criticised the Lithuanian higher education sector as being too easily accessible. The practice of leading countries shows that the proportion of students

graduating from colleges and universities is at least equal. In Lithuania, this proportion is unproductively distorted by 1:3 with the university sector being too large. After the launch of the new 'student vouchers' system, the number of state-funded students at the universities decreased from 14,000 to 11,500 in 2009/2010, and then to 9,680 in 2010/2011. It is expected that introduction of vouchers will lead to more high school graduates (those without a 'voucher') choosing vocational training (college) programmes. Hence, the balance between vocational training and higher education could be restored in a few years.

It is also expected that the reform will balance the match between supply and demand of higher education graduates in the market. Previous studies (e.g. PPMI, 2009e) have demonstrated a mismatch between the supply and demand of the labour force. As one example, the supply of social science graduates (in law, management science and similar) and especially graduates with teaching qualifications strongly exceed market demand. The Ministry of Education and Science contracted a research study in 2010 that will develop a nationwide map of qualification and skills demands and provide guidelines for forecasting the needs for human resources development in the future.

In Lithuania, the education curricula rarely take into account aspects such as creativity, critical thinking, problem solving, teamwork, and communication skills. Few exceptions relate to the private universities specialising in management sciences, and some public-private initiatives such as the 'Entrepreneurship School' at the Sunrise Valley science and technology park, or the 'Business plan contest' organised annually by the Northtown science and technology park in Vilnius. The government approved the 'National Youth Entrepreneurship Training and Development Programme 2008-2012' in 2008. The Programme sets measures for integration of entrepreneurship training in the curricula of high schools (but not universities), other measures linked to monitoring and analysis of the youth entrepreneurship situation in Lithuania. The National Studies Programme identifies a group of activities - 'Development of Students Practical Skills and Entrepreneurship', which will include the following supported activities (€11m): development of models of undergraduate and student practice placement in enterprises and non-profit organisations; development of imitative enterprises (centres) and/or implementation of their activities and informal development of student entrepreneurship.

2.3 Knowledge demand

This section focuses on the structure of knowledge demand drivers and analysis of recent policy changes.

Lithuanian GDP fell substantially over 2009-2010. The contraction in GDP was to be expected because the economy was affected by several adverse factors, such as the shutdown of the Ignalina nuclear power plant and increases in oil and other commodity prices in the world markets. The unemployment rate jumped to a record level of 18.1% in the 1st quarter of 2010. An approaching large wave of emigration will improve the unemployment statistics. In a couple of years, however, this is likely to lead to labour shortages and exacerbate the already vast problems present in the social security system (Swedbank, 2010). The structural factors of the Lithuanian economy still remain unfavourable for boosting private demand for research. Key sectors (in terms of size) of the Lithuanian economy are of low-to-mid tech profile, dominated by traditional technologies (food and beverages, textile, wood and furniture) and based on non-R&D drivers of competitiveness. Those sectors that

grew rapidly on domestic consumption during the economic boom, such as the construction and domestic trades, shrank and suffered the bulk of bankruptcies. In terms of value added, it appears that medium- value-added sectors, which occupy the larger share of Lithuanian industrial production, have been overall more resilient. The structure of the economy in Lithuania did not experience a positive shift towards creating a higher share of high added value sectors. The inflow of FDI is also decreasing – the FDI in the first half of 2010 year-on-year basis dropped by almost 90%.

All in all, the structure of knowledge demand drivers in general remains as described by ERAWATCH Network in 2009. The main R&D investing sectors are medium and high-tech industry and services. The industry sectors performing the largest percentage of R&D in 2008 and 2009 were electrical machinery and apparatus, other machinery and metal products, computer and related sectors, and the chemicals, chemical products and man-made fibres sector. Surprisingly, R&D expenditure increased substantially in the food, beverages, tobacco, and wooden products sectors during 2009; and the share of research carried out in the services sector decreased.

Table 2: Business sector performed R&D by industrial sector, 2008-2009

Sector	2008, €m	2009, €m
Total manufacturing	25.3	28.6
Chemicals, chemical products and man-made fibres	2.60	2.5
Wooden products, except for wood and furniture	1.1	4.4
Pharmaceuticals	8.4	2.9
Electrical machinery and apparatus, other machinery and metal products	10.9	5.9
Food, beverages and tobacco	1.1	3.5
Computer, electronic and optical devices	3.4	3.9
Computer and related services	1.6	2.9
Research and development services	8.1	2.9
Construction	2.6	-
Financial services and insurance	13.7	10.6
Information and communication	2.3	3.3
Health services	7.6	4.1
Total: all enterprises	**61.2**	**52.6**

Source: Lithuanian Statistics Department

Data on the split between thematic versus generic R&D funding is not available. ERAWATCH Network 2009 suggests that thematic R&D funding comprises only 10% of total funding. This ratio would be higher if considering EU SF support granted for the development of research infrastructures in thematic fields. In 2008, the Government of the Republic of Lithuania adopted a resolution on five integrated centres ('valleys') of science, studies and business to be established aimed at consolidating the potential of scientific research, studies and knowledge intensive business. The MoES intends to allocate up to €400m for implementation of the programmes through the 'National Complex Programme' and the 'General National Research and Science and Business Cooperation Programme' (see Annex 1). It has been decided to prepare *Joint Research Programmes* (hereinafter referred to as JRP; 'joint' meaning that both business and science communities are involved in the implementation of research) aimed at co-ordinating implementation of the above projects. The Government of the Republic of Lithuania approved JRPs in the

following fields: natural resources and agriculture, biomedicine and biotechnology, materials science, physical and chemical technologies and engineering and information technologies. Moreover, 12 *national complex research programmes* (NCPs) were approved in: biotechnology and biopharmaceuticals; lasers, new materials, electronics, nanotechnologies and applied physical sciences; sustainable chemistry; ICT; medical sciences; sustainable environment; mechatronics; civil engineering and transport; cultural and creative industries; marine sector; agriculture, forestry and food industry. 34 research projects under the NCPs will be funded from the end of 2010 with a total budget of €34m.

The ability of the business sector to articulate research demand to decision makers is very limited in Lithuania. The Commission of Science, Technologies and Innovation ceased operating in 2008; other coordination instruments (workgroups) are applied on *ad hoc* basis; analytical studies, foresight exercises and various instruments of stakeholder involvement are not common practice. Given the current industrial profile of the country and, as a result – very limited and specialised business R&D demand in a few high technology areas (namely, lasers and biotechnologies), it becomes evident that the main demand-generators for R&D are the government and related governmental programmes.

The Lithuanian Research Council has approved a list of *National Research Programmes* in 2008: future energy; chronic non-infection diseases; Lithuania's eco-system: climate change and human factor; safe and healthy food; State and the nation: heritage and identity. The State will invest €5.7 from the national budget in each of the programmes for three year periods.

Future strategy for the development of the energy sector is one of the national priorities due to the closure of the Ignalina Nuclear Power Plant in 2010. Lithuania intends to remain a nuclear energy country, but efforts are dedicated to investing in other more sustainable alternative energy sectors. The new Energy strategy was approved by Government in 2010 and must now be approved by Parliament. The strategy should achieve energy independence for Lithuania by 2020; its implementation will cost €5-7b, but the funds are not secured yet. The National Research Programme 'Future Energy' has the following two major objectives: development and study of models for energy security and evolution of the energy system in Lithuania; as well as development of a scientific basis for future energy production, supply, and efficient consumption.

2.4 Knowledge production

The production of scientific and technological knowledge is the core function that a research system must fulfil. While different aspects may be included in the analysis of this function, the assessment provided in this section focuses on the following dimensions: quality of the knowledge production, the exploitability of the knowledge creation and policy measures aiming to improve the knowledge creation.

2.4.1 Quality and excellence of knowledge production

It has been widely acknowledged in various reports (ERAWATCH Network 2008, 2009; PPMI, 2009d) that the Lithuanian research and innovation system suffers from an imbalance of the relatively high inputs in research (public funds for R&D and available human resources) and an extremely low scientific output.

The data presented in the Lithuanian Higher Education and Research Review published by RHEMAC in 2009 show several trends.

First, there are substantial differences between different types of research production. The amount of general research production is fairly large. However, the amount of highest quality production (monographs and ISI articles) is modest. In 2007 the proportion of the highest quality research production and the rest of research production was 1:9. This paradox could be interpreted in two ways: (a) the incentives for publishing ISI articles or monographs have not been created; (b) the quality of the major part of the research production is poor and, therefore, cannot qualify for ISI articles or monographs.

Second, the productivity of researchers in preparing the highest quality research is very low. For example, it takes on average 16.6 years for a researcher to make a monograph. Compared to other EU27 with regard to the productivity of researchers, Lithuania is only above Luxembourg and Latvia.

Third, in the period 2004–2007, productivity of researchers was increasing. Over the given period more journals published in Lithuania are included in ISI lists. It cannot be thus maintained that the number of articles written by Lithuanian researchers in established reviewed journals of foreign countries has increased substantially.

Fourth, in Lithuania the universities have the highest potential of research activity and they are in fact the most productive: the share of monographs and ISI articles produced at universities is 69% while it is only 31% in all the research institutes.

Finally, according to the data of Eurostat and the National Patent Bureau, in 2008, Lithuanian international patenting rates per one million inhabitants was 36 times lower than the EU27 average; the number of registered designs per million inhabitants was 10 times lower. With reference to total R&D expenditures, Lithuania stands significantly below the EU average, and also twice as low as the NMS average. Taking into account the fact that Lithuanian public R&D level (0.64% of GDP in 2009) is approaching the EU average (0.65% in 2008), the efficiency of public spending in terms of generating technological knowledge is more than unsatisfactory. The ratio between the public R&D expenditure and the EPO patents registered is worst in the EU27 - in the EU, on average, ten times as many patents are submitted for the same funds. It could be concluded that the efficiency of research activity in Lithuania is very low: the results achieved by Lithuania (in producing ISI publications and filing patents) using the same human and financial resources are substantially weaker than in other EU Member States. Furthermore, according to the assessment of the World Bank (2009) the number of patents in Lithuania is not sufficient even in view of the level of its economic development. Meanwhile, the knowledge and technology intensive sectors remain small and the extent of their development does not provide any grounds for speaking about convergence, i.e. the evidence available does not allow concluding that Lithuania is approaching the EU average in this field.

2.4.2 Policy aiming at improving the quality and excellence of knowledge production

The State has taken systematic measures to improve production and exploitation of intellectual knowledge. *First*, there has been a shift in recent years towards a performance-based research funding (see 2.2.1). New Law on Research and Higher Education (2009) foresaw that Lithuanian Research Council would become

responsible for evaluation of scientific production. In the latest edition of evaluation methodology (2010), publications of high 'scientific significance' (ISI papers and monographs) gained bonus points. Decisions on which of the publications are of high 'scientific significance' are to be made by a national panel of experts (peers) at the LRC. *Second*, the Law establishes a practice of external evaluation of the research institutes to be performed every six years by national and invited foreign peers and supervised by the LRC. The current (2010) version of the evaluation methodology also foresees that research institutes should prepare a self-evaluation report every 3 years. Results of external evaluation will be tied to the accreditation of the research institutes. *Third*, in 2009-2010 the Ministry of Economy continued to reimburse up to 100% of the patenting cost for both private and public researchers. The Ministry of Education and Science has also been trying, since 2009, to foster the development of intellectual property rights development in the public research institutions by presenting the Guidelines for IP protection (see 3.4.1).

Various analyses and evaluation reports in the last 5 years have pinpointed the lack of an effective research policy monitoring and review system, international benchmarking and ex-post evaluation tools. In the ERAWATCH study on strategic governance of R&D related policies (Whitelegg K., Weber M., Hofer R., Polt W., 2008) Lithuania was included in the group of countries where a culture of evaluation was said to be particularly underdeveloped. In these terms, Lithuania lags behind the other New Member States. The recent period demonstrated a shift in government attitude towards policy accountability and policy learning. At national level, an improved Strategic Planning Methodology (2009) introduced an official requirement to evaluate all public programmes funded by the national budget at the ex ante, interim and ex post levels. In the research and HE policy field, RHEMAC has been carrying out a project since 2008 that intends to develop a comprehensive monitoring and evaluation system (indicators, guidelines and regulations) for research and HE in Lithuania. The new system of indicators will be developed before 2012. The Ministry of Education and Science has launched an international tender in 2010 for reviewing and developing a monitoring system for the integrated business and science 'valleys'. Implementation of separate initiatives raises a need for coordinating these initiatives, while not neglecting the monitoring systems already installed, such as SFMIS, the monitoring system at the Ministry of Finance for SF implementation in Lithuania.

2.5 Knowledge circulation

Tackling the challenges that European society faces in the 21st century will require a multi-disciplinary approach and coordinated efforts. Many debates and conferences, e.g. the Lund Declaration recognise that such complex issues cannot be solved by single institutions, technology sectors or MS acting alone. Hence strong interactions within the 'knowledge triangle' (education, research and innovation) should be promoted at all levels. Moreover, in the context of increasing globalisation, cross-border flows of knowledge are becoming increasingly important. This section provides an assessment of the actions at national level aiming to allow an efficient flow of knowledge between different R&D actors and across borders.

2.5.1 Knowledge circulation between the universities, PROs and business sectors

The LIS 2010-2020 declared improvement of knowledge circulation and transfer between various actors in the innovation system as one of its priorities. The current

policy mix contains a set of measures and funding instruments targeted at inter-sectoral R&D co-operation between the business sector and public research organisations, including universities. The total budget allocated directly for this purpose is about €100m (8% of total funds for research and innovation) for the 2007-2013 period (see 2.2.2).

The greater part of the measures aimed at increasing collaboration in research and knowledge transfer is funded by the SF 2007-2013 'Economic Growth OP' 1st priority 'R&D for Economic Development and Competitiveness'. *Firstly*, measures related to the development of innovative clusters with the original R&D and partnership infrastructures will be implemented in the period 2010 to 2013 ('Inocluster LT' and 'Inocluster LT+', €40m). However, not a single cluster project was funded before autumn 2010. The underlying reasons behind the delay possibly relate to the lack of a collaboration culture in the research and innovation system and the high requirements set for the applications (PPMIb, 2010). *Secondly*, the group of measures was introduced in order to support the development of the Lithuanian innovation support system. 'Inogeb LT- 1' (€20.8m), to be followed by 'Inogeb LT-2', aims to develop an effective knowledge and technology transfer environment (and specifically technology incubators and technology transfer centres at the science parks and universities), which would in turn support innovation and R&D in business and facilitate business and science partnership in R&D activities. However, the implementation of the latter measure has been delayed (no funds were allocated to specific projects before autumn 2010).

Thirdly, in July 2010, the MoE launched a pilot measure to provide 'innovation vouchers' (worth €2,900 – €5,800) for SMEs. The new measure is administered by Science, Innovation and Technology Agency (SITA). The measure proved to be extremely successful – the funds (€0.3m) were distributed in 22 days. In the 2011-2013 period, it is planned to distribute another €2.9m worth of innovation vouchers. The measure is financed from the national budget. *Finally*, the complex set of joint research programmes and integrated business and science centres ('valleys') are expected to contribute significantly to the knowledge transfer and circulation in the medium to long-term period. In 2010, only 1.5% of the total funds foreseen were allocated for construction of the 'valleys'.

All the measures are newly introduced; hence there are no interim or ex post evaluation results to be presented.

2.5.2 Cross-border knowledge circulation

The importance of integrating national research into ERA has been emphasised by several strategic documents, LIS 2010-2020 among them, but policy actions to encourage better access to international knowledge are scarce. There are no major policy changes in this field to be reported since 2008. The only novelty in this area is related to the LIS Action Plan for 2010-2013 approved in October 2010. It foresees implementation of several initiatives generating involvement of innovative Lithuanian companies in the international clusters: a) implementation of EVIT (Enterprise Europe Network) with €1.45m of State budget requested for 2011; b) StarDust application submitted to the INTERREG programme, that involves 5 pilot projects, related to clean technologies and future energy, welfare and health, future transport, digital business and services; c) a 'BSR Stars' project coordinated by the MoE together with Swedish partners and aimed at the preparation of a development programme for the Baltic Sea SME innovation clusters (part of the Art.185 initiatives

– the 'Eurostars' joint research programme). The objectives of this project include implementation of international collaboration projects and creation of a macro-regional communication platform based on digital technology. However, it is worth mentioning that so far these initiatives do not have national funding secured for implementation. Before December 2010 the decision of the Government remained to postpone implementation of all new research and innovation measures (including those mentioned above) that require State budget funding. This decision has increased tension between the main actors in the research and innovation governance system.

2.5.3 Main societal challenges

The need for international linkages is stressed in each one of the national complex research programmes (NCPs) in these fields: biotechnology and biopharmaceuticals; lasers, new materials, electronics, nanotechnologies and applied physical sciences; sustainable chemistry; ICT; medical sciences; sustainable environment; mechatronics; civil engineering and transport; cultural and creative industries; marine sector; agriculture, forestry and food industry. However, no national policy addresses the need for transnational collaboration.

2.6 Overall assessment

Table 3: Summary of main policy related opportunities and risks

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	• Increased share of competitive versus block funding of research.	• Delayed implementation of the SF programmes and measures secured for research, partly due to bureaucratic administrative approach. • Over-reliance on SF funding.
Knowledge demand	• State commitment to increase knowledge demand coming from governmental programmes.	• No mechanisms based on stakeholder involvement (for example, foresight) in place to identify drivers for knowledge demand. • Belated recognition of potential for service innovation. • Belated introduction of innovative public procurement policies. • Lack of attention to knowledge production in business enterprises sector (focus on strengthening R&D supply side in public research system).
Knowledge production	• Introduction of external evaluation of research institutes, based on international peer review. • Increased emphasis on performance based funding of research. • Commitment to building policy accountability and evaluation culture at national level.	• The identified strategic research areas are too diverse for a small country like Lithuania.

Domain	Main policy opportunities	Main policy-related risks
Knowledge circulation	• Recommendations for IP policies and strategies of PROs. • Commitment to fostering collaboration in research and knowledge transfer in LIS 2010-2020, followed by introduction of 'innovation vouchers'.	• Lack of State policy on cross-border knowledge circulation and internationalisation of science hampers profiting from access to international knowledge. • Lack of instruments aimed at the absorptive capacity of knowledge users.

Summing up, the strength of the current policy mix for encouraging private R&D investment lies in a variety of tools to improve innovation performance in existing businesses. Close attention to public R&D sector reform might also foster the improvement of R&D intensity in business in the long term, but the extent of leverage on private R&D might be insufficient. Furthermore, too little emphasis is on supporting the creation of knowledge-intensive companies, spin-offs and building of an entrepreneurial spirit in the economy.

As also noted by INNO-Policy TrendChart in 2009, the heavy reliance of the national innovation policy on EU SF funds creates an imbalance between public support (supply) and market formation (innovation-demand) policies. While strengthening the public sector and innovation support institutions, the government had paid little attention to the creation and facilitation of innovative markets, including those within existing governmental investment programmes that target energy, health care, and other important sectors. Limitations of the policy mix might delay achievement of the BERD/GDP targets.

Table 4: Main barriers to R&D investments and respective policy opportunities and risks

Barriers to R&D investment	Opportunities and Risks generated by the policy mix
Low and declining numbers of firms performing R&D	Lack of government incentives for private R&D. Current policy mix is focused on public research system, while there is too little focus on the R&D performing firms, on fostering R&D activity in those firms that are not engaged in this activity yet, and on the creation of new knowledge-intensive companies.
Shortage of high quality, industry-relevant skills	Higher education and research reform builds more emphasis on education quality and will foster a better balance of skills demand and supply.
Limited industry-HEI linkages	New measures (innovation vouchers) and implementation of earlier foreseen SF measures tackle this issue. However, measures aimed at knowledge transfer lack critical mass; implementation is delayed; policy measures too strongly oriented towards knowledge circulation towards established firms; and variety of measures is limited.
Lack of innovation culture in the economy, perceived lack of demand for new products and services	There is a lack of government attention to demand- and market-side of innovation policies. However, LSI 2010-2020 foresees new measures aiming at the introduction of an innovative public procurement policy.
Overall unfavourable framework conditions, especially macroeconomic pressures, exacerbated by the global economic crisis since 2008 and worsened by the strict tax policy	Lack of government attention to improving overall framework conditions to business. SF and national policy instruments designed to foster business investment in R&D might fail due to unfavourable framework conditions and lack of limited private co-financing capacity.

3 Interactions between national policies and the European Research Area

3.1 Towards a European labour market for researchers

The Communication Better careers and more mobility: A European Partnership for Researchers proposed by the EC in May 2008 aims to accelerate progress in four key areas:

- Open recruitment and portability of grants;
- Meeting the social security and supplementary pension needs of mobile researchers;
- Providing attractive employment and working conditions;
- Enhancing the training, skills and experience of researchers

The Commission has also launched concrete initiatives, such as dedicated information services for researchers, in particular through the activities grouped under the name of EURAXESS – Researchers in Motion. Based on the assessment of the national situation in the four key dimensions detailed above, this section will conclude if national policy efforts are supporting a balanced 'brain circulation', with outward mobility levels matching inward mobility levels. High levels of outward mobility coupled with low levels of inward mobility often signal an unattractive national labour market for researchers and unsuitable research infrastructures. This may trigger, despite the policy efforts supporting the mobility the 'brain drain' rather than brain circulation.

3.1.1 Stocks and mobility flows of researchers

The number of researchers has increased slightly since 1995 in Lithuania. In 2009, there were 13,827 researchers, of which only 10.7% (1,485) worked in the private sector, while the rest worked in higher education (10,633 or 76.9%) and government (1,409) sectors. The number of researchers in higher education institutions and the private sector has increased most rapidly over the last decade while in the government sector this number has decreased. In 2009, the share of R&D personnel constituted 1.12% of the total labour force (1.44% in EU27 in 2007). In the period 2000-2009, the share of R&D personnel was approaching the EU average. According to optimistic forecasts (assuming the crisis will not affect the increase in the share of the R&D personnel) Lithuania should reach the EU average after 2020. On the other hand, pessimistic forecasts claim that it is unlikely and the share of the R&D personnel will fall by around 20% in 2009-2011 (PPMI, 2009d).

The ageing of researchers was for quite a long time considered as one of the biggest challenges for the R&D sector. Substantial EU support was allocated to solve this problem in the programming periods of 2004-2006 and 2007-2013. The data available enable a few conclusions to be made. *First*, the share of researchers between 60 - 65 years of age is increasing; however, this tendency has slowed down over the past few years. *Second*, the number of younger researchers is increasing quite rapidly. This has most probably been preconditioned by the increase in the number of PhD students in the 2000-2008 period. On the other hand, taking into account the speed of the age dynamics, it is unlikely that the share of researchers in

the under 45 age group will comprise 50% of the total number of researchers by 2013, as specified by the objective in the Human Resource Development Programme 2007-2013 (PPMI, 2009d).

Official data on the inward and outward mobility of the researchers is unavailable. However, various sources allow concluding that outward mobility outweighs the inward mobility of researchers, thus contributing to the highly emphasised 'brain drain' problem. Information on Lithuanian researcher mobility and career paths are retrieved from the report produced by the qualitative study done on behalf of Centre for Quality Assessment in Higher Education (CQAHE) in 2010. Results of this study indicate that outward mobility of Lithuanian researchers is clearly increasing. This tendency is first of all related to the structural (political and institutional) changes that took place in Lithuania after the country became independent. By institutionally joining various EU scientific research and development programmes, Lithuania has objectively broadened opportunities for mobility. However, researcher mobility is still largely dominated by short international visits (up to 60% of the researchers go abroad for no more than three months). Only a small percentage of researchers (about 10%) stay in foreign research or scientific institutions for longer than one year. The fact that the numbers of researchers returning to the same foreign research institutions have increased more than four times during 2006-2008 allows the assumption that joining the FP6 and FP7 and other international programs provided Lithuanian researchers with the possibility of participating more permanently in scientific research networks. Only about 8% of Lithuanian researchers are actively engaged in international networks of research, moreover only 3% of them belong to European Research Centers of Excellence (Leonavičius V.et.al., 2010).

Results of this study indicate that a lack of finances, high workload, and insufficient information about international research networks constitute the major barriers for long-term international mobility. Also, results of this study indicate that Lithuanian researchers do better in trans-sectional mobility and in transdisciplinary research than in transnational mobility. The mobility of researchers from natural and technology sciences was higher than that from social sciences and humanities. The mobility of doctoral students was much lower than of postdoctoral researchers with long-term research experience. No data was available on the inward flow of foreign researchers, nor on outward flows of post-graduate students leaving for full-time PhD studies abroad. No evidence was found that would indicate the existence of some systematic discrimination of Lithuanian researchers by gender.

Enhancement of transnational mobility is an objective of the 'Researchers Career Programme' (RCP) that foresees funding for these measures: grants for international level researchers (including non-nationals); support for reintegration of researchers that used to work abroad; post-doctoral fellowships; promotion of scientific work of PhDs (support for research, funding scientific internships, PhD scholarships).

3.1.2 Providing attractive employment and working conditions

The level of remuneration for researchers in Lithuania was the seventh lowest in the EU27 in 2006, 63% below the EU25 average (CARSA, 2007). The comparison of remuneration levels in the public and the private business sector reveals that there is a huge difference between the sectors, as the remuneration of researchers working in the higher education sector is 43% lower than that of those working in the business sector. Unattractive employment and working conditions (low salaries and poor

access to academic databases and libraries, world class equipment) are the main obstacles for making a career in research attractive (Taljūnaitė, 2008).

Until recently, the regulation of researcher salaries used to hinder entrance into the researcher career. Since 2009, greater autonomy of universities and research institutes to determine the salaries of academic staff, and increased competitive funding might positively affect researcher salaries in those PROs that are more competitive on the national research 'market'. At the present time it is too early to evaluate the results.

The difference in the annual average salary between men and women in Lithuania is close to the EU27 average (25.4%), however the gap increases with experience (the difference is above 30% after 15 years of career). The number of women in much better paid leadership positions in institutions of higher education is still very small. No systemic policy actions or regulation acts promoting equal gender representation on academic and research committees, boards and governing bodies were observed over the period of 2009-2010 (or earlier). The only attempts to tackle the issue relate to several studies that were funded by the SF 2004-2006 and 2007-2013.

3.1.3 Open recruitment and portability of grants

The EURAXESS Lithuania web site offers information on a range of issues including social security, taxation, finance and pensions, as well as information on funding programmes and fellowships available. However, the portal does not advertise international research vacancies (there were no vacancies posted in October 2010). This may also point to a lack of awareness or interest of the national research institutions.

Overall, it may be summarised that the research system is very closed in Lithuania, with almost no funding programmes open to foreign researchers (except for the Global Grant scheme administered by the LRC). Moreover, the research grants awarded are not portable to another (foreign or national) institution. Several research studies have concluded that there is a need for open and transparent recruitment procedures that do not favour Lithuanian researchers, with positions being filled on the basis of qualifications.

3.1.4 Meeting the social security and supplementary pension needs of mobile researchers

There are no policy changes to report since 2009. Lithuania has not implemented the Scientific visa package. At the national level there is little tailoring of Article 17 of regulation 1408/71 for researchers through bilateral agreements. No tax incentives exist to facilitate the participation in supplementary pension schemes. After the European Council Directive No. 2005/71/EB was issued, the Lithuanian Parliament issued an amendment in 2008 to the Law on the Legal Status of Foreigners that provided regulation on the issuing of residence permits for foreign researchers having a contract with a Lithuanian research institution. According to the Law, a temporary residence permit is issued for one year and it is not necessary to apply for a work permit.

3.1.5 Enhancing the training, skills and experience of European researchers

There are no policy changes to report since 2009. Enhancement of the training, skills and experience of the researchers are subject to funding by the Researchers Career Programme (RCP). Measures of RCP include: State support for employment of researchers in business companies; funding training and qualification enhancement of researchers according to the specific needs of the research field or general competences and skills.

3.2 Research infrastructures

Research infrastructures (RIs) are a key instrument in the creation of new knowledge and, by implication, innovation, in bringing together a wide diversity of stakeholders, helping to create a new research environment in which researchers have shared access to scientific facilities. Recently, most EU countries have begun to identify their future national RI needs, budgets and priorities in the so called National Roadmaps for Research Infrastructures. These strategic documents also set out a strategic view on how to guarantee and maintain access to research facilities. Although some countries invest heavily in RIs, none can provide all the required state-of-the-art facilities on a national basis. Several large RIs have already been created in Europe. While optimising the use and development of existing RIs remains important, new infrastructures are needed to respond to the latest research needs and challenges. European Strategic Forum for Research Infrastructures (ESFRI) was established in April 2002 to support a coherent approach to policy-making on RIs in Europe and to act as an incubator for international negotiations on concrete initiatives. This section assesses the research infrastructures national landscape, focusing on the national RI roadmap and national participation in ESFRI.

3.2.1 National Research Infrastructures roadmap

Until recently, Lithuania had no strategy for maintaining, upgrading and establishing new research infrastructures. Building on the results of two extensive reviews carried out in 2007, massive investments of the SF 2007-2013 were planned in the new and existing RIs under the so called 'National Complex Programmes'. €450m are to be invested in building and upgrading existing research centres over the period 2010-2015, of which €300m will be used specifically for strengthening the leading RIs. As a result five science-industry clusters will be created: i) 'Santara' in Vilnius specialising in biomedical research, ii) 'Saulėtekis' in Vilnius specialising in laser technologies and material science, iii) 'Santaka' in Kaunas specialising in material science, chemistry and mechatronics, iv) 'Nemunas' in the Kaunas region specialising in agro-science, and v) Integrated Marine Science and Industry Center in the Klaipeda region. In the period 2009-2010 contracts for carrying out the foreseen projects have been signed with the PROs. However, the funds actually allocated until August 2010 were low (less than 2%, according to the data of the Ministry of Finance Lithuania).

The investment in RIs is accompanied by significant organisational changes in the PROs. A highly fragmented network of research institutes underwent consolidation in 2009-2010. The main objective, following the established principles of the HE and research reform was that no independent research institution in the priority sectors should have less than 200–300 PhD researchers. The new University on Health Sciences started operation in 2010. Seven state research institutes (centres) are to

be formed in the area of Natural, Technical and Social Sciences and up to four state research institutes (centres) are to be formed in the area of Humanities.

There are several leading research groups and infrastructures that managed to attract considerable international sources over the last decade. These infrastructures rest in the traditionally strongest thematic research areas such as biotechnology, laser technologies, material science and physics. For example, the Department of Quantum Electronics of Vilnius University hosts the VU Laser Center (VULRC), a pan-European infrastructure in high power laser technologies, a member of the LASERLAB-EUROPE consortium of European laser infrastructures since 2004 (ESFRI, 2009). However, involvement of Lithuanian RIs in international initiatives such as ESFRI has been (and still is) relatively vague. VULRC is a partner in ELI (Extreme Light Infrastructure), and the Institute of Lithuanian Language and Center of Computational linguistics of Vytautas Magnus University are members of CLARIN (Common Language Resources and Technology Infrastructure) initiative. In the ESFRI update process, which is still ongoing, Lithuania initiated the European Election Studies infrastructure, which is currently the only ESFRI proposal in the field of Social Science and Humanities (ESFRI, 2009).

3.2.2 National participation in the ESFRI roadmap. Updates 2009-2010

In 2008 the Ministry of Science and Education established a working group composed of international experts to prepare a Lithuanian roadmap on research infrastructures and to elucidate the strategic needs of Lithuanian science and industry for further investment in the RI of the country for the period 2007–2013. Unfortunately, the process took much longer than expected and as of October 2010 the national roadmap was not yet finalised. It is projected that the recommendations concerning a list of infrastructure projects that could potentially become ESFRI partners will be presented by the end of 2010.

During the period 2009-2010, the situation of national participation in the ESFRI roadmap did not change much, i.e. remained limited and not supported by public funds. The updates relate to Lithuanian Social Sciences and Humanities Data Archive (LiDA) becoming a member of the Council of European Social Sciences Data Archives (CESSDA). At the level of intent, Lithuania is aiming to participate in BBMRI, INSTRUCT, ELIXIR, other RIs of bio-sciences.

3.3 Strengthening research institutions

The ERA green paper highlights the importance of excellent research institutions engaged in effective public-private cooperation and partnerships, forming the core of research and innovation 'clusters', mostly specialised in interdisciplinary areas and attracting a critical mass of human and financial resources. The Universities/ research institutions should be embedded in the social and economic life where they are based, while competing and cooperating across Europe and beyond. This section gives an overview of the main features of the national higher education system, assessing its research performance, the level of academic autonomy achieved so far, dominant governing and funding models.

3.3.1 Quality of National Higher Education System

Prior to the Higher Education and Research Reform, the Lithuanian higher education sector comprised 15 state universities and eight private universities and colleges of

higher education. By the end of 2010, there were only 14 State universities (two smaller HEIs merged into the State University of Health). The HERD intensity ratio (HERD as a % of GDP) was 0.44% in 2009 which is similar to the EU27 average. However, expenditure in R&D in the higher education sector nominally decreased by 14% in 2009 from €137m to €116.7m.

Table 5: HERD as a percentage of GDP/GNP

	1998	2000	2002	2004	2006	2008*	2009**
HERD/GDP EU27	0.37%	0.38%	0.41%	0.40%	0.41%	0.43%	-
HERD/GDP Lithuania	0.21%	0.22%	0.33%	0.41%	0.39%	0.43%	0.44%

* Estimate; ** Data of the Lithuanian Department of Statistics

In the period 2003-2008, the income of colleges and universities more than doubled. The increase in the income of colleges mostly came from national budget, while the increase in the income of the universities mostly came from the private sector (two thirds of this income consisted of student payments). Since 2006, the income flow from abroad to colleges and universities has also increased; however, the share of this income in the overall income structure is still below 10%. In 2000-2008, the number of students doubled as well as the budgetary appropriations per student. It should be mentioned though, that the share of funding per student in Lithuania is still among the lowest in the EU. Although this conclusion is widely commented on in Lithuania, the country occupies an 'average' position among CEE countries. According to expenditure per student (in view of the purchasing power parity) Lithuania is ahead of Latvia, Poland and Estonia.

The accessibility and quality of higher education are the two goals of higher education in Lithuania mentioned most frequently. Lithuania stands out by the rate and extent of the increase in the number of students: in 18 years the higher education sector has tripled. In the 2009/2010 academic year there were about 144,300 students enrolled at 23 public and private Lithuanian universities (5% less than the year before), while the total population was 3.4 million inhabitants. In 2009, the number of university graduates was 42,400, or 2.5 times higher than in 2000 (17,200), whereas at vocational schools, the profession of skilled worker was acquired by just 12,700 vocational training students (in 2000, 14,900). Overall, in the academic year 2009/2010, fewer students were accepted by both universities and colleges, and vocational schools.

In the period 2000-2009, the number of academic staff in colleges and universities has increased. However, this could be explained by the fact that the share of the academic staff in colleges and universities to whom this is a secondary job has increased as well (up to one third of the academic staff in 2008-2009).

The performance of the Lithuanian higher education sector can be evaluated by several indicators, *first of all*, by its ability to compete in international research and higher education. Although there are no reliable statistics on the mobility of 'brains', the indicator of the capacity to attract PhD students from abroad can be used. In this field, the United Kingdom, France, Belgium and the Scandinavian countries hold the leading positions among the EU27 while Lithuania is the country with the lowest percentage of PhD students from foreign countries. Moreover, more than 10% of Lithuanian students choose to do their PhD studies abroad. The number of PhD students from abroad as a percentage of the total number of PhD students illustrates the international competitiveness of the country in attracting young 'brains'. With regard to both these indicators Lithuania occupies the last place among the Central

Eastern European countries and EU27. The situation is very unfavourable as the agglomeration effect is very strong in the competition for 'brains': high-ranking institutions of research and higher education are the ones, which can most easily attract 'the best brains' and this further strengthens their competitive supremacy. However, with regard to the share of graduates of natural, technical and applied science in the total number of graduates, which is one of the indicators for the implementation of the Lisbon Strategy, Lithuania is among the leaders in the EU.

Second, in the World University Ranking published by The Times Higher Education in 2008 Vilnius University (VU) was for the first time included in the top 600 (or 5%) world universities. VU shares with other higher education institutions the positions 501-600. This is the only university from the Baltic countries with such a high score. On the other hand, in the above mentioned rankings the positions of even four Polish universities and one Romanian university are substantially better while less expenditure per student is allocated in these countries than in Lithuania.

The data presented above implies that the Lithuanian system is extremely closed — it is not able compete on the international stage either for students or for 'brains'. The data presented in the overview does not allow concluding that the gap between Lithuania and the average EU Member States is decreasing. The comparison of Lithuania against other Central Eastern European countries allows the conclusion that the level of expenditure on higher education in Lithuania is average, but the indicators of outputs and results are poor. Moreover, the Research and Higher Education Review published by RHEMAC in 2009 warned that Lithuanian colleges and universities are changing into institutions of extra-mural higher education. In 2008, 53% of college students studied in extra-mural higher education programmes and for 49% of the academic staff in colleges their job in the college was secondary (it means they have another full time job that is not related to higher education). 36% of university students studied in extra-mural higher education programmes and for 34% of the academic staff their job in the university was secondary in 2008. These facts have a direct negative impact on the quality of the higher education process (PPMI, 2009d).

3.3.2 Academic autonomy

The Law on Research and Higher Education redefined the higher education and research governance model. HEIs governance model has shifted from State bureaucracy and academic oligarchy to the principles of new public management (PPMI, 2009a; PPMI, 2009b). *First of all*, the legal status of national higher education institutions changed from State budget appropriation managers to the new legal status of scientific research institutions. Since 2009, higher education establishments *de jure* have been granted full autonomy. *De facto*, the legal status and management of higher education establishments should be fully reformed by the end of 2011, when state universities and colleges will gain full right to use their real estate and earnings. Up to now, the major part of an institution's assets has belonged to the State.

Second, the Law unties the autonomy of institutions from academic freedom. This freedom is granted by the Constitution, but it belongs to an individual. Therefore, the principles of autonomy enforcement (e.g. selection of methods of academic activity, hiring staff or enrolment of students) have been fundamentally reformulated. The procedural autonomy is expanded. Strict centralised regulation in the areas of engagement and dismissal of researchers, their career, remuneration, etc. is given

up. After implementation of the projected changes all the above mentioned issues will be dealt with by the Boards of higher education institutions, not by public institutions. The approval of general and special requirements for higher education programmes is given up.

Third, strong emphasis is placed on the governance of HEIs. Up to 2009, the Senate, which was composed of representatives of the academic community, had the strongest influence on the governance of a university. Meanwhile, the new Law provides for granting the principal rights of decision-making to the boards of higher education institutions: they should take strategic decisions on changing the status of higher education institutions, their structural reorganisation as well as take decisions on the management of their funds, asset, etc. The Senate shall only retain an advisory function on major issues of operational management. On the other hand, the Senate will continue solving major academic issues of university governance. The Board will also elect the Rector who will be the major executor of the Board's decisions.

Principal changes are also preconditioned by reform of the formation of the Board. The provision is that half of the members of the Board should be comprised of persons who are not part of the staff of the HEI and who should be appointed by the Minister of Education and Research upon nomination by the Council of Higher Education, while the Minister him/herself shall nominate one member having consulted the Senate of the University. No representatives of the staff of a higher education institution or students can become the chairman of the Board. This implies that extensive self-governance was narrowed and the plan is to rely more on the governance of fiduciaries (social partners), which is typical of the market models of governance in higher education. These changes are aimed at making the activity of universities more open to the public as well as to creating governance levers to enable different groups of society to have greater impact on the activity of universities both with regard to the content and processes. Furthermore, the expectation is that this will enable the introduction of management novelties, typical to the private sector. All universities and research institutes should elect and approve their boards by the end of 2011. By autumn 2010, four universities and one college have completed that.

3.3.3 Academic funding

Prior to 2009, institutional 'block' funding for research and higher education comprised 88% of total funding. In 2009-2010 the share of research funding on the basis of research quality and results has been increased: the ratio of basic funding against competitive funding was 60/40 in 2010. It is projected that this ratio will be increased to 50/50 in 2011. Institutional funding is provided by the MoES, while the competitive funding is provided by the SSF, LRC and ESFA. Since 2009, the funding system has undergone major changes. In the Law on Research and Higher Education the main focus is on the change of funding mechanisms (in particular for higher education). Three major changes could be pointed out.

First, the provision that appropriations for research and higher education are allocated as a separate budget line is renounced, i.e. by changing the status of higher education institutions and transferring them to public institutions they lose the rights of appropriation managers they have enjoyed up to now. This way, the 'automatic', formula-based funding is renounced and legal preconditions for the competition of research and higher education institutions for resources are created.

These changes also imply that detailed reports on the use of funds, which are obligatory for all appropriation managers, will not be obligatory anymore.

Second, the projected funding of higher education is based on the 'voucher' principle. A student's decision to study in a certain higher education institution decides which school will receive government funding. In this model unlike the market model there are certain limitations– the movement of vouchers is restricted by the total number of vouchers and quotas according to the area of higher education, which is fixed by the Government. Universities are granted the right to set the price for higher education themselves; however, the size of vouchers is calculated according to the regulative prices of higher education. The law also provides for the possibility of targeted funding for higher education. The expectation is that in the future the targeted funding would be granted through tendering procedures (e.g. the funding institution would announce a tender for training a few hundred teachers).

Third, the tendencies are further strengthened by the increasing dependence of the basic funding of PROs and HEIs on their performance (see 2.2.1).

3.4 Knowledge transfer

The importance of knowledge dissemination and exploitation in boosting competitiveness and contributing to the effectiveness of public research has been increasingly recognised by EC and EU Member States. Following the publication of the ERA Green Paper in April 2007, the EC Communication 'Improving knowledge transfer between research institutions and industry across Europe' was issued, highlighting the importance of the effective knowledge transfer between those who do research, particularly HEIs and PROs, and those who transform it into products and services, namely the industry/SMEs.

Several Member States have taken initiatives to promote and facilitate knowledge transfer (for instance new laws, IPR regimes, guidelines or model contracts) and many others are planning to intensify their efforts in this direction. However, these initiatives are often designed with a national perspective, and fail to address the trans-snational dimension of knowledge transfer. This section will assess the national policy efforts aimed to promote the national and trans-national public-private knowledge transfer.

3.4.1 Intellectual Property Policies

A number of recent studies (PPMI, 2010a; PPMI, 2010b; INNO-Policy TrendChart, 2009) have concluded that intellectual property (IP) policies in Lithuania are an issue of extreme urgency, being one of the main bottlenecks in the exploitation of knowledge generated by the public research system. Not only are there gaps and unresolved issues in the current legal system regulating IP rights; the strategies for IP management and knowledge transfer at the public research institutions are vague and vary case by case. Knowledge Transfer Offices (KTOs) do not exist in most of the institutions, except for rare cases; and even in these cases (as in the case of the Technology Transfer Centre in Vilnius University, linked to the Sunrise valley science cluster) are not yet fully operational due to the lack of interest from the PROs' administration and lack of competent IP management specialists in the country.

In general, before 2009 the principles of IP ownership and transfer of IP rights applying to the intellectual work products generated from publicly funded R&D depended on the model under which research is carried out: through a separate legal

person established on the basis of the aforementioned interaction or on the basis of contracts. Law of Copyright and Neighbouring Rights establishes that copyright to the work belongs to the author (natural person). Pursuant to the Law on Research and Higher Education, researchers were guaranteed with the copyright to their intellectual work products. It was unclear however whether the IP rights to design and patent could be the property of a researcher when the research is carried out within the HEI or PRO. Previous legislation did not grant IP rights of designs and patents to the researchers, thus IP rights could be regarded as the property of the said institutions. The new Law has provided for a different set of rules. Generally the Law establishes that all rights stemming from the intellectual work products belong to the natural persons who have created them, while the HEIs might be granted economic IP rights under the agreements with creators of intellectual work products (Inteligentsia, 2009).

In December 2009, the Minister of Education and Science approved a set of IP Management Recommendations (guidelines) for the HEIs and PROs. In these Recommendations, the organisations are advised to organise IP management strategies in a way that creates more incentives for knowledge commercialisation, for example:

- A HEI or PRO must include the IP management principles in its long-term strategy and foresee its implementation framework and monitoring strategy, exploitation and dissemination strategy;
- An institution is advised to delegate the functions of IP management to a specific employee or establish a separate entity – a technology transfer centre;
- Contracts between the institution and its employees and students should include issues related to IP rights when intellectual work products are created during working/leisure time, using institution property, etc;
- HEI or PRO should ensure that the framework for creation of research results is clear; the exploitation of new knowledge is simple; the results of intellectual work created are publicly announced without violating the IP rights;
- If a spin-off company is created as a result of an R&D partnership agreement, it is recommended that the HEI/PRO seeks to acquire part of its shares;
- A HEI/PRO should establish a methodology for distributing the profit acquired as a result of commercialising intellectual work products, between the HEI structural department and its employee/student/group.

Current SF assistance measures mix for the period 2007-2013 foresees support for building technology transfer centres at the universities (measure Inogeb LT-2) that has not been used so far. Support is also available for the preparation of strategic plans at the universities using assistance from the Studies Programme. However, the overall guidance and support for building strategic planning capacities and strategic orientation at all the universities and colleges is missing. Training on how to foster knowledge transfer is not available.

3.4.2 Other policy measures aiming to promote public-private knowledge transfer

The Lithuanian Innovation Strategy 2010-2020 is the main strategic document with one of the explicit objectives to foster public-private knowledge transfer. Despite the fact that the Strategy does not foresee further enhancement of intellectual property

policies, it lists other key elements of the Government strategy to promote public-private knowledge transfer:

- Financial support from national sources (provided by the Ministry of Economy) ensured for legal entities and natural persons who aim to protect intellectual property rights (up to 100% of costs can be covered). In 2008 the Ministry introduced two new ways to support the acquisition of patents – prepayment and payment on accounts. After the introduction of prepayment and payment on accounts procedures, the numbers increased dramatically.
- Funding is provided to ensure inter-sectoral mobility for researchers, first of all the measure '*Employment of Researchers in Business'* (€9.1m) under the Human Resources Development OP that encourages employment of highly skilled researchers in private companies. However, only employment of national researchers is funded, while businesses often complain that required expertise in specific research fields simply does not exist in Lithuania.
- A set of policy measures aimed at fostering PROs and SME interactions: the complex 'integrated science valleys' initiative, development of clusters culture, joint research projects and others as described in detail in section 2.5.1.

So far the country has failed to set up an effective spin-offs support system. Despite a great number of financial engineering measures that provide business loans, venture capital and risk capital to established businesses since 2008, none of these measures are directly aimed at supporting spin-offs. Seed capital funds at either universities or public funding agencies are non-existent. The LIS Action Plan 2010-2013 indicates specific support (a one-off lump sum allocated for registering a company and getting necessary training) for spin-offs and newly established innovative companies at the science and technology parks and technology incubators. Funding for this measure has not been secured yet due to a strict budget-saving policy by the government in 2010.

3.5 Cooperation, coordination and opening up national research programmes within ERA

The articulation between the R&D Framework Programmes, the Structural Funds and the Competitiveness and Innovation Programme is still underdeveloped in terms of coordination, synergies, efficiency and simplification. The policy fragmentation at EU and national level, and between EU and national policies can hinder the build of critical masses of research excellence, leads to the duplication of efforts, sub-optimal impacts of the different instruments and unnecessary administrative overheads. Differences between research selection procedures and criteria can also be an obstacle to the overall spread of excellence. This section assesses the effectiveness of national policy efforts aiming to improve the coordination of policies and policy instruments across the EU, all part of the drive to create an integrated ERA.

3.5.1 National participation in intergovernmental organisations and schemes

According to the data of the European Commission, 150 Lithuanian institutions were involved in 116 new FP7 projects with an overall €26.7m budget (of which EU contribution amounted to €20m) in 2010. Lithuanian institutions are involved in the traditionally strongest fields: health, energy, also research for SMEs and Research

potential (about 15% of the total EU grant each); ICT, nano-sciences, also research infrastructures, Marie Curie (about 5% each); and Social sciences and humanities, environment, transport (2-3% each), and others below €0.5m. In 2010 Lithuania was engaged in eight FP7 research infrastructures: ELI-PP, Euro-RIS-Net (since 2007); LASERLAB-EUROPE CONT, BalticGrid-II (since 2008); PESI, LASERLAB-EUROPE, GN3, Geo-Seas, OpenAIRE (since 2009).

Lithuania also participates in the Eureka (since 1999) and Eurostars (since 2009) programmes. In 2009 Lithuanian institutions were involved in 29 Eureka projects and 7 Eurostars projects. Five new Eureka projects were approved in 2009 with a total budget of €2.19m (total grant €1.21m). The numbers of projects submitted and funded by Eureka have been more or less stable over the period 2007-2009, with most applications submitted in the fields of pharmaceuticals, biotechnologies and ICT.

Overall, participation of Lithuanian actors in the international programmes is increasing, but it is still not satisfactory. On the one hand, the average success rate (20.6% in 2010 as compared to 19.2% in 2009) and total amount of FP7 grants allocated for Lithuanian participants (0.16% as compared to 0.12% in 2009) have slightly increased. The average grant per participant has also increased from €76,000 (average data of FP6) to €133,600 (data of FP7, 2010). On the other hand, the ratio between Lithuanian institution-coordinators and Lithuanian institutions as FP7 project partners is the lowest in EU27. Moreover, none of Lithuanian-lead applications submitted to the FP7 Ideas sub-programme were successful. This points to the so-far limited international competitiveness and low research potential. Previous studies concluded (PPMI, 2007) that the abilities to attract international funds are not constrained only by the state of development of the national public research system, but also by lack of administrative capacities at the PROs. Limited capacities are currently directed towards implementation of the national research programmes and participation in the SF funded programmes. Thus participation in the international programmes is not increasing at a speed that could be expected. The analysis conducted by SITA (2010) concluded that the weak national research policy (with respect to encouraging research internationalisation), scattered priorities and lack of experience of Lithuanian institutions remain the main weaknesses that lead to mediocre participation results.

Involvement in inter-governmental European research infrastructures is vague. In 2004 Lithuania signed a collaborative agreement with CERN. The agreement is considered as a first step towards more intense participation in EIROforum. Fostering the participation of Lithuanian researchers in the construction of ERA is one of the specific objectives of the Lithuanian Innovation Strategy 2010-2020 (under the objective No.1 'To accelerate Lithuania's integration into the global market -'Lithuania without borders'). On the other hand, evidence points to the weak governmental strategy for achieving this objective. *The Programme for Internationalisation of Higher Education in Lithuania 2008-2010* does not include measures related to internationalisation of research. Nevertheless, a mix of guidance, advice and financial assistance (e.g. for FP7 project coordinators) is provided via SITA and LRC (since 2009).

3.5.2 Bi- and multilateral agreements with other ERA countries

Lithuania has signed a number of bilateral agreements with other ERA countries: Bulgaria, Italy (since 1996), Czech Republic, Romania, Spain (since 1995), Finland,

Poland, Estonia and Latvia (since 1998), Belgium (since 2009), France, Germany (since 1993), Greece, Hungary (since 1997), Slovenia (in 1997), Sweden (since 2000). However, bilateral cooperation in research has not been encouraged by active governmental policy or specific funding allocated. Most of the bilateral agreements did not lead to financially significant research programmes, except for the case of the Lithuanian-French programme 'Gilibert' (since 2003).

3.5.3 Other instruments of cooperation and coordination between national R&D programmes

Lack of active research and internationalisation policy in Lithuania resulted in vague involvement in various frameworks for coordination and co-operation of national research programmes. Lithuania is engaged in 4 ERA-NET projects:

- EMIDA: Coordination of European Research on Emerging and Major Infectious Diseases of Livestock;
- RURAGR: Facing sustainability: new relationships between rural areas and agriculture in Europe;
- EuroNanoMed: EUROpean network of trans-national collaborative RTD in the field of NANOMEDicine;
- ERA-NET ROADII.

There is no data available of national experience of engagement in European public-private partnerships such as Joint Technology Initiatives or Joint Programming Initiatives. There are 26 National Technology Platforms in Lithuania; their engagement in the European Technology Platforms is limited. SITA provides some funding for attending ETP meetings. Lithuania also aims to participate in one of Art. 185 initiatives – "Eurostars", a joint research programme for R&D performing SMEs and their partners. The project called 'Baltic Sea Stars' was submitted for above mentioned programme together with Swedish partners.

3.5.4 Opening up of national R&D programmes

Lithuanian research funding programmes have traditionally been closed to non-national researchers. None of the recent strategic policy documents point to the need to open national research programmes. Nevertheless, the necessity to attract world-class researchers, including those that have migrated from Lithuania years ago, is widely recognised in most of the research-related strategies and programmes. The period 2009-2010 brought some important changes. None of the funding programmes (by national or SF funds) are targeted specifically at non-nationals. However, since 2009 world-class non-national researchers carrying out research in Lithuanian institutions can apply for support of the measure '*Support to Research Activities of Scientists and Other Researchers (Global Grant)'* (see 2.2.3). One of three main objectives of the Global Grant scheme is to attract foreign researchers of international excellence and world-class to Lithuania. Non-national researchers are to compete on an equal basis with the leading national researchers. It is however not permitted to carry out research in the non-national's own country.

The question of ensuring possibilities to employ foreign researchers or collaborate with them in research projects has been lifted many times by Lithuanian business associations. Currently business companies are engaged in international agreements with foreign researchers or research institutions by their own means.

3.6 International science and technology cooperation

In 2008, the European Commission proposed the Strategic European Framework for International Science and Technology Cooperation to strengthen science and technology cooperation with non-EU countries. The strategy identifies general principles which should underpin European cooperation with the rest of the world and proposed specific orientations for action to: 1) strengthen the international dimension of ERA through FPs and to foster strategic cooperation with key third countries through geographic and thematic targeting; 2) improve the framework conditions for international cooperation in S&T and for the promotion of European technologies worldwide. Having in view these aspects, the following section analyses how national policy measures reflect the need to strengthen the international cooperation in S&T.

3.6.1 International cooperation

There is no specific internationalisation policy concerning cooperation with third countries in Lithuania. Lack of interest is clearly demonstrated by the fact that so far there has not been a single Lithuanian project in FP7's 'International Cooperation' sub-programme. Moreover, while there is a high number of bilateral agreements signed with third countries (Belarus since 2008, China, Columbia since 1995, Georgia, India since 2001, Israel since 2009, USA and Mexico since 2002, Mongolia since 2003, Philipines, Serbia and Montenegro, Turkey, Uzbekistan, Venesuela since 1995), most have not resulted in actual implementation of research. In 2010, there were two jointly funded research programmes: trilateral Lithuania-Latvia-China (Taiwan) programme (three projects funded in 2010) and Lithuania-Belarus programme.

3.6.2 Mobility schemes for researchers from third countries

So far, Lithuania fails to recognise the benefits of opening the research programmes to non-nationals. The national research system is extremely closed. This impedes the propensity of the system to rejuvenate itself, and creates a threat to enhancing the international competitiveness and building the research potential in Lithuania. There are no mobility schemes particularly targeting researchers from third countries. Moreover, the immigration and work permit policy for non-EU citizens remains a problematic issue. There are no incentives or new legislation to report in this field. Examples of researchers from third countries being employed by Lithuanian PROs are rare. More often researchers from third countries (post-Soviet countries such as Russia, Ukraine, Belarus, but also India and China) are employed by the private sector and using private funding sources.

4 Conclusions

4.1 Effectiveness of the knowledge triangle

Important reforms were implemented in the period from 2008 to 2010 in Lithuanian education, research and innovation policy sectors. The year 2010 has also been decisive in terms of putting emphasis at the intersections between the knowledge triangle policies in the Lithuanian Innovation Strategy 2010-2020. The increased policy attention and reformed public higher education and research sector should

contribute to the effectiveness of the knowledge triangle. However, current policy mix aimed towards increasing R&D investments is mostly supply oriented and neglects some other structural weaknesses in Lithuanian innovation system (such as the need to foster establishment of new R&D performing firms). The government had paid little attention to the creation and facilitation of innovative markets, including those within existing governmental investment programmes that target energy, health care, and other important sectors. Limitations of the policy mix might hamper achievement of the BERD/GDP targets. The following table gives a short assessment of the interaction between different policies in place in the knowledge triangle.

Table 6: Effectiveness of knowledge triangle policies

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	• More emphasis on performance based funding and increased share of competitive funding. • Introduction of external evaluation and self-assessment of research institutes. • Reduced fragmentation of the public research system by optimisation of research institutes network.	• Increased emphasis on research performance and increased share of competitive funding will in the medium term increase the quality of research. • Lack of co-ordination between research and innovation governance systems. • Lack of government policy on cross-border research collaboration and internationalisation of research. • Lithuanian research system remains to a large extent closed to other ERA countries and third countries.
Innovation policy	• Broad-based Lithuanian Innovation Strategy 2010-2020 and its Action Plan for 2010-2013 map the RTDI policy mix and establish Government's commitment and priority to promotion of innovations, put emphasis on interaction of knowledge triangle policies. • Newly established Science, Technology and Innovation Agency aims at reducing the fragmentation of research and innovation support system at the medium term period. • Introduction of 'innovation vouchers' scheme.	• LIS 2010-2020 introduces systematic approach towards innovation promotion. Versatile innovation policy mix secured for 2007-2013; focusing also on non-technological innovations. • Funding for fostering HEI-industry linkages and cluster policies is not substantial enough. • The policy mix focuses on supporting 'the winners', too little emphasis on firms not yet engaged in R&D, spin-offs and fostering entrepreneurship in general. • Imbalance of innovation supply and demand side measures, limited use of public procurement as a driver for innovation. • Fragmentation of innovation and research support system and poor inter-departmental coordination remains a problem.
Education policy	• HEIs governance reform (e.g. the power of the boards increased). • Increased autonomy of HEIs to use their assets, determine salaries of researchers etc. • Recommendations on IP policies and strategies at HEIs introduced.	• Introduction of quasi-market instruments, autonomy of universities and governance reform are expected to lead to better market demand and supply match and increased quality of studies. • Lack of support for building strategic capacities at universities, including training and guidance in setting knowledge transfer policies and KTOs.

	Recent policy changes	Assessment of strengths and weaknesses
Other policies	• FDI policies increasingly focused on attracting mobile R&D investment (at least two major R&D investments generated in 2009-2010 in ICT and biotechnologies).	• Business climate remains average, economic policy does not favour fostering of entrepreneurship. Framework conditions worsened by increased company taxes.

4.2 ERA 2020 objectives - a summary

Unfortunately, ERA-related policies have not attracted higher attention over the last years. Government policy towards trans-national collaboration, internationalisation of science and opening the national research system to researchers from other countries is underdeveloped. Joint design and coordination of policies remain low on the political agenda. Lack of policy attention to opening up the national research programmes stems from the need to first address the national problems related to unattractive researchers' careers and limited research capacity. A mix of measures under the 'Researchers Career' Programme addresses those issues. In 2010 the Lithuanian Research Council started implementing the Global Grant Scheme, which is for the first time available to non-national world class researchers. Substantial funding (about €400m) is also secured for building world-class research infrastructures; first funds were allocated to the research centres in 2010. The following table gives a short assessment of the national policies/measures supporting the strategic ERA objectives.

Table 7: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
1	Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers	• No policy changes. Policy attention is focusing on the implementation of a framework for researcher careers via the 'Researchers Careers' Programme, funded by SF. Implementation of a versatile mix of measures started in 2010.	• Adequate supply for science & engineering, however the quality of graduates does not fully match market demand. • Overall unattractive working conditions for researchers: low salaries, low access to world-class equipment, however a substantial amount of national and SF funding will be invested towards improvement of the working conditions of researchers in 2010-2015.
2	Increase public support for research	• Public budget for R&D decreased by 14% in 2009	• Low levels of R&D expenditure, also affected by the crisis and delayed implementation of the SF.
3	Increase European coordination and integration of research funding	• No policy changes.	• Government strategy on trans-national collaboration and coordination of research remains underdeveloped.

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
4	Enhance research capacity across Europe	• Bulk of measures, including the NCPs, JRPs and Programmes for science 'valleys' are approved, implementation started in 2010.	• Government places investment in the public research infrastructure and research capacity at the core of national policy for research and innovation development.
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	• No policy changes. Implementation of previously approved measures started. Some €400m will be invested in national RIs in five year period	• Government funding ensured for developing world-class research infrastructures. However, over-reliance on SF funding makes maintenance and further development of RIs post-2013 periods questionable
6	Strengthen research institutions, including notably universities	• The Law on research and studies grants full autonomy to universities since 2010, and strengthens the power of the Board comprised of socio-economic partners. • Methodology on evaluating research performance (2010) provides guidelines on peer-review and performance indicator based evaluation of research results and quality, and embeds performance based research funding. • Methodology for external evaluation and self-assessment of research institutes presented.	• Higher education and research reform, that puts stronger emphasis on research and studies quality, increases the share of competitive funding and introduces performance based funding, will positively affect the quality of studies and research. • Closer involvement of stakeholders in the governance of HEIs will ensure better match between skills supply and market demand.
7	Improve framework conditions for private investment in R&D	• No positive policy changes.	• Framework conditions for private investment in R&D remain average. Tax incentives for R&D are applied since 2008; however business climate remains relatively unfavourable, especially because of the recession and strict fiscal policy. Lack of investment in capital in domestic companies results in the low level of R&D investment in capital.
8	Promote public-private cooperation and knowledge transfer	• Introduction of innovation vouchers scheme. • Commitment to fostering R&D collaboration and knowledge transfer in LIS 2010-2020.	• Funding secured to foster public-private knowledge transfer and R&D collaboration, but its share in the total share of resources allocated for R&D and innovation is relatively limited (8%), and implementation is delayed. • Third mission is not a high priority for Lithuanian HEIs; limited priority to knowledge transfer at HEIs strategies; few KTOs operating.

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
9	Enhance knowledge circulation across Europe and beyond	• Global Grant scheme by Lithuanian Research Council is *de jure* open to non-national researchers since 2010.	• Most of the research funding programmes remain closed to the researchers located outside Lithuania; the one scheme available does not allow non-nationals to carry out research in their home country.
10	Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world	• No policy changes.	• Lithuania's policy towards international cooperation in research remains underdeveloped; this issue is low on political agenda.
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	• No policy changes.	• Lithuania's engagement in joint design of policies and programmes is vague.
12	Develop and sustain excellence and overall quality of European research	• More focus on funding world class research projects and on attracting high quality international researchers (in the Global Grant scheme).	• Impressive investments are secured for national RIs and excellence in research. However Lithuanian research system remains extremely closed.
13	Promote structural change and specialisation towards a more knowledge - intensive economy	• New Lithuanian Innovation Strategy 2010-2020 approved by Government decree represents a strong signal of intent to create a knowledge based economy in Lithuania.	• Lithuanian Government has committed to put STI agenda at the core of economic renewal. So far most attention is on strengthening of the public research system.
14	Mobilise research to address major societal challenges and contribute to sustainable development	• National research programmes on future energy and climate change approved and budget for 3 years secured.	• Number of research priorities (12 NCPs approved) remains too broad for a small country like Lithuania. • Instruments (like foresight) for identifying knowledge demand drivers and setting clear national R&D priorities are not applied.
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	• Several SF measures are directly addressing this issue (especially the interest of the younger generation in science).	• Numbers of graduates in science and technology fields remain high. • State puts even more emphasis on attracting young graduates to start research career.

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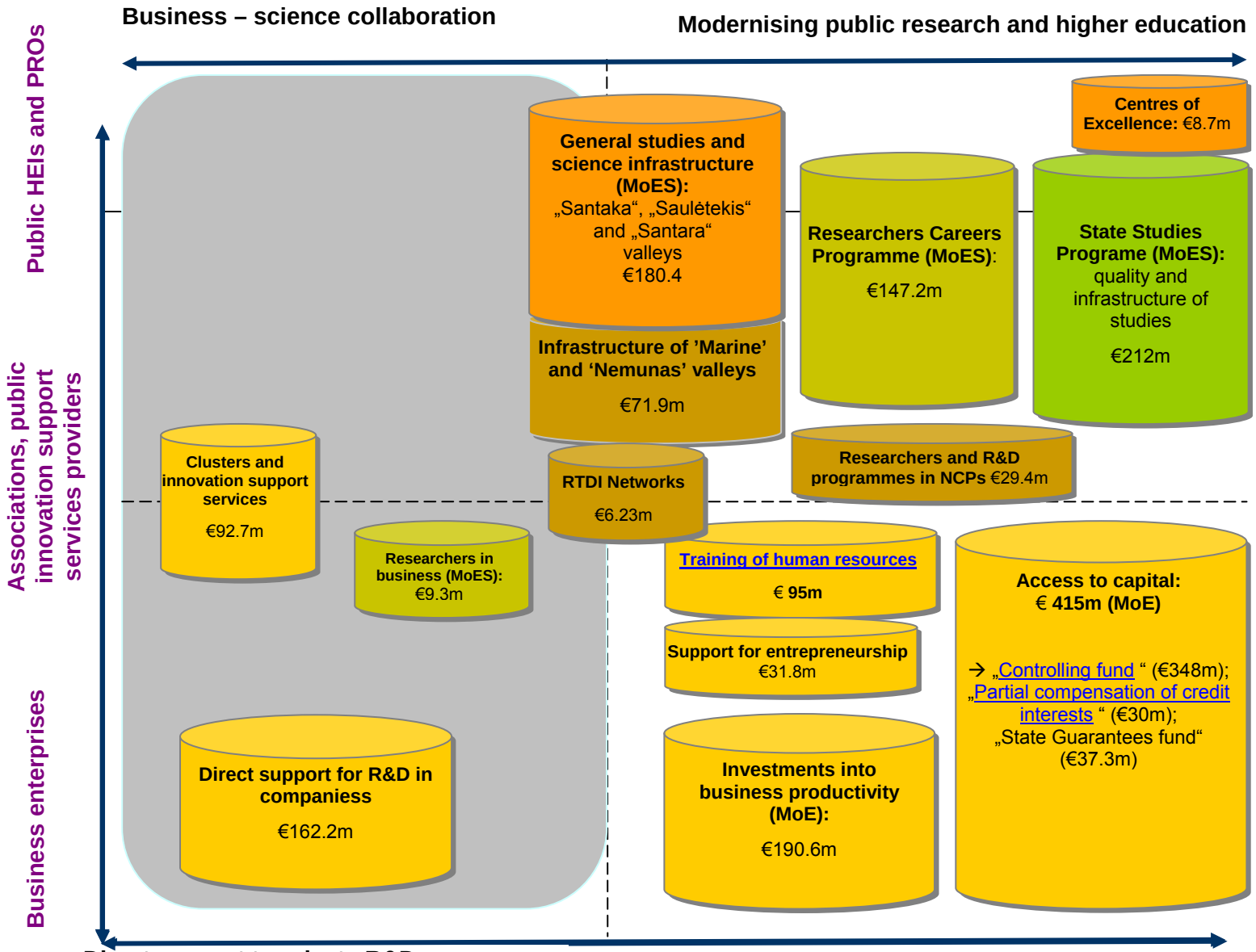
List of Abbreviations

AISDP	Agency for International Science and Technology Development Programmes
BERD	Business Expenditures for Research and Development
BSR	Baltic Sea Region
CEE	Central and Eastern Europe
CERN	European Organisation for Nuclear Research
CLARIN	Common Language Resources and Technology Infrastructure
COST	European Cooperation in Science and Technology
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFA	European Social Fund Agency
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU-12	European Union including 12 new Member States
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FP	European Framework Programme for Research and Technology Development
FP	Framework Programme
FP7	7th Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
ICT	Information and Communication Technology
IP	Intellectual Property
JRC	Joint Research Center
JRP	Joint Research Programme
KTO	Knowledge Transfer Organisation
LBSA	Lithuanian Business Support Agency
LCQAHE	Lithuanian Centre for Quality Assessment in Higher Education
LIC	Lithuanian Innovation Centre
LIS	Lithuanian Innovation Strategy

LRC	Lithuanian Research Council
LSD	Lithuanian Statistics Department
MoE	Ministry of Economy
MoES	Ministry of Education and Science
MS	Member State
NCP	National Complex Programme
NMS	New Member States
OECD	Organisation for Economic Co-operation and Development
OP	Operational Programme
PPMI	Public Policy and Management Institute
PRO	Public Research Organisations
R&D	Research and development
RCP	Researchers Career Programme
RHEMAC	Research and Higher Education Monitoring and Analysis Centre
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
S&T	Science and technology
SF	Structural Funds
SFMIS	Structural Funds Management Information System
SITA	Science, Innovation and Technology Agency
SME	Small and Medium Sized Enterprise
SSF	State Studies Foundation
SSH	Social Sciences and Humanities
VAT	Value Added Tax
VC	Venture Capital
VU	Vilnius University
VULRC	Vilnius University Laser Research Center
WUR	World University Ranking

Annex 1: EU SF 2007-2013 support for RTDI in Lithuania



Source: PPMI, 2010a. Data on budgets valid on 12-2009

NATIONAL COMPLEX BUSINESS AND SCIENCE COLLABORATION PROGRAMME: €218m
- „High Level Research and Competence Centres“ (€8.7m):
- „National Open Source Scientific Communication Centre“ (€29m);
- „Strengthening General Science and Studies Infrastructure“ (€180.4m)

RESEARCHERS CAREERS PROGRAMME: €156.4m
- „Researchers mobility and students scientific work“ (€44m);
- „Building qualification and skills of researchers and other R&D personnel“ (€46.3m);
- „State support for employment of researchers in companies“ (€9.2m);
- „R&D quality and R&D experts“ (€9.2m);
- „R&D thematic networks and associations“ (€4.8m);
- „Global Grant Scheme“ (€34.8m);
- „Improvement of knowledge about S&T among youth and fostering equality in science“ (€8.7m);
- Studies on the quality of R&D and HE (€2.5m)

GENERAL NATIONAL COMPLEX PROGRAMMME: €114.4m
- „Study programmes in the NCPs“ (€13.9m);
- „Strengthening General Science and Studies Infrastructure (€71.9m);
- Higher education infrastructure modernisation in priority fields (€10.1m)
- „R&D thematic networks and associations“ (€ 1.44m);
- Mobility of researchers and capacity building in the NCPs" (€ 15.3m)

DIRECT SUPPORT TO PRIVATE r&d ACTIVITIES: „Idea LT“ (€10.25m); „IntellectLT“ (€57.9m); „Intellect LT+“ (€92.4m)

ENCOURAGING ENTREPRENEURSHIP: SADM - „Entrepreneurship skills“ (€14.5m); ŪM - „Asisstant-2“ (€17.4m).

INVESTMENTS IN PRODUCTIVITY: „Leader LT“ (€118.2m); „E-business LT“ (€29m); „Process LT“ (€14.5m); „New opportunities“ (€29m)

CLUSTERS AND INNOVATION SUPPORT SERVICES „Inoklaster LT“ (€7.7m); „Inocluster LT+“ (€17.4m); „Inogeb LT-1“ (€9m); „Inogeb LT-2“ (€28.7m)

State Studies Programme