ERAWATCH COUNTRY REPORTS 2010:
Latvia

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Executive Summary

Latvia is a small country with a population of 2.25 million (2010), which amounts to 0.45% of the total EU-27 population. In 2009, its GDP per capita made up only 49% of the EU-27 average. While the annual growth rate of GDP in 2006 was 12.2%, under the conditions of economic recession by 2009 it has fallen to minus 18%. An accompanying substantial decrease has been observed with regard to the gross domestic expenditure on research and development (GERD), which had reached 0.7% of GDP in 2006 after stagnating around 0.4% in 1996-2004, but has dropped again to 0.45% in 2009 – level way below the EU average (1.9% in 2008). In absolute terms GBAORD has decreased from €53m (2008) to €23.5m (2010).

The distribution of GERD by sources of funds still demonstrates the predominance of the government sector, while in other EU-27 countries the major contribution comes from the business enterprise sector. So far the latter has played a limited role in the national research system of Latvia since BERD has been negligible (2001 - 0.15% of the GDP, 2009 - 0.16%) and is seven times lower than the EU average (1.21%). The main barriers to private R&D investments are related to the setback induced by the economic and financial crisis as well more longstanding problems with low R&D intensity of the limited industrial sector, weak cooperation between public research institutes and universities, on the one hand, and business companies, on the other, as well as lack of human resources and gaps in the scope of policy measures facilitating such private investments.

The present R&D policy mix is characterised by quite a considerable range of measures aimed both at public research organisations and business companies as well as at encouraging their collaborative efforts. Nevertheless, the major emphasis is still on the measures geared towards increasing R&D in the public sector, which is seen as a potential stimulus for subsequently encouraging R&D also in the private sector. Against the backdrop of the crisis, the main emphasis with regard to the development of business sector is rather related to export promotion incentives. Besides, many of the present major R&D policy measures rely almost exclusively on the availability of the EU Structural funds that causes concern over the sustainability of public support for research in a more long-term perspective beyond 2013.

The following table also gives a short assessment of the interaction between different policies in place in the knowledge triangle.

Knowledge Triangle

Effectiveness of knowledge triangle policies

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	• Further radical reduction of GERD only partially compensated for by the EU SF co-funded programmes. • Adoption of a new set of research priorities for 2010-2013 and launch of respective state research programmes. • Initial incentives aimed at consolidation of the leading research performers into units of state significance. • Increased emphasis on applied research in newly launched support programmes. • Expanded composition of the Latvian Council of Science aimed at strengthening links between different policy domains. • Increased efforts for facilitating inflow of young people in science.	**W**: Reduced government funding for R&D leading to an increased outflow and reduced re-emigration of talented scientists. **W**: Limited provision of researchers' positions for the growing number of newly awarded PhDs. **S**: Potential for reducing the fragmentation of supervisory and coordination issues in research domain presented by the planned consolidation of the leading research performers. **W**: Lack of an adequate system of research evaluation leading to mistrust towards the present system by certain parties. **W**: Low performance in terms of national research output (bibliometric indices).
Innovation policy	• Launch of the long-awaited Competence Centre programme. • Initial incentives aimed at optimising the regulation of IPRs regarding inventions made by public HEIs and PROs.	**W**: Lack of correlation between national R&D priorities and strengths of the national economy. **W**: Limited scope of beneficiaries of targeted innovation policy measures in the business enterprise sector. **S**: Potential to build on Latvia's research strengths in key sectors (biopharmacy and materials science). **W**: Lack of tax incentives for R&D performing companies. **W**: Overemphasis on high-tech R&D activities.
Education policy	• Further reduction of government funding for higher education and research budget thereof. • Widening high-level debate on the need for structural reforms of HE and research. • Recurrently postponed adoption of the draft Law on Higher Education.	**W**: Danger of funding cuts and disarrayed system leading to lowered international rankings of public HEIs. **W**: Mismatch between the skills of university graduates and the needs of the national economy. **W**: High share (70%) of fee-paying students at public HEIs. **W**: Restrictions set by the present legislative framework on the implementation of a more progressive and internationally-oriented HE system. **W**: High level of unemployment, including among the highly educated population.
Other policies	• Emphasis on export promotion and policy for renewable energy.	

European Research Area

Assessment of the national policy orientation towards supporting the strategic ERA objectives as defined by the ERA 2020 Vision shows that not all of the 15 objectives have been equally addressed in Latvia, though at least some level of activity can be detected with regard to each of those (see Table below). Many of the ERA-related topics are at least formally addressed in the newly adopted and long awaited Guidelines for Development of Science and Technology for 2009-2013. Yet, in practice, there are far more weaknesses than strengths identified upon the assessment of the reviewed national policies and measures with regard to almost all ERA objectives testifying of the need for further major inputs in Latvia along all the lines of the ERA 2020 Vision.

The main challenges for the national R&D system in relation to ERA development are currently posed by the need for more determined actions with regard to implementing a range of long debated structural changes within the system, ensuring the continuity of present research efforts and long-term predictability of funding flows, facilitating the attractiveness and accessibility of local R&D base by foreign researchers and simultaneously retaining the local critical mass of researchers, along with setting and achieving high research quality standards, enhancing national participation in European RTD schemes and organisations, not to mention the long standing need for boosting the absorptive and innovative capacities of business companies.

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

	ERA objectives	Main national policy changes	Assessment of strengths and weaknesses
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	• A new EU SF co-funded programme for the attraction of human resources to science launched.	• Limited attractiveness of Latvia for incoming foreign researchers. • Formally equal career opportunities for both male and female researchers.
2	Increase public support for research	• Further radical cuts in the state budget funding for science. • Certain leverage effect attempted by the distribution EU SF for several R&D-related programmes. • Scale down of the target for GERD to be reached by 2020.	• Low feasibility of achieving the 3% target of R&D funding. • Continuous uncertainty about annual funding for R&D-related activities.
3	Increase European coordination and integration of research funding	• Introduction of a coordinated and regulated mechanism for national participation in ERA-NET schemes.	• Increased involvement of Latvian partners in ERA-NET schemes and projects. • So far limited openness of national R&D programmes to foreign participation.
4	Enhance research capacity across Europe	• Implementation of an EU SF co-funded programme (scholarships) aimed at increasing the number of newly awarded PhDs.	• Comparatively low completion rate of doctoral studies. • Limited possibilities for post-graduate training.

	ERA objectives	Main national policy changes	Assessment of strengths and weaknesses
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	• Several new EU SF co-funded programmes aimed at modernising existing and creating new RIs launched. • Reinforced commitment of Latvia for participation in the ESFRI roadmap and related projects.	• Presence of several (though limited in number) world-class national infrastructure objects. • So far limited debate and targeted incentives for facilitating foreign access to national RIs.
6	Strengthen research institutions, including notably universities	• Further radical cuts in public funding for HE (in both educational and research domains). • Adoption of an informative report drafted by a high-level task force on the required structural changes in HE and research for boosting international competitiveness.	• Legal regulations on national language requirements in public HES act as a serious obstacle for the internationalisation of national HEIs. • Prolonged postponement of the new draft Law on HE.
7	Improve framework conditions for private investment in R&D	• Greater attention being paid to the entrepreneurship component at all levels of education system.	• Continuous lack of tax incentives for private R&D performers. • Public R&D funding so far not acting as a catalyst for the attraction of private R&D investments.
8	Promote public-private cooperation and knowledge transfer	• Competence centre programme aimed at promoting cooperation between business companies and research institutions launched.	• Limited absorptive capacity of R&D results by the business enterprise sector. • Still limited entrepreneurial drive of national academic institutions. • Low national innovation performance.
9	Enhance knowledge circulation across Europe and beyond	• New EU SF co-funded support measure aimed at facilitating participation of Latvian scientists in international projects and activities launched.	• National participation in EU R&D programmes – COST, EUREKA, EUROSTARS. • Recently decreasing national participation in FP7 (number of applicants, EC contribution). • Comparatively slow national involvement in European RTD schemes and organisations (ETPs, JTIs, JPIs, ESF, etc.).
10	Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world	• Declared prioritisation of facilitating internationalisation of national HE and science by the Ministry of Education and Science.	• Presence of a range of bilateral and multilateral agreements on research collaboration and mobility of researchers. • Still negligible inflow of foreign researchers.

	ERA objectives	Main national policy changes	Assessment of strengths and weaknesses
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	• New expanded membership of the Latvian Council of Science including representatives from different research-related ministries in addition to proxies delegated by scientists.	• Difficulties still experienced in efficiently coordinating national research and innovation governance structures.
12	Develop and sustain excellence and overall quality of European research	• Crisis-induced termination of the initiated international peer review procedure of national applications for collaborative research projects. • Debate on the introduction of higher quality standards upon evaluation of national project proposals (e.g., SCI publications).	• Low values of internationally competitive output indicators (publications, patents). • Limited national and institutional access to databases on peer reviewed journals and articles (Scopus, ISI Web of science).
13	Promote structural change and specialisation towards a more knowledge - intensive economy	• Adoption of the Guidelines for Development of Science and Technology for 2009-2013. • Adoption of research priorities for 2010-2013, launch of respective state research programmes. • Initiation of consolidating leading research performers into scientific centres of state significance.	• Emerging incentives aimed at eliminating the present fragmentation of research activities. • Internal contradiction and dissent regarding the most appropriate measures for restructuring among the involved parties.
14	Mobilise research to address major societal challenges and contribute to sustainable development	• Selected major societal challenges (e.g. public health, climate change, renewable energy) covered by individual state research programmes.	• Prevalence of public support for established national competencies with economic potential rather than novel research addressing major societal challenges.
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	• Ex-post evaluation of the state research programmes carried out in 2005-2009.	• Predominance of a technocratic approach to research and innovation governance. • Limited incentives for citizen engagement in setting research agenda.

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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

This section gives the main characteristics of the structure of the national research and innovation systems, in terms of their wider governance.

Latvia has a total of 2.25 million inhabitants, featuring a constant decrease of population since 1990 and, according to Eurostat, currently accounting for only 0.45% of the total EU-27 population (2010). While Latvia's gross domestic product (GDP) per capita in purchasing power standards (PPS) by 2008 had reached 57% of

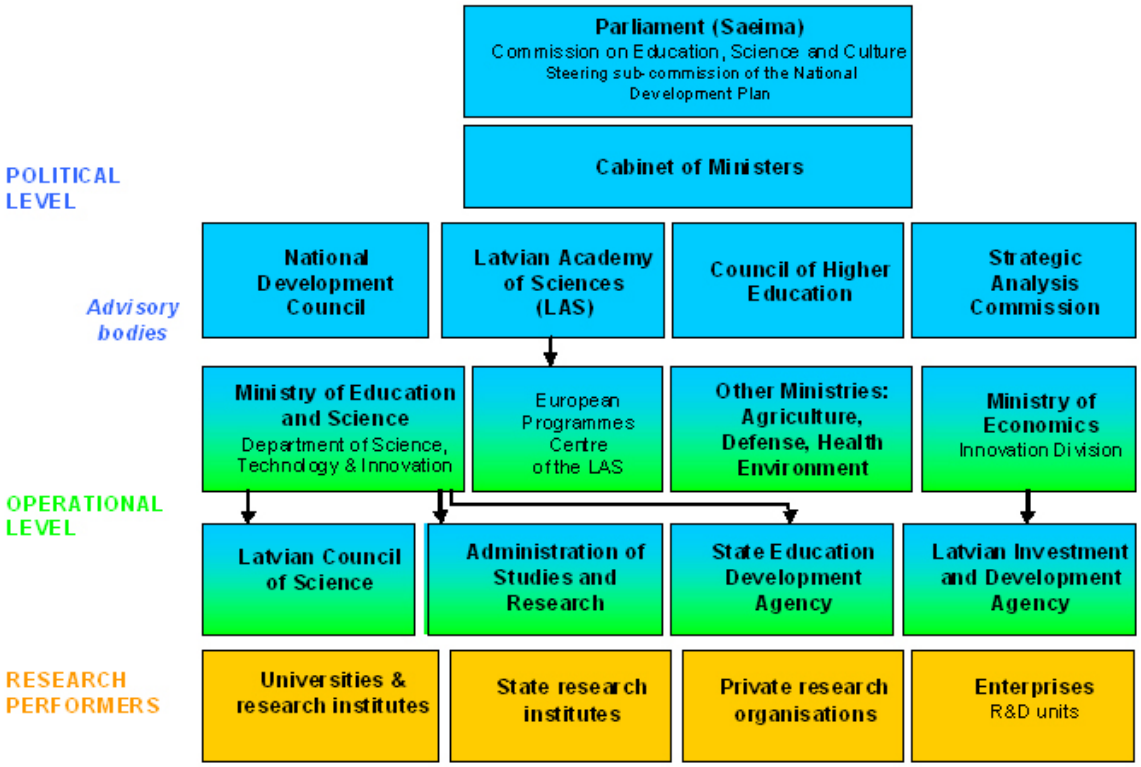
the EU-27 average with GDP having grown at an impressive rate of over 10% since 2005, due to the following harsh economic recession, in 2009 it felt back to the level present in 2005 (49% of the EU-27 average) characterised by the real GDP growth rate of -18 (additional -3.5 forecasted for 2010). This decline has also been accompanied by a drop in the total employment rate from 68.6% in 2008 to 60.9% in 2009 whereby the unemployment rate reached 20% in the beginning of 2010.

A substantial decrease has also been observed with regard to the gross domestic expenditure on research and development (GERD), which had reached 0.7% of GDP in 2006 after stagnating around 0.4% in 1996-2004, but dropped again to 0.61% in 2008 thereby making up only 32% of the EU-27 average (see also section 2.2.1). An additional cut by 40% in the national science budget from €51.65m in 2008 to €31.16m in 2009 (MoES, 2010a:14) has, according to the data provided by the Central Statistical Bureau (CSB, 2010) of Latvia, led to an even further reduction of GERD down to 0.45%. The shares of GERD by sources of funds in 2008 were as follows: government sector – 47.3%, higher education sector – 2.3%, business enterprise sector – 27%, and abroad – 23.1%, thus demonstrating that the government is still the major contributor. For comparison, the EU-27 average accordingly features a major (55%) contribution from the business enterprise sector with only 33.5% coming from the government sector.

Main actors and institutions in research governance

The governance of the national research and innovation system can be characterised by the main actors at the political, operational and performing levels. At the political level, high-level decisions with regard to R&D issues are taken and priorities are set by the Parliament and the Cabinet of Ministers (see Figure 1). So far the sole body on the political decision making level dealing with R&D issues is the parliamentary Commission on Education, Science and Culture. The central organisation in Latvian R&D policy is the Ministry of Education and Science, which is not only the main policy-maker, but is also directly involved in the funding and implementation of several R&D programmes. In its turn, the Ministry of Economics holds prime responsibility for innovation policy and exerts influence on the research domain mainly through selected innovation policy measures.

Figure 1: Overview of Latvia's research system governance structure



Source: ERAWATCH Research Inventory, updated (31.12.2010)

At the operational level, R&D funding is managed by the Latvian Council of Science (around 25% of government-funded research), the Administration of Studies and Research, with selected (mainly EU SF co-funded) policy measures administered by the State Education Development Agency and the Latvian Investment and Development Agency (LIDA). As noted above the distribution and administration of funding for specific state-funded R&D programmes is also carried out by the Ministry of Education and Science. In terms of advisory functions, R&D policy advice is provided by the Latvian Academy of Sciences, the Council of Higher Education, the Strategic Analysis Commission under the auspices of the President of Latvia established in 2004, as well as the National Development Council formed in 2007.

The overall governing structure for the design and implementation of research and innovation policies in Latvia is currently rather stable in terms of the main institutional actors involved at the political, advisory and operational level, notwithstanding the fact that several of those have experienced various changes either in the delegated functions or in their composition in 2008-2010. As of 30 June 2010, the new extended composition of the Latvian Council of Science includes representatives from the Employers' Confederation of Latvia, the Association of Latvian young scientists and of State research institutes, six ministries and the Rectors' Council. Since 2008, the Strategic Analysis Commission has a brand new composition, the National Development Council no longer features the thematic expert commissions, and on 1 July 2009, the LIDA formally closed down its Knowledge and Innovation System Department (ZINIS) established in 2006.

The conditional stability, however, does not necessarily imply an undoubted effectiveness of the present structure, which still lacks an overarching high-level coordinating political body ensuring the fulfilment of and commitment to the declared

strategic orientation of the country. As noted by the experts of the Policy mix peer review of Latvia, “a key missing feature is an ‘arena’ or Council that brings the stakeholders and actor involved with research and innovation policy together round a single table to discuss strategy and set priorities. Nor is there a minister with ‘lead’ responsibility for this integration” (CREST, 2010: 11).

The institutional role of regions in research governance

It has to be noted that research and innovation policy in Latvia (a country as a whole categorised as a single region at NUTS I and II levels) is predominantly developed, funded and implemented at the national level therefore the institutional role of regions in research governance is comparatively limited. The existing five planning regions have neither the level of responsibility nor the funding capacity to develop their own explicit R&D policies. While research activities are predominantly concentrated in the capital city, note has to be taken of the growth and strengthening of regional higher education institutions (HEIs) and development of related research activities, as well as efforts made by the planning regions to integrate R&D and innovation-related issues in their development programmes, strategies and action plans.

Main research performer groups

The main research performer groups in Latvia are represented by HEIs and their affiliated research institutes as well as independent state research institutes with certain research activities undertaken also by commercial companies. In October 2010, the Register of scientific institutions of the Ministry of Education and Science contained a total of 151 entries. According to Eurostat, GERD as a percentage of GDP by sectors of performance in 2008 was as follows: the major performer was the higher education sector (HES) (0.29=47%), followed by the government sector (0.17=28%) and business enterprise sector (0.15=25%). A similar distribution is revealed also by the figures on the number of researchers (FTE) by sectors of performance whereby in 2008 from the total number of 4,370 almost 70% (3,032) represented HES with additional 19.5% (851) employed in the government sector and only 11% (487) representing the business enterprise sector.

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

The Law on Research Activity (2005) stipulates that an annual increase of financing for R&D shall comprise not less than 0.15 per cent of GDP. The increase of state allocation for R&D started in 2005-2006, and it continued to grow in absolute terms until 2008. The economic recession, however, brought a steep decline in government-financed R&D, and, in 2009, Latvia saw the largest decline of GERD among the EU-27 countries (see Table 1). The latest statistical data bear evidence that Latvia's GERD (% of GDP) has decreased from 0.61 (2008) to 0.45 (2009). Thus, the projected GERD in the year 2015 in Latvia should be treated with caution, because GERD could see slight increase only owing to inflow of the EU SFs. The increase in GOVERD and BERD could hardly be expected in the nearest future.

Table 1: Gross Expenditure on Research and Development, % of GDP

	2005	2006	2007	2008	2009	2015	2020	2030
EU-27	1.82	1.82	1.85	1.9				
Latvia	0.56	0.7	0.59	0.61	0.45	1.0	1.5-2.0	3.0
Estonia	0.93	1.14	1.11	1.29	1.42			
Lithuania	0.75	0.79	0.81	0.8	0.84			

Source: Eurostat; Statistics Estonia, Statistics Lithuania, Latvia's Project „EU 2020". For 2015, 2020, 2030 – forecast

Research and innovation are said, among other, to be priorities of national development, but in practice promotion of export is seen as the main strategic tool to recover from recession. Hence, the elaborators of the Latvian National Reform Programme (NRP) "EU 2020" (CoM, 2010e) are cautious about setting a fixed value for the increase in GERD up to the years 2020-2030. While the Guidelines for Development of Science and Technology for 2009-2013 (MoES, 2009a) have set a target for GERD to reach 2% by 2013 with an equal split between public and private investments, the draft NRP features more reserved investment targets: 1.0% of GDP in 2015 and 1.5% in 2020, without specifying the particular split between public and private investment. The above-mentioned provision of the Law on Research Activity has not been revoked, but in the hierarchy of laws the Annual State Budget Law has supremacy. The Latvian government policy toward science, however, shows positive signs, for instance, in terms of providing the necessary co-financing to the EU SFs.

The elaboration of a multi-annual RDI strategy was started in Latvia several years ago and the features of this strategy were incorporated in the National Development Plan and National Strategic Reference Framework. On 16 September 2009, the Guidelines for Development of Science and Technology for 2009-2013 were finally approved by the government (MoES, 2009a) and it also approved research priorities (5 in total) for the same quarter in August 2009 (see section 2.3). There is much public debate, however, on what should be the conformity between research priorities and economic priorities.

The main sources of R&D funding are the state budget and the EU SFs. Main funding instruments in state budget include the provision of research activity through grants for fundamental and applied research and collaboration projects (25%), institutional ('core') funding (50%), and state research programmes (25%). Due to the recession, all lines of funding have seen at least a 50% cut. Although institutional funding encompasses several competitive elements, these cannot be said to have substantial influence upon the final result – the fact of making institutional funding available. Undoubtedly, the allocated amount depends on a number of indicators as the number of publications, patents and completed doctoral theses. There are special

grants for collaboration projects that are granted on competitive basis. So far, there have not been in Latvia tax allowances for research-related activity, although science policy makers have been continually suggesting it.

Since 2004, when Latvia joined the EU, the EU SFs have become an important source of R&D funding supporting development and upgrading of research infrastructure, doctoral studies and post-doctoral research, etc. Support is envisaged for applied research, international S&T cooperation, development of human resources in R&D, academia-business co-operation, etc. There are, however, certain doubts about an overreliance on this funding as a substitute for the national budget resources that strongly puts under question the sustainability of public support for research in a more long-term perspective (beyond 2013).

In general, since 2008, under recession conditions the role of R&D has weakened because, instead of prioritising science, the government puts emphasis on the development of exports. However, two EU SF activities feature a certain policy change. In the framework of one of those, the research infrastructure of more than 30 scientific institutes, state HEI and scientific institutes of HEI is to be upgraded and scientific research is to be concentrated in single and independent centres, namely, Scientific centres of state significance (MoES, 2010b). These are seen to be the focal points for collaboration of scientific institutions with the purpose to pool research resources for performing European level research in the priority areas, thereby strengthening priority branches of national economy and enhancing social development. A total of nine such centres are expected to be established by 2011.

The year 2009 also saw the launch of the ESF activity "Modernisation of premises and equipment at HEIs for improvement of study programme quality, including provision of education opportunities for Individuals with functional disabilities" (CoM, 2009a). As of 14 September 2010, there were 30 contracts signed with HEIs for the total amount of €143m (for instance, the University of Latvia will build a new and modern joint research and training centre in natural and life sciences).

Allocation and distribution of the national public research funding in Latvia is mainly decided upon by the government (and ministries) and to a large extent by the scientific community without any involvement of the ordinary citizens in the debate on the research priorities to be addressed by national science. Thus a technocratic approach to science and innovation governance still strongly predominates in Latvia (see Ādamsone-Fiskoviča, 2005). While the Ministry of Education and Science has initiated a platform for promoting public engagement in policy making on its website, so far it has mainly focused on education development but not on science matters.

Also the topical and crucial concept of 'societal challenges' does not yet form an integral part of the vocabulary of the policymakers used upon the allocation of resources for research activity. However, some trends leading into this direction can be observed over the recent years, for instance, through the identification of national research priorities. Some of the state research programmes are aimed at addressing such national challenges, for instance, in the domain of public health, as the high mortality rates of children as well as those resulting from cardiovascular diseases, or, in the social and cultural sphere, the maintenance of national identity. Along with those one can also trace elements of such more global societal challenges as the reduction of climate degradation via usage of renewable energy resources, development of new drugs for curing various diseases encountered by modern society, etc. (see also section 2.5.3).

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

Over the last five years, BERD practically has not increased and, being at the level of €30m-€35m, it comprises 0.15-0.20% of GDP (see Table 2). It is far below the EU-27 average, and the share of BERD in total R&D funding has been less than a half. The next few years will hardly see any improvements because, on the one hand, Latvia's entrepreneurship is not tended towards implementation of R&D achievements and setting tasks to R&D sector. On the other hand, Latvia almost lacks industrial production, which currently represents a very small part of that present before 1990. Under recession conditions, the situation cannot be seen to improve in the nearest future. The large state support programmes launched comparatively recently have not yet given the expected effect to the increase of BERD.

Table 2: Business Expenditure on Research and Development

	2005	2006	2007	2008	2009
Latvia, €m	29.3	50.1	40.7	35.4	31.0
Latvia, % GDP	0.23	0.35	0.19	0.15	0.16
Estonia, % GDP	0.42	0.51	0.52	0.56	0.63
Lithuania, % GDP	0.15	0.22	0.23	0.19	0.20
EU-27, % GDP	1.15	1.18	1.19	1.21	

Source: Eurostat; Statistics Latvia, Statistics Estonia, Statistics Lithuania

Under present conditions, Latvian business sector cannot be expected to extensively expand their R&D activities, since many enterprises produce goods and services with low R&D intensity and added value. Latvian industry, in terms of R&D, is not highly developed, with a few exceptions, such as pharmacy industry, and single chemical industry and electronic industry enterprises. Thereby, ERAWATCH Country report for 2009 (Adamsone-Fiskovica et al., 2009a) has attached the highest importance to the policy mix Route "Increasing R&D in the public sector", seeing the public sector development as a stimulus for developing R&D also in the private sector. Of medium importance might be the following routes: promoting the establishment of new indigenous R&D performing firms; stimulating greater R&D investment in R&D performing firms; stimulating firms that do not perform R&D as yet.

A special mention in the review period should be given to the Competence centre programme, which was launched in 2010 after repeated postponement during the previous years (CoM, 2010a). With regard to other policies, one should mention that, on 30 October 2009, the government approved the „Concept on support measures for micro enterprises", which is aimed at creating the necessary preconditions to encourage jobless people to start their own business, to build a micro business-friendly environment (see MoE, 2010). In 2010, the share of micro enterprises in the total number of registered enterprises was 36%. Yet, due to its profile, this initiative cannot be expected to bear a direct effect on boosting business R&D.

In the review period, the barriers to R&D investment have remained largely the same as defined in the 2009 report (Adamsone-Fiskovica et al., 2009a) and are related to the setback induced by the economic and financial crisis as well more longstanding problems with low R&D intensity of the limited industrial sector, weak cooperation between public research institutes and universities, on the one hand, and business companies, on the other, as well as lack of human resources and gaps in the scope of policy measures facilitating such private investments (e.g., lack of tax incentives and underdeveloped public procurement of innovative goods and services).

2.2.3 Providing qualified human resources

In 1990s, the sharp decline in science funding and economic 'shock therapy' resulted in a fourfold decrease in the number of people employed in R&D sector from approx. 17,000 to 4,000. Only enthusiasts remained dedicated to science, others established their own enterprises or moved to public institutions. Many talented middle aged researchers left Latvia and went to research centres abroad. They formed the first wave of emigration of scientists that was followed by at least two successive waves: in 2004, when Latvia joined the EU, and in 2009-2010, when the economic recession set in. It has to be acknowledged that the current loss of human resources of Latvian science is very critical at the moment, especially given the fact that only a few scientists from highly developed countries have moved to Latvia.

Over the past two decades training of new generation of scientists remains a challenging problem. The Guidelines for Development of Science and Technology for 2009-2013 state that the number of annually awarded PhDs should be increased to at least 425 (MoES, 2009a). During 2000-2004, the actual number was even below 100, while in 2010 the number grew to 230 new PhDs (Report, 2011). This increase largely results from granting the so-called European scholarships (ca. €1,000 per month) for completing the doctoral thesis within a year, which are also expected to improve the overall completion rate of doctoral studies pursued at national HEIs (CoM, 2008a). Similar scholarships are also granted on a competitive basis for those still in the process of drafting their doctoral thesis. Another problem is ageing of the academic staff of HEIs resulting in a considerably lower quality of higher education (see also section 3.3.1) as well as limited possibilities for post-graduate training in Latvia.

Science and education policy in Latvia focuses on the two following problems. The University of Latvia, in search of the ways to provide excellence of HE, has set itself the target to develop into a research university and to enter the top list of the best universities. Another problem is commercialisation of research results and technology transfer. The R&D-related entrepreneurs are interested in a more flexible system of training specialists in their respective field, on the grounds that normally business sector requirements cannot be projected five years ahead. But being a small country Latvia cannot educate a wide range of engineers and other specialities. Another problem is that school and university curricula are rather designed to prepare potential employees, instead of encouraging young people to start their own business. Not enough activity is directed toward creating interest in entrepreneurship and in developing the necessary skills, which then correlates with an unwillingness of many people to take the risks, etc.

2.3 Knowledge demand

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

According to Eurostat, the average share of government budget appropriations or outlays for R&D (GBAORD; funds allocated to R&D in central government) in Latvia has fluctuated from 0.55% of total general government expenditure in 2005 to 0.83% in 2007 and down to 0.75% in 2008, which is a level half that of the respective average indices for the EU-27 and the neighbouring Estonia (1.5%). In turn, in 2008 the total GBAORD as a percentage of GDP in Latvia made up only 0.29% compared to the EU-27 average of 0.72% (Eurostat, 2010:15-19). The breakdown of GBAORD by socio-economic objectives in 2008 reveals that while in Latvia the prime socio-

economic objective was represented by 'General advancement of knowledge: R&D financed from other sources than general university funds' (33.9%), other considerable objectives include 'Agriculture' (18.4%) as well as 'Industrial production and technology' (9.7%), and 'Health' (8.1%).

Over the last five years the prioritisation of various sectors of the economy has generally emerged as one of the tools for pursuing specific knowledge demand by the Latvian government. The Law on Research Activity stipulates that every four years the government shall define a set of research priorities that then form the basis for the elaboration and implementation of corresponding state research programmes. The following priorities have been approved for the years 2010-2013 (CoM, 2009b):

- Energy and the environment;
- Innovative materials and technologies;
- National identity;
- Public health;
- Sustainable use of local resources.

Meanwhile, in 2010 the Competence centre programme has been launched (CoM, 2010a). Within the programme, the following activities will be funded: industrial research, experimental R&D and purchase of research infrastructure necessary for carrying out the related research activities. The terms of reference of the programme stipulate that, under the current economic conditions, the priority is granted to research in the branches featuring a greater return potential in carrying out the consolidated interdisciplinary research activities in a short and medium-term:

- Food industry;
- Wood industry;
- Chemical industry (including pharmacy and biotechnology);
- Production of electrical and optical equipment;
- Information and communication technologies;
- Mechanical engineering and metal working (including environmentally friendly, renewable resource-based power industry).

The analysis of the governmental demand is of primary focus here, given the fact that private demand for R&D so far has been very limited in Latvia, probably with an exception of the pharmaceutical industry that is a comparatively strong and internationally competitive branch of the national economy. At the backdrop of crisis, the government has chosen to place the main emphasis on export promotion. In 2008-2009 efforts were made to launch a debate on the need also to prioritise industrial branches with the purpose of helping the national economy to restructure to more profitable branches of production with higher export capacity (SAC, 2008), yet, so far this initiative has not received any follow-up on a governmental level.

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

While the Summary Innovation Index of the European Innovation Scoreboard 2009 shows a slight improvement of Latvia from the value of 0.252 in 2008 to 0.261 in 2009, it is still enlisted among the least performing catching-up countries (EIS, 2010). Being positioned among the moderate growers within the respective group, Latvia's innovation performance is still well below the EU-27 average (0.478 in 2009).

One of the toughest conclusions of the recent CREST task force on the national R&D system in Latvia (CREST, 2010) was related to the extremely low number of publications in respectable academic journals (included in the Thomson Reuters or Scopus databases). Since the accession of Latvia to the EU in 2004, there have been gradual improvements with regard to the level of funding for R&D and the availability of quality research infrastructures (see section 3.2), yet, if we look at the current situation regarding output indicators (see Table 3) Latvia features considerably lower numbers of publications included in the above-mentioned databases if compared to the neighbouring countries, even if calculated per capita. If assessed by the funding per scientist, the figure is higher for Estonia, yet the absolute number of scientists is approximately the same for both Estonia and Latvia.

Table 3: Documents and Hirsch index in the Scopus database, 1996-2008

	Number of documents	Hirsch index
Latvia (LV)	5,426	65
Estonia (EE)	10,647	94
Lithuania (LT)	12,834	83

Source: Scopus (Scimagojr) database

This leads to the question on whether the higher level of R&D funding in Estonia alone underlies the notable difference, for instance, with regard to the indices for Estonia and Latvia. In our opinion, the main reason for the backwardness of Latvia lies in a wrong approach taken in developing the scientific milieu (Kristapsons et al., 2003). Officially, for a decade from 1998 to 2008 the so-called List of journals adopted by the Latvian Council of Science was in effect in Latvia (and still is preserved by inertia by many scientists), based on which it was sufficient to have publications in local journals to be eligible for receiving a new grant, be elected as a professor, defend PhD theses, etc. Admittedly, until the accession to the EU there was also a rather negligible attitude demonstrated by the state characterised by the low levels of R&D funding allocated from the state budget.

Table 4: Patent applications to the European Patent Office (per million inhabitants)

	2005	2006	2007
Lithuania	2.61	2.84	2.41
Latvia	8.02	7.20	8.40
Estonia	4.73	15.04	17.42
EU-27	112.57	113.94	116.54

Source: Eurostat

A slightly different scene is provided with regard to such an output indicator as the number of European patents. If compared to the EU-27 average, one can note a

considerable lag demonstrated by all three Baltic States (see Table 4) with slight improvement in recent years for Latvia and a more marked one for Estonia.

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

Excellence of knowledge production has been in the centre of attention of the Latvian Council of Science since its establishment in 1990. At the outset, it was envisaged to be achieved via introduction of a grant-based system of research funding, yet efficiency of such an approach was hindered by the negligible funding levels and competition for even smaller grant funding per project. Over the recent years a shift towards allocation of a smaller number of more notable grants in terms of funding per project has been undertaken. Besides, the presence of SCI publications has been set as a criterion for receiving funding under several EU SF co-funded programmes. These developments thereby provide certain grounds for a potential improvement in the performance indicators in the years to come.

There is no special monitoring system in place yet, nevertheless in the large tenders with participation of research institutes as applying bodies (incl. allocation of institutional funding) output indicators emerge as binding criteria. Also annual evaluations of state research programmes are being carried out (see, e.g., Supervisory board, 2010, 2011), that as such introduce a new element in the overall system of science governance with an aim of improving the quality and excellence of knowledge production. So far international criteria have not been applied for the evaluation of research institutes. However, in line with the Law on Research Activity such a procedure is to be initiated. Gradually international peer review is beginning to be used for the evaluation of project applications under selected funding programmes in Latvia. Yet, for the time being the public funding instruments, with some exceptions, generally do not encourage trans-national cooperation (see sections 3.5 and 3.6). Given the limited national R&D funding, there is also limited national and institutional access to databases covering peer reviewed journals and articles (Scopus, ISI Web of Science) that hinders the uptake of the international standards regarding the related research output indicators.

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

Facilitation of knowledge sharing and circulation between university, public research organisations (PROs) and business sectors has been continuously addressed as one of the major challenges in the national R&D policy. As noted by the annual

TrendChart report, Latvian companies take almost no advantage of the research potential at universities and state research institutes (see Adamsone-Fiskovica et. al., 2010: 11). For instance, the Innobarometer survey carried out in 2009 revealed that since 2006 only 3% of Latvian enterprises had developed strategic relationships with research institutes and 7% with universities or other educational institutions to support innovation against the EU average of 15% and 25% respectively (Innobarometer, 2009: 48-49). As also revealed by a study commissioned by LIDA in 2009, the majority of cases of new product development by companies have not involved collaboration with researchers or research institutions with a comparatively little share of entrepreneurs treating such collaboration as meaningful (37% from all; 50-69% from those having had such an experience) (SKDS, 2010).

So far cooperation between universities, research and business has been reinforced by such policy measures as support for technology transfer offices (2005-2007, €0.84m; 2008-2013, €3.02m) aimed at ensuring efficient introduction of research results of PROs into production. During the first round a total of six offices were established at HEIs, while the subsequent programme has granted support to eight projects. The scheme as such is deemed crucial for facilitating technology transfer, but some concern has been voiced by the representatives of the established offices over the lack of a centralised unit in charge of overseeing, coordinating and promoting cooperation of the offices to facilitate wider public awareness of their activities and ensure their synergetic and complementary rather than competitive and mutually overlapping operation. It has been envisaged to launch an additional activity for the establishment of technology transfer centres co-funded by the EU SFs, yet this programme is currently held on a waiting list due to the financial situation.

Given the limited responsiveness of potential beneficiaries, the state aid programme "Attraction of highly qualified workforce" that was developed with an aim of promoting inter-sectoral mobility by means of providing support for temporary placements of engineers and scientists in companies had not been re-launched in 2009-2010 following the first call (2008; €0.24m). In its turn, due to the scarcity of budgetary resources, a certain break in the funding flow has been witnessed in 2009 under the long-standing national funding scheme for market-oriented research projects also aimed at facilitating research-industry collaboration. In the end of 2009 a new EU SF co-funded national programme "Support for science and research" (2009-2013) envisaging support for applied research projects potentially facilitating the integration of science and industry along with application of research results in the priority fields defined by the state was launched. The total funding of €51m is to be provided for 120 research institutions with first agreements signed in October 2010.

Further on, in 2010 the Ministry of Economics finally launched the long awaited, EU SF co-funded, Competence centre programme (legal entities incorporating scientific and field cooperation partners - entrepreneurs). This programme (2010-2013, €51.68m) is aimed at boosting the competitiveness of business companies by means of promoting research-industry cooperation in the implementation of projects of industrial research and development of new products and technologies (CoM, 2010a). In total, nine proposals were submitted under the call, which are to be evaluated by the end of 2010 with project implementation expected to start as of 2011. It is envisaged to fund seven centres that are expected to yield 50 collaborative research projects involving industry and academia by 2013.

There are also a range of international projects aimed at facilitating technology transfer and inter-sectoral collaboration with involvement of Latvian partners. Thus, for instance, the Ministry of Economics and LIDA are involved in the implementation

of the cross-border leading programme "Baltic Sea Region Programme for Innovation, Clusters and SMEs Networks" (*BSR Stars;* http://www.bsrstars.se/). As of 2007 LIDA had acted as a project partner in an EU-funded project *CERT-TTT-M* (http://www.ttt-manager.eu/) aimed at elaborating a common training programme for technology transfer specialists, which has been followed up by a project *EuKTS* (2010-2012). Latvia has recently become also involved also in the Interregional Partnership Platform (2010-2012) launched under the INTERREG-IV-C programme (http://www.interreg4c.net/) priority "Innovation and the knowledge economy" aimed to increase the outward orientation of the regional innovation intermediaries.

On the whole, it can be argued that on a national policy level there has been a rather notable push for such cooperation to enhance the knowledge circulation and sharing between universities, PROs and business companies, yet there is a range of structural reasons present in the country that still hinder a notable progress in this respect. These include the low share of innovative companies (19.5% according to the CIS of 2006-2008), the low share of R&D personnel from the total labour force employed by the business enterprise sector (0.1% in 2008 against the EU-27 average of 0.54%), the low share of high technology products in total exports (4.2% in 2006 against the EU-27 average of 16.6%) and the low share of employment in high- and medium-high-technology manufacturing sectors (1.88% in 2007 against the EU-27 average of 6.6%), just to mention a few.

As noted by the Policy mix peer review, "industrial linkage to external knowledge sources cannot be tackled without developing technological capabilities in industry", which is something to be achieved prior to funding industrial-academic consortia (CREST, 2010: 20). One of the conclusion of a study commissioned by LIDA on demand and supply of finance for international innovation projects for SMEs states that entrepreneurs fear partnerships with other cooperation partners given the competitive rather than collaborative nature of the business culture in Latvia (LASS, 2010: 64). The study also points to the lack of collaboration among educational institutions and entrepreneurs as well as insufficient competency, knowledge and education of entrepreneurs in implementing innovation projects (ibid.: 65), that can hinder the efforts in pursuing collaborative projects with universities and PROs.

2.5.2 Cross-border knowledge circulation

The category of policy measures reinforcing international cooperation has been increasing over the last decade given the integration of Latvia in the European market and ERA. Research collaboration between national and foreign research organisations is promoted via participation in EU FP7 as well as other EU-initiated programmes such as COST, EUREKA, EUROSTARS, not to mention the bilateral and multilateral governmental or interdepartmental agreements with both ERA and third countries envisaging support for joint research projects and/or mobility of researchers (see section 3.5). Likewise Latvia is becoming involved in several inter-governmental European RIs that envisage also participation of national teams in thematic research projects (see section 3.2).

While with regard to the above-mentioned EU programmes until recently national funding was provided only for covering national participation fees and, where applicable, co-funding for successful applicants, as of 2010 financial support for drafting project proposals has been earmarked within a special activity co-funded by the EU SFs. This is essential particularly in the light of the reduced national science budget that does not allow using the already scarce resources of research institutes

for these activities. An indirect reflection of this trend can be found in the figures for national participation in the EU FP7, where the number of applicants from Latvia has decreased from 58 in 2007 to 34 in 2009 along with an accompanying notable decrease in the EC contribution that has dropped from €7.8m (success rate 15.1%) in 2007 to €2.7m (success rate 9.7%) in 2009 (EC, 2010: 72).

With regard to cross-border collaboration in the domain of S&T, notice has to be made also of the EU Baltic Sea Region (BSR) Programme 2007-2013 that supports transnational cooperation specifically in this region and involves eleven countries around the Baltic Sea. The EU Strategy for the BSR was adopted by the European Council in October 2009 and has been rated as the first macro-regional policy concept in the EU (BSR, 2010: 5). Priority 1 of the above-mentioned funding programme is aimed at fostering innovations and it supports innovation sources and facilitation of transnational transfer of technology and knowledge, in particular targeted at SMEs. By the end of October 2010 Latvian partners had been involved in 16 out of 24 projects launched under this priority since 2009-2010 and address issues relating, for instance, to transnational cluster development, technology transfer activities, innovation governance, etc. (see http://eu.baltic.net).

2.5.3 Main societal challenges

Several national programmes (e.g., State research programmes, Competence centre programme, Support for science and research) prioritise specific research fields for inter-sectoral and interdisciplinary knowledge circulation that are in line with the priority fields of science defined by the state. Yet, these priorities (int. al. covering topics of renewable energy, public health and sustainable use of natural resources) are set based more on the existing capacities of the national economy rather than triggered by the orientation towards the so-called European Grand societal challenges (global warming, tightening supplies of energy, water and food, ageing societies, public health, pandemics, security) identified on the EU level, for instance, in the Lund Declaration (2009) with an aim of moving beyond current rigid thematic approaches. In this respect an exemplary case in prioritising specific fields for the cross-border knowledge circulation is represented by the above-mentioned EU BSR Programme 2007-2013, which focuses on such major societal challenges as environmental sustainability, incl. water management, maritime safety, energy efficiency, climate change, etc.

2.6 Overall assessment

Table 5: Summary of main policy related opportunities and risks

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	• Economic crisis as an accelerator for implementation of declared policy orientation towards a knowledge-based society. • Development of public procurement of innovative goods and services.	• Prevalence of short-term measures for cutting budget expenses over long-term development prospects of the national economy. • Overreliance on the EU SFs for substituting the national budget funding for R&D.

Domain	Main policy opportunities	Main policy-related risks
Knowledge demand	• Streamlining and consistent alignment of research along the national priorities in the field of R&D. • Mobilisation of research efforts in addressing major national and global societal challenges.	• Limited demand for R&D by the local business enterprise sector.
Knowledge production	• Utmost use made of the upgraded research infrastructure by both public and private actors. • Enforcement of international research performance standards and assessment procedures.	• Insufficient incentives leading to a further national tailing off in terms of research and innovation output quality and quantity. • Undetermined policy actions in facilitating a balanced inward and outward mobility of R&D staff.
Knowledge circulation	• Efficient implementation of new policy measures aimed at knowledge and technology transfer. • Facilitated participation in international and cross-border collaborative S&T programmes and projects.	• Failure to increase the number and intensity of strategic (long-term) partnerships between PROs and business companies.

Table 6: 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
Very low level of BERD (0.2%)	**R**: Lack of sources and incentives for a considerable increase in business R&D investments.
Weakly developed sector of industrial production	**R**: No economic stimulus for developing new industries given the low production costs featured by competing economies.
Production of goods and services with low R&D intensity and added value	**O**: Stimulation of existing R&D-intensive firms and incentives for creation of new R&D-intensive start-ups. **R**: Insufficiency of the present policy mix to ensure long-term effects of facilitating companies to carry on with their R&D activities after termination of specific state aid schemes.
Very low number of innovative enterprises (19.5%)	**R**: Stagnation of the number of innovative companies given the lack of experience and competitive advantages in producing innovative goods and services.
Economic and financial crisis	**O**: Maintenance of research support and application of some of the generated knowledge in the national economy by means of immediate promotion of public-private cooperation schemes. **R**: A relapse of public research funding at the level present in 2004 with a high likelihood of a heavy brain drain.
Weak cooperation between PROs and universities, on the one hand, and business companies, on the other	**O**: Implementation of policy measures to stimulate cooperation between firms and research institutions, e.g. via competence centres and clusters. **R**: The undefined IPR regimes within the current cooperation-promoting measures serving as a hindering factor for their efficient uptake and implementation.

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 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

In 2009, the total R&D personnel amounted to 5,485, down 16% compared with the earlier year (CSB, 2010). The percentage of R&D personnel in the entire working population was 0.46% in 2009, compared to 0.54% in 2008, while the EU-27 average was 1.03%. In higher education and university research institutes the current age profile of academic staff and researchers shows a high proportion, 62%, of persons aged 50 and older. This is largely a result of the wave of outward migration and also sectoral movement of researchers. The increase in the number of researchers with relevant academic qualification is regrettably low. Although the number of PhDs awarded gradually increase, so far reaching a peak of 174 in 2009, it is still insufficient and should be increased to at least 425 new PhDs awarded annually (MoES, 2009a:23).

Latvia's researchers are less internationally mobile than researchers in the EU. The annual reports of six public universities show that only 4–5% of the Latvian researchers in HES have had a visit, longer than a month, in another country. Also the share of non-Latvian researchers and PhD candidates in Latvia amounts to 1.2% (Andersons, 2008) and 1.3% respectively. One of the promising traits in enhancing transnational mobility applies to young Latvian researchers who show much greater interest in training and working abroad (Kokorevičs, 2008). In its turn, with a view to enhance inward mobility the Law on Research Activity has been amended in 2007 by adding an article on the participation of foreign researchers coming from non-EU countries (see section 3.1.3). A positive effect is also expected from the EU activity "Attraction of human resources to science", launched in 2009.

3.1.2 Providing attractive employment and working conditions

Research organisations have started to provide workplaces for qualified research staff from abroad on both short and long-term basis, although this is not yet a common practice. The level of remuneration for researchers, which gradually increased by 2008, went down significantly in 2009 and 2010 (MoW, 2010:3). The number of doctoral candidates, however, shows a well-marked upward trend, including full fee-paying doctoral students, which is also due to attractive possibilities offered by the EU SF co-funded programme "Support for implementation of doctoral study programmes" (2007-2013). These scholarships are to be awarded to approximately 1,600 doctoral students (CoM, 2008a). Foreign students are formally allowed to take a state funded PhD place in Latvia, yet it is very hard to do in reality due to the language barrier, while programmes available in English require personal funding.

As regards inward mobility, universities and research institutions have a rather high degree of flexibility in setting the level of salaries for their academic staff and individual income can vary significantly according to the research projects, both national and international, in which they are involved, the funding source, etc. Latvian universities and research institutions have been provided with full information about the 'Charter for Researchers' (EC, 2008). Nevertheless, according to EURAXESS, no institution in Latvia had signed the Charter by November 2010.

A researcher career is not gender dependent in Latvia. The Labour law (2002), sections 155 and 156 provide equal opportunities for females and males and restrict discrimination against women in employment. Female researchers have equal chances to their male counterparts for their progression after career breaks. The Law stipulates that a woman who makes use of maternity leave shall have ensured her previous work or, if this is not possible, with similar or equivalent work with not less favourable conditions and employment provisions. The same regulations refer to fixed-term contract. The Law also states that every employee has the right to parental leave in connection with the birth or adoption of a child.

In 2009, women comprised 47.1% of human resources in S&T in Latvia. In academic year 2009/2010, the percentage of females among the doctorate students in all disciplines made up 59%. At HEIs, 54% of all lecturers are women, yet the ratio gradually decreases at the top level, with 44% of associate professor positions and 30% of full professorships being occupied by women (MoES, 2009b). Nevertheless, when compared to other countries in Europe, the representation of women in science in Latvia is still among the highest.

3.1.3 Open recruitment and portability of grants

Latvia has clearly recognised the need to put efforts in major academic staff and researcher renewal and development. The primary effort to correct the existing deficiencies is focused on internal human resources - providing doctoral training to considerably bigger number of students and to retrieve those working abroad.

The employment of foreign researchers in Latvia is governed by the mandatory legislation on immigration and research activity. The Law on Research Activity, last amended in 2010, and the Cabinet Regulations (CoM, 2008b) incorporate legal norms arising from Council Directive 2005/71/EC of 12 October 2005 on a specific procedure for admitting third-country nationals for the purposes of scientific research. It means that accredited scientific institutions are entitled to recruit third-country nationals to participate in scientific research projects.

As a clear starting point, a foreign national visiting Latvia for employment, irrespective of the duration of the stay in Latvia, is required to have a temporary residence permit. An EU researcher and a third country national, having a permanent residence permit and/or the status of a long term EU resident, may apply for any research position in Latvia. The recruitment of non-national applicants is, however, closely related to knowledge of the Latvian language as required by the Official Language Law (1999) and the related regulations (CoM, 2009c). Academic position vacancies in scientific institutions are announced in the official newspaper *Latvijas Vēstnesis* (in Latvian). The EURAXESS portal publishes these vacancy notices and provides a link to the official newspaper.

Also, the Law on HEIs (1995) envisages that all programmes in public HEIs must be given in the state language, while those in other languages can be provided if a HEI has an agreement or it has formed a franchise with another foreign HEI. There has been a debate on the necessary changes to allow universities to become more open for international students and programmes. Yet, the draft Law on HEIs has been stuck in the country's legislative system already for a couple of years.

In case an academic or professional qualification is obtained in a country other than Latvia, its official recognition is a prerequisite for both Latvian and foreign researchers to be able to apply for academic positions in Latvia. Latvia participates in the European diploma recognition networks ENIC/NARIC and in the international cooperation of the Europass framework. The Academic Information Centre represents Latvia in these networks and is the central source of information related to recognition of foreign qualifications. In the case when a person intends to continue studies in Latvia the final decision on academic recognition of a foreign degree/diploma is taken by that HEI at which the studies are going to be continued. The doctoral degrees obtained abroad are approved by the promotion councils established at the universities.

While research grants are portable to another national research institution, the current law doesn't regulate portability to another country.

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

Latvia is a part of the European coordination framework on the application of national social security schemes, governed by Council Regulation (EC) No 1408/71 and, since 1 May 2010, new regulations that guarantee preservation of a person's rights in the area of sickness insurance, pensions, unemployment and family allowances in the event of moving within Europe

As regards third country nationals, Latvia has signed bilateral social security agreements with the Ukraine (1999), Canada (2006), USA (in 1993 about a mutual pension payments), Belarus (2010). Information on social insurance and social services is available on the internet portal of the State Social Insurance Agency and on the EURES Portal. The terms and conditions of employment of foreign researchers generally don't differ from those of academic staff at universities or research institutes. Social security rights for the EU nationals in Latvia are the same as for its citizens with no special tax incentives for research personnel. The „Scientific Visa" package is implemented in Latvia.

3.1.5 Enhancing the training, skills and experience of European researchers

Over the last decade, career progression for researchers has not been duly considered and appreciated in Latvia. Some positive steps have been taken recently to alleviate the situation, yet it is premature to speak of the results. In the academic year 2009/2010, the first doctoral schools were set up in two largest public universities: the University of Latvia and the Riga Technical University. Also, two international doctoral schools, in social sciences and humanities, have been set up.

As regards the mobility of permanent research staff, short-term visits dominate. Although the Law on Research Activity stipulates a paid sabbatical leave of 26 calendar weeks, this opportunity has rarely been used. The hindering factors include the shortage of finances, need for a temporary replacement and, not unimportant, the situation when researchers combine several jobs. The mobility, however, varies from one scientific discipline to another.

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

One of the officially approved medium-term tasks of Latvian research policy for 2009-2013 is to foster integration in the ERA, in particular by supporting participation in technological platforms and other international initiatives as well as developing RIs of interest for the European and international research communities (MoES, 2009a:25-26) (see also section 3.5.1). While up to 2004, RI in Latvia's PROs and HEIs barely underwent any modernisation, the situation somewhat changed with the availability of the EU SFs. Several EU SF co-funded programmes prioritising development and upgrading of RI have been launched since then, i.e., "Support for modernisation of scientific infrastructure in public research institutions" (2004-2006; €15.7m) and "Development and upgrading of applied research infrastructure" (2006; €3.61m). Likewise mention should be made of the programmes "Modernisation of premises and equipment of HEIs for the purpose of improving the quality of study programmes" (CoM, 2009a), "Support for science and research" as well as "Advancement of IT infrastructure and information systems for research activity". In 2007-2013, €147.6m have been earmarked for the national programme "Development of research

infrastructure" (CoM, 2010b) aimed at establishing ten national level research centres, to be launched in 2010/2011. While much of the national RI is still in need of a further upgrading to make it internationally competitive, it is argued that currently Latvia can participate in the ERA with such unique research infrastructure facilities as the Ventspils International Radio Astronomy Centre and the Liquid Metal Laboratory of the Institute of Physics of the University of Latvia (UL), including the pilot equipment for studies of the Earth's magnetic field (MoF, 2010). An important facility is also provided by the Laser Centre, the largest laser resource in Latvia and a unique experimental facility in the Baltic States. As additionally noted by the report of the ESFRI regional issues working group covering also the Baltic States Meta Region, state-of-the-art research equipment is currently provided also at the Latvian Institute of Organic Synthesis, the Institute of Solid State Physics (UL) as well as the Latvian Biomedical Research and Study Centre 'developing them as the national RI centres' (ESFRI, 2009: 32).

The issue of opening-up of the existing national infrastructures to foreign access has not been too widely debated in Latvia so far. Currently of primary concern is the accessibility of significant national research equipment to researchers from other research institutions and business companies within the country. Efforts are thus envisaged by the public authorities to establish a common information system to address this task.

The ESFRI as such has been brought on the policy agenda in Latvia since 2008 and is nationally coordinated by the Latvian Academy of Sciences. The ESFRI annual report of 2009 enlisted Latvia among the five (out of 33) countries not having initiated the process of drafting their national ESFRI roadmaps, while 13 countries have their national roadmaps already published, and additional 15 are in the process of drafting ones (ESFRI, 2010: 11). Yet, certain developments can be identified in Latvia with regard to the national roadmap in 2009/2010.

Based on the results of survey of 30 research institutions in Latvia carried out by LAS in August 2009, a plan for the development of RI in Latvia eventually representing the National roadmap for RIs was drafted and publicly discussed in January 2010. While the initial listings amounted to 22 RI objects, a further narrowing down of the list has been planned. The 2010-2011 action plan for the implementation of the Guidelines for Development of S&T for 2009-2013 (CoM, 2010c) stipulates that the national plan of Latvia for the development of RI of European importance should be elaborated by mid-2011 and the ESFRI-class RIs are to be identified by the end of 2011.

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

Latvian representatives in the partner status have so far been involved in such ESFRI roadmap projects as the Common Language Resources and Technology Infrastructure (CLARIN), the European Spallation Source, European Life Sciences Infrastructure for Biological Information (ELIXIR) and the European Social Survey. Thus national participation is currently concentrated in the fields of Social science and humanities, Materials and analytical facilities, and Biological and medical science, with no participation so far in the domains of Environmental sciences, Energy, Physical sciences and engineering as well as e-Infrastructures. However, it should be noted that certain activity has been demonstrated also with regard to Council of European Social Science Data Archives (CESSDA), and additional interest by national research institutions has been expressed with regard to such

projects as Biobanking and Biomolecular Resources RI (BBMRI), Pan-European RI for Nano-Structures (PRINS), as well as in the domain of e-Infrastructures.

As for the national funds, the above-mentioned action plan envisages some funding to be allocated to this end from the European Regional Development Fund (ERDF) and the state budget earmarked for ensuring research activity and participation in EU R&D programmes. These resources are to be provided for the establishment of four to five ESFRI-class infrastructures, for ensuring national participation in the CLARIN project and for providing access to the services of the European Spallation Source (ESSS) and the European Advanced Translational RI in Medicine (EATRIS).

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

In 2009, there were 32 accredited HEIs in Latvia, out of which the greatest part were state-owned (6 public universities and 13 public specialised universities and university colleges), and the rest (15) - founded by other legal entities or private persons (MoES, 2009b). Apart from these, there were 26 colleges (18 public and 8 private), which basically provide higher vocational education. In 2009, the total number of students in HEIs amounted to 112,555 or 4.9% of the total population and the number of doctoral students was 2,152. Total HEIs academic personnel is 4,414, while R&D personnel makes up 2,762 (2009). HERD amounted to 0.17% of GDP in 2009, which is relatively very low if compared to the EU-27 average of 0.43%. Due to economic recession, HERD, in the same way as GERD, has in absolute numbers declined twofold if compared to 2008.

The primary mission of all Latvian HEIs is teaching, and only partly - research. Five universities have strongly developed research. Commercialisation of knowledge is being carried out in at least 8 HEIs that have established technology transfer offices. The term ‘third mission’ is not widely circulated in Latvia, yet the designated functions are being, to a certain extent, carried out (see Adamsone-Fiskovica et. al., 2009b). Yet, a considerable level of differentiation between the HEIs can be observed.

International position of the Latvian HE sector is weak. In 2008, Scopus (Scimagojr) database encompassed only 601 scientific publications produced in Latvia that made up 0.03% of world contribution. In these publications the proportion of international collaboration is 50%, yet the citation impact is generally low According to the Ministry of Education and Science, Latvian HEIs produce 7,635 articles per year (MoES, 2009c); it is obvious that the majority of articles are being published in local or national journals. As for other indicators, on the Webometrics Ranking of World Universities list of Eastern European universities (covering 100 HEIs with the highest webometrics indexes) the University of Latvia has the best indicators and ranks 64th

(on the world list of HEIs it is ranked 1,132th), yet it takes lower ranking than similar Estonian and Lithuanian universities (Webometrics, 2011).

An additional aim of the Bologna process is to ensure implementation of HE quality control systems in all EU countries based on the European standards and guidelines, including the establishment of internal quality control systems of HEIs allocating those with the prime responsibility over the quality of the provided education within the limits of their autonomy granted by law. The current legal framework regulating this domain in Latvia is set by the Law on HEIs, adopted in 1995, which stipulates that accreditation of a HEI involves an inspection of the quality of its work organisation and resources on which a decision on granting the status of an officially recognised HEI is based. This function in Latvia is performed by the Higher Education Quality Evaluation Centre involving around 600 national and international experts in the evaluation of HEIs and their study programmes, prior to which self-assessment reports are being drafted by the respective HEIs.

Special attention is increasingly being paid to the assessment of their research output - while earlier the mere number of scientific publications was taken into account, nowadays it is becoming more pronounced to look into the sources of these publications, their citation rates, etc. The recent analysis with regard to the necessary structural reforms in the field of higher education and research (MoE, 2009a) has once again emphasised the need for the adoption of the pending draft Law on HE stipulating the introduction of the internal quality control system by HEIs. It also recognises the need for defining clear and quantifiable quality criteria, introducing and making an utmost use of international expertise, reducing the bureaucratic procedures and costs in the system of external quality control as well as introducing a national monitoring system.

It can be noted that the Action Plan for Necessary Reforms in Higher Education and Science for 2010-2012 (CoM, 2010d), which is in practice more oriented towards HE sector, sets out four tasks: (1) enhancing the quality of HE and research activity, (2) modernising the resource basis of HE and research institutions and improving resource-use efficiency, (3) internationalising HE and increasing competitiveness of HE and R&D, and (4) integrating the HE and science sector with national economy and social development. On 16 November 2010, the Cabinet of Ministers allocated funds for starting implementation of the Plan, envisaging evaluation of study programmes at Latvia's HEIs as the first measure to be implemented.

3.3.2 Academic autonomy

According the 1995 Act, all HEIs in Latvia are autonomous institutions of education and science with the right to self-governance (Law on HEIs, 1995). The constitutions of universities are approved by Latvian Parliament. The HEIs are free to decide on their overall administrative structures. University decision-making and governance structures involve external members coming from outside the university community. The convention of advisors consults the senate and rector in strategic matters for the development of the HEI.

HEIs are essentially free to develop their own academic profiles, but they are, of course, subject to accreditation procedures. While the design of curricula is generally decided upon by HEIs themselves, the introduction of new programmes requires approval by the Council of Higher Education. HEIs can collect 'tuition fees' from both local and foreign students and they are completely free to set fee levels. Apart from the said, public HEIs face limitations in terms of language policy (see section 3.1.3).

3.3.3 Academic funding

Funding of state-founded HEIs (Law on HEIs, 1995) consists of:

- State general budget for education;
- tuition fees;
- funds received by university or college researchers through project competition;
- funding of doctoral study programmes;
- institutional ('core') funding to provide development of research activity;
- funds earmarked for the implementation of definite goals.

The Ministry of Education and Science and public authorities may enter into agreements with state-accredited HEIs about student intake in specific disciplines or about conducting research, allocating the respective State financing. Under recession conditions, all public HEI's are under considerable remuneration and other financial pressure. For instance, the 2010 budget of the University of Latvia (20,500 students) amounts to €62m, and is made up of state funding for performance of study programmes (20%), tuition fees (38%), institutional funding for research (2.5%), EU SFs projects (28%), and other sources (11.5%) (UL, 2010). It should be noted that in 2009/2010 only 30% of students undertook state funded studies at public HEIs, while the rest 70% were fee-paying students (MoES, 2009b).

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

An essential trouble spot in the Latvian R&D system lies in the low national patenting activity both at home and abroad, if compared to the EU average. Eight small budget technology transfer offices have been established at HEIs and PROs, but their work is just at initial stage. So far, scientists have shown limited interest, thus the use of Code of Practice is assessed as not being timely yet. Several EU SF activities have been launched that fund projects aimed at generating patents (e.g., Support for establishing industrial property rights). If patent application is expected to generate revenue, an agreement is made on how the revenue is to be shared between the

inventor and the HEI or PRO. To facilitate functioning of the HEIs or PROs with regard to these IPR issues, the legislation is currently being amended. Although the total number of both domestic and European patents is quite small, a modest annual increase takes place (see section 2.4).

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

Spin-offs

The very term of 'spin-off' is not commonly used in Latvia due to the lack of such a practice. There are, indeed, only a couple of successful examples when active researchers have implemented their own ideas, making use of the infrastructure of their research institute and funding from state-support programmes.

Inter-sectoral mobility

Inter-sectoral mobility can be realised in Latvia since there are no formal hindrances to prevent it, and still there are few such examples. Interdisciplinary research is facilitated through special state-funded grants and through EU SF activities.

Promoting research institutions - SME interactions

Promoting research institutions - SME interactions is carried out through special activities funded by both state and EU SFs, the most important among them potentially represented by the Competence Centre Programme (see section 2.2; also MoE, 2009b, 2010). In the competition to receive support from the EU SFs, several activities, like "Support to science and research", were designed to give better position to projects submitted by a research institution in partnership with an SME.

EU cohesion policy

One example of implementing EU cohesion policy was described above. Another example of boosting regional competitiveness refers to competition for ERDF-supported projects whereby regional project submissions were given additional bonus points.

Involvement of private sectors in the governance bodies of HEIs and PROs

The private sector may be involved in the governance bodies of HEIs and PROs, on the grounds that these institutions are free to decide on their decision-making and governance structures and may involve external members. The private sector representatives are also involved in the Supervisory Board of state research programmes.

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

One of the four strategic tasks set forth by the Guidelines for Development of S&T for 2009-2013 deals with boosting the international competitiveness of scientific activity in Latvia by means of promoting international S&T cooperation (MoES, 2009a: 22, 25-26). The action lines identified include promotion of bilateral and multilateral cooperation in the field of scientific research and technological development with EU MSs and other countries; facilitation of Latvian participation in the EU RTD programmes; support for Latvian participation in international organisations and associations of scientific cooperation, in technological platforms and other joint international initiatives as well as development of world class RI in Latvia. While this is a comparatively recent official R&D policy statement, activities aimed at pursuing this route have been promoted already since early 1990s.

Involvement of Latvia in the EU Framework Programmes has been characterised by comparatively good success rates – 30% in FP5 (195 out of 640 submitted proposals), 21% in FP6 (217 out of 1,027 submitted proposals) and 23% in the first years of FP7 (141 out of 617 submitted proposals) (Ūbelis, 2010). The amount of contracted sums by Latvian participants has increased from €14.6m in FP5 to €21.6m in FP6, reaching €15.68m on the halfway of FP7 (ibid.). Thematically the largest number of projects in FP7 has so far been submitted in the following activity areas (specific programme 'Cooperation' – collaborative research): information and communication technologies (75), health (50), and socio-economic sciences and humanities (47). Within the specific programme 'Capacities' the largest number of proposals have been submitted under 'Research for the benefit of SMEs' (87) with 57 proposals submitted within the specific programme 'People' (human resources).

After a decade of being a member the COST programme, in 2009, Latvia participated in 24% of all running COST actions (LT-40%, EE-25%) with a lower participation rate from the rest of 35 countries demonstrated by six other countries (COST, 2010:73). Out of the 73 COST actions with the participation of Latvian representatives active in October 2010, 17 end in 2010, 16 in 2011, 16 in 2012, 22 in 2013 and 1 in 2014. Up till October 2010, Latvian scientists and entrepreneurs had been involved in 51 EUREKA projects (37 finished and 14 running). Latvia has also recently joined the related EUROSTARS programme launched in 2007, but so far there has been only one approved project with the participation of Latvia (EE-10, LT-9).

National funding for participation of Latvia in the above-mentioned intergovernmental organisations and schemes is mainly provided from the annual budget for science. While the respective budgetary sub-programme ('Participation in the EU RTD programmes') received €1.33m in both 2007 and 2008, in 2009 this earmarked funding was reduced to €1.1m under the conditions of budgetary cuts. At the same time a special activity "Support for international collaborative projects in S&T (incl. FP7, EUREKA, etc.)" (CoM, 2009d) has been launched in the beginning of 2010 (€7m) in the framework of the EU SF planning period for 2007-2013 aiming to ensure the capacity-building of scientific institutions, to facilitate project implementation, elaboration of new collaborative projects and participation in technological platforms.

As for national participation in inter-governmental European RIs, Latvian researchers have been involved in such a collaborative arrangement as the European Fusion

Development Agreement (EFDA) (EU Fusion programme; ITER project). In July 2009, an agreement between the Latvian government and the European Space Agency (ESA) was signed. While Latvia is not an official member of the European Organization for Nuclear Research (CERN), Latvian scientists have contributed to selected research activities (e.g., the Compact Muon Solenoid (CMS), the Enabling Grids for E-sciencE (EGEE); BalticGrid; the Worldwide LHC Computing Grid (WLCG)). Negotiations have also taken place on the possibilities of Latvia joining the European Synchrotron Radiation Facility (ESRF). Finally, Latvia is also planning to offer some of its RIs for gaining the status of the European Research Infrastructure Consortium (ERIC) launched in 2009 with an aim of facilitating the joint establishment and operation of research facilities of European interest (see also section 3.2).

3.5.2 Bi- and multilateral agreements with other ERA countries

There are quite a few inter-governmental agreements on institutionalised cooperation in the fields of culture, education, and S&T signed by the Latvian government with such ERA countries as Croatia, Bulgaria, Hungary, Slovenia, Cyprus, Greece, Turkey, France, Portugal, Finland, and Israel. Special emphasis is being placed on S&T cooperation within the French-Latvian programme “Osmosis”, as well as on the financial mechanism of the European Economic Area (EEA) and the bilateral financial mechanism of the Norwegian government that provide means for funding specific research activities in Latvia aimed at promoting research cooperation with Iceland, Liechtenstein and Norway. Foreign scholarships made available for Latvian researchers on the basis of intergovernmental and interdepartmental agreements are offered, for instance, by Austria, Switzerland, and Germany.

Active cooperation, given the geographical proximity and historical links, is pursued by Latvia with both Nordic and Baltic countries via the Nordic Council. The Guidelines for Cooperation of the Nordic Council of Ministers with the Baltic States for 2009-2013 (NORDEN, 2008) among other things gives priority to cooperation in the area of education, research and innovation. With regard to cooperation among the Baltic States, in 2007, an interdepartmental agreement between the Ministry of Education and Science and its counterparts in Estonia and Lithuania on the exchange of students, researchers and teaching staff was signed.

Many bilateral and multilateral agreements have been signed by the Latvian Academy of Sciences with its partner organisations in Austria, Bulgaria, Germany, United Kingdom, Czech Republic, France, Estonia, Israel, Italy, Lithuania, Norway, Poland, Slovakia, Slovenia, Switzerland, Finland, Hungary, Sweden and Montenegro. As of 1 January 2010, LAS had concluded 28 bilateral agreements on scientific cooperation, majority of those also envisaging support to short-term scientific visits. The overall dynamics of the execution of the bilateral agreements demonstrates an increase in the annual number of incoming visits from 19 in 1995 to 58 in 2009, while the number of outgoing visits has grown from 29 to 54 respectively (having so far reached a peak of 76 in 2005). In 2009, most of the outward visits were to Lithuania, the Czech Republic and Estonia, while the incoming researchers mostly came from Lithuania, Estonia and Russia.

Thus it can be argued that the presence and number of bilateral and multilateral agreements with other ERA countries on S&T cooperation demonstrate a rather high importance attached to cross border collaboration. Yet it has to be noted that many of the signed intergovernmental agreements cover rather broad areas (incl. education, culture, etc.) and not all of those are followed-up by concrete collaborative initiatives.

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

Since the launch of ERA-NET scheme in FP6, Latvia has been involved in such ERA-Net projects as BONUS and MATERA (currently followed up by BONUS+ and MATERA+), yet a more intense and coordinated national participation has been marked only since 2009 in the framework of FP7 when the Centre for European programmes at LAS was formed and delegated the respective function by the Ministry of Education and Science as of 2008. In 2009-2010, LAS has joined such ERA-NETs as EuroNanoMed, WoodWisdomNet-2 (together with the Ministry of Agriculture), ICT-Agri, PrioMedChild, RurAgri, SmartGrids, and eInfraNet. Additionally, Latvia has been involved in the NET-HERITAGE since 2008, represented by the Ministry of Culture, and since 2009 in ERA-AGE2 and FUTURAGE both represented by the Latvian Council of Science. Finally, in 2010, the Latvian State institute of Agrarian Economics joined CORE ORGANIC II. Thus Latvia is currently involved in the implementation of eleven (out of 54) ERA-NET (mostly lasting for 2009-2012) and two (out of nine) ERA-NET+ projects. The most frequent Latvian partner countries in the ERA-NETs include Spain, France, Italy and the United Kingdom, followed by Germany, Sweden, Belgium, Finland as well as Turkey, Switzerland and the Netherlands. But also Israel, Poland, Slovenia and Ireland are among the regular partners involved in at least 6 ERA-NETs each. Yet, given the recent engagement of Latvia in most of the ERA-NET scheme projects it is too early to appraise the results of these collaborative activities since many of the calls for research projects have been launched only in late 2009 or planned for 2010/2011.

As for the initiatives undertaken under Article 185 of the Treaty of Lisbon (four in total), in October 2009, the EC adopted a proposal on a Joint Baltic Sea Research Programme ('BONUS-169') (2010-2016) with an objective to enhance the Baltic Sea region research capacity in the field of environmental research. In 2009, Latvia also joined the EUROSTARS programme aimed at supporting R&D-performing SMEs.

Latvia is among the few countries not represented at the European Science Foundation (ESF) (30 countries in 2010). While Latvian scientists have been involved in selected collaborative research projects in the capacity of an associated partner, the scope of present national participation is very limited. Yet the new action plan of the Guidelines for Development of S&T for 2009-2013 in 2010-2011 (CoM, 2010c) envisages representation of Latvia in ESF, along with national participation in the European Technology Platforms (ETPs), Joint Technology Initiatives (JTIs) and Joint Programming Initiatives (JPIs). So far Latvian partners have been involved in such ETPs (out of the total of 36) as the European Food Technology Platform “Food for Life”, the Forest-Based Sector Technology Platform, and the Sustainable Nuclear Energy Technology Platform, with some national activity demonstrated also in the European Technology Platform for Zero Emission Fossil Fuel Power Plants and the European Technology Platform for the Electricity Networks of the Future. Latvian researchers also participate in three (out of five) European long-term JTIs – i.e. ARTEMIS (embedded computing systems), ENIAC (nanoelectronics) and IMI (innovative medicines). So far Latvia has demonstrated limited activity in joining proposals for submission under JPIs.

As can be implied from the review of the national engagement in the above-mentioned European instruments of cooperation and coordination between national R&D programmes, Latvia has only recently started to undertake an initiative of becoming involved in this kind of activities. Such a rather belated response to EU initiatives largely demonstrates the predominance of wait-and-see policy and follower

strategy used by the responsible public authorities in Latvia, that to a various degree, depending on the particular instrument, points to either lack of managerial skills or strategic orientation of policy makers, with the latter also severely hindered by the continuous uncertainty about the annual amount of funding for R&D-related activities.

3.5.4 Opening up of national R&D programmes

According to the CREST policy mix peer review, developing means for efficiently attracting foreign researchers is identified as one of the policy challenges faced by Latvia in the domain of human resources in S&T (CREST, 2010:34). So far there have been limited targeted mechanisms contributing to the openness of research organisations and national programmes to foreign researchers in Latvia. National programmes are generally designed for local researchers and research teams with a common condition for beneficiaries to be registered in the national register of scientific institutions automatically excluding foreign institutional and individual participants not residing and registered in Latvia. The Law on Research Activity also specifies that state budget funding for research activities can be allocated only to those institutions listed in the register. Besides, in most cases the terms of reference are provided only in the national language thereby limiting the possibilities for foreign applicants.

Accordingly, foreign researchers can be involved in the execution of national R&D programmes only if being employed as individual researchers by a local scientific institution (see also section 3.1). In the latter case no specific provisions placing restrictions on the participation of foreign researchers in national R&D programmes are provided, yet this has more to do with the so far limited number of leading cases rather than an intentional national policy strategy. The only recent exception with regard to the presence of national regulation so far is the EU SF co-funded programme “Attraction of human resources to science” that inter alia aims to facilitate re-emigration of expatriate Latvian researchers as well as attraction of foreign researchers. But this also pertains only to researchers intending to move to Latvia.

Otherwise, the general rationale of national authorities for limiting access of non-domestic researchers or research teams that might be willing to conduct work in their home countries to funding made available for national R&D programmes is largely based on the scarcity of national R&D budget funding that is already being severely struggled for by nationals as well as a certain degree of protectionism of national research centres which do not always meet the international standards that would guarantee their position in an equal competition with foreign peers.

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

Internationalisation of HE and science has been generally set as one of the primary tasks by the Ministry of Education and Science for 2010. Cooperation in the domain of S&T with non-ERA countries is rather intensively pursued by Latvia with a range of intergovernmental agreements on cooperation in education (culture) and science signed with such countries as Uzbekistan, China, the Ukraine, Vietnam, India and Egypt. A particularly intensive cooperation is taking place in the framework of the Latvian-Byelorussian cooperation programme in S&T as well as the Mutual Funds for Science Cooperation of Lithuania, Latvia and Taiwan. These programmes provide support for the initiation and implementation of joint research projects, joint symposiums and guest lectures, as well as the mobility of researchers. There are no formal thematic restrictions set for the project proposals submitted for funding under these programmes as long as they are collaborative and jointly drafted by researchers from the different countries. Yet the trilateral programme is more oriented towards projects with clear potential for technological development in collaboration with industry.

While most of the bilateral cooperation agreements signed by the Latvian Academy of Sciences with its partner organisations cover European countries, there are also many signed with the former post-socialist countries outside ERA, e.g., Russia, Byelorussia and the Ukraine, that have a track record of former scientific collaboration, as well as such overseas countries as Canada.

3.6.2 Mobility schemes for researchers from third countries

Aside from the stand-alone agreements on the exchange of researchers with individual countries – both EU and non-EU - listed in the preceding sections, there are no other specific mobility schemes particularly targeting researchers from third countries. With regard to inward mobility, it is only the difference in the legal regulations governing the employment of foreign researchers that are not citizens of the EU countries that has to be taken account of (see section 3.1).

4 Conclusions

4.1 Effectiveness of the knowledge triangle

Table 7: Effectiveness of knowledge triangle policies

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	• Further radical reduction of GERD only partially compensated for by the EU SF co-funded programmes. • Adoption of a new set of research priorities for 2010-2013 and launch of respective state research programmes. • Initial incentives aimed at consolidation of the leading research performers into units of state significance. • Increased emphasis on applied research in newly launched support programmes. • Expanded composition of the Latvian Council of Science aimed at strengthening links between different policy domains. • Increased efforts for facilitating inflow of young people in science.	**W**: Reduced government funding for R&D leading to an increased outflow and reduced re-emigration of talented scientists. **W**: Limited provision of researchers' positions for the growing number of newly awarded PhDs. **S**: Potential for reducing the fragmentation of supervisory and coordination issues in research domain presented by the planned consolidation of the leading research performers. **W**: Lack of an adequate system of research evaluation leading to mistrust towards the present system by certain parties. **W**: Low performance in terms of national research output (bibliometric indices).
Innovation policy	• Launch of the long-awaited Competence Centre programme. • Initial incentives aimed at optimising the regulation of IPRs regarding inventions made by public HEIs and PROs.	**W**: Lack of correlation between national R&D priorities and strengths of the national economy. **W**: Limited scope of beneficiaries of targeted innovation policy measures in the business enterprise sector. **S**: Potential to build on Latvia's research strengths in key sectors (biopharmacy and materials science). **W**: Lack of tax incentives for R&D performing companies. **W**: Overemphasis on high-tech R&D activities.
Education policy	• Further reduction of government funding for higher education and research budget thereof. • Widening high-level debate on the need for structural reforms of HE and research. • Recurrently postponed adoption of the draft Law on Higher Education.	**W**: Danger of funding cuts and disarrayed system leading to lowered international rankings of public HEIs. **W**: Mismatch between the skills of university graduates and the needs of the national economy. **W**: High share (70%) of fee-paying students at public HEIs. **W**: Restrictions set by the present legislative framework on the implementation of a more progressive and internationally-oriented HE system. **W**: High level of unemployment, including among the highly educated population.
Other policies	• Emphasis on export promotion and policy for renewable energy.	

4.2 ERA 2020 objectives - a summary

Table 8: 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	• A new EU SF co-funded programme for the attraction of human resources to science launched.	• Limited attractiveness of Latvia for incoming foreign researchers. • Formally equal career opportunities for both male and female researchers.
2	Increase public support for research	• Further radical cuts in the state budget funding for science. • Certain leverage effect attempted by the distribution EU SF for several R&D-related programmes. • Scale down of the target for GERD to be reached by 2020.	• Low feasibility of achieving the 3% target of R&D funding. • Continuous uncertainty about annual funding for R&D-related activities.
3	Increase European coordination and integration of research funding	• Introduction of a coordinated and regulated mechanism for national participation in ERA-NET schemes.	• Increased involvement of Latvian partners in ERA-NET schemes and projects. • So far limited openness of national R&D programmes to foreign participation.
4	Enhance research capacity across Europe	• Implementation of an EU SF co-funded programme (scholarships) aimed at increasing the number of newly awarded PhDs.	• Comparatively low completion rate of doctoral studies. • Limited possibilities for post-graduate training.
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	• Several new EU SF co-funded programmes aimed at modernising existing and creating new RIs launched. • Reinforced commitment of Latvia for participation in the ESFRI roadmap and related projects.	• Presence of several (though limited in number) world-class national infrastructure objects. • So far limited debate and targeted incentives for facilitating foreign access to national RIs.
6	Strengthen research institutions, including notably universities	• Further radical cuts in public funding for HE (in both educational and research domains). • Adoption of an informative report drafted by a high-level task force on the required structural changes in HE and research for boosting international competitiveness.	• Legal regulations on national language requirements in public HES act as a serious obstacle for the internationalisation of national HEIs. • Prolonged postponement of the new draft Law on HE.

	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	• Greater attention being paid to the entrepreneurship component at all levels of education system.	• Continuous lack of tax incentives for private R&D performers. • Public R&D funding so far not acting as a catalyst for the attraction of private R&D investments.
8	Promote public-private cooperation and knowledge transfer	• Competence centre programme aimed at promoting cooperation between business companies and research institutions launched.	• Limited absorptive capacity of R&D results by the business enterprise sector. • Still limited entrepreneurial drive of national academic institutions. • Low national innovation performance.
9	Enhance knowledge circulation across Europe and beyond	• New EU SF co-funded support measure aimed at facilitating participation of Latvian scientists in international projects and activities launched.	• National participation in EU R&D programmes – COST, EUREKA, EUROSTARS. • Recently decreasing national participation in FP7 (number of applicants, EC contribution). • Comparatively slow national involvement in European RTD schemes and organisations (ETPs, JTIs, JPIs, ESF, etc.).
10	Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world	• Declared prioritisation of facilitating internationalisation of national HE and science by the Ministry of Education and Science.	• Presence of a range of bilateral and multilateral agreements on research collaboration and mobility of researchers. • Still negligible inflow of foreign researchers.
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	• New expanded membership of the Latvian Council of Science including representatives from different research-related ministries in addition to proxies delegated by scientists.	• Difficulties still experienced in efficiently coordinating national research and innovation governance structures.
12	Develop and sustain excellence and overall quality of European research	• Crisis-induced termination of the initiated international peer review procedure of national applications for collaborative research projects. • Debate on the introduction of higher quality standards upon evaluation of national project proposals (e.g., SCI publications).	• Low values of internationally competitive output indicators (publications, patents). • Limited national and institutional access to databases on peer reviewed journals and articles (Scopus, ISI Web of science).

	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	• Adoption of the Guidelines for Development of Science and Technology for 2009-2013. • Adoption of research priorities for 2010-2013, launch of respective state research programmes. • Initiation of consolidating leading research performers into scientific centres of state significance.	• Emerging incentives aimed at eliminating the present fragmentation of research activities. • Internal contradiction and dissent regarding the most appropriate measures for restructuring among the involved parties.
14	Mobilise research to address major societal challenges and contribute to sustainable development	• Selected major societal challenges (e.g. public health, climate change, renewable energy) covered by individual state research programmes.	• Prevalence of public support for established national competencies with economic potential rather than novel research addressing major societal challenges.
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	• Ex-post evaluation of the state research programmes carried out in 2005-2009.	• Predominance of a technocratic approach to research and innovation governance. • Limited incentives for citizen engagement in setting research agenda.

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List of Abbreviations

BERD	Business Expenditures for Research and Development
BSR	Baltic Sea Region
CERN	European Organisation for Nuclear Research
CoM	Cabinet of Ministers of the Republic of Latvia
COST	European Cooperation in Science and Technology
CREST	Committee for Scientific and Technical Research
EC	European Commission
EE	Estonia
EIS	European Innovation Scoreboard
ERA	European Research Area
ERA-NET	European Research Area Network
ERDF	European Regional Development Fund
ESA	European Space Agency
ESF	European Science Foundation
ESFRI	European Strategy Forum on Research Infrastructures
ETP	European Technology Platform
EU	European Union
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FP	European Framework Programme for Research and Technology Development
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
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
IMF	International Monetary Fund
IP	Intellectual Property
JP	Joint programming
JTI	Joint Technology Initiative
LAS	Latvian Academy of Sciences
LASS	Laboratory of Analytical and Strategic Studies
LIDA	Latvian Investment and Development Agency
LT	Lithuania
LV	Latvia
MoE	Ministry of Economics of the Republic of Latvia
MoES	Ministry of Education and Science of the Republic of Latvia

MoF	Ministry of Finance of the Republic of Latvia
MoW	Ministry of Welfare of the Republic of Latvia
MS	Member State
OECD	Organisation for Economic Co-operation and Development
OP	Operational Programme
PRO	Public Research Organisations
R&D	Research and development
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
S&T	Science and technology
SF	Structural Funds
SME	Small and Medium Sized Enterprise
UL	University of Latvia