



# **ERAWATCH COUNTRY REPORTS 2010: Estonia**

ERAWATCH Network – Technopolis Group Tallinn

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The opinions expressed are those of the authors only and should not be considered as representative of the European Commission's official position.

## Executive Summary

Estonia is one of the smallest EU Member States accounting for 1.3 million inhabitants, i.e., 0.26% of the population of the EU27. The national economy grew rapidly from 2000 to 2007 but was then hit by the financial crisis with a decline of the real annual Gross Domestic Product (GDP) growth rate in 2008 (- 5.1%) and a further steep drop of -13.9% in 2009. The growth forecast for 2010 is 2.9% (Eurostat, 2010). The structural weakness of the national economy is a relatively low share of high tech and knowledge-intensive companies. However, gross expenditure on R&D (GERD) has tripled between 2003 and 2008 and, despite the crisis, the business expenditure on R&D (BERD) share in GERD slightly increased from 2008 to 2009 from 45% to 47%. This is partly a statistical effect but does seem to reflect a certain resilience of investment by a small group of R&D intensive firms.

Given the limited national budgetary resources, the national objective to meet the 3% target, as stated in the Action Plan for Growth and Jobs 2008-2011, the National Strategic Reference Framework 2007-2013 (NSRF) and the Research, Development and Innovations Strategy 2007-2013, could be jeopardised. However, due to the scale of funding from the Structural Funds (SF) for the period 2007-2013, the government expenditure on R&D (GOVERD) was stable and steadily increasing, even during the recession.

Estonia has show commitment to the previous Lisbon Agenda and current Europe 2020 strategy via national plans such as Growth and Jobs (in 2007) and a draft (2010) Estonia 2020 Strategy. The current data suggests that Estonia will reach a number of the targets set for the 2007-13; since for some indicators, the performance is already better than the EU27 average).

The national policy measure implemented, in line with the abovementioned strategies, was developed further in 2010, with a focus on the support of a knowledge-intensive development model for the economy and knowledge transfer. There are several advanced and well-budgeted measures in place to promote the establishment of new indigenous R&D performing firms, to stimulate greater R&D investment in R&D firms, and stimulate firms that do not perform R&D yet. Two other important directions of the R&D and innovation policy mix are increasing extramural R&D carried out in cooperation with the public sector or other firms and increasing R&D in the public sector. In addition to existing measure, like the Competence Centres, several new measures were launched in 2010, namely a cluster programme and grants funding for testing and semi-industrial laboratories.

The thematic national technology programmes on health, environment and ICT of the Ministry of Education and Research (MER) and Archimedes Foundation, and on material technology of the Ministry of Economic Affairs and Communications (MEAC) were under preparation in 2010. These programmes coordinate R&D funding relevant to national challenges, in addition to the six national R&D programmes (launched in 2008-2009).

Education policies have an important, even key role in the national 'knowledge triangle'. Estonian HEIs are not only education organisations since the four public universities also carry out a significant share of R&D activities. Various new measures in support of knowledge production, quality, curricula development, internationalisation and competitiveness of HEIs, academic mobility and commercialisation of research results were introduced in 2008-2010. These include

DoRa, Doctoral Schools, Primus, SPINNO; the measure for life-long learning support (TuLe) and for institutional capacity development (EKKA). A completely new kind of programme for the popularisation of scientific research was created in 2010. TeaMe aims to increase the popularity of science amongst young people through media, education and leisure-time activities.

The main actor in research and innovation policy governance is the Research and Development Council, which operates under the auspices' of the State Chancellery. At the policy design level, the two central organisations are the Ministry of Economic Affairs and Communications (MEAC), and the Ministry of Education and Research (MER).

The following table gives an overview of the developments and interaction between national policies in the knowledge triangle.

### Knowledge Triangle

#### Effectiveness of knowledge triangle policies

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	<ul style="list-style-type: none"> <li>• National RI Roadmap completed (20 investment objects selected in 6 research fields).</li> <li>• More national R&amp;D programmes under preparation, addressing strategic thematic areas (health, environment, material science and technologies, etc).</li> </ul>	<ul style="list-style-type: none"> <li>• Ambitious, competent and advanced in terms of policy planning and implementation planning.</li> <li>• Performance is still moderate, due to the low investment capacities and access to RI.</li> <li>• Raising the role of thematically oriented programmes is positive, as it consolidates the limited resources in the strategic areas.</li> <li>• The provision of qualified research personnel is satisfactory (national HEIs and international mobility) but employment options are limited.</li> </ul>
Innovation policy	<ul style="list-style-type: none"> <li>• Few new measures, (Start Up Estonia, Material Technology Programme, Cluster Programme), but no principal changes.</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation remains project-oriented and lacks coherency with entrepreneurship, tax and industrial policies.</li> <li>• Main strength is in the various, well-managed support measures, integrating efforts of business sector and HEIs.</li> <li>• Policy instruments and funding are multifarious and advanced, but dominantly depend on the EU SF.</li> <li>• R&amp;D investment, absorption and implementation capacity of knowledge production in the business sector is not competitive.</li> </ul>
Education policy	<ul style="list-style-type: none"> <li>• Few new measures launched (TuLe, EKKA) and some under preparation.</li> </ul>	<ul style="list-style-type: none"> <li>• Best performing (by comparative data and trends) policy sector, based on the strong and autonomous HEIs, and excellent (PISA) performance of secondary education.</li> <li>• Competent and advanced in terms of policy and implementation planning.</li> <li>• Policy instruments and funding are manifold, but to a large extent (about 50% in 2009) depend on the SF.</li> <li>• This policy area is the most affected by the demographic trends.</li> </ul>
Other policies	<ul style="list-style-type: none"> <li>• Space policy; R&amp;D in the Defence sector.</li> </ul>	<ul style="list-style-type: none"> <li>• The role and real impact on knowledge triangle is small or uncertain.</li> </ul>

## European Research Area

The ERA concept is recognised as an important driver for Estonian R&D policy and participation of HEIs in European initiatives is strongly encouraged (IHE Strategy, RDI Strategy, 2006) and supported by several programmes and public co - financing (e.g. baseline and targeted funding, etc.). The main policy components (at the implementation level) contributing to the ERA are for mobility of academic staff and the internationalisation of the Estonian HEIs. These include, since 2008, new measures such as Doctoral Schools, DoRa, Mobilitas, amongst others.

Concerning Estonian participation in international research, Estonian researchers have been relatively successful in applying to FP7 (with the exception of ERA-NETs). By 2010, Estonian organisations had cooperation with partners from 56 countries. Moreover, the participation in other pan-European cooperation schemes, such as COST, has grown markedly.

In 2010, several initiatives in the research infrastructure (RI) field also contribute to strengthening Estonia's position in ERA. The investment plan of the national RD&I infrastructure projects was developed in parallel to the preparation of the Estonian Research Infrastructures Roadmap (approved as an annex of the RDI Strategy Implementation Plan in June 2010). This was aligned with the decision to participate in five ESFRI projects.

### 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	No major changes	<ul style="list-style-type: none"> <li>• Investment in boosting HRST notably for doctoral studies. However, there is a medium-term, negative demographic trend.</li> <li>• No labour market restrictions for researchers from other EU countries and mobility supported by diverse measures.</li> <li>• Agreement on Good practice of Internationalisation signed and the Charter of Researchers is adopted (but not signed) by all public universities.</li> <li>• The share of female researchers is higher than the EU average.</li> </ul>
2	Increase public support for research	No major changes	<ul style="list-style-type: none"> <li>• Limited national budgetary resources are compensated (at least until 2015) by the large EU SF allocations.</li> </ul>
3	Increase European coordination and integration of research funding	No major changes	<ul style="list-style-type: none"> <li>• Estonian participation in JTIs or ESF initiatives has been relatively modest.</li> <li>• However, Estonia is a founding member of two joint technology undertakings, participated in three EUROCORES programmes, took part in six ERA-NET projects in 2009.</li> </ul>

	ERA objectives	Main national policy changes	Assessment of strengths and weaknesses
4	Enhance research capacity across Europe	No major changes	<ul style="list-style-type: none"> <li>• State budget support for taking part in EU collaboration programmes (FPs, COST) launched in 2008 aiming to increase Estonian participation in EU programmes.</li> <li>• Participation in Eurostars has opened additional international cooperation for Estonian R&amp;D intensive SMEs.</li> <li>• The EU Strategy for the Baltic Sea Region may open also new opportunities for Estonian researchers.</li> </ul>
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	National IR Development Roadmap developed	<ul style="list-style-type: none"> <li>• The Roadmap is a strong advantage of Estonia to encourage its involvement in inter-governmental infrastructure development projects.</li> <li>• Too high importance of EU SF share in public funding of R&amp;D against national allocations.</li> </ul>
6	Strengthen research institutions, including notably universities	No principal changes. The Draft Law of Tartu University Act proposes new governance forms for this university, in terms of closer inter-action with stakeholders.	<ul style="list-style-type: none"> <li>• Autonomy is supported by stable state funding instruments, a wide set of mobility support measures and individual programmes (SPINNO, DoRA, Doctoral Schools, etc.).</li> <li>• Public universities have a relatively high degree of financial independence and some - various other sources of financing than the state (or the EU SF).</li> </ul>
7	Improve framework conditions for private investment in R&D	No major changes. One new support programme - Start-up Estonia is launched.	<ul style="list-style-type: none"> <li>• A core element of innovation policy with various measures effective in terms of support of individual firms. Their cumulative effect to foster comprehensive structural economic change is, however, unclear.</li> <li>• No tax incentives or other horizontal measures to support private investments.</li> <li>• Funding dependent on the EU SF with no feasible alternative national sources.</li> </ul>
8	Promote public-private cooperation and knowledge transfer	No major changes. One new support programme is launched by MEAC.	<ul style="list-style-type: none"> <li>• Another core element of innovation policy, with a number of measures operational and evaluated positively (e.g. competence centres). However, again the cumulative effect is unclear; e.g., moderate changes to high tech export performance or IPR in business sector.</li> <li>• Funding dependent on the EU SF with no feasible alternative national sources.</li> <li>• Participation of Enterprise Estonia in international networks (i.e. VALOR) is an additional source for learning and funding of knowledge transfer.</li> </ul>

	ERA objectives	Main national policy changes	Assessment of strengths and weaknesses
9	Enhance knowledge circulation across Europe and beyond	No principal changes. The EU Strategy for the Baltic Sea Region (adopted by EC on 10 June 2010).	<ul style="list-style-type: none"> <li>• State budget support for taking part in EU collaboration programmes (FPs, COST) launched in 2008 aiming to increase Estonian participation in EU programmes.</li> <li>• Participation in Eurostars has opened additional international cooperation for Estonian R&amp;D intensive SMEs.</li> <li>• The EU Strategy for the Baltic Sea Region may open new opportunities for Estonian researchers.</li> </ul>
10	Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world	National RI Roadmap developed. The EU Strategy for the Baltic Sea Region (adopted by EC in June 2010).	<ul style="list-style-type: none"> <li>• The National IR Roadmap is a strong advantage of Estonia to encourage its involvement in inter-governmental (inside, outside ERA) infrastructure development projects.</li> <li>• The EU Strategy for the Baltic Sea Region may open also new opportunities for Estonian researchers.</li> </ul>
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	National Strategy on implementation of "Europe 2020" started (June 2010).	<ul style="list-style-type: none"> <li>• An initiative is taken by State Chancellery to encourage inter-ministerial efforts on R&amp;D and innovation.</li> </ul>
12	Develop and sustain excellence and overall quality of European research	No major changes	<ul style="list-style-type: none"> <li>• Estonian researchers continue to be successful in the FP7.</li> <li>• General commitment to participate in the international joint programmes and infrastructure projects.</li> </ul>
13	Promote structural change and specialisation towards a more knowledge - intensive economy	No major changes. Foresight (ICT, health care, etc) undertaken by Estonian Development Fund	<ul style="list-style-type: none"> <li>• No systematic approach to initiate and support coherent structural changes in the economy via entrepreneurship, tax and industrial policies.</li> <li>• Over-reliance on specific measures (highly dependant on the SF financing).</li> </ul>
14	Mobilise research to address major societal challenges and contribute to sustainable development	Some specific societal challenges are addressed through the R&D policies.	<ul style="list-style-type: none"> <li>• National energy technology programme is a comprehensive, multi-targeted initiative, and it covers not only technological but also energy security and sustainability aspects.</li> <li>• The ICT policies cover also cyber-defence, internet access and e-services development.</li> <li>• Life long education support measures address the ageing society issues.</li> </ul>
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	<ul style="list-style-type: none"> <li>• Launch of a special administrative unit for Science communication and the TeaMe programme.</li> <li>• No major changes in terms of systematic policy evaluations.</li> </ul>	<ul style="list-style-type: none"> <li>• As Estonian society appreciates and respects education and science, the measure encouraging public dialogue and popularising scientific careers should meet their objectives.</li> <li>• A policy evaluation culture is not well developed; the general awareness about its role in governance and public management is low even in the public sector. There are some positive exceptions in the innovation policy area.</li> </ul>

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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*

Estonia is one of the smallest EU Member States with just over 1.34 million inhabitants or 0.26% of the total EU population (Eurostat, 2010). Gross domestic product (GDP, in current prices) was €13,860.8m (Statistics Estonia, 2009) and GDP per capita (purchasing power standard, PPS) was at 60% of the EU average in 2009. As a result of the recent financial and economic crisis, GDP fell by 13.9% in 2009. Unemployment has increased significantly from 5.5% in 2008 to 13.8% in 2009 and is now amongst the highest in the EU27 (average 4.2%) (Eurostat, 2010). More

positively, the latest trade figures show exports rising by 40% in September 2010 compared to the previous year.

Not surprisingly given the small size of the population and economy, higher education and R&D activities are concentrated in the two largest cities: Tallinn and Tartu. In 2008, gross expenditure on R&D (GERD) as a percentage of GDP stood at 1.29%, well below the EU27 average of 1.9% (Eurostat, 2010). Despite an absolute fall in expenditure due to the crisis, the rate was 1.42% in 2009 (Statistics Estonia, 2010).

### **Main actors and institutions in research governance**

The Research and Development Council is an expert consultative body that advises the Government on R&D and innovation matters. The State Chancellery's Strategy Office is an active intermediary in the R&D-related strategy and policy consultations, and acts as a secretariat of the Research and Development Council. Together they provide policy coordination and guide the national RTDI policy.

Policy design and evaluation is carried out, principally, by the Ministry of Economic Affairs and Communications (MEAC), and the Ministry of Education and Research (MER). The former oversees support for and funding of industrial R&D, as well as planning, coordination and implementation of innovation policy; the latter is responsible for research and education policies, the financing and evaluation of research institutes and coordination of international cooperation in research.

**Two permanent advisory bodies, the Research Policy Committee and the Research Competence Council provide advice to the MER<sup>1</sup>; whilst the Innovation Policy Commission advises the MEAC. Implementation agencies and intermediaries**

At the operational level, both the MER and MEAC have implementing agencies/bodies and intermediaries. The main implementing body of the MEAC is the Enterprise Estonia Foundation, which is responsible for managing business support, innovation and technology programmes. The MER has two main agencies that deliver funding and support: the Archimedes Foundation is responsible for national activities related to the ERA, international research programmes, academic mobility measures, etc.; and the Innove foundation manages a range of programmes and support measures in the fields of lifelong learning and active labour market policies<sup>2</sup>. The Estonian Science Foundation (ESF) provides grants to scientific researchers.

### **The institutional role of regions in research governance**

Given the scale of the country, research and innovation policy is managed by central government bodies and implemented at a national level. Local authorities have neither the devolved responsibility nor the financial capacity to develop their own research policies.

### **Main research performer groups**

By source of funding, GERD continues to be dominated by the government sector, which provides, via various instruments, around 50% of total GERD, compared with an average of 33.5% in the EU27 (in 2008). The share of the business enterprise

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<sup>1</sup> In particular, the Scientific Competence Council provides expert advice and submits proposals to the Ministry on distributing targeted funding, assessing the conformity of the research results with international standards and making proposals for the approval of the results of evaluation of RD, etc.

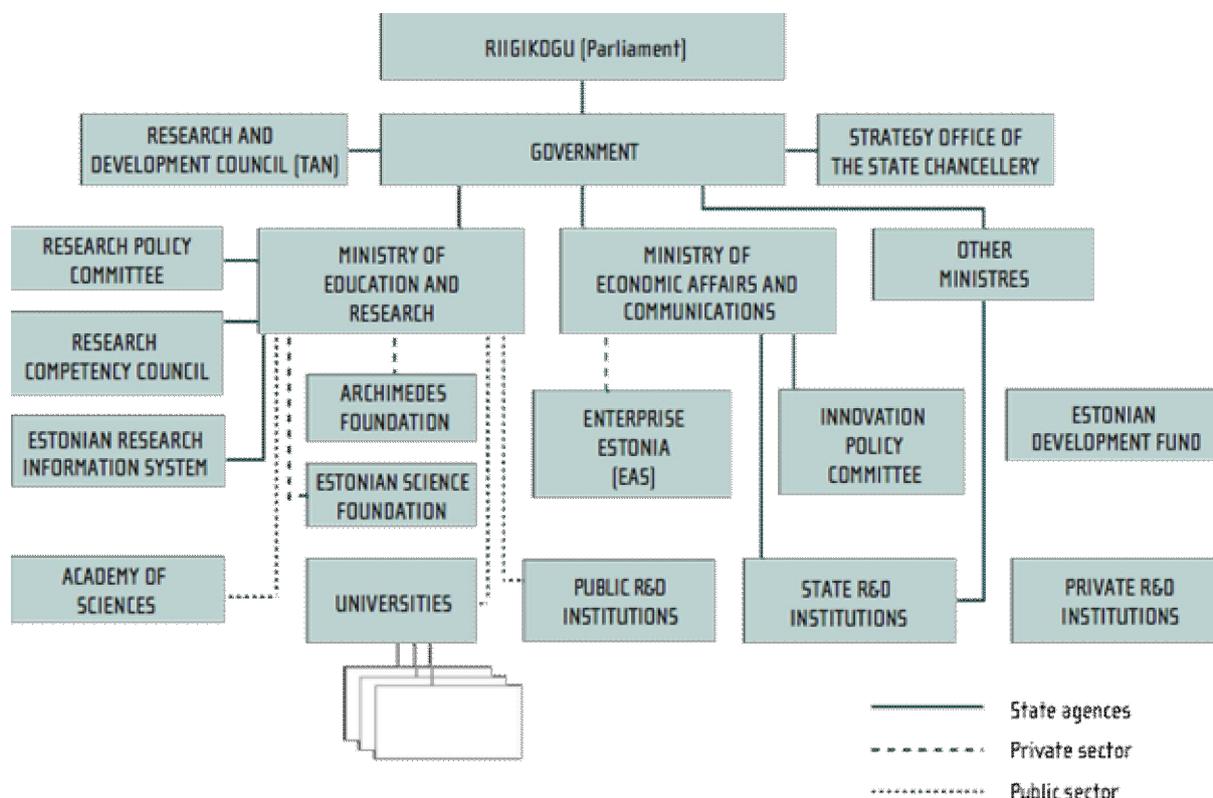
<sup>2</sup> The three foundations are also implementing agencies for the Structural Funds for the period 2007–2013.

sector was 33.6% (EU27 55%), and the third largest source is from abroad with 15.5% (EU27 8.9%). Other sources like private non-profit and higher education sectors finance together 0.8% of national GERD (Eurostat, 2008).

In terms of performance, the higher education and business sectors have an equivalent share of GERD (0.56% of GDP) while the government sector is a more marginal performer (0.15% of GDP) (Table 1). The majority of academic research and development in Estonia is performed at the four public universities.<sup>3</sup> BERD is dominated by a limited number of high-tech SMEs (ICT, biotech) and the service sector (financial and telecom services providers). Their R&D actively is largely intramural (see Table 2).

Compared with many other EU Member States, public research organisations (PROs) have a marginal role as the majority of the former research institutes of the Estonian Academy of Science were incorporated into universities during the 1990s.<sup>4</sup> Hence, despite a wide range of actors in the national research and innovation system (see Figure 1), in operational terms the MER, MEAC, the public universities and a limited number of enterprises play a decisive role.

**Figure 1: Overview of the Estonia’s research system governance structure**



Source: Estonian Ministry of Education and Research

## 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

<sup>3</sup> The [University of Tartu](#), (UT), [Tallinn University of Technology](#), (TUT), [Tallinn University](#) (TU) and the [Estonian University of Life Sciences](#), (EULS).

<sup>4</sup> However, some non-HEIs research institutes still exist, such as the National Institute of Chemical Physics and Biophysics and the Estonian Biocentre.

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

In order to provide a multi-annual framework for research and innovation policy, the Estonian Parliament adopted a first national R&D strategy for 2003-2006 (Knowledge-Based Estonia: Research and Development Strategy for 2003-2006, hereafter RD Strategy) which was followed by the Research, Development and Innovation Strategy for 2007-2013 (hereafter RDI Strategy). The RDI Strategy is supplemented by an implementation plan for 2009-2013 that provides a predictable policy framework for short- and medium-term planning, via annual implementation plans, investment plans, etc.

The 1997 *Research and Development Organisation Act* (last amended 2009) provides the legal framework for public funding of the R&D system. The financial planning on R&D is carried out as part of the State budget planning process.<sup>5</sup> Consecutive governments have maintained a prudent fiscal policy to maintain a balanced budget and public investment in favour of R&D was limited until 2003. However, since the 2004, and the first period of Structural Fund support, a stable framework for longer-term investments in R&D has been put in place.

After initial investments during 2004-2006, R&D and innovation are a key priority of the Estonian national reform programmes, namely the Action Plan for Growth and Jobs 2008-2011 for implementation of the Lisbon Strategy (hereafter AP Growth and Jobs), and the Estonian Strategy for Competitiveness 2009-2011.

Partly as a result of this policy commitment, Estonian GERD has grown by around 20% per year from 1998 until 2008, the second highest growth rate in the EU (Estonian Statistics, Eurostat; see Table 1). Indeed, during the period 2003-2008, GERD has tripled in absolute terms (Statistics Estonia Yearbook, 2010). In terms of the structure of GERD, the business sector share has slightly increased from 45% in 2008 to 47% in 2009 (Eurostat, 2010; Statistics Estonia, 2010).

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<sup>5</sup> Budget formulation in Estonia can be divided into two stages: the elaboration of the multi-annual State Budget Strategy (i.e. medium-term approximation and budget trends) and the preparation of the annual budget.

**Table 1: R&D expenditures: trends and prognosis**

Performers/ sectors	Estonia					EU27 average	Target AP Growth & Jobs	Target of RDI Strategy
	2004	2005	2006	2007	2008	2008	2011	2014
<b>R&amp;D intensity (GERD as % of GDP) including:</b>	0.85	0.94	1.15	1.14	1.29	1.9	2.0	3.0
• <b>Government sector, % of GDP</b>	0.11	0.11	0.15	0.1	0.15	0.24	-	-
• <b>Business sector, % of GDP</b>	0.33	0.42	0.51	0.52	0.56	1.21	1.05	1.6
• <b>Higher education sector, % of GDP</b>	0.39	0.39	0.46	0.46	0.56	0.43	-	-
• <b>Private non-profit, % of GDP</b>	0.02	0.02	0.02	0.03	0.03	0.02	-	-
<b>GBAORD as share of total general government expenditure</b>	1.11	1.2	1.5	1.43	1.62	1.52	NA	NA

Source: Own compilation based on Eurostat 2010, RDI Strategy 2002-2006, RDI Strategy 2007-2013, AP Growth and Jobs

The steady growth of GBAORD reflects the public sector commitment to attaining the 3% objective (the revised target date being 2014) set in the RDI Strategy. The funding allocated for quasi-competitive R&D projects under the defence policies budget has also increased annually: from €0.108m in 2001 to €1.66m in 2008<sup>6</sup>. A new long-term Estonia 2020 Strategy is being drafted, (State Chancellery, 2010a) and seeks to implement the Europe 2020 targets, including the 3% target.

The role of government funding is particularly important for the intramural R&D activities in HEIs and PROs which are predominantly publicly funded (state budget and EU Structural Funds). In contrast, the business sector is much less dependent on the state budget with less than 10% of business's total intramural R&D expenses sourced from the state budget (See Table 2).

**Table 2: Government financing of Intramural research and development expenditure by institutional sector, 2004–2009, by share (%)**

Year/Sector	Government	Higher education	Private non/profit	Business
<b>2004</b>	82	69	22	4
<b>2005</b>	80	73	43	7
<b>2006</b>	63	80	28	8
<b>2007</b>	92	77	52	9
<b>2008</b>	91	82	52	7
<b>2009</b>	85	81	18	na

Source: Statistics Estonia Yearbook, 2010

The majority of public R&D expenditure is distributed via the MER budget to HEIs and PROs (including research and archive libraries, and scientific collections), which

<sup>6</sup> However, the investment in defence-related R&D in 2008 is still lower than the level suggested by the European Defence Agency (0.5% of the defence budget instead of the suggested 2%), (Ministry of Defence, 2010).

receive a mix of institutional non-competitive and project-oriented competitive funding. The second most important source of funding is for industrial R&D, innovation and business-academia collaboration from the MEAC's budget. Support for the business sector is granted through competitive bids for project funding. Programme management and financing decisions are delegated to the respective agencies or foundations (Enterprise Estonia, Archimedes, ESF).

The main institutional, non-competitive instruments providing HEIs and PROs with annual baseline funding are allocated on the basis of R&D performance evaluations. During 2005-2009, the budget for baseline funding has steadily increased (in 2009 to €83m). For state-funded HEIs and PROs, their operating costs for research infrastructure are provided from the budget of the responsible ministry. The share of infrastructure operating costs is stable and at a level comparable with the baseline funding. Additional non- or quasi-competitive public funding is provided through the multi-annual State research programmes in certain key fields as well as the R&D infrastructure programme.

The targeted financing budget doubled during 2003-2008. In 2009 the budget was €24.90m which funded about 209 projects.

Competitive financing measures funded by the state budget are:

- Grants for individual researchers; they are allocated on a competitive basis through the ESF (via the MER budget);
- A range of competitive support measures for HEIs, PROs and business sector (see also section 2.2.2).

In contrast, there are no tax incentives for R&D-related activities/expenses for the public, higher education, business or non-profit sectors.

Obviously, institutional instruments dominate public investment in research, with baseline and infrastructure funding assuring the institutional stability of Estonian HEIs (and PROs). Given this finding and the trends in the available financial means via the State budget, the significance of, or even dependence on EU Structural Funds for a number of support measures can be stressed.

The EU SF is consolidated with and distributed through the State budget, under the National Strategic Reference Framework 2007-2013 (NSRF), in particular via two out of three of the Operational programmes (OP)<sup>7</sup>. The NSRF is implemented through a special law on Structural Aid, under which Estonia can draw on more than €3.4b.<sup>8</sup> The SFs are the principal source of funds for competitive support measures and research infrastructure (see Chapter 3). Currently, there is no alternative source of funds within the national budget (Auditor General, 2010).

The strategic objectives formulated in the RDI Strategy are as follows:

- Competitive quality and increased productivity of R&D activities;
- Innovative business activity creating added value in the global economy;

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<sup>7</sup> <http://www.strukturifondid.ee/index.php?id=12034>

<sup>8</sup> The share of EU SF in the budget of the MEAC is 50% and in the budget of MER 40% (Auditor General, 2010). In the OP "Human Resource Development," the second priority axis is "Developing human resources for R&D. Indicative structural assistance expenditure available for all activities falling under the heading of research and technological development, innovation and entrepreneurship is around 20% (Ministry of Finance, 2007), i.e. €680m (compared with the GBAORD in 2008 as of €78 m) (Statistics Estonia, 2010).

- Innovation-friendly society aimed at long-term development.

A focus on certain strategic challenges is made explicit through the national R&D programmes, which according to the RDI strategy, should be launched, *inter alia*, for **solving socio-economic problems** (e.g., in the field of energy, national defence and security, health care, environment protection and information society). Thematically oriented **national technology programmes** on health, environment, ICT and material technology were under preparation in 2010, in addition to the six existing national R&D programmes.<sup>9</sup>

In addition, the centres of excellence and competence centres programmes, although not thematically focused, clearly aim to contribute to resolving challenges in areas such as environment and new materials, health care and medicine, new communication technologies, etc.<sup>10</sup>

At a broader policy level, energy, sustainable development and environmental issues are increasingly prioritised. This is reflected in the creation of the [Climate and Energy Agency](#) (KENA), in 2010, which has a mission to improve energy security and reduce the environmental impact of current energy providers. In particular, it aims to support and fund educational solutions and ideas in energy innovation.

Encouraging society to shift to a knowledge-intensive development path requires close interactions and trust between the scientific community and all social partners. To raise awareness about the role of science and boost interest in scientific careers, a unit for Science Communication (SCU)<sup>11</sup> was established in 2010 within the Archimedes Foundation. It co-ordinates several publicly funded initiatives such as the Contest for Young Scientists (since 2002), Contest for Young Inventors (since 2008), Estonian Science Communication Award (since 2006). The SCU also manages the quasi-competitive awareness programme TeaMe with the objective to raise the interest of young people in science and technology careers. The budget of the TeaMe programme for 2009-2013 is €3.4m, which comes mainly from the SF.<sup>12</sup>

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

In absolute terms, BERD has progressed steadily since 2004 (Table 1). However, the BERD intensity remains about half of the EU27 average and there has only been a slight narrowing of the gap in the last five years. Despite the 2008/2009 crisis and the sharp fall in GDP growth, BERD grew by 10% in 2008 (compared to 2007) before falling slightly by 2% in 2009 (compared to 2008) (Statistics Estonia, 2010). Nevertheless, the share of the business sector in GERD increased from 43% to 45% from 2008 to 2009. As the new programme period of EU SF started in 2008, the growth of government financing of R&D activities was significantly higher than in previous years. Hence, it is likely that the various new programmes targeting

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<sup>9</sup> Estonian Language and Cultural Memory (2009–13); Language Technology Support for the Estonian Language (2006–10); Supporting Terminology in Estonian (2008–12); Compilation and Publication of Textbooks in Estonian for Institutions of Higher Education (2008–12); Energy Technology Programme; Biotechnology Programme.

<sup>10</sup> The Centres of Excellence consist of internationally recognised research groups working in close or complementary areas and performing advanced-level, basic and applied research while the Competence Centres focus on applied and industrial applications and technology development in areas of strategic importance.

<sup>11</sup> SCU site <http://archimedes.ee/teadpop>

<sup>12</sup> A small share of the programme budget is reserved for bottom-up competitive project initiatives (€0.2m annually for 15-20 initiatives).

enterprises introduced in 2008 have had a positive impact on the investment capacities of the business sector in the first year of the financial crisis (Statistics Estonia Yearbook, 2010).

In terms of a longer strategic perspective, the BERD trend is more uncertain, as the core investment barriers stemming from the size and structural limitations of the national economy are still in place.<sup>13</sup> The existing fiscal and tax policies have proven to be successful in supporting business investments (RD Strategy, 2006), but they do not promote particularly knowledge-intensive business, the creation of jobs in research and development and investments in added value production and services (Landesmann, M., 2000, Varblane, U. et al, 2008).<sup>14</sup>

The fact that 75% of BERD can be attributed to only 58 firms (Statistics Estonia, December 2010), reflects a structural weakness of the Estonian economy. Equally, the role of high-tech firms in the economic structure remains weak - the high-tech export share of total exports was 8% (compared to 16.6% in the EU27) in 2006, (Eurostat). The high-tech sector employs less personnel than more industrially developed economies (see data in Chapter 2.3.).

Moreover, some experts suggest that the structural changes in general are more likely to be achieved via educational policies, as the impact of other components of the knowledge triangle is not sufficient (State Chancellery, 2009) and as the other policies are not proving effective (National Audit Office, 2010).<sup>15</sup>

Still, both the RDI Strategy and the AP Growth and Jobs have estimated that an R&D intensity of 2.0% (GERD/GDP) and BERD/GDP intensity of 1.05% are possible to achieve by 2011. For the business sector intensity, the target level is 1.6% by 2014 (RDI Strategy). These estimates are based on the pre-defined EU SF resources, which until 2013 are incorporated into the state budget. One other challenge for the achievement of the national BERD target is the labour market for R&D personnel in the business sector (discussed in detail in Chapter 2.2.3).

### **The policy mix to support increased private R&D investment**

Of the routes proposed in the Policy-Mix study to increase BERD, four are particularly important in terms of the structural reorientation of the Estonian economy:

1. Promoting the establishment of new indigenous R&D performing firms;
2. Stimulating greater R&D investment in R&D performing firms;
3. Stimulating firms that do not perform R&D yet, and
4. Increasing extramural R&D carried out in cooperation with the public sector.

A priori, the promotion of new indigenous R&D performing firms (route 1) is supported by various business start-up measures, notably of Enterprise Estonia, and the generally favourable regulatory framework in favour of entrepreneurship (e.g. simple registration of a new business, e-taxation, liberal employment laws, and

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<sup>13</sup> In 2009-2010, the Development Fund has launched several foresight reports to discuss and analyse the growth potential of Estonian industry (Industry Engines 2018), ITC sector (EST\_IT@2018) and other sectors that could, in case of political will, become certain bases for policy discussion.

<sup>14</sup> The national data on VC investments is scarce and fragmented. No data provided by Eurostat.

<sup>15</sup> National Audit Office has found in its critical report (August 2010) that the entrepreneurship policies are out-of-focus, and the state enterprise support measures in place "have not made Estonia's economy more competitive – the low productivity and export capacity of companies, which form the basis of an economy's competitive advantages, have not improved significantly as a result of the state's support".

particularly taxation policies). Moreover, given the scale and structure of the Estonian economy, the needs of micro-companies and SMEs are taken into account by both the RDI Strategy and the 2007-2013 Entrepreneurship Strategy. In October 2010, the MEAC launched a new initiative for start-ups and SMEs, called Start-up Estonia (estimated budget €3.7m). However, the policy effort is focused on the promotion of entrepreneurship in general, not specifically in R&D-intensive sectors. Exceptions include seed-capital investments through the Estonian Development Fund into high-growth, and hence generally technology intensive, early-stage firms.

In terms of routes 2 and 3, and given the acknowledged need to re-orientate the Estonian economy to knowledge-intensive business activities and promote structural change, there are a number of well-established measures, which have been extended in the 2007-2013 period, including: Technology Competence Centres programme (est. in 2002), Research and Development support (est. in 2004), etc. In addition, several new R&D and innovation relevant measures were started in 2008 and 2009, such as the Involvement of Development specialist, the Business cluster and collaboration development, and Innovation voucher measures. The common goal of these programmes is to stimulate local companies to shift to higher added value or R&D intensive manufacturing via technological modernisation.

In 2010, two new programmes relevant to routes 3 and 4 were launched, namely: the awareness programme for creative industries (this sector is considered to have an increasing role in supporting competitiveness and a knowledge-based economy) and the Testing and semi-industrial laboratories support programme. The total budget of the latter is €3.94m (consolidated budget for 2009 and 2010). It is a highly relevant measure for industrial research and contributes further to boosting the R&D capacity of the technology-intensive companies.

Concerning route 5, insufficient business-academia collaboration is a persistent challenge in the Estonian R&D system (OECD, 2007; PREST, 2003). By the end of 2009, the set of competitive support programmes was expanded by several new measures: for HEIs the HEIs-business collaboration development; and for the business sector Involvement of innovation and R&D staff, Manufacturing R&D projects and the academic-business cooperation programmes. Nevertheless, the pre-existing Competence Centres Programme is the key instrument for promoting industry-academic co-operation and spans all types of research in certain thematic areas by integrating activities of public and private sectors

In general, Estonian R&D and innovation programmes are effectively managed (Technopolis Group, 2006) but findings about performance, impacts and results are not sufficient to draw an overall conclusion, as the evaluations so far are not systematic and comparable. In particular, MEAC and Enterprise Estonia have the practice to commission feasibility studies and evaluations for core measures, but mostly on a periodic or *ad hoc* basis rather than as a systematic process.<sup>16</sup>

To support development in the key technology areas identified in the RDI Strategy, two types of thematically oriented programmes are planned. First, the existing technology programmes on energy and biotechnology of Enterprise Estonia, plus one new programme, under preparation, on materials. These programmes, despite their titles, do not provide funding but have a coordination and integration function of

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<sup>16</sup> As common, all competitive programmes clearly define their target groups, scope and objectives of support, and the qualification, selection and eligibility rules and criteria. All this programme information is stated directly in the respective programme regulation, which makes the application process clear and streamlined even if it is sometimes subjectively argued to be a rigid (Technopolis Group, 2008).

stakeholders and research activities in these fields. The thematically oriented national R&D programmes, managed by Archimedes, are a completely new type of funding measure. In 2009-2010, three such programmes were under preparation: in ICT, health care, and environment technologies. Due to the overarching nature of these programmes, they support all policy routes mentioned above.

### **Innovation-oriented procurement policies (POPP)**

In Estonia, POPP is in a very initial development phase and, mostly takes the form of one-off initiatives or specific elements of regular procurement procedures. There is no visible political or organisational leadership so far to define the principles and steps for a more systematic, comprehensive approach.<sup>17</sup> The Ministry of Finance (MF) is responsible for public procurement policy and drafting the respective laws and hence, formally, should oversee the development of a framework for POPP.

The Public Procurement Act (in force since 1 July 2010) regulates the “Idea competitions” but there is no reliable data on how often and in which fields such competitions occur<sup>18</sup>.

There are other examples of forms of procurement used to stimulate R&D. In 2007, the MEAC and the Ministry of Defence collaborated on a first offset contract worth over €64m (TrendChart Report Estonia, 2007).<sup>19</sup> Equally, e-government policy has led to systematic, large-scale public procurement from ICT providers (e.g. creation of novel technology platforms for e-voting, e-health, e-customs and e-taxation).<sup>20</sup>

As noted above, Estonian industrial and entrepreneurship policies tend not to be sectorally/thematically focused and hence there are no preferences or incentives. However, in 2010, the first meeting of the Estonian Space Council was held to define the future activities in this R&D-intensive sector and to outline practical collaboration with the European Space Agency (ESA).

Moreover, various sectoral policies have a potentially positive impact on R&D investments (particularly in the business sector) most notably through the energy and environment policy instruments and, as previously mentioned, information society policies. [Kredex](#), the Estonian Credit and Export Guarantee Fund manages a set of measures to implement Estonia’s residential housing and energy conservation policy: grants for energy efficiency, awareness programme, etc. (Estonian National Housing Development Plan for 2008-13). A similar initiative has been introduced by the

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<sup>17</sup> The lack of organisational leadership could be explained by a fact that there is no governmental agency on public procurement: the activity of the Public Procurement Office was terminated and since 1 July 2010, the Ministry of Finance (MF) holds the rights and obligations of this former entity.

<sup>18</sup> From discussions with the MEAC, MF and the [Public Procurement Centre](#), only a very few examples of the practical solutions supporting innovation by public procurements were identified. According to the practical experience of the PPC (which carries out joint public procurements on behalf of its members/stakeholders: local municipalities and some public organisations like regional hospitals), the best option to support innovation, R&D and also environmental policies under the current legal framework is to set relevant quantitative and qualitative criteria in the tenders’ technical specification, qualification, and assessment requirements. For instance, this approach can be used in procurements of transportation vehicles (for CO<sub>2</sub> emission control), and of construction services (for modern energy and lighting solutions), etc.

<sup>19</sup> The offset contract consisted of public defence procurement (prepared by the MEAC and signed by the Ministry of Defence), which sets “conditionally for seller to buy goods or services in target country. The first military offset was expected to encourage R&D cooperation, technology transfer and development of high-tech products.” (TrendChart Report for Estonia, 2007). Enterprise Estonia managed of the mediation of Estonian companies for the offset purposes lies with Enterprise Estonia.

<sup>20</sup> See more about e-initiatives on the site on Estonian Informatics Centre, <http://www.ria.ee/index.php?lang=en>

Climate and Energy Agency [KENA](#) in 2010. The Environmental Investment Centre (EIC) runs the environmental management programme supporting various surveys and work to reduce the negative impact of the oil shale based energy system and to improve the condition of ambient air. In 2010, it launched a new financing measure - the Green Investment Scheme channelled for renovation of heating and energy networks. The overall strategic framework for the EIC support measures is the Estonian Environment Strategy until 2030 (EIC, 2007).

### 2.2.3 Providing qualified human resources

Higher education is the policy area with the most direct impact on the capacity to facilitate and to use R&D investments. As the core public R&D organisations are HEIs, the Higher Education Strategy for 2006-2015 has a strong impact in shaping the provision of human resources for R&D. The strategy proposes, *inter alia*, further modernisation of the R&D funding system for Estonian higher education and a better alignment between educational and research functions of HEIs.

Moreover, HEIs are the main employers of R&D personnel (with over 55% of total R&D employees) in general and specifically of researchers (see Table 3). Hence, the Estonian situation is rather different from the EU27 average, in particular compared to the more industrially developed MS, where HEIs employ a maximum of 40% of researchers and the majority of researchers is employed in the business sector.

In terms of the supply of science and technology graduates and the provision of the doctoral education (see Table 3), Estonia is seeing a decrease in the share of S&T graduates per capita but a gradual increase in terms of doctorate students. In absolute terms, the years 2006 and 2008 saw general decreases in the number of graduates in many fields of science, thus the decrease of the share of S&T graduates is similar to other fields. However in absolute numbers, there are less graduates in S&T fields than social sciences, business and law graduates.

The State-commissioned student places (SCSP), regulated by the 2006 Universities Act, are a highly important instrument in terms of HRST supply and demand. The SCSP allocates funds from the state budget in favour of certain curricula in HEIs and covers, to a varying degree, not only teaching costs but also operational costs (but not investments) of the infrastructure of dual purpose (i.e. for R&D and education).<sup>21</sup>

Politically, there is a preference for the SCSP to support science and technology curricula: during 2003-2009, the share of SCSP going to science and technology courses at all three higher education levels, steadily increased and was at least 40% on average. In addition to SCSP, the supply of qualified graduates is supported by various grants and scholarships supporting international mobility such as the SCSP grants for doctoral studies abroad. Moreover, the new educational programmes, introduced by the MER in 2008 and 2009, support internationalisation, doctoral and post-doc studies. These programmes, which receive €32.2m including SF co-financing, are: "PRIMUS" (3<sup>rd</sup> level education quality development), "BeSt" (e-studies in HEIs) and "DoRa" and "Mobilitas".

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<sup>21</sup> SCSP is also an important factor to govern and direct a supply/demand situation, as only State-commissioned education is free of charge. Obviously, in that situation the public HEIs tend to lobby the highest possible volume of SCSP but at the same time, they are allowed to introduce a tuition-based education for students not qualifying or who have personal preferences other than those set by the SCSP

**Table 3: Human resources for research and development, 2005-2009**

Indicator	2004	2005	2006	2007	2008	2009	EU27, 2009 (2008)
HRST, % of the economically active population in the age group 25-64	41.5	44.8	44.1	44.4	44.2	45.6	40.1
Doctorate students in science and technology, % of population aged 20-29	0.36	0.39	0.42	0.46	0.51	na	0.30 (2007)
Science and technology graduates, per 1000 of population aged 20-29	8.9	12.1	11.2	13.2	11.4	na	13.9 (2008)
Researchers (FTE), incl. in:	3,369	3,331	3,513	3,690	3,979	na	1,504,575 (2008)
- Government sector	486	474	513	545	531	na	188,391 (2008)
- Higher education sector	2,162	1,905	2,042	2,084	2,126	na	608,649 (2008)
- Private non-profit	60	69	82	100	89	na	17,667 (2008)
- Business	661	883	876	961	1233	na	689,867 (2008)
R&D personnel (FTE), incl. in:	3,369	3,331	3,513	3,690	3,979	na	na
- Government sector	1,099	991	1,080	1,097	1,108	1,072	na
- Higher education sector	4,894	4,591	4,949	5,303	5,338	5,543	na
- Private non-profit	154	124	177	190	152	167	na
- Business	1,735	2,249	2,586	2,686	3,023	na	na

Source: own compilation based on Eurostat, 2010 and Estonian Statistics Yearbook 2010

In March 2010, MEAC launched a new support measure called 'Continuing education for tertiary education leavers (TULE), which is designed to create up to 800 SCSP between 2010-2013 for students who interrupted their higher education studies, but are interested in completing them.

A range of life-long learning measures exist, notably the national support programmes launched in 2008 and 2009. They are administrated by the Innove Foundation. Continuous education is relatively popular and accessible: 10.5% of surveyed persons aged 25-64 stated in 2009 that they received education or training for four weeks at least (in the preceding year of the survey). This share is comparable with the advanced EU economies (Eurostat, 2010). In 2010, under the priority axis "Lifelong learning" Innove Foundation has launched open calls for proposals for new measures to decrease the drop-out rate, increase the availability of education and improve the quality of education; develop learner oriented and innovative vocational education and training, etc.

**Table 4: Progress towards the targets of Lisbon Strategy 2010 for growth and jobs and Europe 2020, a strategy for jobs and smart, sustainable and inclusive growth**

	Estonia		EU		EU targets	
	2000	2008	2000	2008	2010	2020
Pre-school education (from age 4 until school)	87%	95.9% <sup>(3)</sup>	85.6%	90.7% <sup>(2)</sup>	-	95%
Share of low-performing pupils in PISA test (15 years old)	reading	13.6% <sup>(1)</sup>	-	24% <sup>(1)</sup>	<17%	<15%
	maths	12.1% <sup>(1)</sup>	-	24%	-	<15%
	sciences	7.7% <sup>(1)</sup>	-	20% <sup>(1)</sup>	-	<15%
Early school age group 18-24	15.1%	13.9% <sup>(3)</sup>	17.6%	14.9%	<10%	<10%
Share of persons with secondary education, age group 20-24 years	79%	82.3% <sup>(3)</sup>	76.6%	78.5%	85%	-
Growth of science and technology graduates in period 2000-2008	-	47%	-	33.6% <sup>(2)</sup>	+15%	
Share of persons with tertiary education, age group 30-34	31%	35.9% <sup>(3)</sup>	22%	31%		40%
Share of persons involved to life-long education, age group 26-64	6.7% <sup>(3)</sup>	10.6% <sup>(3)</sup>	8.5% <sup>(3)</sup>	9.5%	12.5%	15%
Investments in education, % GDP	6.1%	5.2%	4.9%	5.1% <sup>(1)</sup>	-	-

Sources: MER compilation, by the Progress Towards the Lisbon Objectives in Education and Training, Indicators and Benchmarks 2009; MER; EHIS; Estonian Statistics  
Notes: (1): 2006; (2): 2007, (3): 2009

Estonian public universities have become increasingly more attractive as a studying destination for foreigners, particularly after joining the EU. While the education system is able to provide qualified personnel for R&D, engineering, and technology jobs, the provision of qualified graduates is still considered inadequate in terms of knowledge demand, particularly in the business sector.

### 2.3 Knowledge demand

The AP Growth and Jobs highlights the importance of business demands to the R&D and education system, and states that supply of qualified personnel and R&D services should be more connected with the business needs, and should support economic competitiveness. Also the annual progress report of the RDI Strategy (2007) points out that in the new budgeting period of the SF, development of human resources will be prioritised, to meet better the societal needs.

Still, when analysing **business driven knowledge demand**, it is noteworthy that Estonia's economic structure is not oriented to knowledge-intensive manufacturing and services (with the exception of the ICT sector), and it is far less competitive and productive in comparison to more developed economies. CIS surveys (Viia *et al*, 2007) indicate that innovation in Estonian companies (which is relatively high) is mainly related to processes and acquisition of new equipment, and far less to knowledge-intensive outcomes (as indicated by patenting and high-tech export data).

Is such an economic structure ready to absorb the knowledge and the qualified science and technology graduates from national HEIs? What are the actual business needs? Arguably, the existing liberal entrepreneurship policies together with virtually

non-existing systemic and active industrial policies (State Chancellery, 2009) do not support proactive structural changes (Ibid).

It is highly problematic to find reliable data on the demand side.<sup>22</sup> As a result, there is no evidence-based picture on the supply-demand situation for R&D personnel. From one side, the business sector claims (the Estonian Chamber of Commerce and Industry, Praxis, 2010; Praxis, 2004; OECD, 2006, SQW, 2003, etc) that the provision of qualified engineering personnel (and most recently also marketing personnel,) is not sufficient for business needs, but at the same time the unemployment rate for the population with tertiary education in Estonia in 2009 was higher than the EU average with 6.3% vs 4.5% (Eurostat, 2010). Moreover, the number of actual R&D personnel employed in the business sector has remained low, even if it is slightly growing in real terms. In 2008, the number of R&D personnel in the business sector was 3,023 persons, of which, 725 were in manufacturing and 929 in the ICT sector (Estonian Statistics Yearbook, 2010).

These figures suggest that there is actually a very small labour market for highly qualified R&D staff outside of HEIs (which employed in 2008 5,543 researchers, see Table 3). The structure and the real economic activities of enterprises are neither favourable nor supportive for the creation of knowledge-intensive jobs.

The demand for engineers/technology specialists (master level and diploma) and technicians (bachelor level and vocational) is not clear since the number of jobs and vacancies by economic sector is not known and there is only fragmented and outdated statistical data on these professions. During the 1990s, the general trend was that employment in the core industrial engineering sectors (mechanical, electro-technical, energy and mining, and construction) was rapidly decreasing due to the loss of earlier industrial structures and only stabilised by 2000 (Praxis, 2004).

Indirectly, the rather stable employment in high- and medium-high technology manufacturing sectors and the employment in knowledge-intensive service sectors reflect a slow growth in demand (see Table 5).

There are only a few recent, quantitative studies on jobs and vacancies per sector in Estonia. A recent foresight study (Eamets et al, 2009) has forecast the demand until 2015 for high-tech and medium-tech industries and knowledge intensive services, based on three scenarios for structural change in the economy:

- a baseline scenario, where the demand for personnel with tertiary education will increase by 1%, with more demand for humanities (comparisons - 2008 actual employment in the sector vs 2015);
- a “proto-Denmark” scenario with a decrease by 9.3% (mostly in sciences and services); and
- a knowledge based scenario with an increase of 2.8%.

Unfortunately, the data is calculated on the aggregated level (education and sector), and no data is available about the structure of the forecast demand (i.e. specialisation required by different sectors, etc.).

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<sup>22</sup> The medium and long-term employment demand forecast (done regularly by the MEAC) are too general and not sufficiently accurate (see Prognosis until 2017, MEAC, 2010, annexes 9), to use them for estimating R&D intensive jobs (available, planned or vacant).

**Table 5: Employment in high-tech and knowledge-intensive service sectors, 2004-2008**

Indicator	Estonia					EU
	2004	2005	2006	2007	2008	2007
Employment in high- and medium-high technology manufacturing sectors as a % of total employment	5.12	4.16	3.75	3.90	5.03	6.69 (2007)
Employment in knowledge-intensive service sectors as a % of total employment	27.49	28.67	28.64	27.84	28.16	32.96 (2007)

Source: Eurostat, 2010

Hence, it seems fair to conclude that from the demand and supply perspectives, for HRST the real gap and distortion is on the demand side. There are insufficient knowledge-intensive jobs in local industries and service companies due to the structure of the economy. Indeed, the policy mix includes several innovation-oriented programmes that could boost demand and qualitative re-orientation on a single company level and in some cases, on a sector level too (e.g., via the cluster and technology competence measures). It is arguable (especially in the light of the evidence presented in Chapter 2.2.2) that there is a critical mass of companies involved in these competitive measures, able to initiate principal structural changes and raise the capacity of knowledge absorption in the business sector.

## 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

Due to a steady growth since 2004, GBAORD amounted to 1.62% of the total Government expenditures budget in 2008 (EU27 1.52%). Stable institutional financing has supported the capacity of public HEIs to provide also qualified graduates and future personnel in engineering and science and technology. Indeed, trends for patenting and for scientific publications are positive. However, in absolute terms the number of patents increased from seven in 2004 to 21 in 2007. Hence, HEIs research and knowledge production skills need to be leveraged more, both by supporting the development of existing businesses and as recommended earlier, by “creating new businesses through spin-outs and spin-ins” (SQW, 2003). Concerning publication data, see also Chapter 3.3.1.

**Table 6: Knowledge production, 2004-2009**

Indicator	Patents (applications at EPO per million population)		European high-technology patents - (EPO applications per million population)		WoS publications
	Estonia	EU27	Estonia	EU27	Estonia
2004	6.4	111.6	1.725	21.6	752
2005	4.7	112.6	3.614	20.4	811
2006	15.0	114.0	8.9	20.1	877
2007	17.4	116.5	5.2	11.5	706
2008			na	Na	779
2009			na	Na	969

Sources: Eurostat, ISI Web of Science

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

Since the late 1990s, a performance-oriented system has been in place to monitor and review the quality and performance of knowledge production by the academic sector<sup>23</sup>. The legal framework is the Research and Development Organisation Act which provides that all R&D institutions which operate as a state agency, a local government agency, a legal person in public law (like all public universities) or an agency with legal personality under public law should be registered and should be evaluated at least once every eight years. This relatively long period between evaluations is the main weakness of the system, especially compared with the efficient organisational aspects.

The research evaluation is organised by the MER in co-operation with the Research Competence Council by creating evaluation committees formed by three to six independent experts carrying out the R&D performance evaluations, according to transparent rules and evaluation ethics. To assure the international competitiveness and exchange of best knowledge, at least three committee members are foreigners.

All state institutional and targeted financing is directly linked to the academic evaluation results: by law, only those R&D institutions that have been positively evaluated may apply for these funding measures.

Two support measures specifically aim to consolidate the best available resources and capacities in research: Centres of Excellence (collaboration of R&D institutions and research groups) and Competence Centres (collaboration of academic and business R&D). Hence, these measures provide a stimulus to develop and maintain a high level, internationally competitive R&D.

## 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-

<sup>23</sup> No account is taken of socio-economic impact (commercialisation of research, subsequent employment of graduates, etc.).

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**

Since the early 2000s, there are a considerable number of policy measures aimed at increasing extramural R&D by enterprises carried out in cooperation with the public sector as well as support for commercialisation of research by HEIs and knowledge transfer. In addition, certain higher education policy measures launched in 2009 address this issue.

The share of the higher education sector funded by the business sector (HERD funded by BERD) has declined since 2005 from 5.2% (with a small increase in 2007) to 4.3% in 2009. The EU27 average shows an opposite trend and in 2008 was 7% (OECD: MSTI 2010). However, Estonia compares favourably to several other larger EU countries, such as France or Sweden. This share should also be seen in light of the limited size of the business sector and notably the limited number of R&D personnel in firms.

However, according to the Community Innovation Survey (CIS8), the public sector is not the main source of knowledge provision. More than 60% of the respondents point to the business sector itself (the own enterprise, suppliers, competitors). Estonian companies use the public research organisations the least as a source of information for innovation (0.9%) while universities and other higher education institutions were mentioned by 2.7% of respondents. This is far below scientific journals (3.9%), consultants (4.4%) or conferences (6.4%). From the business sector's perspective, the public sector is a rather unpopular cooperation partner. Again using CIS8 data, the public research institutes are the least often mentioned with 1.4% and the universities with 3.2% of all co-operation 'encounters'. Estonian companies tend to cooperate more often with their national competitors than with public sector researchers.

These findings may point to a mismatch; it seems likely that the public research sector supply is not matching the business structure's needs. This conclusion is reinforced by the finding in CIS8 that innovative Estonian firms engaged in cooperation, cooperate very often with foreign partners.

There are measures such as the Innovation Vouchers (budget of €2.9m for 2009-2013), product development grants (budget €77m for 2007-13) competence centres, and clusters. They are good examples of measures targeting dual, even triple, policy targets in all three policy areas – education, innovation and research. However, their cumulative effect on knowledge circulation is unclear (with exception of the Competence Centre programme) as there is no evaluation data on performance and impact available (partly due to the newness of several measures).

The Competence Centre programme is the most long-standing, large-budget instrument (de Jager et al, 2001, Technopolis Group, 2008) that aims to facilitate knowledge circulation between public-private research. In the 2007-13, each of the eight centres can receive annually up to €1.28m, within a limit of 70% of their eligible budget budgets (for IPR related costs 50% of costs).

According to a 2008 mid-term evaluation, the centres tackle efficiently intra-university barriers to industry cooperation (e.g. need for clearer strategies and improvements in

administration, ability to manage IPR, boosting industrial doctoral studies) and on the industrial side, improve technology absorption and high-tech product and process development capacities (Technopolis Group, 2008).

The Involvement of Development specialist programme (budget of €10.2m for 2007-13) is a targeted measure to support a fixed-term hiring (from Estonia or abroad) of researcher, engineer, and designer or marketing specialist in the business companies, to make them more competitive and raise ability to innovate.

All these competitive R&DI measures are co-financed by Structural Funds.

### **2.5.2 Cross-border knowledge circulation**

The international dimension of knowledge circulation is addressed by the specific mobility measure for HEIs, the Mobilitas programme (budget of €20.3m for 2008-2015), and scholarships. Cross-border activities are eligible for funding under most of the competitive R&D and innovation support measures too (cluster development, competence centres, development specialist). Indeed, the Estonian competence centres have visibly advanced in terms of internationalisation of their activities and providing teaching and research opportunities for Master and doctoral studies (Technopolis Group, 2008).

Estonia is involved in a number of international research endeavours such as CERN and other European research infrastructures (see Chapter 3.5.1) as well as in the European Framework Programmes. For the business sector, no special national measures are in place but there is an administrative support to apply for participation in international programmes like the Framework Programme, as well as EUREKA and COMPERA (facilitated by Enterprise Estonia). Further measures are provided by Enterprise Estonia via funding for study visits abroad and thematic meetings (on space technology, high tech and traditional manufacturing, quality and creativity management, etc) and awareness events (see also Chapter 3.6 on internationalisation of R&D system).

### **2.5.3 Main societal challenges**

According to the Estonian Research and Development and Innovation strategy, the focus is the economic development of the country through intensified utilisation of skills. According to the position paper of the MEA (MEA 2011) on FP8 and in relation to the grand challenges mentioned at EU-level, Estonia suggests tackling them with top down instruments such as Joint Programming. It also acknowledges the role of the social sciences and humanities in order to address these challenges. When it comes to concrete societal challenges within Estonia, the integration of the Russian minority can be mentioned as well as the “sustainability of research related to Estonian national culture, language, history, nature and the Estonian state” (RDI 2007). The former is addressed via a joint programme between the Estonian Science Foundation and the Humanities Foundation of the Russian Federation (total est. budget €1m, €155.6 for 2009-2011), and the latter through the national programme “Estonian language and cultural memory” 2009-2013, with a total budget of €3.5m. The societal language issue is joined with a technological view in the programme for Language Technology (2011-2017, €7.6m). The latter programme is addressed at the public as well as private sector organizations.

## 2.6 Overall assessment

Research, higher education and innovation continue to have a high priority on the national political agenda and the policy mix in place since 2004 has evolved and been added to provide a relatively complete mix of measures tackling the need to increase not only R&D activity but knowledge production in the form of qualified scientists and engineers. The domain in which Estonian policy has perhaps the least influence or activity is in terms of knowledge demand. In terms of resource provision, the EU Structural Funds allocation to Estonia for the period of 2007-13 (€680m, compared with the GBAORD in 2008 as of €78m) could effectively compensate in the short-run an expected reduction or stagnation of national funds. The inter-linkages to other policies (fiscal, industrial, etc) are not always explicit and hence, they do not lend significant support to the national strategic R&DI objectives.

As a result, the 3% R&D intensity goal reaffirmed and stated by the national strategies are unlikely to be met by 2014, as national public funding sources are decreasing due the rapid fall of GDP in 2008-09. The level of BERD in Estonia is dependent on the continued competitiveness of about 60 high-tech enterprises accounting for around 75% of BERD. During 2008-2009 they seem to have continued to invest in R&D at previous levels and despite the crisis.

The mix of the new and re-launched national support programmes, based on the Action Plan for Growth and Jobs 2007-2011 and co-financed according to the NSRF, is diversified, and several new programmes were introduced in 2010 in education, especially life-long learning and business-academia collaboration.

The new national R&D programmes attempt to strengthen further the orientation to strategic priority areas in research such as health and environment.

**Table 7: Summary of main policy related opportunities and risks**

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	<ul style="list-style-type: none"> <li>• There is a relatively clear and stable political consensus on the importance of “knowledge based Estonia” (Growth and Jobs, etc) supported by the stable GBAORD and state support regulated by law.</li> <li>• The provision of R&amp;D resources is in the centre of NSRF, filling out effectively the limited national sources.</li> <li>• Diversified support measures for industries and business-academia collaboration are in place.</li> <li>• The consolidation of resourced around strategic topics is continued.</li> </ul>	<ul style="list-style-type: none"> <li>• The private sector is expected to contribute a significant share of the R&amp;D spending by 2014, but given the economic trends and the economic structure it is a challenging objective.</li> <li>• No systematic policy evaluation in place to assess the impact of all policy measures.</li> <li>• The state budget policies do not offer a viable medium term alternative to the SF (the main investment source for the majority of measures).</li> </ul>
Knowledge demand	<ul style="list-style-type: none"> <li>• The scope of the foresight activities in Development Fund is broadened and due to the foresight activities, more social partners involved.</li> </ul>	<ul style="list-style-type: none"> <li>• Few reliable instruments and quantitative data for monitoring or identification of broader societal needs for knowledge and supply of HRST.</li> <li>• No clearly focused entrepreneurship policies and lack of clearly formulated industrial policies, linked to the R&amp;DI or education policies.</li> <li>• No systematic policy evaluation in place to assess the impact of policy measures.</li> </ul>

Domain	Main policy opportunities	Main policy-related risks
Knowledge production	<ul style="list-style-type: none"> <li>• Research quality assessment, accreditation and peer review mechanisms are well regulated and based on independent expert panels, including international experts.</li> <li>• The importance of life-long and adult education is acknowledged (Growth and Jobs, education strategies, NSRF) and respective measures are introduced.</li> </ul>	<ul style="list-style-type: none"> <li>• Research quality assessment is still based largely on scientific criteria and less on their relevance for the economy or society (moderate attention to economic impact such as number of patent applications, revenue from contract research).</li> <li>• No systematic policy evaluation in place to assess the impact of policy measures, except certain competitive programmes (also mostly ad hoc).</li> </ul>
Knowledge circulation	<ul style="list-style-type: none"> <li>• Effectively supported by the R&amp;DI and education strategies on national level.</li> <li>• Diversified measures targeting sectors and clusters, business-academia collaboration, mobility of researchers, teachers and students, etc.</li> <li>• Estonian research teams have been strongly involved in the EU programmes and research mobility</li> <li>• Internationalisation of the research is a clear priority in all research support measures, incl. competitive support programmes.</li> </ul>	<ul style="list-style-type: none"> <li>• Both national and international knowledge circulation depends too much on project-based funding.</li> </ul>

**Table 8: 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
Structural limitations of economy	<p>The highly liberal entrepreneurship policy has few, if any, horizontal measures to initiate and boost the changes. Instead, various single measures are in place, targeting business players.</p> <p>The well-performing educational policies are claimed to be virtually the only instrument to initiate certain structural changes, and indeed, they impact the knowledge and technology absorption capacity in the business sector – if there are these jobs available for R&amp;D and engineering staff.</p>
Inter-sectoral barriers (consistently low extramural BERD)	<p>The RDI and education policy mix addresses the barrier via diversified, but mostly project-oriented measures.</p> <p>The policy mix lacks, by opinion of independent sources, coherency with entrepreneurship, tax and industrial policies with a clear focus.</p>
Limited types of government incentives for private R&D	<p>Despite a set of various competitive support programmes, no other incentives like targeted loans, tax breaks or special tax regimes, etc. are in place. From the other hand, internationally competitive R&amp;D-oriented companies might find alternative sources (private VC, foreign programmes funding) – very much in the spirit of the liberal economic policies.</p>

## 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

The share of researchers in the total population is extremely low (0.52% in 2008) in Estonia, while the total R&D personnel as a share of the labour force is at 0.73% compared to an EU27 average of 1.03%. Estonia belongs to a group of EU countries with a very low inward flow of researchers: foreign EU candidates accounted for less than 5% of enrolments at doctoral level in 2005 (JRC-IPTS, 2008). The number of non-EU citizen doctoral candidates as a percentage of the total number of doctoral candidates in Estonia was only 1%. The vast majority of researchers in the higher education sector was nationals (98.6%); followed by EU15 researchers 1.2% and 0.2% from other countries in 2004. More recent data suggests that since Estonia joined the EU, more exchange students and visiting PhD students are coming to study in Estonia supported by various programmes. The number of foreign PhD students for example increased from 56 in 2005/2006 to 85 in 2008/2009 (Government of Republic of Estonia, 2009).

In terms of the number of doctoral candidates continuing their doctoral education in another EU country, the figure for Estonia was one of the highest in the EU in 2004 (JRC-IPTS, 2008). They can obtain funding via several [sources and programmes](#):

- Doctoral Studies and Internationalisation Programme “DoRa” activities are intended for Master’s students, doctoral students and members of teaching staff who are already working or studying at Estonian higher education institutions, or are planning to do so. The measure funded 16 scholarships in 2008-2009.

- The SCSP measure supports full-time PhD students at a foreign university in a specific field during the nominal duration of curriculum. The average number of scholarship holders was 12 in 2002-2009.
- Based on applications for study loans from Estonian commercial banks, the total number of PhD students studying permanently abroad varied between 26 and 37 during 2004-2009 (Government of Republic of Estonia, 2009).
- The Kristjan Jaak Scholarship programme offers a number of scholarship types for short term and longer term stays abroad. The number of scholarships for PhD students was 55, 174, and 487 respectively in 2003-2009.
- The Researchers' mobility programme "Mobilitas" issues post-doc grants for both Estonians to work in a foreign research and development institution as well as foreign post-doc researchers working in RD&I priority areas in Estonia.

### 3.1.2 Providing attractive employment and working conditions

The Estonian Universities Act (1995, consolidated in 2005) provides universities with a significant degree of self-governance and autonomy, including rights to set their academic and other collaborations, employment requirements and conditions (contract forms, extra remuneration), salary rates. The universities have budgetary autonomy and thus distribute internally the state (and other) non-competitive, generic funding allocations, etc. The salary level and other conditions of employment can be based on university regulations as long as they are in full accordance with the articles of the Employment Contract Act (1992)<sup>24</sup> on general working time, holidays and vacations, maternity benefits, parental leave, social and public health securities, etc. To adopt the main principles of the Charter for Researchers, all six Estonian public universities<sup>25</sup> have signed the Agreement on Good Practice in the Internationalisation of Estonia's Higher Education Institutions (2007)<sup>26</sup>.

Low salaries of researchers are one of the main reasons why despite rapid growth in R&D funding, the number of R&D personnel has not grown sufficiently (MER, 2008). In order to tackle this problem, all state budget-financing instruments that have an impact on research personnel salaries were increased by 30% in the 2008 budget. However, the 2009 economic downturn also caused cut-back in the research sector. Compared to other European countries, researchers' salaries in Estonia rank among the lowest, and the same is true domestically in comparison to salaries in the private sector (CARSA, 2007; Rõõm, 2007). The salary level and other conditions of employment are established in an employment contract, based on the rules of the university and on the Employment Contracts Act. The salary rules vary for professors, docents (assistant professors), specialists and other academic positions, and the rules are reviewed on a regular basis. For example an assistant at the University of Tartu obtained in 2008 as a starting salary €610, a full professor €1,500 (EUI, Academic Careers Observatory)

Provision of attractive employment and working conditions is viewed as a priority area for Estonia (European Commission, 2009). This is in particular aimed at young researchers. Estonia aims at increasing the number of doctoral students; with this general objective in mind, the key goal is to change the legal status of PhD students from that of students to that of employee status with related employee rights.

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<sup>24</sup> RT 1992, 15/16241

<sup>25</sup> UT, TUT, Estonian Academy of Arts, EULS, Estonian Academy of Music and Theatre, Tallinn University.

<sup>26</sup> <http://www.tlu.ee/files/arts/190/heade8d71e83e43ac7c8d3ad1f82e5274c40b.pdf>

Currently, PhD students enjoy only health insurance but do not contribute to the pension system nor do they obtain pension rights. Legislative action is foreseen in this area (European Commission, 2009).

Employment stability in terms of permanent positions is currently secured only for professors who have been (re)selected for the same position for three times and have more than 11 years of experience<sup>27</sup>.

Staff may have one sabbatical semester of paid leave for every five years of service. Part-time employees shall have the same benefits as full-time employees (EUI 2009).

The Parental Benefit Act (2004)<sup>28</sup> has been designed to contribute to the successful intertwining of work and family life. As a regular practice of equal treatment, for female applicants for a researcher's position or funding, the period of maternity (parental) leave is taken into account in the process of evaluation and selection just as compulsory military service is in case of male applicants.

### 3.1.3 Open recruitment and portability of grants

With regard to the recognition of qualifications from other countries, Estonia has already introduced the necessary regulation to ensure that this is not an obstacle for hiring foreigners into research institutions (European Commission, 2009). In practice, language can be a significant barrier to recruiting internationally, as for most jobs which involve teaching, a good command of the official national language is required.

In order to apply for a lecturer, teacher, or assistant position, the applicant must have a magistrikraad (Master's Degree) or a corresponding qualification. Associate professor (dotsent) and professorship positions require a PhD: a person who possesses an Estonian PhD or a corresponding foreign degree may apply for these positions. To become Lead or Senior Research Fellow, candidates must hold a Ph.D. conferred in Estonia or another academic degree of an equivalent level. A MA is enough for obtaining a Research Fellow position. Members of the academic staff are increasingly selected on the basis of "their competence in research" and "teaching experience."

Post-doctoral research grants are for two to three years. Notices of opening of post-doctoral competition are published on the websites of the Estonian Science Foundation, the Estonian Research Portal, and the Information Centre for foreign researchers. Grants are awarded to applicants on the basis of an open international competition for a specific research project. Grants include the remuneration of the post-doctoral researcher (incl. payable taxes), research costs and a one-time relocation support (EUI 2009).

On the portability of grants, Estonia has signed EUROHORC's letter of intent 'Money follows researchers'<sup>29</sup>, which aims to improve the starting conditions of researchers who accept a position at a research institution.

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<sup>27</sup> However, in this case, the council of a university may give the name "*Professor Emeritus*" to professors who have worked for at least ten years or at least twice in the regular professor related to a person who has received the age pension. A *professor emeritus* has the right to participate in activities of the university and get the salary established on procedure of the council of the university. A *professor emeritus* fees are supported from state budget with the submission of public education budget through the MER (European Commission, 2009).

<sup>28</sup> <http://www.sm.ee/eng/for-you/families/parental-benefit.html>

<sup>29</sup>

[http://www.eurohorcs.org/SiteCollectionDocuments/EUROHORCs\\_MFR\\_Letter\\_of\\_Intent\\_Revised\\_081105.pdf](http://www.eurohorcs.org/SiteCollectionDocuments/EUROHORCs_MFR_Letter_of_Intent_Revised_081105.pdf)

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

Permanent residents of Estonia and persons living in Estonia under a temporary residence permit are entitled to receive a state old-age pension in Estonia if they have pensionable service in Estonia or in another EU Member Country for at least 15 years. Work in another EU Member Country or in EFTA countries is taken into account if the person has worked in one of those countries for at least one year and has the necessary documents to prove it (i.e. employment contract).

In addition to the state pension, the Estonian pension scheme also includes a funded pension scheme and a voluntary supplementary pension scheme.

Joining the funded pension scheme is optional for persons born before 1983 and obligatory for persons born later than 1983. A person pays 2% her/himself for the funded pension (deductible from the salary by the employer), and the state adds 4% from the social tax paid by the person. However, due to the current economic conditions, the payments have temporarily been made voluntary for everyone until the end of 2010 and obligatory payments will be 1% of the salary instead of the 2% in 2011.

Joining the supplementary funded pension scheme is voluntary. The amount of the contribution can be determined individually, as well as the period of receiving payments from the supplementary funded pension. Income tax from payments for the supplementary funded pension is refunded. It is also possible to continue payments to the supplementary funded pension from another country. It is possible to continue to make payments in Estonia to supplementary pension funds that were established elsewhere (Euraxess.EE).

### **3.1.5 Enhancing the training, skills and experience of European researchers**

With regard to developing a “National Skills Agendas”, Estonia is focusing on the enhancement of the quality and efficiency of doctoral studies with a general emphasis on the development of entrepreneurship and economic courses and modules for students of non-business studies in all three university cycles (European Commission, 2009). It is not done at the expense of the core academic programmes in certain science fields but it rather supports their links to the business world. Mobility measures for both incoming and outgoing researchers exist to develop and diversify Estonian research potential (see also chapters 2.2.3 and 3.1.1).

In terms of ensuring better links between academia and industry, the Development of collaboration and innovation in HEIs is a specific measure to support the collaboration between universities and enterprises, co-funded by the European Social Fund. The aim is to create a platform for curricular development to better match the labour market needs. Support is given to programmes (including joint programmes) on master and professional higher education levels. Also the Estonian Doctoral Studies and the International Programme “DoRa” promote the cooperation of universities and companies in R&D. Under this programme an industrial doctorate model is being implemented (See also Chapter 2.5).

## **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

After the transition period, a strategic basis for modernising the higher education, research and innovation infrastructure was developed by MER and MEAC in 2004<sup>30</sup>. The initial estimate of the investment required to bring the research infrastructure up to date was in the range of €256 to €383m; a figure that had not changed significantly by 2008 (MER, 2008a). It concerned about 20% of all RI.

The RDI Strategy Implementation Plan 2009-2013 however aims at having 80% of RD&I infrastructure modernised by 2013 (Government of Republic of Estonia, 2008). The size of upgraded and new research infrastructures at universities and other research institutions will be close to 6,000m<sup>2</sup> in total. In 2008, about 1000m<sup>2</sup> of upgraded or new RI were publicly funded (MER, 2008).

The overall budget planned for infrastructure objects of national importance is €29.4m during the EU SF period of 2007-2013 (Government of Republic of Estonia, 2009). From the Structural Funds approximately €256m will be allocated for RD&I infrastructure investments. In addition, the Government has decided to gradually increase its support for RD&I from the state budget (Government of Republic of Estonia, 2009).

The creation of up-to-date R&D infrastructures is one of the sub-objectives of the RDI Strategy and implemented mainly through measures "Modernising work and study environment infrastructure of R&D and higher education institutions" and "Modernising research machinery and equipment" of the Operational Programme for the Development of the Economic Environment. In addition to these measures, building of new infrastructures will also be supported from the measure of developing centres of excellence (up to 20% of the project budget) and national programmes. MER is the implementing agency of these measures. The co-financing rate of ERDF is 85%. The Government will cover 10% of the amount of the measures as well as ineligible value added tax (MER, 2008).

Out of 11 investments, two new infrastructures that followed the investment plan enforced by order of the Government of the Republic (May 30, 2008) were implemented in 2009 with the Research Library at the Tallinn University of Technology, and the Environment and Material Analysis Research Centre at the University of Tartu (Government of Republic of Estonia, 2009).

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<sup>30</sup> <https://www.etis.ee/Portaal/includes/dokumendid/strateegilised%20alused.mkm.doc>

Parallel to the investment plan, the Estonian Research Infrastructures Roadmap was developed in 2009 by MER and the Estonian Academy of Sciences, and approved in 2010 as an annex to the RDI Strategy Implementation Plan in June 2010 (MER, Estonian Academy of Sciences, 2010). This strategy document concerns investments of national importance over a 10-20 years period. It covers 20 proposed RI in social sciences and humanities, environmental sciences, biological and medical sciences, materials science, natural sciences and engineering, e-infrastructures. The roadmap will be updated every three years and will be used as an input for the forthcoming investment decisions.

Estonia hosts the [Estonian Genome Project](#) a large RI that is open to other European and international researchers, public and private organisations. Estonian partners are participating in RI projects funded under the Framework Programme such as the EU-NMR (FP6) and its follow-up EAST-NMR (FP7).

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

In parallel with selecting the Estonian Roadmap projects, participating in ESFRI projects in the coming years was also decided. The selected projects are:

- Common Language Resources And Technology Infrastructure ([CLARIN](#));
- European Social Survey ([ESS](#));
- Biobanking And Biomolecular Resources Research Infrastructure ([BBMRI](#));
- An Integrated Structural Biology Infrastructure For Europe (INSTRUCT);
- [European Spallation Source](#) (MER, Estonian Academy of Sciences, 2010).

The national budget for the ESFRI projects is not available (MER, 2010).

The ESFRI framework is assessed to be an important driver for future intergovernmental joint infrastructure projects; Estonian participation in these was more the exception rather than the rule so far. The MER launched the new internationalisation programme on R&D infrastructure in 2010 (MER, 2010). It is intended to join administrative forces for coordinating ESFRI and other international R&D infrastructure programmes, networks as well as projects.

## 3.3 Strengthening research organisations

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 provides 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

There are two types of higher education institutions in Estonia: universities providing academic higher education and applied and professional higher education programmes; and the higher education institutions providing professionally oriented diplomas. In total, there are 12 universities, six public and six private. Access to

higher education is regulated by the Universities Act (1995, consolidated in 2005) and the [Institutions of Professional Higher Education Act](#). HEIs are major performers of R&D and providers of researchers for the public sector in Estonia (see Chapter 2.1 and Chapter 2.2.3).

The share of the higher education sector in GERD was 42.2%, similar to the level of the business sector (44.6%) in 2009. The business sector funds only 4.3% of HERD in 2009 (Statistics Estonia, 2010). The government provides 81% of funds for HERD and is the main funder. The share of the HERD in GDP was 1.07% (2008) (MER, 2010).

The share of higher education expenditures as a share of the total education expenditure was around 18-19% in recent years. The share of total education expenditure from the state budget was less than 13% in 2008. The number of tertiary level students was 65,659 in 2004 and increased to 68,168 in 2008. Compared to 2001, an absolute increase of 15%. The share of tertiary level students in the population was 5.07% in 2008. The number of foreign students in this educational level has equally grown. There were 2,200 foreign students studying in Estonian universities in 2007, an absolute increase of 60% since 2001 (Eurostat, 2010) (see also Chapters 2.2.3 and 2.3).

There are no Estonian universities listed in the top of [Academic Ranking of World Universities](#) (2010), in the [World University Ranking](#) (2010), nor in the European research universities by scientific production in 2000-2006<sup>31</sup>.

The number of publications as well as international co-publications by researchers in Estonia has grown rapidly (MER, 2008, 2009). Similarly to the situation in the mid 1990s, about 50% of 1,077 publications of 2009 were co-publications. Most collaboration partners are from Finland, Sweden, Germany, the UK, and the US. In international comparison, Estonia occupies an average position in terms of the number of publications per full-time researcher. This ratio remained the same in 2008 and 2009 at 0.39 (MER, 2009). The Estonian RDI strategy includes the objective to increase the number of scientific publications listed in the Web of Science database to 1,500 publications by 2013 (Government of Republic of Estonia, 2009).

### 3.3.2 Academic autonomy

Estonian public universities have a high degree of autonomy guaranteed by the [Universities Act](#) (1995, consolidated 2005). The university council is the collegial decision-making body, the procedure for the formation of which and the basis for the activities of which are provided for in the statutes of the university. The university council exercises, autonomously from the owner (i.e. the MER on behalf of the State), a wide range of academic, economic and social rights and responsibilities, for example the approval of the statutes, adoption of the budget, investment and development plans, approval of the curriculum, deciding the rate for the reimbursement of study costs, etc. (Universities Act, 1995). An elected rector ensures the day-to-day management of a university. The governing bodies of universities are not open non-academic individuals. The share of women working in administrative positions is close to 60%. In research and teaching positions, over 40% of the staff in Estonian universities are female (JRC-IPTS, 2010).

Autonomy, self-governance and the relative financial independence of public universities are supported by the state financing system (see Chapter. 2.2.1).

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<sup>31</sup> JRC-IPTS, 2009

Moreover, universities have the right to enter into agreements under civil and commercial law.

Since 2005, the leading science universities have become more oriented to a social dialogue with student groups and with partners outside the academic sector (especially businesses and NGOs) via the specially appointed consultative board, alumni organisations and sponsorship committees (TUT, 2006, TUT, 2008, UT, 2007). The performance contract concept (i.e. contracts with the State) was introduced in the public HEIs from the 2009/2010 academic year.

### 3.3.3 Academic funding

Estonian higher education institutions receive funding from the public budget for the provision of graduates, so-called State-commissioned places, for capital investment and for other expenditure such as foreign aid projects, education allowances for students, library expenditure, etc. Finance from the public budget is provided primarily in the form of a state commission. Its share is about 80% of the budgets. The remaining 20% are provided for SCSPs in the form of a block grant. Private institutions receive funding through the State commission, however, the allocation is relatively small (OECD, 2007).

The amount of the grant is determined by the number and distribution of State-commissioned places by funding categories. Funding for capital infrastructure is provided as a separate funding stream. Institutions have to bid for investment funding for particular projects.

Institutional funding for 2010, administered mainly by the MER is divided into the following categories:

- targeted funding (€25m);
- base funding (€8.1m);
- infrastructure expenses (€7.7m).

Individual funding in form of ESF grant financing amounted to €8.7m. Programme funding – which equalled €52.5m – is another source for the universities. The Centres of Excellence obtain funding of €53m (2007-13) from the SF for their activities.

Both public and private institutions receive income from tuition fees, however, the share within the total HEI's budget is not available.

### 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-national 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

The most important legal acts for IPR in Estonia are the [Copyright Act](#) and for the protection of patentable inventions the [Patents Act](#). In addition, all universities have their own detailed IPR policies<sup>32</sup> (incl. portfolio, licensed technologies, etc)<sup>33</sup>.

In general, Estonian universities own the economic rights of industrial inventions (i.e. patents and utility models) created during the execution of contractual duties of their employees (UT 2003, TUT 2003). This rule is generally included in the employment contract but it can also be concluded by a separate contract. Applications for patents and utility models are made to the Estonian Patent Office (EURAXESS, 2010).

Estonian universities do not have separate transfer offices despite the fact that it is a declared priority of the universities to foster stronger interactions with the business sector. Approximate annual budgets for knowledge transfer activities have been provided by both larger universities: Tallinn University of Technology allocates €288,000 or 0.3% of the total university budget (TUT, 2010); whilst the University of Tartu spent €345,000 (0.3% of the university budget (UT, 2010). These figures concern both administrative, spin-off activities and IP protection costs of the universities. Estonian universities are amongst the 90% of European universities which have a budget for knowledge transfer activities below €500,000.

Larger universities manage IP in line with the Code of Practice for universities and public research organisations adopting the main principles in their operational research and knowledge transfer activities. These activities are mainly financed by Enterprise Estonia (SPINNO programme) and from European Commission funding, e.g. Enterprise Europe Network (see also Chapter 2.4.1). Indeed, the State support, particularly through SPINNO, has been a key driver in fostering the development of know-how on technology transfer from the universities to the business sector.

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

The main constraints for the commercialisation of research and proof of concept are, amongst other factors, limited knowledge and practical experience on how to protect and commercially exploit IP in universities. The most acute barrier was judged to be IPR related to spin-off creation (Zernike, 2004). Indeed, the ability to commercialise the research outcomes remains low, especially in high-tech fields. The SPINNO programme is the main source of State support to facilitate knowledge transfer between academia and the business sector. The mid-term evaluation of the programme (2007)<sup>34</sup> found the programme to be highly relevant for the development of knowledge transfer 'infrastructure' in Estonia and the 'legal framework' for knowledge transfer within specific institutions.

Various other measures support business-academia collaboration such as the Competence Centre Programme, R&D grant support, Involvement of Development

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<sup>32</sup> The University of Tartu - [http://www.ut.ee/livelihood\\_files/1432683.htm](http://www.ut.ee/livelihood_files/1432683.htm), Tallinn University of Technology - <http://euraxess.ee/estonia/research-landscape/intellectual-property-rights/>

<sup>33</sup> i.e. for the UT, [http://www.tuit.ut.ee/index.aw/set\\_lang\\_id=2](http://www.tuit.ut.ee/index.aw/set_lang_id=2)

<sup>34</sup> Brighton R., *et al.*, 2007

Specialists, and the transfer of research-intensive technologies. The Innovation vouchers programme is expected to contribute to change of academic attitudes towards interactions with business and more business-thinking in universities.

Concerning inter-sectoral mobility of research personnel, the general employment and working conditions legislation applies (see also Chapter 3.1.2). Mobility of researchers and other innovation staff is encouraged through two measures: Support for the involvement of the innovation staff and the Development of collaboration and innovation in HEIs.

In the context of the governance of Estonian universities the involvement of business participants in university boards is not yet common practice. However, the topic is widely discussed and University representatives participate in the governing bodies of the science and technology parks: [Tartu Science Park](#) and [Tallinn Technology Park \(Tehnopol\)](#). This is one of the main ways for universities to develop relations with businesses and to receive relevant feedback from the market.

### ***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 up of critical mass of research excellence, leads to the duplication of efforts, suboptimal impact of 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**

The draft “Estonia 2020” strategy (State Chancellery, 2010a) prioritises the international competitiveness of higher education and research institutions. This is to be facilitated through creating a favourable environment for world-class level research, supporting mobility, and participation in international research endeavours.

Estonia is participating actively in the European Cooperation in Science and Technology (COST) scheme. COST has been an effective form of international cooperation for Estonia. More than 100 researchers from all leading universities and research institutions participated in 78 projects by 2009 (MER, 2009).

Estonian researchers are equally active in the EU Framework Programmes. To date, Estonian researchers have been relatively successful in FP7: 218 participations were supported as of November 2009 representing €3.7m in grants. At 24%, the success rate for applications was slightly above the EU average (EU average: 21.7%) (MER, 2009). Estonian organisations coordinate project consortiums in the ICT programme (APPRISE Ltd, TUT) and the SME programme (Estonian Innovation Institute, LAPI MT Ltd, Remedium Ltd). With four Estonian organisations participate in the Research Potential programme which is a positive result. In total, Estonian organisations cooperate with partners from 56 countries. The largest share comes from the UK, Germany, Italy, Spain, Finland, and Sweden. (Archimedes Foundation, 2010).

There are state budget support schemes to stimulate and support the participation of Estonian participations in European collaboration programmes. They were established by the MER and Archimedes Foundation in 2008. They support directly the Estonian organisations, for example, by compensating for VAT incurred in FP7 projects (MER, 2008).

Enterprise Estonia, together with the Archimedes Foundation, is the contact point for FP7, EUREKA, Eurostars, ESA, and CIP for R&D institutions and enterprises. The Eurostars programme, initiated by EUREKA, offers support of up to €1m a year for international cooperation projects to Estonian R&D intensive SMEs (MER, 2008).

On a strategic level, Estonia has expressed a general commitment to participate in the joint programming and international research infrastructure projects linked to its national strategy for RI development (2009). Estonian organisations thus participate in five ESFRI projects (see Chapter 3.2.1). The only inter-governmental agreements concluded to ensure access to major European infrastructures, are those with CERN (signed in 1996, complemented in 2004 with a research collaboration protocol), the European Molecular Biology Conference, with EUMETSAT (on the use of weather satellites) in 2006, and with ESA from 2007. The agreement of the European Cooperating State (ECS) was signed in November 2009. This agreement will open international business-research cooperation in developing space technologies and their applications (MER, 2009).

### 3.5.2 Bi- and multilateral agreements with other ERA countries

There are several bi- or multilateral agreements signed with other ERA countries. The ones presented below are the most relevant active ones in 2009/2010 (according to the report of the RDI Strategy Implementation Plan).

Given its geographical position, agreements with Baltic and Nordic partners are rather important. This includes collaboration with the Nordic Council and the EU Strategy for the Baltic Sea Region (2009). These schemes are useful for opening new opportunities for R&D collaborations for Estonia.

Estonian researchers participate in programmes of the Nordic Council of Ministers such as NordForsk (start-up grants for research groups and trainings), Nordplus (education cooperation) and several exchange programmes. A Nordic-Baltic *ad hoc* research-working group was established in 2008. The working group prepared a report in the spring 2009, which determined the general basis, priorities, instruments and financing principles of Nordic-Baltic cooperation in the framework of Nordic Council of Ministers (MER 2008, 2009).

A research cooperation grant scheme of the Norwegian Financial Mechanism and European Economic Area Mechanism opened for Estonian researchers in 2007. The Estonian researchers performed ten joint research projects with R&D institutions from the EFTA countries with a budget of €481,254 in 2008. The ESF co-finances 15% of the projects total costs (MER, 2008).

Archimedes Foundation has [bilateral agreements](#) with nine EU MS and seven non-EU countries that enable students and Ph.D. candidates to apply for scholarships in Estonia. Similarly the Estonian Academy of Sciences has 24 bilateral agreements with partner organisations, used for its exchange programme.

Also, the Estonian-French science and technology cooperation programme PARROT finances travel grants of joint research groups based on the principle of parity. The programme encourages cooperation between researchers from the two countries

and also promotes their participation in EU research programmes. In 2009-2010 17 joint projects received funding from the programme. The financial support of the Estonian side through the Science Foundation amounted to annually €19,000 (MER 2009).

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

The Estonian participation in ERA-NETs has been relatively modest (ERA-NET Review, 2006; Archimedes, 2007). During the period of FP6, Estonia participated in 12 out of the 899 subtotal ERA-NETs (ERA-NET, 2006). Under FP7, Estonia is involved in 12 ERA-NETS and two ERA-NET plus. The Estonian Science Foundation is the leading organisation in terms of participation rate; it participated in six ERA-NET projects: NORFACE, BIODIVERSA, AMPERA, HERA, EUROPOLAR, PRIOMEDCHILD in 2009 (MER, 2009).

Concerning participation in initiatives under Art 185 (ex 169), Enterprise Estonia participates in the FP7 funded [Eurostars](#) programme as well as in EMRP, which brings together the European Association of National Metrology Institutes ([EURAMET](#)). The ESF participates in [BONUS](#), the Joint Baltic Sea Research Programme, an integral part of the EU Strategy for the Baltic Sea.

European Science Foundation (ESF) Research Networking Programmes are 4-5 year cooperation schemes for networking researchers studying the same research theme across national and research field borders. Estonia took part in 17 ESF programmes in 2008 (MER, 2008b). ESF Cooperative Research Programme (EUROCORES) enables European researchers to develop collaboration and build scientific synergies in fields, where pan-European scale is needed in order to reach world-level excellence. Estonia was participating in three programmes (BOREAS, EuroDIVERSITY, FANAS) in 2008 (MER, 2008b).

Joint technology initiatives of public and private sector started in 2008. Estonia is a founding member of joint undertaking of embedded systems [ARTEMIS](#) and nanoelectronics joint undertaking [ENIAC](#). Estonian researchers also participated in an innovative medicine joint undertaking project call in 2008<sup>35</sup> (MER, 2008b).

### 3.5.4 Opening up of national R&D programmes

The general political position on opening of national research programmes is not formulated in the RDI Strategy, and the research and innovation plans and priorities are nationally focused. Other state RDI policy support programmes, the targeted financing and the Estonian Science Foundation grant financing are open only for applicant-organisations located in Estonia but there are no restrictions for a foreigner to be employed and to participate in the applying research teams. Two national programmes are in principle open, as part of Estonian-led consortia, to foreign researchers and companies: the Centres of Excellence Programme and the Technology Competence Centres Programme.

## 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

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<sup>35</sup> <http://www.imi.europa.eu>

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. In view of 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

The RDI strategy does not distinguish between international cooperation inside and outside ERA. As noted earlier, international cooperation in higher education and research (particularly in the fields of national importance: ICT, energy, material sciences and technologies, biotechnology) is a priority for Estonian R&D institutions.

Provisional figures from contracts signed as a result of FP7 calls for proposals launched in 2007 and 2008, show that Estonian cooperation with third countries represents 3% of overall Estonian activities under FP7 (EC Member States 87%, associated countries 10%). In absolute terms, cooperation with third countries is very small, with Russia leading with seven partnerships, followed by South Africa with five and Belarus and Canada with four each.

Complementing the list of bi- and multilateral international agreements with the countries outside ERA (see also Chapter 3.5.2) there are three agreements identified as relevant in the 2009 implementation report of the RDI Strategy. Estonia-USA cooperation takes place in the fields of information technology and materials science and the US Civilian Research & Development Foundation and Estonian Science Foundation co-financed four projects in these fields. In 2009, a call for joint energy projects was announced to co-finance four projects from 2010. The Estonian Science Foundation (ESF) and the Russian Foundation of Humanitarian Sciences co-finance seven projects in the field of society and cultural studies as a result of a call in 2008. The ESF also coordinates post-doctoral stipends for conducting research in Japan for 12-24 months. One researcher was funded in 2009.

### 3.6.2 Mobility schemes for researchers from third countries

In general, the share of foreign researchers in Estonia is very small (see more detailed discussion in Chapter 3.1.1) and while the researchers' mobility programmes DoRa and Mobilitas also address foreign researchers, a special state support for researchers from third countries does not exist. While the number of foreign researchers in Estonia has increased, mainly due to joining the EU, no information on the mobility programmes is available on researchers by country of origin.

## 4 Conclusions

### 4.1 Effectiveness of the knowledge triangle

The current trends in GERD (both in terms of its intensity and structure) show that Estonia is moving towards a more knowledge-intensive economy. There are positive developments in the RDI system towards the EU2020 targets through implementing a set of coherent national plans (RDI Strategy, Growth and Jobs Strategy). Although the real impact of the recent crisis is not yet assessable, the data for 2009 does not show significant drops in the R&D expenditure indicators.

Progress has been made in 2009-10 on implementing or further developing the national policy mix in favour of research and innovation. For instance, the adoption of the national research infrastructure roadmap and further progress in launching the national research programmes provide a basis for the further development of Estonian science policies. Innovation policies have been further developed with the launch of cluster and innovation voucher measures, amongst others. The major challenges of education policy for the coming years relate to demographic trends and the need for more significant internationalisation of the higher education in Estonia. Other policy areas (defence, space, etc.) are not yet called drivers in the R&D field in Estonia. The following table gives a short assessment on the effectiveness of policies in the knowledge triangle.

**Table 9 : Effectiveness of knowledge triangle policies**

	<b>Recent policy changes</b>	<b>Assessment of strengths and weaknesses</b>
Research policy	<ul style="list-style-type: none"> <li>• National RI Roadmap completed (20 investment objects selected in 6 research fields).</li> <li>• More national R&amp;D programmes under preparation, addressing strategic thematic areas (health, environment, material science and technologies, etc).</li> </ul>	<ul style="list-style-type: none"> <li>• Ambitious, competent and advanced in terms of policy planning and implementation planning.</li> <li>• Performance is still moderate, due to the low investment capacities and access to RI.</li> <li>• Raising the role of thematically oriented programmes is positive, as it consolidates the limited resources in the strategic areas.</li> <li>• The provision of qualified research personnel is satisfactory (national HEIs and international mobility) but employment options are limited.</li> </ul>
Innovation policy	<ul style="list-style-type: none"> <li>• A number of new measures, (Start-Up Estonia, Material Technology Programme, Cluster Programme).</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation remains project-oriented and lacks coherency with entrepreneurship, tax and industrial policies.</li> <li>• Main strength relays in the various, well-administrated support programmes, integrating efforts of business sector and HEIs.</li> <li>• Policy instruments and funding are multifarious and advanced, but dominantly depend on the EU SF.</li> <li>• R&amp;D investment, absorption and implementation capacity of knowledge production in the business sector is not competitive.</li> </ul>
Education policy	<ul style="list-style-type: none"> <li>• A number of new measures launched (TuLe, EKKA) and more under preparation.</li> </ul>	<ul style="list-style-type: none"> <li>• Most well-performing (by actual comparative data and trends) and effective policy sector, based on the strong and autonomous HEIs, and contribution of the excellent performance of secondary education.</li> <li>• Competent and advanced in terms of policy and implementation planning.</li> <li>• Policy instruments and funding are manifold and advanced, but to a large extent (about 50% in 2009) depending on the EU SF.</li> <li>• This policy area is the one most affected by the demographic trends.</li> </ul>
Other policies	<ul style="list-style-type: none"> <li>• Space policy; R&amp;D in the Defence sector.</li> </ul>	<ul style="list-style-type: none"> <li>• The role and real impact on knowledge triangle is small or uncertain.</li> </ul>

## 4.2 ERA 2020 objectives - a summary

Participating in the ERA-related initiatives has been one of important drivers in positive trends in the R&D field of Estonia. They have particularly opened new opportunities for international R&D collaboration but also encouraged inward research mobility to Estonia. So far, participation in the FPs and COST network are found to be the most efficient channels of international cooperation for Estonia's stakeholders. In 2008, state budget support schemes for taking part in mentioned EU collaboration programmes (so called preparation support) were established by the MER and Archimedes Foundation. Considering bi- and multilateral agreements with other ERA countries, there is an evidence for concentrating regional research resources (in the Baltic Sea or Nordic region). The following table gives a short assessment of national policies supporting the ERA objectives.

**Table 10: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)**

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
1	Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers	No major changes	<ul style="list-style-type: none"> <li>• Investment in boosting HRST notably for doctoral studies. However, there is a medium-term, negative demographic trend.</li> <li>• No labour market restrictions for researchers from other EU countries and mobility supported by diverse measures.</li> <li>• Agreement on Good practice of Internationalisation signed and the Charter of Researchers is adopted (but not signed) by all public universities.</li> <li>• The share of female researchers is higher than the EU average.</li> </ul>
2	Increase public support for research	No major changes	<ul style="list-style-type: none"> <li>• Limited national budgetary resources are compensated (at least until 2015) by the large EU SF allocations.</li> </ul>
3	Increase European coordination and integration of research funding	No major changes	<ul style="list-style-type: none"> <li>• Estonian participation in JTIs or ESF initiatives has been relatively modest.</li> <li>• However, Estonia is a founding member of two joint technology undertakings, participated in three EUROCORES programmes, took part in six ERA-NET projects in 2009.</li> </ul>
4	Enhance research capacity across Europe	No major changes	<ul style="list-style-type: none"> <li>• State budget support for taking part in EU collaboration programmes (FPs, COST) launched in 2008 aiming to increase Estonian participation in EU programmes.</li> <li>• Participation in Eurostars has opened additional international cooperation for Estonian R&amp;D intensive SMEs.</li> <li>• The EU Strategy for the Baltic Sea Region may open also new opportunities for Estonian researchers.</li> </ul>

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses with regard the specific ERA objective
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	National IR Development Roadmap developed.	<ul style="list-style-type: none"> <li>• The Roadmap is a strong advantage of Estonia to encourage its involvement in inter-governmental infrastructure development projects.</li> <li>• Too high importance of EU SF share in public funding of R&amp;D against national allocations.</li> </ul>
6	Strengthen research institutions, including notably universities	No principal changes. The Draft Law of Tartu University Act proposes new governance forms for this university, in terms of closer inter-action with stakeholders.	<ul style="list-style-type: none"> <li>• Autonomy is supported by stable state funding instruments, a wide set of mobility support measures and individual programmes (SPINNO, DoRA, Doctoral Schools, etc.).</li> <li>• Public universities have a relatively high degree of financial independence and some - various other sources of financing than the state (or the EU SF).</li> </ul>
7	Improve framework conditions for private investment in R&D	No major changes. One new support programme - Start-up Estonia is launched.	<ul style="list-style-type: none"> <li>• A core element of innovation policy with various measures effective in terms of support of individual firms. Their cumulative effect to foster comprehensive structural economic change is, however, unclear.</li> <li>• No tax incentives or other horizontal measures to support private investments.</li> <li>• Funding dependent on the EU SF with no feasible alternative national sources.</li> </ul>
8	Promote public-private cooperation and knowledge transfer	No major changes. One new support programme is launched by MEAC.	<ul style="list-style-type: none"> <li>• Another core element of innovation policy, with a number of measures operational and evaluated positively (e.g. competence centres). However, again the cumulative effect is unclear; e.g., moderate changes to high tech export performance or IPR in business sector.</li> <li>• Funding dependent on the EU SF with no feasible alternative national sources.</li> <li>• Participation of Enterprise Estonia in international networks (i.e. VALOR) is an additional source for learning and funding of knowledge transfer.</li> </ul>
9	Enhance knowledge circulation across Europe and beyond	No principal changes. The EU Strategy for the Baltic Sea Region (adopted by EC on 10 June 2010).	<ul style="list-style-type: none"> <li>• State budget support for taking part in EU collaboration programmes (FPs, COST) launched in 2008 aiming to increase Estonian participation in EU programmes.</li> <li>• Participation in Eurostars has opened additional international cooperation for Estonian R&amp;D intensive SMEs.</li> <li>• The EU Strategy for the Baltic Sea Region may open new opportunities for Estonian researchers.</li> </ul>

	<b>ERA objectives</b>	<b>Main policy changes</b>	<b>Assessment of national strengths and weaknesses with regard the specific ERA objective</b>
10	Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world	<ul style="list-style-type: none"> <li>• National RI Roadmap developed.</li> <li>• The EU Strategy for the Baltic Sea Region (adopted by EC in June 2010).</li> </ul>	<ul style="list-style-type: none"> <li>• The National IR Roadmap is a strong advantage of Estonia to encourage its involvement in inter-governmental (inside, outside ERA) infrastructure development projects.</li> <li>• The EU Strategy for the Baltic Sea Region may open also new opportunities for Estonian researchers.</li> </ul>
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	National Strategy on implementation of "Europe 2020" started (June 2010).	<ul style="list-style-type: none"> <li>• An initiative is taken by State Chancellery to encourage inter-ministerial efforts on R&amp;D and innovation.</li> </ul>
12	Develop and sustain excellence and overall quality of European research	No major changes	<ul style="list-style-type: none"> <li>• Estonian researchers continue to be successful in the FP7.</li> <li>• General commitment to participate in the international joint programmes and infrastructure projects.</li> </ul>
13	Promote structural change and specialisation towards a more knowledge - intensive economy	No major changes. Foresight (ICT, health care, etc) undertaken by Estonian Development Fund.	<ul style="list-style-type: none"> <li>• No systematic approach to initiate and support coherent structural changes in the economy via entrepreneurship, tax and industrial policies.</li> <li>• Over-reliance on specific measures (highly dependant on the SF financing).</li> </ul>
14	Mobilise research to address major societal challenges and contribute to sustainable development	Some specific societal challenges are addressed through the R&D policies.	<ul style="list-style-type: none"> <li>• National energy technology programme is a comprehensive, multi-targeted initiative, and it covers not only technological but also energy security and sustainability aspects.</li> <li>• The ICT policies cover also cyber-defence, internet access and e-services development.</li> <li>• Life long education support measures address the ageing society issues.</li> </ul>
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	<ul style="list-style-type: none"> <li>• Launch of a special administrative unit for Science communication and the TeaMe programme.</li> <li>• No major changes in terms of systematic policy evaluations.</li> </ul>	<ul style="list-style-type: none"> <li>• As Estonian society appreciates and respects education and science, the measure encouraging public dialogue and popularising scientific careers should meet their objectives.</li> <li>• A policy evaluation culture is not well developed; the general awareness about its role in governance and public management is low even in the public sector. There are some positive exceptions in the innovation policy area.</li> </ul>

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## List of Abbreviations

AGPI	Agreement on Good Practise in the Internationalisation
AP and Jobs	Growth Action Plan for Growth and Jobs 2008-2011 for implementation of the Lisbon Strategy
BERD	Business Expenditures for Research and Development
CC	Competence centre(s)
CERN	European Organisation for Nuclear Research
CoE	Centre(s) of Excellence

COST	European Cooperation in Science and Technology
ECCI	Estonian Chamber of Commerce and Industry
EHEQA	Estonian Higher Education Quality Agency
ERA	European Research Area
ERA-NET	European Research Area Network
ERDF	European Regional Development Fund
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU-27	European Union including 27 Member States
EULS	Estonian University of Life Sciences
EUROCORES	ESF Cooperative Research Programme
FDI	Foreign Direct Investments
FP	European Framework Programme for Research and Technology Development
FP6	6 <sup>th</sup> Framework Programme
FP7	7 <sup>th</sup> Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
HE Strategy	Higher education strategy 2008-2015
HEI	Higher education institution(s)
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
HRD	Human resource development
IHE	Strategy on Internationalisation of Higher education until 2015
IP	Intellectual Property
KT	Knowledge transfer
MEAC	Ministry of Economic Affairs and Communications
MER	Ministry of Education and Research
NPO	Not-for profit organisation
NSRF	National Strategic Reference Framework
OECD	Organisation for Economic Co-operation and Development
PRO	Public Research Organisations
R&D	Research and development
RDI Strategy	Research, Development and Innovation Strategy for 2007-2013
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
S&T	Science and technology
SCSP	State-commissioned student places
SCU	Unit for Science Communication
SF	Structural Funds

SME	Small and Medium Sized Enterprise
SSEES	School of Slavonic and East European Studies
TU	Tallinn University
TUT	Tallinn University of Technology
UT	University of Tartu