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# ERAWATCH Country Report 2009

## Analysis of policy mixes to foster R&D investment and to contribute to the ERA

# Estonia

**Ruta Rannala**

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# ERAWATCH COUNTRY REPORT 2009: Estonia

## Analysis of policy mixes to foster R&D investment and to contribute to the ERA

ERAWATCH Network – Technopolis Group, Estonia

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# Executive Summary

As highlighted by the Lisbon Strategy, knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are thus at the heart of the Lisbon Strategy. This is reflected in guideline No. 7 of the Integrated Guidelines for Growth and Jobs. This advocates increasing and improving investment in research and development (R&D), with a particular focus on the private sector. This report aims at supporting the mutual learning process and the monitoring of Member States efforts. Its main objective is to characterise and assess the evolution of the national policy mixes in the perspective of the Lisbon goals, with a particular focus on the national R&D investments targets and on the realisation and better governance of the European Research Area. The report builds on the analytical country reports 2008 and on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

Due to the size and central governance system the structure and governance principles of the Estonian **R&D system and its state financing are simple and transparent**, regulated by a single law. In terms of R&D funding sources, Estonia shares characteristics common with many of the other 'Convergence'[1] Member States. Namely, the government sector provides the largest share (45.6%) of total GERD, compared with an average share of 34.2% in the EU27, in 2007); the business sector is far below the two-thirds target set at the EU level and the EU level average (41.6% in 2007, compared to 54.5% in the EU27). The Government's commitment to invest in R&D has been strong; from 1998 to 2008, expenditures on R&D in Estonia have grown by ca. 20% per annum, the second highest growth rate in the EU27, leading the GERD/GDP ratio to rise from 0.57% in 1998 to 1.24% in 2008. The R&D intensity trend is connected to general economic growth in the same decade and notably by the increase in BERD from 38.5% in 2005 to 41.6% in 2008; and has also been strengthened by the availability of finance from the EU Structural Funds (SF) since 2004.

The year 2008 was decisive in strategic terms; two documents, the **Action Plan for Growth and Jobs 2008-2011 (National Reform Plan) and** the **National Strategic Reference Framework 2007-2013 (NSRF)** for the implementation of the Structural Funds, were approved. Both documents express full commitment to the Lisbon Strategy and provide a broad basis for development and financing of Estonian policies and implementation programmes in economic development, R&D, education, labour market, etc. Unfortunately, as both documents have been elaborated before the magnitude of the ongoing economic recession was realised, the strategy plans are too optimistic in terms of economic growth.

The existing fiscal policy of Estonia has proved to be successful in supporting business investments in general, but it does not particularly promote knowledge-intensive business, creating jobs in research and development and investments in added value production and services. While fiscal policy constraints are recognised,

[1] That is, Member States or regions with less than 75% of the EU27 average GDP per capita http://ec.europa.eu/regional_policy/policy/region/index_en.htm.

no policy documents discussing tax or social incentives in favour of R&D investment had been introduced by April 2009.

As a result, many national development objectives, including the 3% target, could be under great pressure, as the national funding sources are decreasing. Therefore it is important to assure effective management and co-financing of the EU Structural Funds allocated to Estonia for the period of 2007-2013 (ca. €680m, compared with the GBAORD in 2008 as of €78m) to compensate the estimated reduction (or stagnation) of national funds.

The mix of the new and re-launched national support programmes, based on the Action Plan for Growth and Jobs 2008-2011, and co-financed according to the NSFR, is varied. To a different extent, the policy support measures address all six policy routes, most visibly – business–research sectors' collaboration and development of higher education institutions (HEIs).

The majority of the programmes under all policy routes have a dual or a mixed nature and more than one target group. Some programmes are oriented or consolidated thematically (e.g. Centres of Excellence, CoE, programme), others are elaborated to support a mix of the performance, quality or competitiveness objectives without any thematic focus (e.g. Awareness programme, Technology vouchers, etc.).

Policy mix routes 1, 2 and 3, focusing on the support knowledge-intensive development model of the national economy, are advanced and present various measures 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. Due to the structural limitations of the national economy and a need to increase business sector R&D expenditures, routes 2 and 3 are crucially important. The other two policy mix routes (5 and 6) – increasing extramural R&D carried out in cooperation with the public sector or other firms and increasing R&D in the public sector – are traditionally important and remain in the centre of the national RDI policy. Route 6 is especially highly important, as it also supports internationalisation and competitiveness of national R&D organisations. Some of the programmes under policy mix route 6 are also aimed to supplement generic state financing (e.g. R&D investments programme) and all of them are in line with the ERA mobility component (especially MOBILITAS and DoRa programmes).

The ERA concept is recognised as an important driver for Estonian R&D policy and participation of HEIs in European initiatives is strongly encouraged (MER, 2006a) and supported by several programmes and public co - financing (e.g. baseline and targeted funding, etc.).

The main policy components (especially on the practical implementation level) most contributing to the ERA are mobility of academic staff and internationalisation of the Estonian HEIs. The set of national support programmes on mobility and internationalisation has notably progressed since 2008 (Doctoral Schools, DoRa. Mobilitas, and others).

Being the core elements of the national R&D system, highly autonomous Estonian universities effectively promote the basic principles of ERA – share of knowledge, networking and interdisciplinary. Nevertheless, additional efforts are needed to make the Estonian R&D system and institutions truly attractive and competitive in terms of working and salary conditions. The performance contract system (between the state and HEI) is the most recent initiative (2009) to facilitate steady performance and competitiveness of HEIs.

One particularly challenging ERA-related topic, requiring urgent political and development actions, is elaboration of the national concept of the joint research infrastructure (RI) and optimisation of the research infrastructure. The main constraints are low national investment capacities and an underdeveloped strategic framework for RI development, including for shared RI.

| Barriers to R&D investment | Opportunities and Risks generated by the policy mix |
|---|---|
| Systemic structural barriers: Natural limitations of resources and demographic situation.<br>Unfavourable structural pattern of national economy | **Systemic risk**: the country is small by size and acquires limited RDI resources per se, and these limitations are associated with the non-competitive economic structure.<br>**Opportunity:** RDI Strategy recognises the strategic challenge to concentrate resources, and increasing role of the public sector in valuing the strategic choices.<br>The programming of the political support measures is in line with the complex needs to focus, concentrate and share resources: the measures have often complex (R&D and innovation, or R&D and education) objectives and joint target groups.<br>Policy mix performs particularly well in internationalisation of R&D and strengthening of the HEIs.<br>**Risk:** there are no systematic and integrated policies to initiate and support coherent structural changes in economy AND education. Too much faith on single programmes and high dependence on foreign financing. |
| Weak or missing capacity in policy, social and technology foresights sets no focus or wrong focus of investment and HR development plans | **Opportunity:** RDI Strategy acknowledges that policy directions should be based on the forecasts of the future technology areas, and research foresight (RDI Strategy).<br>**Opportunity:** initial public technology foresights in the Development Fund are executed.<br>**Risks:** the policy mix does not support effectively the correlation of knowledge supply and demand (e.g., state-commissioned education vs paid education proportions and structure). |
| Investment, absorption and implementation capacity barriers in business sector: limited competencies and limited resources | **Risk:** no fiscal incentives to attract R&D-intensive FDI or start up local R&D and innovative businesses.<br>**Risk:** the policy mix does not support effectively the correlation of knowledge supply and demand (in the R&D services and personnel supply).<br>**Opportunity**: concentration on the certain limited areas of science, technologies and industrial development (RDI Strategy)<br>**Opportunity**: a significant share of the EU SF budget is available for the R&D investments and HRD needs. |
| Absorption and implementation capacity barriers in PROs and HEIs: Limited competencies or competencies in limited fields | **Risk:** HEIs and PROs face difficulties to achieve the expected policy results (e.g., in the commercialisation of their R&D results).<br>**Opportunity:** RDI strategy has defined the key technology areas where the development focus could be<br>**Opportunity:** The CoE and Competence Centres Programmes (focusing respectively on fundamental, inter-institutional/ interdepartmental and joint applied research of private and public sector institutions) have helped to focus and group R&D competences in Estonia. |

| | Short assessment of its importance in the ERA policy mix | Key characteristics of policies |
|---|---|---|
| Labour market for researchers | • The central principle of the R&D and higher education strategies is to encourage national as well international cooperation between all counterparts.<br>• Equal treatment, non-discrimination and quality of teaching and research are basic principles.<br>• For researchers, the labour market is badly affected not only by demographic reasons but also low supply of science and engineering graduates, and international competition for "brains."<br>• Hence, compared with the general strict immigration rules, the R&D personnel and students are treated under a favourable regime. | • Wide, diversified set of mobility support measures – both for Estonian and foreigners, on all 3 levels, but particularly focused on master's and doctoral studies.<br>• No restriction for study or employment in R&D for foreigners (conditions depend on the origin, e.g. for EU and EAA – accessible with no limits)<br>• Agreement on Good practice of Internationalisation is signed by all public universities, advertising open academic vacancies internationally<br>• Leading universities declared their principles to be in accordance with the Charter of Researchers<br>• Repatriation support for Estonians, studied or worked abroad |
| Governance of research infrastructures | • The set up or participation of joint or shared RI is strategically important (RDI Strategy), due to the limited financing of RI by national means only.<br>• Need for national RI strategy is clearly expressed and the concept for core laboratories of shared RI should be elaborated. | • Nationwide, strong support for institutional concentration of research and education, and due to that, prioritisation of public universities<br>• The internal policies of the leading science universities support set up of joint RI and shared use. |
| Autonomy of research institutions | • Development and facilitation of autonomy is supported by stable state funding instruments, a wide set of mobility support measures and individual programmes (R&D investments, SPINNO, CoE, etc.).<br>• State-commissioned education is concentrated in public universities. | • Autonomy of universities is assured by law and effectively implemented (full self-governance)<br>• Steady institutional financing<br>• Public universities have a relatively high degree of financial independence and some universities also have various other sources of financing than the state (or the EU SF). The universities also have the right to establish paid student places<br>• Consolidation of activities of public universities (via the Rectors Conference) in mobility support and other shared strategic interests |
| Opening up of national research programmes | • This pillar is not central or priority due to the practical reasons and limitations. International collaboration as a part of programme activities is highly appreciated. | • In state-financed targeted financing and research grants, institutional applications are accepted by local HEIs and PROs only, but foreign researchers may be included in the research teams. Personal applications are accepted only from researchers employed by a local institution (the exception is the mobility support for foreigners)<br>• As a rule, individual measures specifically target Estonian organisations, except CoE and Competence Centres. Several programmes are open for facilitation/employment of foreign specialists, technology or R&D services. |

# TABLE OF CONTENTS

# 1 Introduction

As highlighted by the Lisbon Strategy, knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are thus at the heart of the Lisbon Strategy. This is reflected in guideline No. 7 of the Integrated Guidelines for Growth and Jobs.[2] This advocates increasing and improving investment in research and development (R&D), with a particular focus on the private sector. For the period 2008 to 2010, this focus is confirmed as main policy challenge and the need for more rapid progress towards establishing the European Research Area, including meeting the collective EU target of raising research investment to 3% of GDP, is emphasised.

A central task of ERAWATCH is the production of analytical country reports to support the mutual learning process and the monitoring of Member States' efforts in the context of the Lisbon Strategy and the ambition to develop the European Research Area (ERA). The first series of these reports was produced in 2008 and focused on characterising and assessing the performance of national research systems and related policies in a comparable manner. In order to do so, the system analysis focused on key processes relevant for system performance. Four policy-relevant domains of the research system have been distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The analysis within each domain has been guided by a set of generic "challenges", common to all research systems, which reflect possible bottlenecks, system failures and market failures which a research system has to cope with. The analysis of the ERA dimension still remained exploratory.

The country reports 2009 build and extend on this analysis by focusing on policy mixes. Research policies can be a lever for economic growth, if they are tailored to the needs of a knowledge-based economy suited to the country and appropriately co-ordinated with other knowledge triangle policies. The policy focus is threefold:

- An updated analysis and assessment of recent research policies
- An analysis and assessment of the evolution of national policy mixes towards Lisbon R&D investment goals. Particular attention is paid to policies fostering private R&D and addressing its barriers.
- An analysis and assessment of the contribution of national policies to the realisation of the ERA. Beyond contributing to national policy goals, which remains an important policy context, ERA-related policies can contribute to a better European level performance by fostering, in various ways, efficient resource allocation in Europe.

[2] COM(2007) 803 final, "INTEGRATED GUIDELINES FOR GROWTH AND JOBS (2008-2010)", http://ec.europa.eu/growthandjobs/pdf/european-dimension-200712-annual-progress-report/200712-annual-report-integrated-guidelines_en.pdf

# 2 Characteristics of the national research system and assessment of recent policy changes

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

Estonia is one of the smallest European countries by population (1.3 million inhabitants in 2007, Statistics Estonia). Higher education and research activities are concentrated in the two largest cities, Tallinn and Tartu. In some larger counties regional education colleges of public universities have been also established. Gross domestic product (GDP, in current prices, 2008) was 248,149 million EEK (€15,859.6m) (Statistics Estonia online, 2009).

R&D expenditures are dominated by the government sector, which provides, via various instruments, for the largest share of GERD (45.6% of total GERD, compared with an average of 34.2% in the EU27, in 2007, see Table 1); the business sector is far below the two-thirds target set at the EU level, or EU level average (41.6% in 2007, compared to 54.5% in the EU27), (see Table 1) even improved rapidly.

### Governance of research policy

The organisation, structure and state financing obligations of the national R&D system is set out in a special law: the Research and Development Organisation Act (enforced 1997, last amended 2007). From a strategic perspective, the Parliament has twice adopted a national strategy for R&D development: Knowledge-Based Estonia I. Research and Development Strategy for 2003-2006; and Knowledge-Based Estonia II. Research, Development and Innovation Strategy for 2007-2013 (hereafter RDI Strategy). The elaboration of R&D related laws and national R&D plans and programmes is the responsibility of the Government.

**Table 1: R&D Expenditures, by performers/ sectors, in 2005-2008**

| | | | | EU-27 | |
|---|---|---|---|---|---|
| | **2005** | **2006** | **2007** | **Average** | **Year** |
| **GERD (euro million)** | 104 | 151 | *174* | *226120* | **2007** |
| **R&D intensity (GERD as % of GDP)** | 0.94 | 1.15 | *1.14* | *1.83* | **2007** |
| **GERD financed by government as % of total GERD** | 43.5 | 44.6 | *45.6* | *34.2* | **2005** |
| **GERD financed by business enterprise as % of total GERD** | 38.5 | 38.1 | *41.6* | *54.5* | **2005** |
| **GERD financed by abroad as % of total GERD** | 17.1 | 16.3 | *11.7* | *9.0* | **2005** |
| **GBAORD (euro million)** | *45* | *67* | *78* | *87639* | **2007** |
| **GBAORD as % of general government expenditure** | *1.20* | *1.50* | *1.43* | *1.55* | **2007** |
| **BERD (euro million)** | 47 | 67 | *82* | *144089* | **2007** |
| **Business sector R&D intensity (BERD as % of GDP)** | 0.42 | 0.51 | *0.54* | *1.17* | **2007** |
| **BERD financed by government as % of total BERD** | 6.9 | 7.6 | *9.3* | *7.2* | **2005** |

Data Source: Eurostat

The main beneficiary of State funding is the higher education sector and public research organisations (respectively ca. 70% and 17.5% of GOVERD), followed by the business sector (ca. 9.6% of GOVERD) (data by Eurostat, Estonian Statistics, Ministry of Education and Research, 2007). Business expenditures are dominantly intramural, i.e. ca 93% of BERD are spent by the business sector itself, and the rest goes to HEIs in 2007. Not-for profit organisations (NPOs) are marginal beneficiaries of State and business funding (less than 2%) and NPOs have extremely low,

dominantly intramural financing capacity (2007). Foreign sources are mainly constituted from EU SF allocations, and they are channelled (via different support programmes) mostly to HEIs (57.5%) and the business sector (ca. 31%).

**Main actors and institutions in research governance** (see Figure 1)

**The Research and Development Council** is an expert and consultative body that advises the Government in the fields of R&D and innovation. Two permanent committees that focus respectively on research policy and innovation policy support the work of the council. The State Chancellery (**Strategy Office unit**) is an active intermediary in the R&D-related strategy and policy consultations, and acts as the secretariat of the Research and Development Council.

At the policy elaboration level, the two central organisations are the **Ministry of Economic Affairs and Communications** (MEAC), and **the Ministry of Education and Research** (MER). Competence for policy design for support for and funding of industrial R&D, as well as planning, coordination and implementation of innovation policy lies with the MEAC. The MER implements national research and education policies, organises financing and evaluation of research institutes and coordinates international cooperation in research. Two permanently established **advisory bodies** (the **Research Policy Commission** and the **Scientific Competence Council**) provide advice to the MER.[3]

**Implementation agencies and intermediaries**

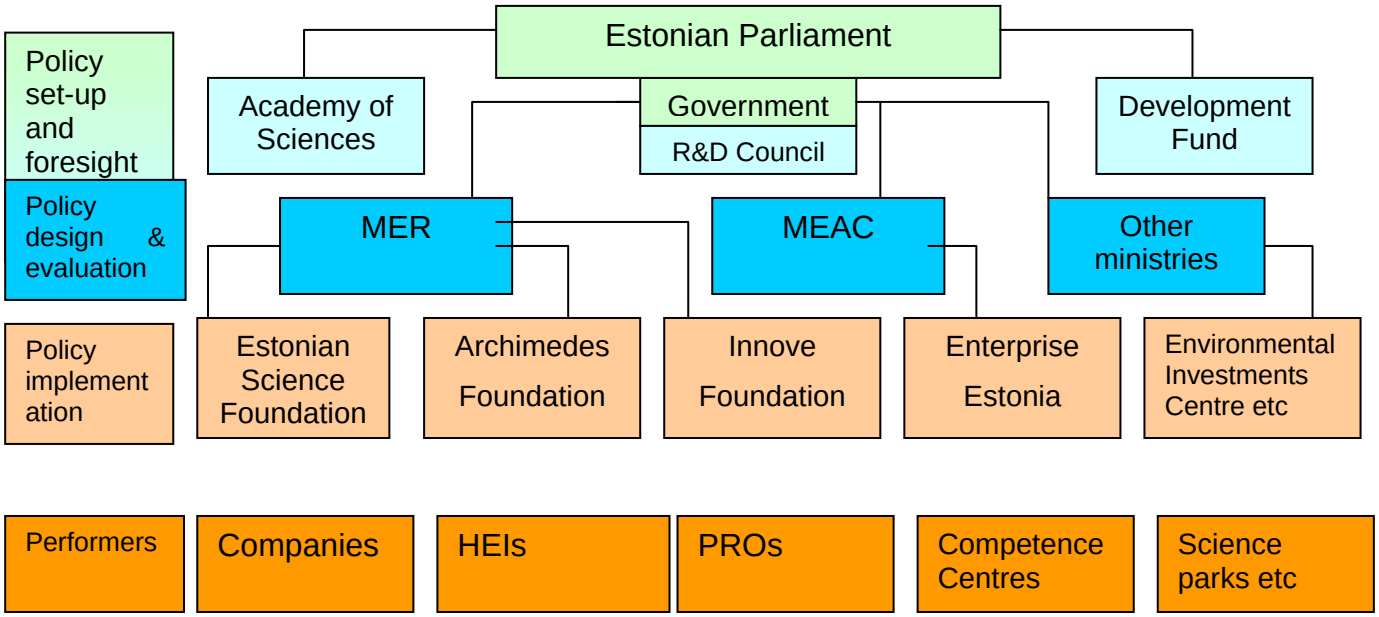
At the **operational level**, both the MER and MEAC have implementing agencies. The main implementing agency of the MEAC is the **Enterprise Estonia Foundation**, which is responsible for managing innovation and technology programmes. The implementing agency of the MER, the **Archimedes Foundation**, is responsible for national activities related to the European Research Area, international research programmes, academic mobility measures, etc. Another MER agency, **INNOVE Lifelong Learning Development,** manages a range of support measures in the fields of lifelong learning and active labour market policies. All three of the above-mentioned agencies are implementing agencies of the EU Structural Funds for the period of 2007–2013. In addition, the **Estonian Science Foundation** (ESF) supports scientific research by allocating grants to individual research.

**Scientific and research institutions**

The former system of research institutes of the **Estonian Academy of Science** was fully restructured during the 1990s, and the majority of the institutes were incorporated into the public universities (OECD, 2007). All together, there are 31 higher education institutions in Estonia – six of them are public (state) universities and four are private universities (State Education Information System, 2008). The four largest **public research universities** are the University of Tartu, (UT), followed by Tallinn University of Technology, (TUT), Tallinn University (TU) and the Estonian University of Life Sciences (EULS). Virtually all academic research in Estonia is performed at the public universities.

[3] In particular, the Scientific Competence Council provides expert advice and submits proposals to the MER on distributing targeted funding, assessing the conformity of the research results with international standards and makes proposals for the approval of the evaluation results of R&D, etc.

**Figure 1: Overview of the governance structure of the Estonian research system**




Source: own compilation

Given the scale of the country and the **centralised governance** structure, research policy elaboration, governance and implementation are done only at the national level. Local governments have neither the devolved institutional responsibility nor financial capacity to develop their own research policies.

## *2.2 Summary of strengths and weaknesses of the research system*

The analysis in this section is based on the ERAWATCH Analytical Country Report 2008 which characterised and assessed the performance of the national research system. In order to do so, the analysis focused on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The analysis within each domain is guided by a set of generic "challenges", common to all research systems, which reflect possible bottlenecks, system failures and market failures a research system has to cope with. The Analytical Country Report for Estonia can be accessed on the ERAWATCH web site.

**Table 2: Summary assessment of strengths and weaknesses of the national research system**

| Domain | Challenge | Assessment of strengths and weaknesses |
|---|---|---|
| Resource mobilisation | Justifying resource provision for research activities | • There is a relatively clear political consensus on the importance of creating a "knowledge based Estonia". |
| | Securing long term investment in research | • The Structural Fund programming approach has provided longer-term commitment, balancing the short-term vagaries of annual budgeting rounds<br>• The private sector is expected to contribute a significant share of the increased R&D spending by 2014, but given economic trends this is unlikely to be achieved. |
| | Dealing with barriers to private R&D investment | • The value added in industrial production is low on average and hence resources for investing in business R&D limited.<br>• Lack of attention to FDI as a source for increased investment in research<br>• Estonian Development Fund aims to structure public-private financial resources for knowledge intensive firms |
| | Providing qualified human resources | • Estonian policy makers have begun to take action to improve the attractiveness of the science as a career, faced by insufficient levels of (doctoral) students in S&T |
| Knowledge demand | Identifying the drivers of knowledge demand | • **Tradition of transparent public consultation on policies** – remains and enforced along drafting of AP Growth and Jobs for 2008-2011, RDI Strategy Annual Implementation reports, other consultative forums. Still, public transparent consultations or information could be suddenly compromised as was seen during the negative supplementary budget 2009 negotiations.<br>• **Although initial measures have been launched, the foresight and strategic planning of scientific and industrial research still requires greater efforts** – during 2008 and 2009 so far, several new, wide-scope foresight projects have been commissioned (Development Fund). The Coordination Group of the RDI Strategy has proved to be a reliable monitoring and consultation body.<br>• **Few mechanisms for technology assessment or identification of broader societal needs for knowledge** – the situation remains unchanged in political and institutional terms (Development Fund), the scope of the foresight has broadened (see more Ch.3), and due to the foresight activities, more social partners involved. |
| | Co-ordination and channelling knowledge demands | • The launch of state (national) technology programmes should improve coordination of knowledge demand and production **– compared with 2008, more new programmes are under preparation (see more Ch.3)** |
| | Monitoring of demand fulfilment | • **Little is done aside from programme level evaluations to monitor the impact of policy initiatives** – compared with 2008, the situation is basically unchanged, and the impact assessment of programmes and support measures is not systematic and not linked as a condition for establishment or re-launching of the measures. Few positive examples for programmes in the governance area of the MEAC and analytical monitoring activities in the MER (on RDI Strategy implementation plans and higher education).<br>• On the policy coordination level, there is a plan to **launch a comprehensive impact assessment during 2009** . |

| Domain | Challenge | Assessment of strengths and weaknesses |
|---|---|---|
| Knowledge production | Ensuring quality and excellence of knowledge production | • **Research assessment and peer review mechanisms are in place but remain based largely on scientific criteria and less on their relevance for the economy or society** – remains unchanged, e.g. the criteria for the most stable state funding instrument – targeted financing – still pays only limited attention to economic impacts (number of patents and patent applications, number of research contracts).<br>• **Initial steps towards concentrating funding in science excellence centres with sufficient critical mass to compete in the ERA –** new call for Centres of Excellence, see Ch. 3) Also other measures oriented on growth of competitiveness of Estonian research like Doctoral Schools, etc.<br>• To ensure **international competitiveness** of research and sustain other R&D programmes in PROs and HEIs (CoE), the R&D infrastructure must be, by the RDI Strategy "modernised or if missing but necessary, constructed." The RI investment programme will be continued.<br>• I**nternationally**, collaboration with Finland in specific joint programmes is envisaged. |
| | Ensuring exploitability of knowledge | • **Management processes and capacities in R&D institutions remain weak** (despite support) and incentives to undertake applied research are low for academics – this is a recognised challenge by policymakers too and therefore the range of support measures to support exploitability and commercialisation, and more effective management of knowledge production, has been widened from 2008 (Competence Centres, SPINNO and more, see in Ch. 3.<br>• The performance contract system will be implemented from the 2009/2010 academic year.. |
| Knowledge circulation | Facilitating circulation between university, PRO and business sectors | • **Instruments such as the competence centres have begun to create cooperation between academic and business interests** – the CC programme has proved to be very effective and a new call in 2009 January attracted high interest.<br>• **Circulation of knowledge could be dramatically ramped up and cover a much wider range of companies –** in response to this recognised challenge**,** in 2008/2009, several new measures were launched (e.g. Cluster support programme, see more in Ch. 3) and some previous programmes re-launched. |
| | Profiting from international knowledge | • **Estonian research teams have been strongly involved in the EU programmes and research mobility and internationalisation of the research base is a clear priority** |
| | Enhancing absorptive capacity of knowledge users | • **Limited number of science and engineering graduates working in industry able to act as 'gatekeepers' for cooperation with knowledge institutions –** a new support measure (Collaboration and Innovation in HEIs)<br>• **There is a developing but relatively standard and limited range of support services for enterprises seeking to transfer technology,** etc. – from 2008, some support measures are introduced (Innovation vouchers, Technology Investment support, etc., see Ch. 3). |

The **main strengths of the Estonian R&D system** are concentrated in the domains of knowledge production and knowledge circulation. Both these domains benefit mainly from the well-established public universities. Paradoxically, the high degree of

autonomy (which was recognised as a systemic strength) also creates some **political challenges**. Any integration and optimisation processes initiated in the public universities by purely political decisions (such as budget cuts) are complicated due to institutional ambitions of the individual HEIs. So far, the main drivers for consolidation and interdisciplinarity between local HEIs have been common challenges: unavoidable internationalisation of the HE and R&D system (Bologna process, ERA), and objective demographic trends.

The **main weakness**, due to the size and structure of the Estonian economy, is resource mobilisation, and a particular challenge is the self-sustainability of the national research system. R&D intensity and volume have been rising during the last decade but this trend is unlikely to continue (due to negative economic outlooks). Moreover, the dependence on EU SF support for the research system has deepened: some R&D support measures, programmed for 2007-2013, are fully dependent on EU Structural Fund allocations, which raise serious doubts about their medium-term sustainability (see more in Chapter 3).

Another systemic weakness, associated with this domain as well as the domain of **knowledge circulation**, is insufficient human resources. Due to the demographic situation, a balanced and coordinated education (knowledge) supply has become urgent (OECD Review 2007, MER HE Strategy, 2006b). Responding to both students' and business needs (and faced to some extent by competition from other European education systems), the HEIs have been adapting the process of curricula development (in academic terms) and quality assurance.

## *2.3 Analysis of recent policy changes since 2008*

### 2.3.1 Resource mobilisation

The year 2008 has been decisive in strategic terms; two documents – the **Action Plan for Growth and Jobs 2008-2011** (hereafter the AP Growth and Jobs**) and** the **National Strategic Reference Framework 2007-2013 (NSRF)** for the implementation of the Structural Funds[4] were approved by the Estonian government and by the European Commission. The AP Growth and Jobs is supplemented with detailed implementation and financial plans, and it should be in compliance with the State Budget Strategy (SBS) and the NSRF.

The Estonian Action Plan for Growth and Jobs 2008-2011, approved on 9 October 2008 by the Government, incorporates and takes notice of the EU Commission assessment of the previous plan to **make clear prioritisation** of the national objectives of the Lisbon Strategy. Hence, it **outlines the key areas** of the AP for the next three years: **productivity growth, R&D and Innovation, development and liberalisation of business environment and the labour market.**

AP has defined four main complex challenges for the key areas:

1) Developing an education system, which is more adaptive to the needs of the business sector and modernising the labour law for promoting flexibility of the labour market;
2) Increasing the capacity of the research and development sector and directing it more towards the needs of the business sector;
3) Developing a business and investment-friendly environment, which strongly supports

[4] See: http://ec.europa.eu/regional_policy/atlas2007/fiche/et_en.pdf for a summary. In the previous period, the equivalent document was the Estonian National Development Plan 2004–2006.

innovation and international competitiveness of companies;

4) Increasing the environment-friendliness of the energy sector while ensuring the security of the energy supply and the competitiveness of energy sector.

In response to these challenges, the AP Growth and Jobs covers three policy areas - macroeconomic environment, competitive business environment, education and labour market- and sets 9 development objectives (goals). These challenges and goals have been formulated on the results of analyses (done both by the Estonian task group and EU officials) of the effectiveness of the measures applied during the previous period and the current status of the factors of main impact on Estonian competitiveness. In addition, the recommendations by the European Commission regarding the Government policy for economic competitiveness and the conclusions of the European Council competitiveness summit (2008) were taken into account (the AP Growth and Jobs, Introduction).[5]

The **NSRF 2007-13 and the related Operational Programmes**[6] (OPs) (Human Resource Development; Development of Economic Environment) make provision for financing scientific research and the knowledge-based economy. In particular, the OP Development of Economic Environment includes the priority axis "Improving the competitiveness of Estonian R&D through the research programmes and modernisation of higher education and R&D institutions." In the OP "Human Resource Development," the second priority axis is "Developing human resources for R&D" (The Government of Republic of Estonia, 2007).

The RDI Strategy for 2007-2013 has been supplemented by the Implementation Plan of RDI Strategy for 2007-2013 (Government of Republic of Estonia, 2008b)[7]. Similarly, the Implementation plan of the Higher Education Strategy is being developed for the 2008-2010 period.

Based on these main strategies, the Government has approved several **state investment plans** for the 2008-2013 period on modernisation of research and teaching facilities of R&D institutions and HEIs (in the second semester of 2008).

Since end 2008, the MER and MEAC have visibly progressed with the **programming of the support measures** of the EU SF period 2007-2013 (see more in 3.3.2). The programming process has been associated with some impact and results evaluations of the previous programmes (e.g. Arnold et al, 2008), as well as feasibility studies for new support instruments (e.g. Männik, et al, 2008), were carried out.

However, in the face of the economic crisis, the Supplementary State Budget for 2009 introduced cuts (3-8%) in the state expenditures on R&D and education, mainly of administrative and organisational costs, and some reduction of financing of state-commissioned student places. The volume of the main state financing instruments (baseline, targeted and infrastructure) and the national co-financing of EU SF allocations for R&D programmes remain unchanged nevertheless.

[5] http://ec.europa.eu/growthandjobs/national-dimension/member-states-2008-2010-reports/index_en.htm

[6] http://www.struktuurifondid.ee/index.php?id=12034.

[7] Approved by the Government Decree No. 533 18.12.2008.

**Table 3: Main policy changes in the resource mobilisation domain**

| Challenges | Main Policy Changes |
|---|---|
| Justifying resource provision for research activities | • **The political consensus on the importance of R&D is formally unchanged** (AP Growth and Jobs, NSRF, State Budget, RDI Strategy Implementation Plans), and in terms of economic recession, the R&D measures are seen as a source for future recovery. In practice, minor cuts of some expenditure in the 2009 Supplementary budget. |
| Securing long term investments in research | • The **EU SF programming** approach has provided longer-term commitment, balancing the short-term vagaries of annual budgeting rounds.<br>• **The private sector is expected to contribute a significant share of the increased R&D spending by 2014,** but given economic recession and credit shortages appeared in 2008 is unlikely to be achieved<br>• No new macroeconomic or fiscal policy measures are introduced<br>• **Road-mapping of Estonian RI started (national core laboratories concept)**<br>• **Need for R&D joint infrastructure development with Finland expressed** |
| Dealing with uncertain returns and other barriers | • **The value added in Estonian industry production is often low and consequently also domestic demand for industrial R&D is low.**<br>• No new macroeconomic or fiscal policy measures, and no industry policies are introduced to support structural changes. Some sectoral/technology-oriented state programmes are launched (see more in Ch.3)<br>• **Lack of attention to FDI as a source for increased investment in research**<br>• No new macroeconomic or fiscal policy measures are introduced. Some promotional support and venture capital activities (Development Fund co-investments), see more in Ch.3 |
| Providing qualified human resources | • **Estonian policies to improve the attractiveness of science as a career,** faced by insufficient levels of (doctoral) students in S&T, **have been enforced** by set of new support measures (see more in Ch.3) |

### 2.3.2 Knowledge demand

The AP Growth and Jobs (Government of Republic of Estonia, 2008a) 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 to business needs, and support economic competitiveness. Under the implementation priorities for the period of 2007-2013, the progress report of the RDI Strategy (MER, 2007) points out that in the new budgeting period of the Structural Funds, development of human resources will be prioritised.

In response to the challenges, identified in the AP Growth and Jobs, four new state/national programmes in support of business demand for knowledge production and services are being prepared, or are under preparation (e.g. Development of the concept and network of core laboratories (joint-use of infrastructure), Implementation of the national programme on R&D in energy technology, and some others), (The Government of Republic of Estonia, 2008b)

In connection with **monitoring of knowledge demand and supply**, Mr Kasemets, the Strategy Director of the State Chancellery of Estonia, noted (during the joint meeting of the Estonian and Finnish R&D Councils in April 2008) that impact assessments of policy implementation are underdeveloped in Estonia and that the State Chancellery planned to start a comprehensive impact assessment exercise at the end of 2008 and finish it by 2010.

**Table 4: Main policy changes in the knowledge demand domain**

| Challenges | Main Policy Changes |
|---|---|
| Identifying the drivers of knowledge demand | • **Tradition of transparent public consultation on policies** – remains and enforced along drafting of AP Growth and Jobs for 2008-2011, RDI Strategy Annual Implementation reports, other consultative forums. Still, public transparent consultations or information could be suddenly compromised as was seen during the negative supplementary budget 2009 negotiations.<br>• **Although initial measures have been launched, the foresight and strategic planning of scientific and industrial research still requires greater efforts** – during 2008 and 2009 so far, several new, wide-scope foresight projects have been commissioned (Development Fund). The Coordination Group of the RDI Strategy has proved to be a reliable monitoring and consultation body.<br>• **Few mechanisms for technology assessment or identification of broader societal needs for knowledge** – the situation remains unchanged in political and institutional terms (Development Fund), the scope of the foresight has broadened (see more Ch.3), and due to the foresight activities, more social partners involved. |
| Co-ordinating and channelling knowledge demands | • **The launch of state (national) technology programmes should improve co-ordination of knowledge demand and production** – compared with 2008, more new programmes are under preparation (see more Ch.3) |
| Monitoring demand fulfilment | • **Little is done aside from programme level evaluations to monitor impact of policy initiatives** – compared with 2008, the situation is basically unchanged, and the impact assessment of programmes and support measures is not systematic and not linked as a condition for establishment or re-launching of the measures. Few positive examples for the programmes in the governance area of MEAC and analytical monitoring activities in MER (on RDI Strategy implementation plans and higher education).<br>• On the policy coordination level, Estonia plans to **start a comprehensive impact assessment at the end of 2008 and finish it probably in 2010**. |

### 2.3.3 Knowledge production

There have been no policy changes in this domain. Programme regulations of the measures, facilitating knowledge production, like SPINNO, Doctoral Schools, etc., (see 3.3.2, route 6) have been in force since mid-2008. Some new programmes are under preparation and in particular, the key R&D investments programme is expected to be re-launched in 2009.

One key issue on the political agenda is the internationalisation of the R&D policy. Cooperation with neighbouring Finland (joint meeting in April 2008 of the R&D Councils) has been discussed comprehensively, particularly in the areas of development of human capital and joint programming activities.

The performance contract system (between the state and HEI) is the most recent initiative (2009) to foster steady performance of HEIs in knowledge production. In an initial phase it will focus on educational activities in state-commissioned education. The first performance contract period will start from the 2009/2010 academic year, and the contracts should be signed between the MER and HEIs in May 2009.

**Table 5: Main policy changes in the knowledge production domain**

| Challenges | Main Policy Changes |
|---|---|
| Improving quality and excellence of knowledge production | • **Research assessment and peer review mechanisms are in place but remain based largely on scientific criteria and less on their relevance for the economy or society** – remains unchanged, e.g. the criteria for the most stable state funding instrument – targeted financing – still pays only limited attention to economic impacts (number of patents and patent applications, number of research contracts).<br>• **Initial steps towards concentrating funding in science excellence centres with sufficient critical mass to compete in the ERA –** new call for Centres of Excellence, see more in Ch. 3) Also other measures oriented on growth of competitiveness of Estonian research like Doctoral Schools, etc.<br>• To ensure **international competitiveness** of research and sustain other R&D programmes in PROs and HEIs (CoE), the R&D infrastructure must be, by the RDI Strategy "modernised or if missing but necessary, constructed." The RI investment programme will be continued.<br>• **Internationally**, collaboration with Finland in specific joint programmes is envisaged. |
| Ensuring exploitability of knowledge production | • **Management processes and capacities in R&D institutions remain weak** (despite support) and incentives to undertake applied research are low for academics – this is a recognised challenge by policymakers too and therefore the range of support measures to support exploitability and commercialisation, and more effective management of knowledge production, has been widened from 2008 (Competence Centres, SPINNO and more, see in Ch. 3.<br>• The performance contract system will be implemented from the 2009/2010 academic year. |

### 2.3.4 Knowledge circulation

To **facilitate knowledge circulation** between universities, PROs and the business sector, several new individual programmes have been launched by the MEAC (see complete overview in 3.3.2, especially route 5).

**To profit from access to international knowledge, Estonian SMEs participate in** the Eurostars programme (from 2007[8]). In 2008, Estonia joined the European Space Agency (ESA) notably with the objective to make ESA project funding accessible to Estonian companies. Enterprise Estonia has begun to actively promote space related business and R&D activities to this end. Estonian research teams are also successfully participating in the FP7.

**In international mobility**, the Council Directive 2005/71/EC of 12 October 2005 was fully adopted by the amendments to the Aliens Act in 04.11. 2007. A number of mobility measures are in place (see Ch.4).

**To develop the absorptive capacity of knowledge users,** the contract for the national partner in the Enterprise Europe Network of the European Commission was awarded (in 2008) to a consortium led by the Estonian Chamber of Commerce and Industry to provide support to the activities of small and medium-sized enterprises (SMEs), including in the field of technology transfer.

[8] See more at http://www.eurostars-eureka.eu.

**Table 6: Main policy changes in the knowledge circulation domain**

| Challenges | Main Policy Changes |
|---|---|
| Facilitating knowledge circulation between university, PRO and business sectors | • **Instruments such as the competence centres have begun to create cooperation between academic and business interests** – the CC programme has proved to be effective and a new call in January 2009 attracted high interest.<br>• **Circulation of knowledge could be dramatically ramped up and cover a much wider range of companies –** in response to this recognised challenge**,** in 2008/2009, several new measures were launched (e.g. Cluster support programme, see more in Ch. 3) and some previous programmes re-launched. |
| Profiting from access to international knowledge | • **Estonian research teams have been strongly involved in the EU programmes and research mobility and internationalisation of the research base is a clear priority** |
| Absorptive capacity of knowledge users | • **Limited number of science and engineering graduates working in industry able to act as 'gatekeepers' for cooperation with knowledge institutions –** 1 new support measure (Collaboration and Innovation in HEIs)<br>• **There is a developing but relatively standard and limited range of support services for enterprises seeking to transfer technology,** etc. – from 2008, some support measures are introduced (Innovation vouchers, Technology Investment support, etc., see Ch. 3). |

## *2.4 Policy opportunities and risks related to knowledge demand and knowledge production: an assessment*

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

| Domain | Main policy related opportunities | Main policy-related risks |
|---|---|---|
| Resource mobilisation | • NSRF assures appropriation of available EU SF<br>• Political consensus on R&D prioritisation remains, and the knowledge-based economy is seen as a source of recovery from the economic recession<br>• Political support measures prioritise programmes, consolidating different financial sources or competencies | • Structural limitations and uncompetitive development patterns of the national economy are additionally affected by the recession (which partly resulted from them) but no new practical macroeconomic or industrial policy initiatives<br>• Main policies like the AP Growth and Jobs and RDI Implementation Plan are over-optimistic in economic growth scenarios (e.g. sharp fall of GDP in 2008/2009 and in coming periods, credit shortage, limited access to loans and other financial instruments). No alternative scenarios or coherent plans are elaborated.<br>• No systematic evaluations and impact assessments of the implemented support measures on the policy coordination level |
| Knowledge demand | • In policy implementation, consolidation and integration of prioritises, financial sources, competencies, etc., is preferred (e.g. CC, cluster initiative, R&D support programme, Doctoral Schools, collaboration of HEIs and business) | • Educational, RDI and industrial policies lack coherence, or are not adequately developed |

| Domain | Main policy related opportunities | Main policy-related risks |
|---|---|---|
| Knowledge production | • Commitment of the HEIs to create joint RI | • Optimisation of the higher education system is not launched |
| Knowledge circulation | • Set of measures addressing both academia-business collaboration, and internationalisation of R&D.<br>• Mobility aspects are governed effectively both at the state and the HEIs level. | • Several measures depend primarily on EU SF allocations (CoE, CC, DoRa, Mobilitas, etc.), or other foreign sources (FP), which makes their sustainability uncertain. |

# 3 National policy mixes towards R&D investment goals

The aim of this chapter is to deepen the analysis of national policy mixes with a focus on public and in particular **private R&D investment**. The Lisbon strategy emphasises an EU overall **resource mobilisation objective** for 2010 of 3% of GDP of which two thirds should come from private investment. R&D investment is seen as important yardstick for the capacity of an economy to turn the results of science and research into the commercially viable production of goods and services and hence knowledge into growth. Corresponding investment policies are mainly pursued at national level and determined with a national focus.

The chapter is structured around five questions:

1. What are the specific barriers in the country that prevent reaching the Lisbon goal? What barriers exist in the country to prevent reaching the specific targets, particularly related to the private sector R&D investments?
2. Given the above, what are the policy objectives and goals of the government that aim to tackle these barriers?
3. What Policy Mix routes are chosen to address the barriers and which specific instruments and programmes are in operation to implement these policies?
4. What have been the achievements in reaching the above-mentioned R&D investment objectives and goals?
5. What are the reasons for not reaching the objectives, adaptation of the goals?

The chapter aims to capture the main dimensions of the national policies with an emphasis on private R&D investment. The chosen perspective of looking at investments in R&D is the concept of Policy Mixes. The analysis and assessment follows a stepwise approach following the five questions mentioned above.

## *3.1 Barriers in the research system for the achievement of R&D investment objectives*

The core investment barrier in the Estonian research system is related to the size and **structural limitations** of the national economy. Following Estonia's re-independence in 1991 and the introduction of a liberal economic policy, massive privatisation and sectoral restructuring transformed the structure of the national economy (Landesmann, M., 2000, Varblane, U. et al, 2008).

Due to these structural changes, by 2006, manufacturing has been replaced as the main contributor to GDP by sectors such as real estate, renting and business

services, logistics and communications, and trade (Estonian Statistics, 2008).

Estonian has a high level of foreign direct investment (FDI) which is often viewed as a source of knowledge and technology transfer and R&D-intensive FDI could foster the transition to a more competitive industrial/service structure of the economy. In Estonia, however, financial intermediation, wholesale and retail sectors, have gained most from the surge in FDI (Business Yearbook, 2008, Bank of Estonia, 2002-2006).

High rates of economic growth in the last decade (6-9% annually) have been insufficient to catch up to the average GDP per capita of the EU27, as growth was driven mainly by internal demand (Varblane U. et al, 2008) rather than a shift to high-value added exports. Since 2008, the non-competitive economic structure has been significantly affected by the global economic crisis – from the third quarter of 2008, GDP decreased, and the scenarios of the Bank of Estonia (Bank of Estonia, 2008), predict the recession will continue (decline of GDP by 8-10% annually) until 2010.

Systemic barriers also prevail in the R&D system: comparison of the existing funding flows by the performers (see Ch. 2.1) indicates **inter-sectoral barriers of Estonian R&D** expenditures. Consistently **low extramural BERD** is worrying as it indicates structural weaknesses in the services of HEIs and PROs to businesses such as insufficient quality/capacity of research services, non-competitive quality/cost ratio (outlined for instance in connection with the Competence Centres evaluation, Arnold et al, 2008), etc. Some earlier studies (e.g., the Research and Development Council, 2003, Polt, W. et al, 2007, OECD Review, 2006) also noted the different orientation of research supply and business needs, and suggested that the orientation of research organisations towards industry needs should be improved.

The systemic gap between knowledge supply and demand could be attributed to non-coherent coordination between R&D and innovation policies and education policies (Nedeva and Georghiou, 2003, PREST, 2003), but even more to weak or missing links between R&D, innovation and education policy mix and industrial policies (Varblane U., et al, 2008, Research and Development Council, 2003). During the development of the RDI Strategy for 2007-2013, the permanent **Coordination Commission** was established in 2007 by the MER to deal with R&D and innovation, but a common platform for the national industrial policies is still missing[9].

**Availability and investments in human resources** are important when discussing the ability to produce, facilitate and utilise R&D or attract FDI in knowledge-intensive sectors. In a small country like Estonia, **demographic pre-conditions** are crucial. The size of the population in Estonia has sharply decreased over the past fifteen years, and a further decrease is predicted. At the same time, the population is aging at an increasing rate (Statistics Estonia).

The structural changes in industry discussed above have radically changed the proportions of secondary and tertiary sectors in the local economy, and as a result, caused some **irreversible changes in the labour market** (MEAC, 2005, 2007). The shortages on the labour market for R&D personnel are particularly difficult to solve due to the free movement of persons in the Single Market and disadvantageous salary and employment conditions, compared with some other countries.

[9] Perspectives of the national industrial/sectoral policies have been investigated by the Estonian Development Fund (under the foresight "Estonian growth vision 2018," 2008-2009). Also, some (fragmented) sector-centred policy initiatives like the biotechnology sector strategy are initiated.

## 3.2 Policy objectives addressing R&D investment and barriers

The AP Growth and Jobs, as a national implementation plan for the Lisbon Strategy (following the previous plan for 2002-2007), defines two particular development challenges, connected to RDI investment and human resources development needs (see 2.3.1).

Another important medium-term framework in terms of development and investments in research and human resource development (HR&D) is the **NSFR 2007-2013 and Operational programmes**, regulating the use of the EU Structural Aid in 2007-2013. The NSRF will be discussed further below in context of R&D intensity growth perspectives as the EU SF is the dominant financing source of most national R&D, education and innovation support measures until 2013.

In sectoral strategies, the RDI Strategy is an advanced example of the integrated strategy for two close policy areas – R&D and Innovation. Also Estonia's political commitment to the **3% objective** of GERD (by 2014) is initially stated in this strategy. Taking into consideration that the core R&D organisations are HEIs, another important sector document in the policy mix is the '*Higher Education Strategy for 2006-2015*' (hereafter HE Strategy). The latter document proposes, inter alia, further modernisation of the R&D funding system for Estonian higher education and better alignment between educational and research functions of HEIs. Different aspects of internationalisation in R&D (including impact of ERA) are included in the '*Strategy for Internationalisation of Estonian Higher Education for 2006–2015*' (approved in 2006 by the MER, as a complement to the HE Strategy).

The 3% target is not explicitly included in the AP Growth and Jobs, but expressed via the projected levels for 2011 (see 3.4) (Government of Republic of Estonia, 2008a).

**With AP Growth and Jobs and NSRF, these two sector strategies (RDI and HE) and connected implementation and financing plans, and regulations constitute the Estonian R&D policy** mix in terms of R&D investments.

In terms of the **human capital and R&D labour** market**,** both sector strategies (RDI and HE) pay necessary attention to this key development aspect of the national R&D system. For instance, one of the strategic objectives of the RDI Strategy is to motivate young researchers and to ensure their academic careers, and the RDI Strategy Implementation Plan, 2007-2013 has stated a target of achieving annual growth of 6% of scientists and engineers (full-time employed), leading to eight full-time employed scientists and engineers per 1000 employees in 2014. The set of human resource development national programmes and measures is wide-ranging, and relatively well financed (see more in 3.3.2).

## 3.3 Characteristics of the policy mix to foster R&D investment

This section is about the characterisation and governance of the national policy and instrument mix chosen to foster public and private R&D investment. While policy goals are often stated at a general level, the policy mix has a focus on how these policy goals are implemented in practice. The question is what tools and instruments have been set up and are in operation to achieve the policy goals? The following sections will each try to tackle a number of these dimensions.

### 3.3.1 Overall funding mechanisms

R&D activities in HEIs and PROs are funded dominantly from the state budget, via the mix of institutional and project-oriented allocations. The principles and rules of state allocations are regulated by the Research and Development Organisation Act and for EU SF allocations – by the Structural Assistance Act for 2007- 2013.

The majority of the public R&D expenditures are distributed via the budget of the MER, and to some extent, in connection with industrial R&D, innovation and business-academia collaboration via the MEAC. For most funding measures, the financing decisions are delegated to the agencies or foundations (Enterprise Estonia, Archimedes, Estonian Science Fund). Funding of R&D activities from the budgets of other ministries is generally limited to funding of the institutions belonging under their governance, and/or associated with the State Research Programmes.

The main **institutional or non-competitive measures** for research funding are:

**Baseline financing** – HEIs and PROs receive the annual baseline funding on the basis of their R&D performance evaluation results. The institutions are responsible for internal planning of the allocated budget means. During 2005-2008, the budget for baseline funding has steadily increased (in 2009, ca. €83m).

**Infrastructure expenses** for current expenditures (electricity, heating, etc.) should be allocated by the owner of the HEIs and R&D organisations, i.e. for state-owned HEIs and PROs through the budget of the responsible ministry. The share of infrastructure expenses has been stable, and in volumes, comparable with the baseline funding. HEIs and PROs are responsible for internal planning and use of these expenses.

**Competitive financing means** from the state budget are:

**Targeted financing** – the aim is to ensure a competitive basic structure for scientific research and the continuity of research necessary for Estonia. This is open to research groups on a competitive basis. The targeted financing budget doubled in 2003-2008, and in 2008 ca 200 targeted financing projects (total budget 24.73m) were financed. For 2009, the number of projects and estimated budget is comparable (209 projects in total for a sum of €24.90m).

**R&D grants** are intermediated by the Estonian Science Fund and allocated on a competitive basis for several types of the individual grants (funding comes entirely from the state budget, via the MER).

None of the above-mentioned financing instruments are pre-determined thematically, and only the **National (State) Research Programmes** have a thematic focus. These programmes consolidate financing according to the long-term thematic strategic research plans in certain fields of key importance, and based on the AP Growth and Jobs, or other sector strategies (e.g. Sustainable Development Strategy, 2007). By the end of 2008, four national programmes were in place managed by the MER, and two by the Ministry of Agriculture, and in the near future, more national research programmes will be launched.

Comparing all the state financing instruments, the Estonian R&D investment policy mix is dominated by the **generic, institutional instruments**: baseline and infrastructure funding assures the institutional stability of Estonian HEIs and PROs. At the same time, there has been a rapid growth in the volume of the competitive or quasi-competitive instruments like targeted funding, and national R&D and innovation programmes.

Considering the policy mix, fostering (or hindering) R&D investments, it is important to stress a specific financing instrument of educational activities in HEIs, namely – the **state-commissioned student places** (SCSP), (Universities Act, 2006). SCSP cannot be classified as a "traditional" R&D financing, but it is relevant due to the close interaction of educational and research activities in Estonian HEIs, and covers – to a varying extent – operational costs (but not investments) of the infrastructure of dual purpose (R&D and education). It is also an important instrument to influence supply/demand in education, as **only state-commissioned education is free of charge** for higher education students[10].

### 3.3.2. Policy Mix Routes

The "Policy Mix Project" identified the following six 'routes' to stimulate R&D investment:

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;
4. attracting R&D-performing firms from abroad;
5. increasing extramural R&D carried out in cooperation with the public sector or other firms;
6. increasing R&D in the public sector.

The routes cover the major ways of increasing public and private R&D expenditures in a country. Each route is associated with a different target group, though there are overlaps across routes. The routes are not mutually exclusive as, for example, competitiveness poles of cluster strategies aim to act on several routes at a time. Within one 'route', the policy portfolio varies from country to country and region to region depending to policy traditions, specific needs of the system etc.

**Route 1: Promoting the establishment of new indigenous R&D performing firms**

This route benefits from the entrepreneurship policies introduced in Estonia (e.g. simple registration of a new business, e-taxation, very liberal employment laws, and particularly – taxation policies), and is vitally important in terms of the structural reforms needed in the economy. However, the promotion of entrepreneurship is a general objective and there is no particular emphasis on R&D intensive sectors. As the Estonian business activity is still lower than the average in the EU27, the support activities is directed to starters and on improving general entrepreneurial awareness and encouraging potential entrepreneurs.

Enterprise Estonia provides direct financial support via the start-up and development grant programme (co-financed by the European Social Fund), with no special preferences to R&D companies.

Two measures targeting the creation of more knowledge-intensive companies are planned to be re-launched in the second half of 2009: the **business incubators support programme** and the **science-business parks programme.**

[10] State universities are also allowed by law to provide tuition-based education, and its share is comparable with the SCSP.

**Route 2: Stimulating greater R&D investment in R&D performing firms**

The core programmes of this route contributing the most to the promotion of greater R&D investments so far are the **competence centres, Science-business parks and incubators, and R&D financing programmes**. They all aim to strengthen cooperation between the research and business sectors, and foster growth of economic competitiveness and the development of a knowledge-based economic structure. All three programmes were initially launched during 2004-6 period and will be continued in the programme period of 2007-2013.

The Competence Centre (CC) Programme is a competitive measure and it consolidates all types of research (from basic and applied to industrial) in certain thematic areas. Based on the previous calls until 2008, five competence centres were established in Estonia, financed initially by the State and later also by the EU SF. At the beginning of 2009, a new call was launched. Until 2013, the CC programme will be financed by the ERDF (requiring co-financing from the beneficiaries), and the budget of the programme is 63.9m.

In contrast to the CC Programme, the R&D Financing Programme is not oriented thematically. It is a competitive measure open both to SMEs and R&D organisations, and particularly supports the objective of route 2. The programme was launched in the 2004-6 period of the EU SF, and the outcome of the calls indicated a high demand from both target groups. The budget of the programme, financed by the ERDF in the 2007-2013 EU SF budget period, is €89.48m.

A total investment of €2.12m, co-financed by the ERDF, was made through the science-business parks programme during the 2004-2006, and the measure will be re-launched for an additional funding round in the second half of 2009.

In addition to the pre-existing measures, re-launched in 2008, this route should be supported further by several brand new programmes. More or less, they all are elaborated in response to the need to raise knowledge-intensity and inter-sector collaboration. For instance, the Collaboration **of HEIs and business programme** is an example of an R&D, innovation and education policy mix measure, supporting better compliance between knowledge supply and demand. It was launched in February 2009. Another competitive programme aimed at promoting business co-operation is the **cluster development programme,** launched in 2008, the budget of the measure for 2007-13, co-financed by the ERDF, is €6.39m.

**Route 3: Stimulating firms that do not perform R&D yet**

A central plank of Government policy has been to support re-orientation of the business sector to knowledge-intensive activities and hence encourage structural changes in the economy. A number of the policy mix measures relevant to route 3 are the same as for route 2 (science-business parks and manufacturing R&D projects funding, etc.).

Several new programmes aim to improve investments in new technologies and improve capabilities of firms in order to stimulate companies to move to higher added value manufacturing via technological modernisation or R&D, these include: the **involvement of innovation and R&D staff, the transfer of research-intensive technologies and the business cluster and collaboration development, and the innovation vouchers programmes.**

The **Innovation vouchers programme** is a good example of how to initiate collaboration between enterprises and R&D organisations and knowledge-related

service organisations (Patent Office, certification and standardisation services, metrology services, etc.).

**Route 4: Attracting R&D firms from abroad**

The importance of FDI as a source of economic growth and a stimulus for local firms to invest in R&D is highly important for small economies like Estonia. To some extent, the topic was discussed in 3.1, in connection with investment barriers. Despite the exceptionally high FDI stocks as a percentage of national GDP (in 2006, 77.2%, UNCTAD, 2007), Estonia lags behind in absolute volume of FDI compared with other transition economy countries.

In this context, some promotional and intermediating activities to attract FDI in knowledge-intensive sectors have been started by Enterprise Estonia: foreign representative offices in Tokyo, London and San Jose (Silicon Valley, US) have a task of promoting Estonia as an attractive destination for FDI and networking with venture capital firms. The representation office in Silicon Valley focuses specifically on research-related FDI in ITC and electronics (see Enterprise Estonia website[11]). So far, these promotional activities are the only recognisable state-financed measure to support this policy route.

**Route 5: Increasing extramural R&D carried out in cooperation with the public sector**

In terms of the expected impact on the structural changes of the economy and transition to the knowledge-intensive economy, route 5 is possibly less important than routes 1, 2 and 3. Route 5 is essentially supported by the same set of measures, discussed under routes 2 and 3 (as the central policy routes), and the most immediate programmes to highlight are the **Involvement of innovation and R&D staff, the manufacturing R&D projects and the Academy-business cooperation programmes**.

**Route 6: Increasing R&D in the public sector**

Boosting the competitive positions of the national HEIs and PROs is an important objective for Estonia, given that limited (absolute) resources may negatively affect their ability to collaborate in international research. Several financing instruments have been made available or reinforced through the State budget to this end. Notably, the importance of **targeted financing** is increasing, the annual budget in 2008 was €24.73m, and is comparable with the total budget of the largest competitive measure of this route (the Centres of Excellence (CoE) programme with a total budget for 2007-2013 of €33.68m).

The four competitive core programmes of this route are the **CoE, the R&D investments, the SPINNO and the Doctoral Schools** support programmes. They all are particularly valid in the ERA context. All these programmes were first launched in the period 2000-2006, and generally been considered as effective (Brighton and Kells, 2007, Reid and Walendowski, 2006) in improving the potential of the higher education sector to undertake and commercialise research.

The first phase of the R&D infrastructure development programme co-financed by the EU SF was carried out in 2006–2008, but only covered a small part of required investment, given the accumulated under-investment during the 1990s. In the 2007-

[11] http://www.eas.ee/index.php/for-the-entrepreneur/internationalisation

2013 period, an additional €256m will be available for R&D infrastructure investments, co-financed by the ERDF.

The CoE are selected through an open competition and based on the opinion of an international selection committee, to assist and ensure the sustainability of internationally competitive high-quality research and development activities (this programme is particularly valid in the ERA context). The CoE Programme was launched in Estonia in 2002, and during the period 2002-2007, 10 CoEs were supported (€7.88 m from the State budget and €6.36m from the ERDF). During the period 2007-2013, seven new CoEs will be supported (in total €33.68m including ERDF co-financing).

The SPINNO Programme, first launched in 2000, supports HEIs and PROs in developing technology transfer infrastructure and services for establishing spin-offs and encouraging the commercialisation of research results in general. During the 2004-2006 period, seven projects received support, and the most interesting in terms of wide institutional collaboration was BioSPINNO[12]. In the period 2007-2013, it will be dominantly financed by the ERDF (total budget €5.75m).

The most recent package of measures, "**Development of collaboration and innovation in HEIs"**, was introduced in February 2009, consisting of three sub-programmes: Doctoral Schools, HEIs-Business collaboration, and Innovation in HEIs.

### The importance of education and innovation policies

Estonian macro-economic (fiscal) and entrepreneurship policies concentrate mostly on the development of the general economic framework (taxation, investments) and do not give any specific preferences or incentives to R&D intensive investments[13]. As a result, the importance of policy measures supporting directly routes 1 and 4 are relatively minor from a research policy perspective.

The implementation of innovation policy measures designed by the MEAC is mostly via the routes 2 and 3, and less via the routes 1 and 5. As stated previously, due the integrated R&D and innovation strategy, the respective policy support programmes have very often dual objectives and effects are expected on both HE research productivity and business R&D and innovation performance. One reason to focus the support measures mostly on existing companies may be the fact that Estonian companies are ranked high in innovation indicators (e.g. the Community Innovation Surveys, Kurik S. et al, 2006) but not in terms of industrial R&D intensity. Hence, measures fostering the recruitment of innovation and R&D staff, manufacturing R&D projects, etc should boost the innovative potential of the companies further.

In education policy, the researcher training and career support and the quality of education (incl. international competitiveness of the HEIs) are the core priorities. Elaboration of education and research policies are closely tied, as the both policy areas are under the responsibility of the MER. This provides a good basis for elaboration of support measures with integrated objectives for R&D and HE. An illustrative example of such measures is the programme "Development of collaboration and innovation in HEIs" (route 6).

Especially researcher training and research careers are amongst the priorities of

[12] http://www.genomics.ee

[13] General taxation policies (flat tax rate of 21% with no exceptions) could be seen as a hindrance for R&D activities but this policy is balanced by the fact that reinvested profit is not subjected to corporate income tax, which is favourable for long-term development plans.

education policy in 2009. Other discussion has been mainly focused on the quality of education, the selection and support for top performing units, internationalization of education as well as links between education and working life

To highlight the importance of other educational measures (especially important in connection with route 6), the different measures (scholarships for foreign students, promotional work of HEIs), have enabled an increase of the numbers of foreign students, including doctoral students, in Estonian HEIs (by approximately 9% between the 2005-06 and 2006-07 academic years, according to EHIS).

To overcome existing barriers in mobility and promote scientific careers, a wide selection of **national scholarships** is available, dominantly financed by the state, and to some extent by the HEIs.[14]

The new educational programmes, introduced by the MER in 2008/2009 – "PRIMUS" (3rd level education quality development), "BeSt" (e-studies in HEIs) and especially "DoRa" and "MOBILITAS" should particularly support mobility of research staff and internationalisation of research and studies, and integrate effectively some existing measures (short-term grants, etc.). These programmes, co-financed by the EU SF, have a total budget of €32.2m during the period 2007-13.

### Assessment of the importance of policy mix routes and their balance

### Table 8: Importance of routes in the national policy and recent changes

| Route | Short assessment of the importance of the route in the national policy | Main policy changes since 2008 |
|---|---|---|
| 1 | Important in terms of structural changes in national economy and potential growth of BERD. | No major changes: the SPINNO, the Innovation Awareness, and the Science-business parks and incubators support measures are re-launched to help create more companies, and could be further supported by public seed capital of the Development Fund. |
| 2 | Crucially important in terms of structural reorientation of national economy, optimisation and concentration of resources, and growth of BERD | Several new measures (Transfer of research-intensive technologies, Involvement of innovation staff, Innovation vouchers), and reinforcement of the CC and the R&D projects support measures<br>Could be further supported by public seed capital. |
| 3 | Crucially important in terms of structural reorientation of national economy, optimisation and concentration of resources, and growth of BERD | The Innovation Awareness programme has been re-launched; other measures are more important as mentioned earlier<br>Could be supported by the public seed capital. |
| 4 | Declared as a very important (RDI Strategy, AP) but execution is weak | No changes in fiscal policies, only FDI promotional support activities |

[14] The MER, via the Archimedes Foundation, supports studies abroad by special scholarships for Estonian students and researchers to work or visit foreign universities worldwide (Kristjan Jaak Scholarship, with a budget for the 2008/2009 academic year of ca. €90,000), and providing a certain amount of SCSP for PhD studies abroad. The last initiative is governed with the Rectors Conference. One mobility support programme, designed for Estonian bachelor's students, is running in collaboration with the MER, Archimedes and private business companies (called the "Young Researcher Scholarship").

| Route | Short assessment of the importance of the route in the national policy | Main policy changes since 2008 |
|---|---|---|
| 5 | Very important in terms of increasing GERD, optimisation and concentration of resources | Several new measures: the Cluster development, the Technology voucher, the Involvement of innovation staff, the Academia-Business collaboration, the state technology-oriented progammes),<br>Re-enforcement of the R&D project support, the Science-business parks and incubators, the CC programmes. |
| 6 | Very important in terms of growth of GOVERD, optimisation and concentration of limited resources, better connection between curricula and knowledge services provided by HEIs with needs of society and business. | Some new support measures (Innovation in HEIs, Academia-Business collaboration, foresight, the DoRa, the PRIMUS. etc), and reinforcement of existing measures (the Doctoral Schools, the CoE, the RD infrastructure investments, mobility); two new sector or technology-oriented state programmes launched, several under preparation, three state research programmes prolonged.<br>Decrease of SCSP by ca 3%, some other R&D cuts in state budget<br>Joint IR concept nationally, some shared interests with Finland |

## 3.4 Progress towards national R&D investment targets

From 1998 to 2008, expenditures on R&D has grown by ca 20% per annum, the second highest growth rate in the EU27 (Estonian Statistics, Eurostat, See also Table 1). The aim of the Government is that the 3% objective should be reached gradually by 2014 (see Table 9).

**Table 9: Expenditures of R&D, targets and proportions until 2014 (for 2005-2007-Statistical reference), % of DGP**

| | 2005 | 2006 | 2007 | 2008 | 2010 | 2011 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|
| GERD, % | 0.94% | 1.14% | 1.13% | 1.5% | 1.9% | 2.0% | - | 3.0% |
| GOVERD, % | | | 0.52% | 0.8% | 1.05% | | 1.3% | 1.4% |
| BERD, % | | | 0.47% | 0.7% | 0.9% | 1.05% | - | 1.6% |

Source: RDI Strategy, 2002-2006, RDI Strategy, 2007-2013, AP Growth and Jobs, Eurostat, own compilation

In the 2006 (i.e. in the period of extensive economic growth) annual progress report on the implementation of the National Lisbon Reform Programme, the European Commission already considered the intermediate objectives for R&D (1.5% of GDP by 2008, 1.9% by 2010) as “ambitious but not unrealistic” (EC, 2006). By 2009, in a period of economic recession, worsend by the existing need for restructuring of the economy (Varblane, U. et al, 2008), the situation calls for careful and rational re-calculations of the national investment in favour of R&D.

In connection with access to financing, the **significance, or even dependence of EU funding,** should be recognised. Estonia has been eligible for the support provided by the EU Structural Funds and the Cohesion Fund since 1 May 2004, and until 2006 Estonia was allocated €371.4m from the Structural Funds and €428.2m from the Cohesion Fund (Ministry of Finance, 2007)[15]. For the period of 2007-2013, Estonia has been allocated more than €3.4bn from the Structural Funds. In particularly, indicative structural assistance expenditure for activities falling under the

[15] Ministry of Finance, see also http://www.struktuurifondid.ee/index.php?lang=en.

heading of research and technological development, innovation and entrepreneurship is approximately 20%.

Within the EU-SF financial perspective, at least some modest progress towards the targeted GERD/GDP ratio is possible, on the condition of effective administration of EU and national co-financing.

**Table 10: 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 |
|---|---|
| Systemic structural barriers: Natural limitations of resources and demographic situation.<br><br>Unfavourable structural pattern of national economy | **Systemic risk**: the small scale of the economy and has limited RDI resources per se, and these limitations are worsened by the non-competitive economic structure.<br>**Opportunity:** RDI Strategy recognises the strategic challenge to concentrate resources, and increasing role of the public sector in valuing the strategic choices.<br>The programming of the support measures is in line with the complex need to focus, concentrate and share resources: the measures have often dual (R&D and innovation, or R&D and education) objectives and target groups.<br>Policy mix performs well in internationalisation of R&D and strengthening of the HEIs.<br>**Risk:** there are no systematic and integrated policies to initiate and support coherent structural changes in economy and education. There is too much faith on single programmes and high dependence on EU financing. |
| Weak or missing capacity in policy, social and technology foresights sets no focus or wrong focus of investment and HR development plans | **Opportunity:** RDI Strategy acknowledges that policy directions should be based on the forecasts of the future technology areas, and research foresight (RDI Strategy).<br>**Opportunity:** initial public technology foresights in the Development Fund are executed.<br>**Risks:** the policy mix does not support effectively the correlation of knowledge supply and demand (e.g., state-commissioned education vs paid education proportions and structure). |
| Investment, absorption and implementation capacity barriers in business sector: limited competencies and limited resources | **Risk:** no fiscal or social incentives to attract the R&D-oriented FDI or start up local R&D and innovative businesses.<br>**Risk:** the policy mix does not support effectively the correlation of knowledge supply and demand (in the R&D services and personnel supply).<br>**Opportunity**: concentration on the certain limited areas of science, technologies and industrial development (RDI Strategy)<br>**Opportunity**: significant amount of the EU SF available for the R&D investments and HRD needs. |
| Absorption and implementation capacity barriers in PROs and HEIs: Limited competencies or competencies in limited fields | **Risk:** HEIs and PROs face difficulties to achieve the expected policy results (e.g., in the commercialisation of their R&D results).<br>**Opportunity:** RDI strategy has defined the key technology areas where the development focus could be<br>**Opportunity:** The CoE and CC Programmes (focusing respectively on fundamental, inter-institutional/ interdepartmental and joint applied research of private and public sector institutions) have defined present R&D competences in Estonia, and facilitated them further |

# 4 Contributions of national policies to the European Research Area

ERAWATCH country reports 2008 provide a succinct and concise analysis of the ERA dimension in the national R&D system of the country. This Chapter further develops this analysis and provides a more thorough discussion of the national contributions to the realisation of the European Research Area (ERA). An important background policy document for the definition of ERA policies is the Green paper on ERA[16] which comprises six policy dimensions, the so-called six pillars of ERA. Based on the Green Paper and complementing other ongoing studies and activities, this chapter investigates the main national policy activities contributing to the following four dimensions/pillars of ERA:

- Developing a European labour market of researchers facilitating mobility and promoting researcher careers
- Building world-class infrastructures accessible to research teams from across Europe and the world
- Modernising research organisations, in particular universities, with the aim to promote scientific excellence and effective knowledge sharing
- Opening up and co-ordination of national research programmes

In the ERA dimension, the *wider context of internationalisation of R&D policies* is also an issue related to all ERA policy pillars and is normally present in the dynamics of national ERA-relevant policies in many countries.

## *4.1 Towards a European labour market for researchers*

The national need for **internationalisation of research** is driven by human resource factors: decreasing number of students in local universities, aging and insufficient number of domestic researchers, uneven quality of education and research, brain-drain (OECD, 2006, Polt W. et al, 2007).

Another, more strategic and pan-European driver, recognised by the Internationalisation Strategy of Estonian Higher Education for 2006–2015 (IHE), is the impact of ERA policies: the need to consolidate and integrate R&D capacities and competencies to support the growth and competitiveness of Europe. The IHE states the general principles supporting the internationalisation of Estonian HEIs: assurance of equal opportunities, added value for society and local community, and autonomy of universities.

In the practical implementation of the IHE, the legal framework ensuring international mobility and employment of third-country nationals for the purposes of scientific research was adopted in November 2007, and EU citizens and the citizens of Iceland, Norway, Liechtenstein and Switzerland are free to enter Estonia and can work and live here without work or residence permits. Estonian ERA-MORE is designed to assist researchers to take up training and working positions abroad. The

[16] Commission of the European Communities: Green paper: The European Research Area: New perspectives. Brussels 4.4.2007, COM(2007) 161final (see http://ec.europa.eu/research/era/pdf/era_gp_final_en.pdf ).

Estonian ERA-MORE Network consists of two bridgehead organisations and four local mobility centres in the four largest public universities.

**Demand and supply on national labour market for R&D personnel**

Estonia has a relatively smaller proportion of students in the areas of science, engineering, manufacturing and construction, i.e. the areas most contributing to the knowledge-based economy by developing and absorbing new knowledge and technologies, (see e.g. OECD, 2006) [17]. Consequently, both the higher education and business sectors face a **lack of personnel** able to conduct R&D or assist in absorbing the results of R&D or coordinate technology transfer despite the rapid growth of the R&D intensity (Government of Republic of Estonia, 2007). From the business side, according to the Federation of Estonian Engineering Industry's reflection, the number of engineers graduating from HEIs is a quarter of the actual demand for these specialists (Government of Republic of Estonia, 2008a).

The TSCSP should be an effective means to correlate traditionally high demand for a higher education with social and business demands but this mechanism does not seem to be working fully as expected due to the wide supply of paid education (both by public and private HEIs) and strong personal preferences of students (MER, 2008a). Structural gaps and social/business and personal interests in the demand/supply chain are illustrated by the following fact: the Estonian education policy clearly favouring science and technology education via the proportion of SCSP (reaching ca. 40% of all SCSP nationwide during the last decade), and this policy has been relatively successful during the last decade[18], but still, when students pay for their education, roughly 70% of them prefer to study law, business administration, and social sciences (MER, 2008a.). To monitor and direct the performance of HEIs in state-commissioned education, a performance contract system will be implemented by the MER from the 2009/2010 academic year.

HEIs also face challenges in attracting and retaining high quality post-graduates – first, by the limitations of the **student support system** (OECD, 2006)[19], and afterwards due to the **salary rates** (Rõõm, T., 2007)**.** The level of the latter is amongst the lowest in the EU27 (CARSA, 2007), and is also **relatively decreasing**. It is one reason explaining the unattractive nature of a career in the local R&D system (MER, 2007). The employment of foreigners (visiting researchers and PhDs) is also affected by non-competitive compensation conditions (Kirss, L. and Uus, M., 2007). To compensate the lag of salary rates and rebalance the respective budgets of HEIs, the steadily increasing state budget allocations and a set of new programmes launched in 2008/2009 aim to provide extra stimulus to research personnel both in HEIs and PROs.

In conclusion, the demand-supply gap for researchers and technical staff in Estonian society, public and private sectors is high and likely to increase, if no action is taken,, as it is driven by a set of objective reasons: 1) aging personnel in HEIs and PROs, 2)

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[17] In 2002-03, 9% of graduates originated from these study areas compared to an average of 14.2% for the OECD countries. By contrast, 39% of graduates were in the social sciences, business and law, considerably above the average of 30.6% for the OECD area.

[18] According to the MER, for 2008, the highest share of SCSP is in engineering and technology (21%) and science and life sciences (16%).

[19] The student support system in Estonia is extremely limited in its coverage with a vast majority of students on the bachelor's or master's levels receiving no assistance with living expenses. The grant support that is available is very small and allocated on the basis of academic performance. Doctoral students receive monthly ca. 380 EUR.

lack of properly educated young scientists committed to staying in Estonia for reasons of salary, career and social security outlooks, 3) general demographic trends reducing the number of students, 4) inevitable structural changes in the economy, associated with the need for reorientation on knowledge/intensive business models and increasing need for technical staff, and last 5) the need for reliable scientific, social, political and technological advice and foresight.

### 4.1.1 Policies for opening up the national labour market for researchers

The RDI Strategy along with the HE Strategy 2006-2015 sets certain directions to internationalisation of research, particularly on mobility aspects. According to the RDI Strategy, international mobility and free movement of researchers between the academic sphere, public sector and private sector will be promoted.

More specifically for the higher education sector, the IHE manifests the understanding that the international dimension is an inseparable part of the modern higher education and research system. Due to national limitations, and in accordance with the policy priorities in R&D and innovation, the internationalisation of doctor's and master's level education is seen a priority (especially in sciences, life sciences and engineering). Particularly, the IHE strategy stresses the importance of appropriate immigration and social security measures (e.g. public medical insurance) to attract and employ students and staff from abroad, and mobility measures.

**Support to mobility and integration**

Estonia actively facilitates a wide range of international mobility measures/programmes. e.g. the Archimedes Foundation is a coordinator of the COST (European Cooperation in the field of Scientific and Technical Research)[20] programme. With the Estonian Academy of Sciences, UT, TUT, EULS and TU, are members of the European Network of Mobility Centres – ERA-MORE.

The three main science universities (UT, TUT EULS) have a number of bi- and multilateral collaboration agreements and practical activities in place. Particularly, in **thematic collaborations**, the EU's Research Framework Programmes is a major instrument of collaboration between Estonian and foreign researchers. The FP6 projects contributed some €33.1m to R&D funding in Estonia, and funding sourced from FP7 was already €25m by 2008 (Archimedes, 2007, 2008).

Both public and private HEIs actively participate **in educational programmes** like Socrates, Nordplus, and scientific/professional networks like UNICA, BALTECH, The Baltic Sea Region University Network and others. In 2008/2009, several new national programmes, supporting quality, mobility and internationalisation of HEIs, were introduced: DoRa, Mobilitas, PRIMUS (presented in Ch.3.3.2).

Beside the leading public universities, the Estonian Academy of Sciences is active in support of research internationalisation, focusing on researchers' mobility and scientific networking. It is a member (Bridgehead Organisation) of EURAXESS and has signed some 30 bilateral agreements on scientific cooperation with its partner institutions.

[20] See http://www.cost.esf.org/.

### 4.1.2 Policies enhancing the attractiveness of research careers in Europe

**Uptake of the Charter of Researchers**

The Charter for Researchers is not yet signed by any Estonian HEIs. To adopt the main principles of the Charter, all six Estonian public universities[21] have signed on 6 December 2007 **the Agreement on Good Practice in the Internationalisation** (AGPI) of Estonia's Higher Education Institutions. Particularly, the AGPI states that the participating HEIs shall announce all their academic vacancies in the domestic and international media, including the European Researchers Mobility Portal, HEIs provide information and practical assistance to international researchers and teaching staff in relation to work arrangements, etc. In terms of recognition of qualification, HEIs are committed to ensuring "fair and reliable evaluation and recognition arrangements in respect of the qualifications that an international researcher or teaching staff member has acquired outside Estonia." (Rectors' Conference, 2007).

Implementation of these principles of the AGPI is supported by detailed internal organisational procedures and by the personnel departments in the participating HEIs.

**Remuneration policies; General employment conditions at Universities**

The Estonian **Universities Act** provides universities with a significant decree of self-governance and autonomy, including rights to set their academic and other collaborations, employment requirements and conditions, and salary rates, distribute internally the state (and other) non-competitive, generic funding allocations, etc.

Based on the law and the respective sub-laws, every university is entitled to regulate its internal election procedures, employment conditions and related issues (like contract forms, extra remuneration, or similar) based on the decisions of their councils. The salary level and other conditions of employment are established in an employment contract, based on the regulations of the university but with full accordance with the articles of the Employment Contracts Act on general working time, holidays and vacations, maternity benefits, parental leave, social and public health securities, etc.

More generally, Estonian employment legislation (Riigikogu, 1992) effectively considers the rights of female employees during pregnancy, on maternity leave or childcare leave. Under fixed-termed employment contracts, common in HEIs and PROs, a vacancy shall not be announced if the female employee holding the position is pregnant, on maternity leave or childcare leave. Only a temporarily appointed employee could fill this position.

**Promotion of women** is often seen as an additional source to increase the potential of the R&D labour market, but it is not the case in Estonia – the labour market has always been characterised by a high employment share of women[22] and amongst all employed persons, the share of women is steadily around 50%. It clearly indicates high demand for female employees, and the R&D sector is not an exception since the share of female employees is also approximately 50% (Estonian Statistics online,

[21] UT, TUT, Estonian Academy of Arts, EULS, Estonian Academy of Music and Theatre, Tallinn University.

[22] The labour participation rate of women in age group 16 until pension age is ca. 70%.

2003-2007).

However, closer assessment of other employment indicators like employment structure or wages does raise concerns about equality. The most striking finding is a significant wage gap on average, between 1998-2000, wages paid to women in Estonia amounted to 72.7% of the wages paid to men (PRAXIS, 2004). The difference between the remuneration (average weighted total yearly salary) of female researchers and male researchers in international comparison is even 42.93% (CARSA, 2007), which is the absolutely largest difference in the EU[23].

The comprehensive assessment of women employees in science, and the engineering and technology sectors (UT, 2005) shows that a part of the wage gap could be explained by factors like different productivity of women and men or differences in salary conditions in different science fields/universities. The study also highlights another, more important reason, clearly associated with the gender stereotypes and career development perspectives, namely that the highest (and relatively well-paid) academic positions (professors, docents, senior researchers) are dominated by men[24].

In conclusion, even if women choosing R&D careers in Estonia could rely on a high degree of social and employment security when combining career and maternity, they face some structural, career progression and income limitations in science professions.

## *4.2 Governing research infrastructures*

On a strategic level, Estonia has expressed a general commitment to participate in the international joint programmes and infrastructure projects coordinated by science organisations where the country holds membership. In practice, international collaboration in RI has been hindered by the lack of a national strategy for RI development (discussed in 3.2), and resource limitations. 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 **Nordic-Baltic collaboration** is relatively wide (Reid & Walendowski, 2006), and based on direct bilateral collaboration arrangements between HEIs and PROs. Only in 2008 have concrete perspectives to collaborate with neighbouring countries in the establishment of joint RI facilities been envisaged. Discussing the **opportunities for Estonian - Finnish cooperation in R&D** (during the joint meeting of Finnish and Estonian R&D Councils in April 2008), some possibilities for joint RI were raised by the Finnish side: cooperation between CoEs in both countries, development of new joint research infrastructures and joint targets on the European level in the formulation of the ESFRI policies and priorities, particularly focusing on medium-sized and unique infrastructures (e.g. biomedical areas, drug development, various

[23] These controversial differences appearing in the CARSA study can be partly explained by the sample structure (number of replies extremely small, distribution of the total number of replies by scientific domain and gender is very unbalanced and life sciences and engineering sciences are clearly over-presented compared with social, humanities, some science areas missing).

[24] Despite the fact that ca. 52.8% of the Estonian PhD students are female (in 2004-2006); also the share of female researchers and engineers with PhDs in public HEIs and PROs is much less – ca. 33% (Estonian Statistics, 2006) and women hold less than sic! 5% of full professorships nationwide.

robotised systems for structure biology, protein analysis, etc. (State Chancellery, 2008)

Based on Estonia's successful participation in the EU FP (Archimedes, 2007) and under the framework of the Joint Research centres, and participation of Estonian officials in ESFRI and FP consultations, Estonia has indicated a willingness to initiate or facilitate joint RI projects particularly medium-scaled[25].

**Existing Estonian RI**

**The national joint RI strategy** is based on the so-called core laboratories concept, and establishment of the network of core laboratories (joint-use by R&D and business users) are envisaged in the AP Growth and Jobs. Concept elaboration is planned from 2009. The MER has also formulated a set of initial strategic principles for national RI development in HEIs and PROs (Government of Republic of Estonia, 2008b).

At the present time, all RI facilities belong to the respective HEIs or PROs, but the public HEIs are in principal ready to provide access to their RI to partner-organisations (e.g., for CCs, CoEs).

In terms of **virtual or partly physical RI** of distributed, international use, the **Grid technology platform** (e-infrastructure for distributed computing and data management) development in the Institute of Chemical Physics and Biophysics is noteworthy. The Institute is the local coordinator of several international and regional Grid projects: Baltic Grid, Nordic Grid Neighbourhood, Visby Network for Internet-based applications, etc, and a coordinator and developer of the Estonian Grid.

Another example of the (potential) joint RI under development, is a **biotechnological database** – Estonian Genome Bank Project, carried by the Estonian Genome Project Foundation (EGPF)[26]. The database will be accessible to research both for Estonian and foreign scientists, investigating links between human genes, environmental factors and common diseases (cancer, diabetes, depression, etc.) and application of the findings in close research areas (genomics, epidemiology, pharmaceuticals). For research in arts and humanities (e.g. under HERA framework), the **digital library and collections** of the National Library of Estonia are accessible[27], and integrated with the virtual European Library.

## *4.3 Research organisations*

As it was already noted in 2.2, 3.1 and 4.1.2, Estonian public universities posses a high degree of autonomy, assured by the Universities Act. The exceptionally high autonomy compared with any other public body has a long historical background.

The **council of the university** is the collegial decision-making body of a university, the procedure for the formation of which and the bases for the activities of which are provided for in the **statutes of the university**. The council of a university 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, like **approval of the statutes**, **adoption of budget, investment and development plans, approval of the curricula,** decide on the university **joining international organisation**s, and

[25] ftp://ftp.cordis.lu/pub/fp7/docs/estonian_fp7position.pdf
[26] http://www.geenivaramu.ee/index.php?lang=eng
[27] http://www.nlib.ee/17535

annually establish the **rate for the reimbursement of study costs**, etc. (Universities Act,). The immediate direction and management of a university is executed by an **elected rector** (elected for five years pursuant to the statutes of the university).

Autonomy, self-governance and the relative **financial independence** of public universities are supported by the state financing system (described in 3.1). However, more importantly, universities have rights to enter in **agreements under civil and commercial law,** e.g. a university has the right to accept property, including securities, provide services related to the main activities of the university for a charge (regular and continuing education for a charge, contractual research, professional consultations, etc.), to obtain credit (all under the regulation of the Statute and with the permission of the council of the university).

During the last 4-5 years, the leading science universities have become more oriented to social dialogue with student unions, and to partners outside the academic sector (especially businesses and NGOs) via the specially appointed consultative Board (members represent different political and economical institutions, and approved by the Government for 3 years), alumni organisations and sponsorship committees (TUT, 2006, TUT, 2008, UT, 2007). The performance contracting (with the owner, i.e. the State) concept will be introduced in the HEIs from the 2009/2010 academic year but it only covers State commissioned education.

## *4.4 Opening up national research 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. In connection with the research of the higher education sector, the focus on the internationalisation is more important (MER, 2006b), and several mobility measures (they were presented in the previous chapter), are specifically targeting foreign researchers.

Other state RDI policy support programmes, and the targeted financing and the ESF grant financing are open only for applicants-organisations located in Estonia but there are no restrictions for a foreigner to be employed and participate in the applying research teams. Two national programmes are in principal open, as part of Estonian led consortia, to foreign researchers and companies: the Centres of Excellence Programme and the Competence Centres Programme.

Estonian participation in ERA-NET is relatively modest, despite the increasing activities under the other framework initiatives (Archimedes, 2007, ERA-NET Review, 2006): under the FP6, Estonia participated in 15 projects. The participation in full ERA-NETs is also amongst the lowest – number of participation is 12 of the 899 subtotal (ERA-NET, 2006). Still, the beneficial participation in the certain projects under the FP6, e.g. in BONUS[28] and the MANUNET (focused on manufacturing), energy project FENCO (Matrix-Ramboll, 2008) has proved the importance of the ERA-NETs, and the country intends to participate in the projects further, under the FP7. E.g., Estonian scientists are already involved in Research Networking Programme, ERA-NET Plus programme, and several regional projects (MER 2007, MER 2008c).

[28] BONUS for the Baltic Sea science – network of funding agencies, http://www.bonusportal.org

## 4.5 National ERA-related policies - a summary

Integration in the ERA is one of the key priorities of Estonian research and higher education policies as due the natural resource limitations of a small-population and economy, and international competition, the country is not able to optimise its R&D potential.

Development of the labour market for researchers, while in line with the ERA concept, is obviously driven by national factors: unfavourable demographic conditions (causing the lack of personnel, the ageing staff in the HEIs and shortage of students) and non-competitive remuneration conditions, compared with foreign R&D systems. As seen in Table 9, the topic is comprehensively elaborated both at the strategic political and organisational levels.

One particular ERA dimension, the assurance of the autonomy of HEIs, is not a hot topic in Estonia. The relevant laws already effectively support autonomy, self-governance and relatively high financial independence of the public universities.

Moreover, as it was shown in the Chapter 4.3, there is a current trend to integrate the interests of the highly autonomous HEIs with the needs of society and stakeholders.

For Estonia's HEIs centred research system, the ERA concept supports the institutional strategies to modernise and internationalise the academic system on the organisational level, but due the extensive autonomy of the public universities and the high total number of the universities (10 in a country of some 1.3 million people), the national research system in general remains fragmented. The research system clearly needs more active political prioritisation, and channelling of the state and the EU funding towards curricula development, research planning and infrastructure developments in HEIs need to be more consistent with the wider socio-economic needs.

The most urgent topic, closely related to the ERA, is the need for sharing of RI or consolidation and specialisation on RI between the HEIs. The public universities are leading some practical bottom-up initiatives, and have expressed their commitment to the set up the joint and shared RI but their activities are most likely driven more by the pragmatic reasons than the ERA conceptual framework. Still, along with the increasing participation of Estonian research organisations in projects and in the ERA-NETs of the EU'S FPs, the importance of the shared and joint RI for the national R&D system will most likely increase.

Opening up the national research programmes is focused, due the internationalisation of the HEIs, on researchers' mobility, and linked closely to the development of labour market for researchers, discussed earlier.

In conclusion, the exact role of the ERA dimension in the national research and higher education policies, others than the labour market for researchers, is arguable and uncertain. Despite the general political recognition of the importance of the ERA, the other dimensions are relatively underdeveloped (RI, opening up the national research programmes) or not relevant (the autonomy of HEIs).

**Table 11: Importance of the ERA pillars in the ERA policy mix and key characteristics**

| | Short assessment of its importance in the ERA policy mix | Key characteristics of policies |
|---|---|---|
| Labour market for researchers | • The central principle of the RDI strategy, HE and IHE Strategies is to encourage national as well international cooperation between all counterparts.<br>• Equal treatment, non-discrimination and quality of teaching and research are basic principles.<br>• For researchers, the labour market is badly affected not only by demographic reasons but also low supply of science and engineering graduates, and international competition for "brains."<br>• Hence, compared with the general strict immigration policies (if applicable), the R&D personnel and students are treated under a favourable regime. | • Wide, diversified set of mobility support measures – both for Estonian and foreigners, on all 3 levels, but particularly focused on master's and doctoral studies.<br>• No restriction for study or employment in R&D for foreigners (conditions depend on the origin, e.g. for EU and EAA – accessible with no limits)<br>• AGPI signed by all public universities, advertising open academic vacancies internationally<br>• Leading science universities declared their principles to be in accordance with the Charter of Researchers<br>• Repatriation support for Estonians, studied or worked abroad |
| Governance of research infrastructures | • The set up or participation of joint or shared RI is strategically important (RDI Strategy), due to the limited financing of RI by national means only.<br>• Need for national RI strategy is clearly expressed and the concept for core laboratories of shared RI should be elaborated (RDI Implementation Plan) | • Nationwide, strong support for institutional concentration of research and education, and due to that, prioritisation of public universities<br>• The internal policies of the leading science universities, UT and TUT support, according to their strategy plans, set up joint RI and shared use. |
| Autonomy of research institutions | • Development and facilitation of autonomy is supported by stable state funding instruments, a wide set of mobility support measures and individual programmes (R&D investments, SPINNO, CoE, etc.).<br>• State-commissioned education of all levels is visibly concentrated in public universities. | • Autonomy of universities is assured by law and effectively implemented (full self-governance)<br>• Steady institutional financing<br>• Public universities have a relatively high degree of financial independence and some universities also have various other sources of financing than the state (or EU SF). The universities also have the right to establish paid student places<br>• Consolidation of activities of public universities (via the Rectors Conference) in mobility support and other shared strategic interests |

| | Short assessment of its importance in the ERA policy mix | Key characteristics of policies |
|---|---|---|
| Opening up of national research programmes | • This pillar is not central or priority due to the practical reasons and limitations. International collaboration as a part of programme activities is highly appreciated. | • In state-financed targeted financing and research grants, institutional applications are accepted by local HEIs and PROs only, but the foreign researchers could be included in the research teams. Personal applications are accepted only from researchers employed by a local institution (the exception is the mobility support for foreigners)<br>• As a rule, individual programme measures are specifically targeting Estonian organisations, except CoE and CC. Several programmes are open for facilitation/employment of foreign specialists, technology or R&D services (e.g. Innovation staff involvement). |

# 5 Conclusions and open questions

## *5.1 Policy mix towards national R&D investment goals*

The main barriers for public and particularly business sector investments in R&D are structural limitations of the national economy and fiscal policies, deepened by the ongoing economic recession.

Even if the fiscal policy of Estonia has proven to be successful in supporting business investments, it has been less successful in "fostering innovation-based economic development as the fiscal policy does not particularly promote knowledge-intensive business, recruitment of research and development personnel and investments creating the above average added value" (The Government of republic of Estonia, 2006). Specifically for the business sector, relatively low (compared with the EU27) investment capacity is partly explained by a concentration of FDI in sectors not performing R&D, and negative outlooks to attract new FDI or investments by existing foreign owned firms. Even if fiscal policy constraints are recognised, no policy documents discussing any tax or social incentives in favour of R&D investments have been foreseen to date (2009). As a result, attracting R&D firms from abroad (route 4) is not a focus of practical policy, and there are no support measures (except promotional activities) in place.

For other policy routes it is common that due to integration of Estonian R&D and Innovation policies, the majority of specific programmes have a dual or mixed nature and more than one target group. Programmes are sometimes oriented or consolidated thematically (e.g. CoE) but not necessary. Many of them are elaborated to support a mix of the performance, quality or competitiveness objectives without any thematic focus (e.g. Awareness programme, Technology vouchers, etc.).

Policy mix routes focusing on the support knowledge-intensive development model of the national economy are more advanced and presenting various measures to promote the establishment of new indigenous R&D firms; to stimulate greater R&D investment in R&D firms, and stimulate firms that do not perform R&D yet. Due to the structural limitations of the national economy and a need to increase the business sector R&D expenditures, routes 2 and 3 are crucially important.

Most of the measures elaborated to support these routes have the purpose of supporting R&D and innovation, or supporting R&D (except the public seed venture capital of the Development Fund) and they are complementary to each other. Several new measures (Transfer of research-intensive technologies, Involvement of innovation staff, Innovation vouchers) are introduced and reinforcement of the "old" programmes (CC and R&D projects, Awareness programme) should provide various forms of support for business sector R&D strategies.

The other two policy mix routes (5 and 6) – increasing extramural R&D carried out in cooperation with the public sector or other firms and increasing R&D in the public sector – are traditionally important and remain in the centre of the national RDI policy. Route 6 is especially important, as it supports internationalisation and competitiveness of the national HEIs and PROs and deals with a permanent challenge, the gap between knowledge supply and demand. The latter is also a focus of route 5, and the policy measures included here address in a practical way several systemic barriers in R&D investments, particularly – intramural pattern of BERD, institutional and supply-demand barriers between R&D and business organisations.

Some of the programmes under policy mix route 6 are also aimed to supplement generic state financing (e.g. R&D investments programme) and all of them in line with ERA policies, especially the set of mobility measures (MOBILITAS and DoRa).

## 5.2 ERA-related policies

The ERA concept is recognised as an important driver for Estonian R&D policy. E.g. participation of HEIs and PROs in European initiatives like FP, COST, EUREKA, ERA-NET is strongly encouraged (MER, 2006a) and supported by several programmes and public co-financing (e.g. baseline funding, CoE programme, etc.). Even if the initial motivator for participation in ERA-related activities (FPs, EU mobility programmes) is partly financial (Männik. et al, 2008), the professional and personal motives of Estonian scientists to be a part of the international research community should not be under-estimated (see Archimedes, 2006, 2007; Kirss, L. and Uus, M., 2007).

Indeed, the main policy components (especially on the implementation level) contributing to the ERA the most are mobility of academic staff and internationalisation of Estonian HEIs. The set of national support programmes on mobility and internationalisation (both for national and foreign applicants) has notably progressed in 2008, and several new initiatives are introduced in 2009. Hence, EU ERA policies have positively inspired the national programmes in mobility and scientific networking.

The in-house internationalisation strategies of the leading HEIs (e.g., TUT Development Plan, TUT, 2006; UT Development Plan, UT, 2007) effectively support the mobility of staff and non-discriminative employment for foreigners, contributing to the sharing of knowledge and realisation of a single labour market for researchers. Launching and implementation of the AGPI in the public HEIs and the transparent state regulations for immigration and employment of foreigners also support this ERA pillar.

Being the core elements of the national R&D system, highly autonomous Estonian universities effectively promote the basic principles of ERA – share of knowledge, networking and interdisciplinarity. Still, many efforts are needed to make the Estonian R&D system and institutions truly attractive in terms of working and salary conditions,

and competitive internationally. The performance contract system (between the state and HEI) is the most recent initiative (2009) to facilitate steady performance and competitiveness of HEIs.

One particularly challenging ERA-related topic is the elaboration of the national strategy for joint research infrastructure and optimisation of the existing research infrastructure. The main objective constraints are low public and business investment capacities and a politically underdeveloped strategic framework for research infrastructure development. Only very initial RI development principles are formulated (MER 2007, MER 2008b) and there is no visible progress in establishment of the shared RI locally or regionally (e.g., in the Baltic Sea region).

# References

*NB: statistics used in this report are drawn either from the Eurostat or Statistics Estonia's databases.*


Archimedes (2006): Eesti osalemine 6.raamprogrammis. Euroopa Liidu teadus- ja arendustegevuse 6.raamprogramm (2002-2006).

Archimedes Foundation (2007): Researcher Mobility in Estonia and Factors that Influence Mobility.

Arnold, E., Männik, K, Rannala, R. and Reid, A. (2008): Mid-term evaluation of the competence centre programme. Technopolis Group for the Estonian Ministry of Economic Affairs and Communication

Bank of Estonia (2008): Economic policy statement of Eesti Pank (Bank of Estonia) from 15.December 2008

Brighton, R., Kells, A., (2007): Innovation Studies, No 8/2007, Evaluation of the SPINNO programme. Final report to Enterprise Estonia

CARSA (2007): Remuneration of Researchers in the Public and Private sectors. Final report. 2007. By CARSA for the European Commission.

Government of Republic of Estonia (2008a): Action Plan for Growth and Jobs 2008-2011 for implementation of the Lisbon Strategy.

Government of Republic of Estonia (2008b): Implementation Plan of RDI Strategy for 2007-2013 (approved by the Government Decree nr 533 18.12.2008)

Government of Republic of Estonia (2007): Estonian National Strategic Reference Framework 2007-2013 and Operational Programmes.

ERA-NET (2006): The Report of the Expert Review Group. CORDIS 2006 http://ec.europa.eu/research/fp6/index_en.cfm?p=9_eranet

Estonian Statistics (2008): Statistical yearbook of Estonia./ Eesti statistika aastaraamat 2008

European Commission (2006): Annual progress report of NDP 2002-2006, http://www.riigikantselei.ee/failid/2006_annual_report_estonia_en.pdf

INNOVA (2008): Sectoral Innovation Watch report 2008. The European Commission's ´Europe INNOVA´ initiative (see at http://www.europe-innova.org).

Kirss, L. and Uus, M., (2007): National Report on the Implementation of the Socrates and Leonardo Programmes: ESTONIA. Commissioned by: Estonian Ministry of Education and Research through Archimedes Foundation.

Kurik, S., Lumiste, R., Terk, E., Heinlo, A., (2006): Innovation in Estonian Enterprises 1998–2006, Community Innovation Survey. Ministry of Economic Affairs and Communications, Tallinn

Landesmann, M., (2000): "Structural Change in the Transition Economies, 1989 to 1999", Economic Survey of Europe, UN Economic Council of Europe, Geneva

Männik, K., Reid, A., Allinson, R., Bruno, N., van der Veen, G. (2008): Technology investment programme: feasibility study (report in Estonian), Ministry of Economic Affairs and Communications, Tallinn http://www.technopolis-group.com/resources/downloads/tehnoloogiainvesteeringute_teost_raport.pdf

Matrix-Ramboll (2008): Evaluation and impact assessment of the ERA-NET scheme and the related ERA-NET actions under the 6th Framework Programme. 2008. Draft Final Report for the European Commission.

MEAC (2007): Majandus- ja Kommunikatsiooniministeerium./ Tööjõu vajaduse prognoos aastani 2014.

MEAC (2005): Majandus- ja Kommunikatsiooniministeerium. Tööjõu vajaduse prognoos aastani 2011.

MER (2003): RDI Strategy/ Teadmistepõhine Eesti. Eesti teadus- ja arendustegevuse strateegia.

MER (2006a): EHI Strategy/ Eesti kõrghariduse rahvusvahelistumise strateegia aastateks 2006–2015.

MER (2006b): HE Strategy/ Eesti kõrghariduse strateegia aastateks 2006–2015

MER (2007): RDI Strategy Implementation Plan 2007 Annual report/ Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia 2007-2013 "Teadmistepõhine Eesti" strateegia eesmärkide ja rakendusplaani täitmisest 2007. aastal.

MER (2008a): Statistical overview on SCSP./ Statistiline ülevaade kõrghariduse õppekavadel õppijate näitajatest. Haridus- ja teadusministeerium

MER (2008b): RDI Strategy Implementation Plan for 2007-2013/ Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia rakenduskava 2007-2013

MER (2008c): RDI Strategy Implementation Plan 2008 Annual report/ Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia 2007-2013 "Teadmistepõhine Eesti" strateegia eesmärkide ja rakendusplaani täitmisest 2008. aastal.

Nedeva, M., Georghiou, L., (2003): Assessment of Estonian R&D and Innovation Funding System. PREST, The Victoria University of Manchester, UK

OECD (2007): Review on the Tertiary Education for Estonia. OECD kolmanda taseme hariduse temaatiline ülevaade.

Polt, W. et al, (2003): Evaluation of Estonian RTDI Policy Mix. Results of OMC Peer Review Report, Country Report for Estonia.

PRAXIS (2004): Men and Women in the Estonian Labour Market: An Assessment of the Gender Wage Gap. Tallinn

PREST (2003): Assessment of the Estonian Research Development Technology and Innovation Funding System.

Rectors Conference (2006): Agreement on Good Practice in the Internationalisation

Reid, A. and Walendowski, J., (2006): Evaluation of the design and implementation of Estonian RTDI policy: implications for policy planning. Report to the Ministry of Economic Affairs and Communications. Tallinn

Research and Development Council (2003): Competitiveness and Future Outlooks of the Estonian Economy. R&D and Innovation Policy Review.

Riigikogu (1992): Employment Contracts Act/ Eesti Vabariigi Töölepingu seadus. Vastu võetud 15. 04. 1992. a seadusega (RT 1992, 15/16, 241), jõustunud 1. 07. 1992.

Riigikogu (1995): Universities Act. / Ülikooliseadus (RT I 1995, 12, 119; RT I 2003, 33, 206)

Riigikogu (1997): Research and Development Organisation Act/ Teadus ja arendustegevuse korralduse seadus (RT I 1997, 30, 471)

Riigikogu (2009): Supplementary State Budget, 2009. /Riigi 2009. Aasta lisaeelarve ja sellega seonduvare seaduste muutmise seadus. Vastu võetud 20. veebruaril 2009. a.

Rõõm, T. (2007): Haridus ja tööturg Eestis, Eesti Panga Toimetised 12/2007

State Chancellery (2008): Summary of the Joint Meeting between the Science and Technology Policy Council of Finland and the Estonian Research and Development Council in Tallinn, on 15 April 2008.

State Chancellery (2007): Implementation of the EU Sustainable Development Strategy in Estonia. Estonian input into the European Commissions progress report on the implementation of a European Union Sustainable Development Strategy.

TUT (2006): TUT Development Plan, 2006-2010./ Tallinna Tehnikaülikooli arengukava 2006-2010. NÕUKOGU OTSUS 24.jaanuarist 2006 nr 10

TUT (2008): TUT Yearbook, 2008. / Tallinna Tehnikaülikooli aastaraamat 2008. Tallinn

UT (2005): Tackling stereotypes. Maximising the potential of women in SET". Estonia – Report. National Situation of Women in Science, Engineering and Technology (SET). Stereotypes Recruitment, Retention and Progression of Women in SET. 2005.

UT (2007): UT Development Plan until 2015./ Tartu Ülikooli arengukava aastani 2015. Vastu võetud Tartu Ülikooli nõukogu 19.dets. 2007 otsusega nr.69

UNCTAD (2007): World Investment Report: www.unctad.org/wir or www.unctad.org/fdistatistics

Varblane, U. et al, (2008): The Estonian Economy Current Status of Competitiveness and Future Outlooks. Study report. Estonian Development Fund, Tallinn.

World Economic Forum (2008): Global Competitiveness Report 2008.

# List of Abbreviations

| | |
|---|---|
| AP Growth and Jobs | Action Plan for Growth and Jobs 2008-2011 for implementation of the Lisbon Strategy |
| AGPI | Agreement on Good Practice in the Internationalisation |
| BERD | Business sector expenditures on R&d |
| CC | Competence centre(s) |
| CoE | Centre(s) of Excellence |
| ERDF | European Regional Development Fund |
| FP | European Framework Programme for Research and Technology Development |
| GERD | Gross expenditures of R&D |
| GOVERD | Government expenditures of R&D |
| IHE | Strategy on Internationalisation of Higher education until 2015 |
| HEIs | Higher education institution(s) |
| HES | Higher education sector |
| HE Strategy | Higher education strategy for 2008-2015 |
| HRD | Human resources development |
| MEC | Ministry of Economic Affairs and Communications |
| MER | Ministry of Education and Research |
| NPO | Not-for profit organisation |

| | |
|---|---|
| NSRF | National Strategic Reference Framework |
| PRO | Public Research Organisations |
| RI | Research infrastructure |
| R&D | Research and development |
| RDI Strategy | Research, Development and Innovation Strategy for 2007-2013 |
| SF | Structural Funds |

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**Abstract**

The main objective of the ERAWATCH Policy Mix Country reports 2009 is to characterise and assess in a structured manner the evolution of the national policy mixes in the perspective of the Lisbon goals, with a particular focus on the national R&D investments targets and on the realisation and better governance of the European Research Area. The reports were produced for all EU Member State and six Associated States to support the mutual learning process and the monitoring of Member and Associated States' efforts by DG-RTD in the context of the Lisbon Strategy and the European Research Area. The country reports 2009 build and extend on the analysis provided by analytical country reports 2008 and on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

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