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RIO COUNTRY REPORT 2015: Estonia

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Abstract

The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union. The executive summaries of these reports put forward the main challenges of the research and innovation systems.

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Foreword

The report offers an analysis of the R&I system in Estonia for 2015, including relevant policies and funding, with particular focus on topics critical for EU policies. The report identifies the main challenges of the Estonian research and innovation system and assesses the policy response. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The quantitative data is, whenever possible, comparable across all EU Member State reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in February 2016. The report contents are partly based on the RIO country report, 2014 (Ruttas-Küttim, 2015).

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Executive summary

Context

The Estonian economy, like the other Baltic economies, was strongly affected by the 2009 crisis (GDP fell by 14%). Economic growth was restored in 2010, reached 8.7% in 2011 due to increased exports, but slid back to 5.2% in 2012 and to 1.6% in 2013 as foreign demand fell. In 2014 the GDP growth has restored again with 2.9%. The recovery of Estonia's economy was driven mainly by exports. A very strong fiscal position also helped restore financial market confidence. Still, the average GDP per capita remains under the EU28 average – 73% in 2014, which leaves Estonia the recipient of full Cohesion policy support. The structural weakness of the national economy remains, with a relatively low share of high technology and knowledge-intensive companies.

The economic crisis affected seriously the Estonian economic output but the post-crisis fiscal adjustment process has not come at the expense of public support to the Estonian R&D. Even though the country was under pressure to implement fiscal consolidation with pro-cyclical government expenditure patterns, it has maintained, and soon after the peak of the crisis, increased its public spending on R&D. In other words, the sharp decrease in GDP and total government expenditure was not matched by a proportional drop in R&D expenditure. The relatively stable financing was partially due to the previously committed EU Structural Funds, notwithstanding the 9% drop of the regular support measures of R&D activities in MER budget in 2009.

According to the latest Innovation Union Scoreboard (2015), despite some progress in the recent years, Estonia's innovation performance is still below the EU average. Estonia's performance relative to that of the EU average has been improving from 81% in 2007 to 94% in 2013 but fell to 88% in 2014 which is the reason why the country lost its position as an innovation follower and is now classified as a moderate innovator.

The overall level of R&D investments as a percentage of GDP almost doubled in 2008-2011 (from 1.26% to 2.34%), but slid back to 2.16% on 2012. In 2013 and 2014 GERD as a percentage of GDP (1.74% and 1.46% respectively) fell below the EU-28 average of 2.03% due to declining business R&D investment (from 1.29% of GDP in 2012 to 0.54% in 2014) reflecting a one-off investment boom in oil shale research and technology in 2011 – 2012 by a single company – Eesti Energia. This indicates that Estonian business R&D is concentrated in a limited number of companies¹. The public sector R&D expenditure on the other hand has remained stable. The share of government sector investments (GBOARD) as a percentage of GDP has been growing steadily between 2008 and 2013 (from 0.63% to 0.82%) but fell to 0.76% in 2014.

Key developments in the R&I system in 2015 included:

- In January, the Full Report on the "Research and Development and Innovation Strategy 2007-2013 "Knowledge-based Estonia 2007-2013" was presented to the Government. According to the report, Estonia's RDI system has developed considerably - the number of top-level scientific publications has been growing from 0.8 to 1.43 top-level publications per 1000 inhabitants; the share of scientists and engineers in the total labour force rose from 5.6 to 7.1 persons per 1000 employees; a lot has been achieved on the modernisation of infrastructure and technology, internationalisation of research and on science popularisation. The main challenge is to further develop the research and innovation system in ways that it will have bigger impact on the society.

¹ State Audit Office (2014): 90% of research and development expenses in Estonia are incurred by fewer than 100 companies

- The Ministry of Economic Affairs and Communications carried out evaluations of enterprise and innovation policy to assess the measures implemented and the impact, effectiveness and feasibility of those measures: the implementation and the potential of demand-side innovation policy instruments were assessed² and the designed financial instruments from the Cohesion Policy 2014-2020 funds were evaluated ex-ante, giving suggestions for use of financial instruments such as loans, state guarantees and credit insurance.
- Estonia is well aligned with many ERA policies, but its capacity (human and financial resources) to participate in different international initiatives is limited because of the size of the country; consequently, choices have to be made for optimum use of those resources.
- The Estonian R&I policies demonstrate a strong focus on the promotion of knowledge transfer and support for applied research and higher education specialization in the areas of smart specialization, as well as a gradual shift towards increased use of financial instruments.
- The identified challenges for Estonia's R&I system are:
 - Intensifying prioritisation and specialisation in the research and innovation system;
 - Collaboration between science and industry and research commercialization – there seems to be a mismatch between the needs of the business sector and the provision of knowledge from the public sector;
 - Internationalisation and addressing the scarcity of human resources – Estonia is still suffering from a low number of new doctoral graduates and the share of foreign doctoral students remains low.

² The concept of the application mechanism of a new measure “State as a smart customer” is currently being developed.

R&I Challenges

Challenge 1: Intensifying prioritisation and specialisation in the research and innovation system

Description

Estonia received country specific recommendations in the 2012, 2013, 2014 and 2015 European semester cycles. The Council recommendations have been almost identical during the years 2013-2015 and they focus on intensifying prioritisation and specialisation in the research and innovation system. The 2015 CSR is worded as follows: "Focus public support for research and innovation on a coordinated implementation of the limited number of smart specialisation areas."

Estonia does not have a separate national or regional R&I strategy on Smart Specialisation. Instead, the country's smart specialisation framework comprises the Entrepreneurship Growth Strategy (adopted by the government in October 2013) and the Research, Development and Innovation Strategy (adopted in January 2014).

Synergy in the implementation of the two strategies is critical for stimulating RD&I investment in Estonia. Part of the problem is exactly the fact that the S3 is "divided" among two strategic documents and it is not clear to what extent the focus of the S3 priorities is shared between the public research and the business sector. Moreover, according to the Innovation Union progress report 2014 for Estonia, there is little correlation between the areas of Estonia's scientific production (measured by the number of publications) and technological production (patents).

Policy response

The two above mentioned strategies, the Entrepreneurship Growth Strategy and the Research, Development and Innovation Strategy 2014-2020 came as a response to the CSRs of 2013 and 2014 on fostering the prioritisation and the specialisation of the research and innovation systems. In the Implementation plan for the RDI strategy approved in September 2014, the responsibilities for R&D policies have been clarified, the process of establishing smart specialisation growth areas has been set up and growth areas have been narrowed down. The S3 process was guided by the Estonian Development Fund.

Estonia has identified the following smart specialisation growth areas:

- ICT supporting other sectors (use of ICT in industry including automation and robotics, cyber security, software development);
- Health technologies and services (biotechnology, e-health);
- Resource efficiency (material science and industry, knowledge-based construction, health-promoting food industry, chemical industry).

The budget for Smart Specialisation in 2014-2020 (including structural funds and state budget co-financing) is planned to be about €140m (Estonian Development Fund, February 2015), which is a significant amount considering that the total Estonian GERD in 2013 was €326m.

In its Estonia 2020 Action Plan 2014-2018, the government plans to launch a smart specialisation monitoring system in 2015, to develop a longer term and more strategic model of cooperation for technology development centres and (industrial) clusters, linking both formats to smart specialisation and to start the SF funded programme "Supporting applied research in growth areas of smart specialisation" 2015 - 2020.

Assessment

Now that Estonia has come up with its smart specialization areas (although the process has been rather top-down, oscillating between narrowing down and broadening the priorities not necessarily as an outcome of an entrepreneurial discovery process), it needs to set up a sound implementation system to support it. The operational programmes have been approved but the instruments that have been designed to support smart specialization are too recent to be assessed. In any case, the key issue in successfully addressing the 2015 CSR is to ensure synergies in the implementation of the two strategic documents related to RD&I and to avoid an overlap of measures that are too small and too fragmented to be impactful. In order for public spending to be maximally efficient, investing in smart specialisation high-growth areas to increase the return on public investment in R&D should be the guiding principle for targeting priority areas (OECD, 2014). Through the Estonian Entrepreneurship Growth Strategy, the government aims to shift to a more market-based approach to public support, with fewer direct grants and more financial instruments, including venture capital. Whether this would be a successful strategy remains to be seen.

Challenge 2: Enhancing collaboration between science and industry and research commercialization

Description

The need to address the weak cooperation between science and business is identified as a major challenge of the Estonian R&I system in the CSRs for 2012, 2013 and 2014 as well as the Country Reports issued by the European Commission in the frame of the European Semester exercise³. There seems to be an inherent mismatch between the needs of the business sector and the provision of knowledge from the public sector.

There are many factors that signal that the level of knowledge transfer and research commercialization is low in Estonia. The share of privately funded publicly performed R&D as a share of the research spending (GERD), a proxy indicator for the collaboration between academia and business, was 1.96% of GERD in 2013 and 2.09% in 2014, below the EU-28 average⁴. In addition, according to the Community Innovation Survey 2012 only 10.8% of the total sample of innovative companies cooperate with universities and higher education institutions (compared to almost 18.9% in Lithuania). Even less - 5% cooperate with government or public or private research institutes but this is not surprising considering that the share of government research performing organizations (RPOs) is relatively small and their profile (mostly humanitarian) does not match the needs of productive enterprises. Finally, only 3.8% of public R&D is contracted by private enterprises (Ministry of Education and Research Annual Report 2014).

In spite of the increase in the number of cases involving IPR protection, marketing of IPR remains a challenge (EC SWD 2014, 2015). The revenue from IPR commercialisation has remained relatively marginal in Estonia. Connecting to large international networks for IPR commercialisation and acquiring a highly-skilled labour force to work towards commercialisation are still difficult in Estonia (see Challenge 3). Both the legal framework for protecting intellectual property and the university financing system (mostly project-based) discourage universities from becoming more active in basic R&D and from increasing the number of contracts entered into with companies (EC SWD, 2014) although there are positive developments in this respect (see the section below).

Policy response

Estonia's National Reform Programme 2014 acknowledges the need to further strengthen cooperation between research institutes and companies but is vague on specific actions.

³ See EC Staff Working Documents for 2012, 2013, 2014 and 2015.

⁴ RIO elaboration based on Eurostat data.

One positive development is that the number of research contracts has tripled (EC SWD, 2015). This is partially due to the fact that baseline funding of RPOs takes into consideration the volume of RDI contracts with the private and public sector (40% of total) and the number of patents and patent applications (counted respectively 3- and 2-fold higher than scientific publications).

As regards specific knowledge transfer promotion programs, clusters and technological development centres are being set up. The 2014-2020 Technological Development centres (competence centres) programme (opened its new round in November 2014, continuing from the previous programming period) provide Estonia's entrepreneurs with opportunities for cooperation in the development of new technologies, products and services and aims to increase qualified staff in business-oriented R&D, and their movement between businesses and research institutions. Estonia has also introduced innovation voucher grants for SMEs. The 2014-2020 Cluster Development Programme (new round opened in June 2015) aims to increase the value added of companies and the sales of their products/services (including exports) as well as to promote cooperation between companies and research institutions. The Ministry of Education and Research launched the new activity Support for applied research in the areas of smart specialisation in August 2015. The aim is to support enterprises tendering applied research or product development from Estonian public R&D institutions and about 1/3 of financing should come from enterprises.

Estonia is also in the process of renewing its patent and intellectual property rights system. The Ministry of Justice established an Expert Group on the Codification of the Intellectual Property Law. The whole intellectual property system would be thoroughly examined. Although the initial plan was to create new laws, after thorough analysis the Expert group reached a conclusion that right now it is more feasible to wait and see what will be decided on the EU level and until then make some necessary minor amendments to the existing law (Ministry of Justice, 2015). The Agreement on a Unified Patent Court has been signed by the Government of Estonia in 2013, but has not yet been ratified by the Parliament.

In January 2013, a new institution was created – the Estonian Intellectual Property and Technology Transfer Centre, which took over the activities of the Estonian Patent Information Centre.

Assessment

Estonia has a relatively strong public research system, with a high level of public R&D expenditures and decent performance in terms of public-private co-publications.⁵ However, the number of companies undertaking development and innovation activities is still low.⁶ Moreover, entrepreneurial culture is still underdeveloped in Estonian universities and thus requires more effective incentive systems, e.g. modifications to the university IPR policies, vamping up the existing knowledge transfer offices, and entrepreneurial training. The latter is especially important as according to the ERAC peer review the problem lies more in the risk-averse culture of universities and businesses than in restrictions in laws and regulations.

More fundamentally, the mismatch between the needs of the business sector and the provision of knowledge from the public sector is not simply a failure to commercialise scientific activity but also a result of the R&D support system being focused on areas other than those that dominate Estonia's economy today⁷ (see Challenge 1).

⁵ In 2011-2013 Estonia had 69 public-private co-publications per million of population which is lower than the EU-28 average of 87 but much higher than the 21 for Lithuania and 19 for Latvia.

⁶ According to Estonian National Audit Office (2014) 90% of research and development expenses in Estonia are incurred by fewer than 100 companies.

⁷ OECD (2013), Innovation growth in regions: the role of smart specialization

However, the recently introduced measures for applied research in the smart specialization areas are a positive development.

R&D measures (in the 2007-2013 period) have had a less pronounced impact than expected in terms of encouraging companies to use universities' research facilities and some measures have reportedly increased the administrative burden on companies (EC SWD, 2014). Similarly to its Baltic neighbours, Estonia's policies during the 2007-2013 period were characterized by a strong focus on infrastructure/capacity development and less on supporting collaboration and building networks. A positive development is the fact that the new strategic documents for 2014-2020 focus on obtaining social and economic results from these capacities and infrastructures. However, the key challenge remains the level of effectiveness of the attempts to create synergies between the specific policy measures and focus them on a limited number of priorities.

Challenge 3: STI internationalisation and addressing the scarcity of highly-skilled human resources

Description

The basic skills levels of young people in Estonia are high. The country's results in the 2012 OECD Programme for International Student Assessment (PISA) are very strong. Performance has significantly improved since 2009 in all tested areas (reading, mathematics and science) and Estonia now ranks in the top tier of EU countries participating in the survey. However, the specific skills sought by innovative enterprises seem to be in a short supply. The ERAC Peer Review points out that the scarcity of skilled human resources is currently a bottleneck for developing the RD&I system in Estonia. The pool of RD&I competent talent is small and easily absorbed by the needs of a few (larger) enterprises. Although there has been progress in recent years, Estonia is still suffering from a low number of new doctoral graduates and the share of foreign doctoral students remains low (DG RTD, 2014).

High levels of "brain drain" and low attractiveness of research careers remain constant challenges (ERAC, 2012). For highly qualified foreign faculty and researchers to settle in Estonia, the drawback is often the salary level, which is not internationally competitive and the standard of living is not high enough. Moreover, the Estonian language requirements for recruitment of research staff hampers the internationalisation of the research system. Nevertheless the number of foreign students and professors-researchers is growing steadily.

As far as participation in EU FPs is concerned, Estonia's share of EU FP7 contributions received between 2006 and 2014 (compared with FP6) is higher than the EU-13 average and is on par with the EU-15 countries (JRC-IPTS, 2015). This signals that Estonian excellent researchers are actively participating in international consortia. However, while Estonian top scientists are well integrated internationally, this is not the case for the overall research community in Estonia (EC SWD, 2013). This is partially a result of the fact that Estonian RD&I policy-making has been fragmented and overly concentrated on scientific excellence and high technologies, neglecting domestic economic structure (see Challenge 2 assessment part). The Estonian science system follows very different specialization from the business sector (see Challenges 1 and 2) as it finances and supports mostly curiosity-driven excellent basic research in fields such as physics, chemistry and earth sciences for which there is little immediate economic demand.⁸

⁸ <http://researchinestonia.eu/2014/06/smart-specialization-opportunity-challenge/>

Policy response

The Estonian authorities acknowledge the need for special attention regarding fostering the internationalisation of the research and innovation systems in all National Reform Programmes (NRPs).

The Ministry of Education and Research is planning to continue the Doctoral Studies and Internationalisation programme "DoRa" in the new programming period. The measure supports doctoral studies (for both domestic and foreign researchers) conducted in close cooperation with universities and companies based in Estonia in the form of scholarships designed to motivate students to choose areas of study closely related to the needs of key industries.

There is also some progress in improving the relevance of education for the labour market - the 2014-2020 Lifelong Learning Strategy was adopted in February 2014 and the "Programme for linking better labour market needs and training" was approved in April 2015 with the aim to harmonise the training (study) opportunities better with the market demand and increase the number of people with professional qualifications.

In addition, attracting international students and highly qualified specialists from outside the EU has been facilitated by amendments to the Aliens Act adopted in autumn 2013. According to the most recent NRP, although the goal to admit 2,000 foreign students by 2015 has been achieved, measures that support internationalisation will be continued.

Last but not least, Estonia is actively involved in local Baltic initiatives. For example, through the BSR Innovation Express Call in 2013, 28 new international collaboration projects were established. The joint Baltic Sea Research and Development Programme BONUS, the aim of which is to combine scientific research of the Baltic Sea conducted in individual countries into an interdisciplinary, long-term, integrated programme aiming for sustainable development of the Baltic region, was under implementation in 2014. This programme plans to promote multilateral research of high scientific level.

Assessment

Estonia has been active in addressing the human resources and internationalization issue and some results are already visible (e.g. increase in the number of doctoral students and foreign students). This challenge is very important because it is interconnected with the previously described challenges – in order to move up the technological ladder and to achieve the strategic aim to translate acquired capacities into societal benefits Estonia needs people with good qualifications. However, as a small country with small population Estonia cannot build up critical mass and solve its talent challenge alone and needs to be as integrated in international networks as possible.

There is an inherent rationale for continuing the utilisation of the European research and innovation support instruments in Estonia, including Horizon 2020. In addition, the synergies and opportunities opening up within the Baltic Sea Region and Nordic countries should continue to be actively pursued. To derive maximum benefit from transnational R&I collaboration, relevant national R&I measures could include an international dimension, stimulate partnerships and open up for international partners and clusters. On a similar note, the smart specialisation priority areas could also seek to involve international partners. Last but not least, it's in the interest of Estonian R&D institutions and universities to continue to attract as much talent (PhD students, researchers, professors) from abroad as possible

1. Overview of the R&I system

1.1 Introduction

Estonia is one of the smallest EU Member States accounting for ca 0.3% (about 1.3 million) of the population of the EU28. Gross Domestic Product (GDP) per capita in 2014 was €15,200 (Eurostat, 2016). The real GDP growth in 2012 was 5.2% in 2012 and dropped to 1.6% in 2013 due to decline in external demand, but recovered to 2.9% in 2014 (Eurostat, 2016). The recovery of Estonia's economy was driven mainly by exports. A very strong fiscal position also helped restore financial market confidence. Still, the average GDP per capita in PPS remains under the EU28 average – 73% in 2014, which leaves Estonia the recipient of full Cohesion policy support. Except for 2008-2009, Estonian real GDP growth has almost always been above the real average EU27 (now EU28) GDP growth.

Estonia's government deficit as % of GDP was 0.3% in 2012 and 0.1% in 2013, but turned to 0.7% surplus again in 2014 (deficit in the EU28 in the respective years was 4.3%, 3.3% and 3%). The global recession in 2008 drove the general government balance into deficit for the first time after the restoration of independence.

Estonia's government consolidated gross debt as % of GDP has always been the smallest in the EU28 (less than 5% until 2008) and despite the rise since the crisis (7% in 2009, 9.5% in 2012, 9.9% in 2013, 10.4% in 2014), it is still eight times smaller than the EU28 average (86.8% in 2014). About 25% of the debt is related to the involvement in the European Financial Stability Facility (EFSF).

Unemployment (as % of total employment) has been declining after reaching its peak in 2010 with 16.7%, and has been below the EU28 average (10.2% in 2014) for the last three years (10% in 2012, 8.6% in 2013 and 7.4% in 2014).

The input of shale oil refining industry helped to double total intramural R&D expenditure (GERD) in 2011 (in absolute terms) and GERD intensity reached 2.37% in 2011 (Eurostat, 2016). GERD declined to 2.16% of GDP in 2012 and further down to 1.74 in 2013 and 1.46 in 2014, as the impact of investments to the shale oil refining industry disappeared, and is again below EU28 average (2.03 in 2013).

Turnover from Innovation as % of total turnover was 10.2% in 2008, 12.3% in 2010 and 7.8 in 2012 (Eurostat 2015).

More than 71% of the Estonian GDP is derived from the service sectors, industrial sectors yield 25% and primary branches (including agriculture) approximately 4% of the overall output. In Estonia, 90% of enterprises are micro enterprises with less than 10 employees⁹. The main fields of economic activity (as a % of total GDP) are manufacturing (16%), wholesale and retail trade (13%), real estate activities (10%). Information and communication technologies provide about 5% and professional, scientific and technical activities and agriculture both give about 4% of GDP (Statistic Estonia, 2015).

The most common type of enterprise are wholesale and retail enterprises, forming nearly 20% of all enterprises. Enterprises engaging in professional, scientific and technical activities form 13% of all active enterprises and the number increased by 4% over the year. In 2013, the number of information and communication technology enterprises was still growing steadily (by 6%), although not as fast as in the previous years (8% in 2013 and 11% in 2012).¹⁰

RD&I strategic objectives are set in the RD&I Strategy for 2014-2020 "Knowledge-based Estonia" (launched in January 2014).

⁹ Statistics Estonia 2015, News <http://www.stat.ee/78415/?highlight=teenindus>

¹⁰ Statistics Estonia 2015:Statistical yearbook 2015

The target towards total R&D investments (GERD) in 2020 is set on 3% of GDP and business sector R&D investments (BERD) on 2% of GDP. Considering the relatively weak economic growth, the decline of BERD and also of GBAORD (5% decline of the MER R&D budget in 2016 as a result of the decline of the support from structural funds), reaching the target in 2020 is not very likely.

Estonia's strategic objectives for R&D, innovation and enterprise policy have been relatively stable over the last decade (since 2004). However, the structural weakness of the national economy remains, with a relatively lower share (3.4%) of high technology and knowledge-intensive companies. The input of shale oil refining industry helped to double total intramural R&D expenditure (GERD) in 2011 (in absolute terms) and for two years GERD intensity (2.34% in 2011 and 2.16% in 2012) exceeded EU28 average (1.97% in 2011 and 2.01% in 2012) but slid back below EU28 average in 2013 with 1.74%, and further down to 1.46 in 2014, as investments in the oil shale industry diminished (Eurostat, 2016). The shale oil related R&D expenditure peak proved to be a short-term phenomenon which has not affected the R&I system development in the long-term.

Table 1 Main R&I indicators, 2012-2014

Indicator	2012	2013	2014	EU average (2014)
GDP per capita (EUR)	13,600	14,400	15,200	27,400
GDP growth rate	5.2	1.6	2.9	1.4
Budget deficit as % of GDP	-0.3	-0.1	0.7	-3.0
Government debt as % of GDP	9.5	9.9	10.4	86.8
Unemployment rate as % of the labour force	10.0	8.6	7.4	10.2
GERD in €m	380.695	326.045	285.939	283,099.388
GERD as % of the GDP	2.16	1.74	1.46	2.03
GERD (EUR per capita)	287.3	247	217.3	558.4
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	4.2	4.1	3.5	5.7
Employment in knowledge-intensive service sectors as share of total employment	35.0	35.5	36.1	39.8
Turnover from innovation as % of total turnover	10.2 (2008)	12.3 (2010)	7.8 (2012)	11.9 (2012)
Value added of manufacturing as share of total value added	26.3 (2011)	25.1 (2012)	25.0 (2013)	26.2 (2012)
Value added of high tech manufacturing as share of total value added	2.1 (2011)	1.7 (2012)	1.6 (2013)	2.5 (2012)

Source: Eurostat, 2016

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

1.2.1 Main features of the R&I system

The [Organisation of Research and Development Act \(ORDA\)](#) provides the framework for the structure and financing of the Estonian research and development system.

According to ORDA all ministries perform the following functions in the field of research and development:

- 1) organisation of the required research and development in their areas of government and the financing thereof, taking into account the results of evaluation and the related assessments and recommendations;
- 2) drafting national research and development programmes and organising their implementation and drafting the research and development programmes of their area of government and organising their implementation;

In addition to that, the Ministry of Education and Research (MER) implements the national research policy and organises research and development activities, prepares proposals concerning the research policy and submits them to the Government and organises the financing of research and development at research and development institutions.

The Ministry of Economic Affairs and Communications (MEAC) organises technological development and innovation policy, prepares proposals concerning technological development and innovation policy and submit them to the Government and organises the financing of applied research, development and innovation.

RD&I strategic objectives and principles of management and financing are set in two main strategies: [RD&I strategy "Knowledge Based Estonia 2014-2020"](#) (implemented by MER) and the ["Entrepreneurship growth strategy for 2014-2020"](#) (implemented by MEAC).

R&D funded by Business Enterprise Sector (% of GERD) was over 50% as a result of big investments into shale oil refinery in 2011 (55%) and 2012 (51.2%), but slid back to 41.3% in 2013. The share of Government Sector financing changed accordingly from 32.8% in 2011, and 38.2% in 2012 to 48% in 2013 and is now the dominant funding sector.

As Estonia is a relatively small country, there is no regional decentralisation of the R&D system. The main players in the Estonian research system are six public universities (one private university is focused mostly on education, not research). Research policy in Estonia is generally seen as covering university-led research; and innovation policy as covering private sector led research. This is largely due to the fact that nearly all basic research is conducted at universities and private sector focuses almost exclusively on product development and innovation. There are no multinational R&D institutions in Estonia.

The main RDI funders are the Ministry of Education and Research (MER, ca 80% of public funding) and the Ministry of Economic Affairs and Communications (MEAC, ca 13% of funding). MER is responsible for the funding of R&D (including applied and basic research) at R&D institutions and MEAC for funding applied research, technology development and innovation. The amount of funding of R&D through other ministries is relatively small, e.g. in 2013 it was about 5% (Estonian Research Council, 2015).

1.2.2 Governance

The Organisation of Research and Development Act provides the framework for the structure and financing of the Estonian research and development system. According to this law, the Government of the Republic prepares national R&D development plans, submits them to the Riigikogu (Parliament), approves national R&D programmes, ensures the cooperation between the ministries and enacts legislation.

RD&I strategic objectives and principles of management and financing are set in two core strategies - the RD&I strategy "Knowledge Based Estonia 2014-2020" (launched in January 2014) and the "Entrepreneurship Growth Strategy 2014-2020" (launched in October 2013). While the RD&I strategy focuses more on research and higher education, the "Entrepreneurship Growth Strategy" encompasses innovation and relevant educational aspects. Investments in research infrastructures are also planned under the strategies. The strategies are supplemented by annually updated implementation plans that provide a predictable policy framework for short- and medium-term planning, via annual implementation plans, investment plans, etc.

Policy design and evaluation is carried out mainly by the Ministry of Economic Affairs and Communications (MEAC) and the Ministry of Education and Research (MER). Other ministries are also responsible for organising and financing R&D activities, drafting and implementing R&D programmes of their area of responsibility.

A permanent advisory body - the Research Policy Committee - provides advice to the Ministry of Education and Research and the Innovation Policy Committee advises the Ministry of Economic Affairs and Communications. The Research and Development Council (R&D Council) is an expert consultative body that advises the Government on R&D and innovation matters – all policy documents have to pass the R&D Council prior to being submitted to the Government for approval.

An innovation oriented projects promoter is the Development Fund, a public law entity, established by the Estonian Parliament in April 2007¹¹. The aim of the Development Fund is to initiate and support changes in the Estonian economy and society that would accelerate modernisation of Estonian economic structure, lead to growth in exports and contribute to the creation of new jobs requiring high qualifications. For that purpose, the Development Fund (together with the private sector) performs risk capital investments into the starting and growth-oriented technology companies and carries out socio-economic and technology foresight activities.

At the operational level, both ministries have implementing agencies and intermediaries. The main implementing body under the Ministry of Economic Affairs and Communication is the Enterprise Estonia Foundation, which is responsible for managing business support, innovation and technology programmes, etc. Foundation KredEx's mission is to facilitate the increase of competitive strength of Estonian companies by improving the availability of financing and managing credit risks, and the improvement of the energy efficiency in the housing sector by expanding financing possibilities and offering financing solutions aimed at promoting energy efficiency and increasing the use of renewable energy sources.

From the research policy perspective, the Ministry of Education and Research has three main agencies that among their other activities deliver funding and support: the Archimedes Foundation is implementing agency for structural support in the field of R&D and administers schemes for improving mobility and marketing Estonian higher education and research abroad. The Estonian Research Council was established in March 2012 to concentrate the funding of R&D and achieve better functioning of the financing systems.

¹¹ On March 15 2016, the Economic Affairs Committee of the Parliament [decided to terminate](#) the activities of the Development Fund and will prepare the bill in April 2016 that would enable to adopt all reforms by the end of the spring session of the Parliament.

This body is the main funding organization of R&D, consolidating different grants and types of funding and giving research more visibility in the society. The INNOVE foundation manages a range of programmes and support measures in the fields of lifelong learning and active labour market policies.

The Ministry of Rural Affairs (MoRA, former Ministry of Agriculture¹²) is the only non-core ministry that has got a Research and Development Department and a budget line for R&D activities already for years, financing R&D on plant breeding, developing environmentally friendly and effective plant breeding technologies, rural economy and its sustainable development, research on the protection and monitoring of the agricultural environment, food safety, and biological diversity. In other ministries the R&D activities have been carried out sporadically to some extent, but the situation might improve, as the Implementation plan for the R&D strategy indicates R&D activities (and related parts of the budget) of the Ministry of the Environment, the Ministry of Defence, the Ministry of Internal Affairs, the Ministry of Culture, and the Ministry of Social Affairs.

In the framework of the Programme RITA different measures supporting the RDI activities in other ministries are supported.

The Organisation of Research and Development Act indicates two types of external evaluations of research and development: regular evaluations (of organizations) and targeted evaluations. Targeted evaluations (introduced in 2009) serve for preparing field development plans that guide research and development or other research policy decisions and measures, or for assessing and analysing the impact and implementation thereof. MER has the right to organise evaluations at its own initiative or upon proposal of other ministries.

In the process of preparation for the new research, development and innovation (RDI) strategic period of 2014–2020, MEAC carried out or commissioned and MER commissioned a number of evaluations (see also ch.2.2.1) and the results are used in designing new policies and measures. MEAC has quite a long history (since the beginning of 2000s) in carrying out evaluations and feasibility studies of measures and programmes, while MER focused mainly on the evaluation of the performance of R&D organisations. However, in 2011, MER initiated the Research and Innovation Policy Monitoring Programme for 2011-2015 (TIPS Programme) to analyse thoroughly the impact of 2007-2013 policy measures and give policy recommendations for the design and implementation of the new RDI strategy (2014-2020) and policy measures under the strategy.

The evaluation of the implementation of the RD&I strategy is annual¹³ and is presented in the "Report on achieving the objectives and implementing the strategy".

Estonia does not have a specific macroeconomic model to assess R&I impact on economic growth.

1.2.3 Research performers

The main players of the Estonian research system are the six public universities (one private university is focused mostly on education, not research). In 2014, the R&D expenditure in non-profit institutional sectors (higher education, government and non-profit private sectors) was €162m, of which 78% was performed by universities¹⁴ (higher education sector) and 2% by non-profit private sector (Statistic Estonia, 2016). Research policy in Estonia is generally seen as covering university-led research; and innovation policy as covering private sector led research.

¹² Since the 1st September 2015, the Ministry of Agriculture continues to work as the Ministry of Rural Affairs.

¹³ Although reports have been annual and publicly available on the MER web site, reports on achieving the objectives and implementing the strategy in 2013 and 2014 are absent.

¹⁴ 4 universities perform more than 80% of all public sector research in Estonia, estimated on the basis of the distribution of performance based baseline funding.

This is largely due to the fact that nearly all basic research is conducted at universities and private sector focuses almost exclusively on product development and innovation.

From 19 positively evaluated R&D institutions 7 are universities (1 private and 6 public), 4 are private R&D institutions (2 of them funded as Technological development centres; 3 on health services which are also engaged with bio- and environmental sciences, one on ICT field). From 8 positively evaluated public research organisations two are also active on health, bio- and environmental sciences. Most of the private research organisations have less than 50 employees and the teams include foreign researchers.

Multinational R&D organisations do not operate in Estonia and multinational corporations do not carry out research in Estonia. The share of SMEs innovating in-house as percentage of SMEs was 33.6% in 2010 (IUS 2014).

The number of ICT enterprises is quite big (ca 3000 in 2013), but most of them have less than 10 employees. In 2013, most of ICT enterprises provided services as programming and consultations and only 2.4% of them were engaged in manufacturing (Statistics Estonia, 2015).

According to the National Audit Office (2014), the structure of the Estonian economy is still dominated by small and medium-sized low-tech companies whose need for research and development is limited. Only a few companies are engaged in research and development and cooperating with universities: 90% of research and development expenses in Estonia are incurred by fewer than 100 companies.

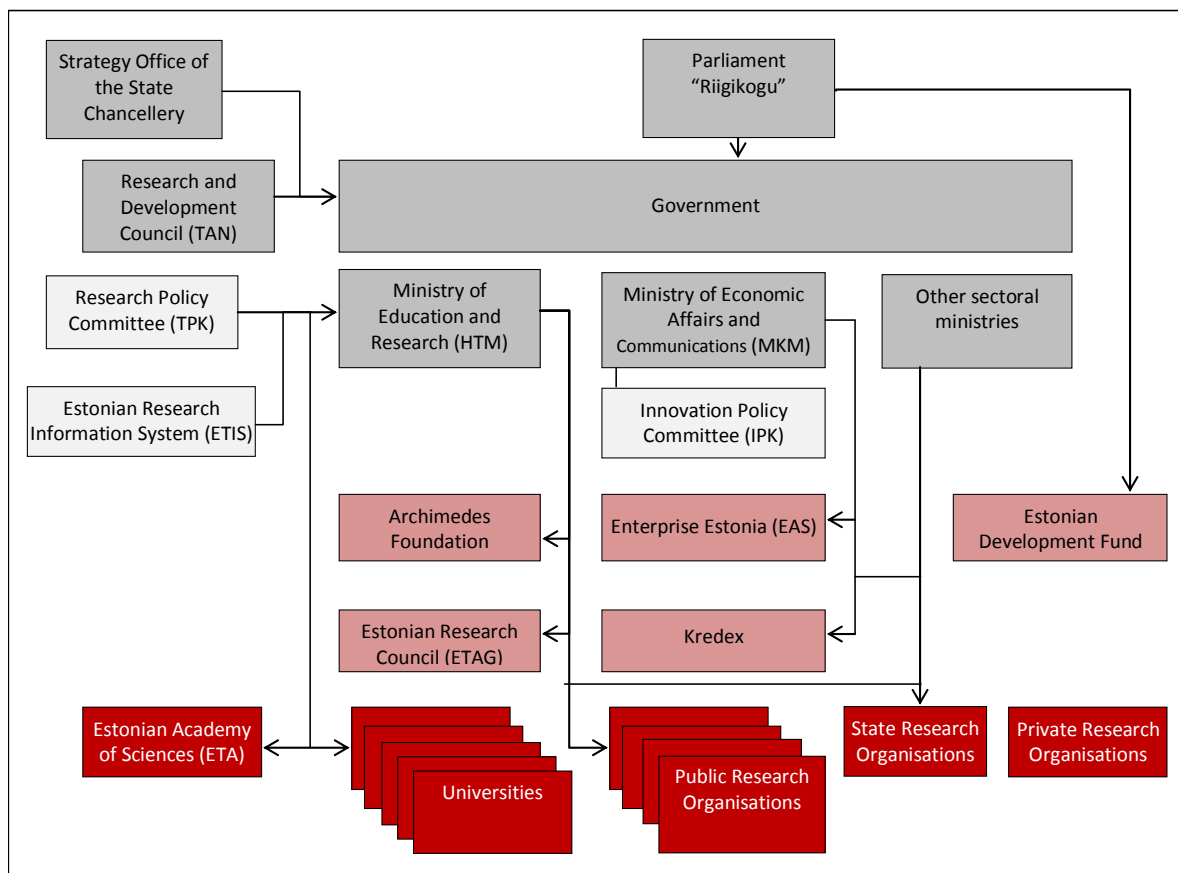


Figure 1 Structure of the Research and Innovation System

Source: ERAC Peer-Review of the Estonian Research and Innovation System, 2012; updated by the author. Note: Estonian acronyms are given in brackets.

2. Recent Developments in Research and Innovation Policy and systems

2.1 National R&I strategy

The innovation governance system has remained basically intact and involves industry, parliament and the scientific community. The present system is uncomplicated with a rather clear division of responsibilities and a firm connection with the political leadership (see Figure 1). RD&I strategic objectives and principles of management and financing are set in the RD&I strategy "Knowledge Based Estonia 2014-2020" (launched in January 2014). The "Entrepreneurship Growth Strategy 2014-2020" which focuses on co-operation between enterprises and R&D institutions, was launched in October 2013. While RD&I strategy focuses more on research and higher education, the "Entrepreneurship Growth Strategy" encompasses innovation and relevant educational aspects. Investments in research infrastructures are also planned under the strategies.

The strategies are supplemented by annually updated implementation plans that provide a predictable policy framework for short- and medium-term planning, via annual implementation plans, investment plans, etc (ERAC, 2012). Both strategies are preceded by international analyses of strengths and weaknesses, emerging opportunities ("smart specialisation") and market developments. The strategies also reflect EU priorities and exploit opportunities for joint programming, cross-border co-operation and the leverage effects of EU instruments.

The main funding instruments are the state budget and EU structural funds. Policies and funding are focused on specific priorities, addressing societal challenges as identified in the Horizon 2020.

The 2007-2013 programming period is being completed and new measures are being initiated for 2014-2020, based on evaluations of the previous period. As implementation plans of both strategies were just approved, and programmes launched in 2015, it is still too early to assess the impact of these measures. While the previous RD&I strategies focused primarily on developing Estonia's capability in research, development and innovation, the new strategy aims to use the created potential for the good of Estonia's development and economic growth. In the setting of priorities the methodology of smart specialization served as a basis.

The RD&I strategy identifies four key goals:

- Research in Estonia is of a high level and diverse;
- Research and development (R&D) serves the interests of the Estonia's society and economy;
- R&D improves the knowledge-intensity of the structure of the economy;
- Estonia is active and visible in international RD&I cooperation.

The implementation plan for RD&I strategy for "Knowledge Based Estonia 2014-2020" was approved by the Government in September 2014.

The implementation plan for 2014-2017 for the "Entrepreneurship Growth strategy 2014-2020" (in Estonian) was approved by the Government in March 2014.

According to the Implementation plan for the RD&I strategy 2014-2020, the balance between generic and thematic/sectoral R&D funding will be in favour of generic funding – 10% of all R&D funding (2014-2017) is allocated for Smart Specialisation, where a clear thematic focus is evident.

2.2 R&I policy initiatives

Major changes in research and development legislation were made in 2011 and implementation started in 2012. In 2012, the Estonian Research Council (ESC), a new funding agency for Estonian research, was established, to gather all R&D and research financing instruments of research institutions 'under one roof' in order to create better synergy and avoid duplication and overlap (incl. in financing). Also amendments were made to the Organisation of Research and Development Act, to offer Ph.D. students an employment contract with the same social guarantees as any other employment. In 2013, the Government approved the Entrepreneurship growth strategy for 2014-2020. The general goal of the strategy is to facilitate the achievement of the objectives within the national competitiveness strategy "Estonia 2020" to enhance productivity and employment. Also amendments were made to the Aliens Act in order to change the procedures for giving work permits with the objective of making it easier for potential top-level specialists and highly qualified employees to enter Estonia's labour market. In 2014, the Parliament approved the new RD&I strategy for 2014-2020 "Knowledge Based Estonia 2014-2020" and the Estonian Research Infrastructures Roadmap was updated. Also amendments were made to the Organisation of Research and Development Act (in force from 01.01.2015) which turned most of temporary (5 years) contracts of research personnel are into permanent contracts

No major legislative changes have been made in 2015.

Evaluations, consultations, foresight exercises

The Organisation of Research and Development Act indicates two types of external evaluations of research and development:

- Regular evaluations (introduced in 1995) for assessing the level of the corresponding field of research and development at a research and development institution. The period of validity of a positive decision of a regular evaluation is 7 years,
- Targeted evaluations (introduced in 2009) for preparing field development plans that guide research and development or other research policy decisions and measures, or for assessing and analysing the impact and implementation thereof. MER has the right to organise evaluation at its own initiative or upon proposal of other ministries.

The most influential report, undertaken in the 2014-2015 period, is the "Report on the network and policies of Estonian universities and other R&D institutions and higher education institutions" (Okk, 2015)¹⁵, which was presented to the Research and Development Council in August 2015. The report recommends to carry out a broad reform of higher education and research by means of consolidation, pooling of resources, and changing the financing model. The report triggered a lot of discussions and a number of critics.

The purpose of the report was to identify whether and what kind of structural changes in the network and policies of the institutions could be needed to boost the performance and increase the international competitiveness of Estonian research institutions and higher education system. The report suggests that the provision of education and research activities of Estonian universities and the institutions of research and professional higher education should be consolidated within bigger universities. It is also recommended to join the resources of Estonian universities in order to ensure the international marketing of learning opportunities, services, and research achievements, as well as connect innovation and technological developments with business and industry.

¹⁵ https://riigikantselei.ee/sites/default/files/riigikantselei/strateegiaburoo/eutarkvt_loppraport.pdf

The number of curricula and duplication between them should be reduced. According to the third major recommendation, the higher education and research funding model should be reshaped.

Critics of the report condemn the administrative-technocratic approach where higher education and research is seen in very practical and utilitarian terms - how it can be applied and how to pay higher salaries. Among other things, critics point to the most controversial recommendations in the report as making higher education paid in full extent (student loans to replace free study¹⁶); teaching one subject only in one university; and suggesting having Masters curricula in technical fields and entire Doctoral curricula in English (as in Estonian there is no chance to be recognised internationally).

To analyse thoroughly the impact of 2007-2013 policy measures and give policy recommendations for implementation of the RDI Strategy "Knowledge-based Estonia 2007-2013" and to design both the new Estonian RDI strategy (2014-2020) and policy measures under the new strategy, the Research and Innovation Policy Monitoring Programme for 2011-2015 (TIPS Programme) was launched in 2011 and a number of final reports published in 2015. The programme activities are grouped into seven Work Packages (altogether 34 reports have been compiled):

- Intellectual property rights in research and development (3 reports);
- Public funding of research activities in Estonia (6 reports);
- Leadership and management models of Estonia's research and development institutions (3 reports);
- Management of cooperation between higher education institutions and industry (9 reports);
- Complex analysis of research, development and innovation policy (4 reports);
- Internationalisation of research, development and innovation activities (6 reports);
- Designing the Estonian research, development and innovation strategy for 2014-2020 (3 reports).

In January 2015, the Full Report on the "Research and Development and Innovation Strategy 2007-2013 "Knowledge-based Estonia 2007-2013" (In Estonian, „Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia 2007–2013 „Teadmistepõhine Eesti”” lõpparuanne”) was presented to the Government.

According to the report, Estonia's RD&I system has developed considerably. A lot has been achieved on the modernisation of infrastructure and technology, internationalisation of research (incl. researchers' mobility) and business, supporting of start-up companies, and developing cooperation between business and academia. Still, the main challenge is to further develop the research and innovation system in ways that it will have bigger impact on the society. Policies should more strongly contribute to creating favourable environment to promote creation of jobs and growing export volumes in medium- and high-tech industries and knowledge intensive services.

¹⁶ The system where only free positions, ordered by the state, are available in the universities (with permission to fill paid positions only if the study programme is in English) was introduced in 2013. Before that, in addition to state positions, paid positions were made available by universities. The present system will probably face changes, as neither universities nor students are totally satisfied.

In addition, in 2014-2015, MEAC carried out or commissioned evaluations of enterprise and innovation policy, to assess the measures implemented and the impact, effectiveness and feasibility of those measures: Mid-term evaluation of innovation and enterprise support policies¹⁷ (2014, summary in English); "Feasibility Study for the Design and Implementation of Demand-side Innovation Policy Instruments in Estonia", which analysed the feasibility of this new policy initiative in smart specialization areas (2014); and "Ex-ante evaluation of designed financial instruments from the Cohesion Policy 2014-2020 funds (in Estonian, Perioodi 2014-2020 ühtekuuluvuspoliitika vahenditest kavandatud rahastamisvahendite eelhindamine; Ernst & Young, 2015) gives suggestions for using financial instruments as loans, state guarantees and credit insurance.

The findings have been used to design the Entrepreneurship Growth Strategy 2014-2020 and its implementation plan and for the development of measures and programmes.

2.3 European Semester 2014 and 2015

The National Reform Programme "Estonia 2020" (updated in May 2015) sets two central objectives of "Estonia 2020" – increasing productivity and employment in Estonia. The main focus in the coming years is on education and employment and the main objectives include integrating long-term and young unemployed people in the labour market and developing their skills.

The European Council country specific recommendation of 2014 on R&D in Estonia was to "further intensify prioritisation and specialisation in the research and innovation systems and enhance cooperation between businesses, higher education and research institutions to contribute to international competitiveness" (European Commission, 2014a).

According to the Country Report Estonia 2015 (EC 2015), the research and innovation systems and cooperation between business, higher education and research institutions have improved. However, public support for research and innovation, under the RDI Strategy and the Entrepreneurship Growth Strategy, seems to lack coordination and should focus more on a limited number of smart specialisation areas. The higher education system, in particular as regards science and technology, still needs to be better aligned with the needs of business and research institutions. Investment in intellectual property is low and few companies work together with research institutions. The Estonian government adopted a lifelong learning strategy in early 2014 and programmes to implement it were presented in March 2015. A reform of curricula in the vocational education and training system is ongoing and participation in lifelong learning has increased. An Adult Education Act and a Professions Act were adopted by parliament in early 2015. The attractiveness of vocational education and training and apprenticeships remains a challenge.

The analysis in Country Report Estonia 2015 (EC 2015) leads to the conclusion that Estonia has made some progress in addressing the recommendation and measures, e.g. the implementation of the updated innovation voucher scheme and Support for applied research in the areas of smart specialisation (see also ch. 3.5.1.), as well as the strategies and action plans for the north-eastern and other regions appear relevant and credible.

Country specific recommendation of 14 July 2015 (EC 2015a) on R&D is to „focus public support for research and innovation on a coordinated implementation of the limited number of smart specialisation areas“.

¹⁷ R&D related conclusions: R&D grant has allowed companies to reach commercialisation more easily compared to the earlier assessment, but company volumes are still small; Three-quarters of companies active in the field of R&D took their product innovations to market and two out of three did it thanks to the support of EAS; Of all R&D investments in private sector, 90% were made with the support of EAS; The R&D grant award was rated the most positive with the strongest effect; Every fifth recipient of an R&D grant award has since terminated its activities.

Estonia's smart specialisation framework comprises the Entrepreneurship and Growth Strategy (adopted by the government in October 2013) and the Research, Development and Innovation Strategy (adopted by the Riigikogu in January 2014) with a focus on shared priorities while further specialising in the thematic areas. There are three smart specialisation growth areas: ICT supporting other sectors (use of ICT in industry incl. automation and robotics, cyber security, software development); health technologies and services (biotechnology, e-health); resource efficiency (material science and industry, knowledge-based construction, health-promoting food industry, chemical industry).

The objective of the support grants for 2014-2020 (mostly financed by ESIF) is to increase the socioeconomic impact of Estonia's science, thus many of the activities are therefore aimed at smart specialisation growth areas.

2.4 National and Regional R&I Strategies on Smart Specialisation

To date, there is no separate national or regional R&I strategy on Smart Specialisation and there is no plan to have one, as Smart Specialisation has been incorporated into the RD&I Strategy 2014-2020 and into the Entrepreneurship Growth Strategy 2014-2020. Monitoring and evaluation of Smart Specialisation is a regular part of the monitoring process of these strategies (see ch. 1.2.2). The budget for Smart Specialisation in 2014-2020 (including structural funds and state budget co-financing) is planned to be about €140m (Estonian Development Fund, Feb. 2015).

In the end of 2012, the Estonian Development Fund completed the first phase (Qualitative Analysis of Smart Specialisation) of the analysis and the areas of Smart Specialisation were selected. In June, 2013, the work on a follow-up was completed (Analysis of deficiencies and new opportunities) and specific bottlenecks were identified that need to be dealt with in order to increase innovation. The second part of the analysis focused on practical recommendations and actions to overcome the obstacles in Estonia's innovation. These analyses were commissioned by the Ministry of Economic Affairs and Communications and the Ministry of Education and Research.

The growth areas were selected using OECD/European Commission Smart Specialisation methodology. The analysis was performed in cooperation with Enterprise Estonia, Estonian Research Council, and leading economists.

Smart Specialisation growth areas are:

- ICT supporting other sectors (use of ICT in industry incl. automation and robotics, cyber security, software development);
- Health technologies and services (biotechnology, e-health);
- Resource efficiency (material science and industry, knowledge-based construction, health-promoting food industry, chemical industry).

In the programming period 2014-2020, the focus of R&D funding is on increasing the socioeconomic impact of Estonia's research, thus a number of programmes and other activities (mostly financed by ESIF) are aimed at smart specialisation growth areas.

MEAC has launched programmes to increase the competitiveness of enterprises in the areas of smart specialisation: the Cluster development Programme (renewed in 2014) is aiming to improve the international competitiveness and to increase the sales and value added of the companies via cooperation between companies and research institutions. Enterprise Development Programme was launched in January 2016 which aims to support well-thought-out development, improved action planning, innovation implementation and product development. The support is given to industrial enterprises or companies of the smart specialisation field (operating for at least 3 years, 8 employees or more) which have clear ambitions and potential for growth and/or ability to bring new or significantly improved products or services to the market.

Also a new measure "State as a smart customer" will be launched to improve demand-side innovation policies (total budget €20m).

MER launched the activity "Support for applied research in the areas of smart specialisation" (in Estonian, Rakendusuringute toetamine nutika spetsialiseerumise kasvuvaldkondades (NUTIKAS). The "Institutional development programme for research and development and higher education institutions" (in Estonian, Institutsionaalne arendusprogramm teadus- ja arendusasutustele ja kõrgkoolidele ASTRA) and "Allocation of support for R&D infrastructure (in Estonian, Riikliku tähtsusega teaduse infrastruktuuri toetamine teekaardi alusel) also consider among other criteria the principles of smart specialisation.

2.5 Main policy changes in the last five years

Main Changes in 2011

At the end of 2011, the Minister of Education and Research launched a reform of higher education and some amendments to the [Organisation of Research and Development Act](#) were made and a new Universities Act was adopted in 2012 with the aim to rearrange the financing of higher education, strengthen the quality and effectiveness as well as to increase fair accessibility of higher education.

Estonian Government approved the strategy "[Estonia 2020](#)", which sets the targets for 2020 and measures for addressing these challenges were taken into the Governments' workplan. (The strategy – also referred to as National Reform Programme - is updated annually.)

Main changes in 2012

In March 2012, [Estonian Research Council](#) (ESC), a new funding agency for Estonian research was established, which took over the functions of the Estonian Science Foundation and some functions of the Archimedes Foundation¹⁸. The aim of this reorganisation of functions of the ESC is to gather all R&D and research financing instruments 'under one roof' in order to create better synergy and avoid duplication and overlap (incl. in financing).

Amendments were made to the [Organisation of Research and Development Act](#), to offer Ph.D. students an employment contract with the same social guarantees as any other employment. This will contribute to improving the attractiveness of doctoral studies.

Main changes in 2013

In October 2013, the Government approved the [Entrepreneurship growth strategy for 2014-2020](#). The general goal of the strategy is to facilitate the achievement of the objectives within the national competitiveness strategy "Estonia 2020" to enhance productivity and employment.

In April 2013, [Estonian Information Technology Foundation for Education](#) (HITSA)¹⁹ was established. The mission of HITSA is to provide a high-quality national network infrastructure for Estonia's research, educational and cultural communities.

Amendments were made to the [Aliens Act](#) in order to change the procedures for giving work permits with the objective of making it easier for potential top-level specialists and highly qualified employees to enter Estonia's labour market.

Main Changes in 2014

In January 2014, the Parliament approved new [RD&I strategy for 2014-2020 "Knowledge Based Estonia 2014-2020"](#), which is Estonia's third strategy on research and development and innovation.

[Estonian Research Infrastructures Roadmap](#) was updated.

Amendments were made to the [Organisation of Research and Development Act](#) (in force from 01.01.2015): a) Most of temporary (5 years) contracts of research personnel are turned into permanent contracts and, as regular evaluation by election disappears, the evaluation of professional performance of research personnel must now take place at least once in 5 years; b) Until the end of 2014, detailed conditions and procedures for organising a competition for research staff in a research and development institution which operates as a state agency or a local authority agency, were established by the ministry or corresponding body of the legal person

¹⁸ Research Cooperation Centre, a department of the Archimedes Foundation, acting as a FP7 National Contact Point, was transferred from Archimedes Foundation to the Estonian Research Council.

¹⁹ From May 1st 2013, the Tiger Leap Foundation and the Estonian Education and Research Network were transferred to the Estonian Information Technology Foundation and the new name of established organisation is Information Technology Foundation for Education (HITSA; www.hitsa.ee)

which governs a R&D institution. Since the beginning of 2015, R&D institutions can establish their own conditions of selection processes.

Main Changes in 2015

In April, new government was established after Parliamentary elections and new Minister of Education and Research was appointed – Jürgen Ligi from the ruling Reform Party – who was previously the Minister of Finance.

In January, the Full Report on the “Research and Development and Innovation Strategy 2007-2013 “Knowledge-based Estonia 2007-2013” (In Estonian, „Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia 2007–2013 „Teadmispõhine Eesti”” lõpparuanne”) was presented to the Government. According to the report, Estonia’s RDI system has developed considerably.

No major changes in legislation.

3. Public and private funding of R&I and expenditure

3.1 Introduction

The RD&I strategic objectives are set in the RD&I Strategy "Knowledge-based Estonia" (new strategy for 2014-2020 launched in January 2014). The target towards total R&D investments (GERD) in 2020 is set on 3% of GDP and business sector R&D investments (BERD) on 2% of GDP.

The overall level of R&D investments as a percentage of GDP almost doubled in 2008-2011 (from 1.26% to 2.34%), but slid back to 2.16% in 2012 and dropped again below the EU28 average in 2013 (EU28: 2.03%; EE: 1.74%) as the effect of the investments in a shale oil refinery ended. For 2014, GERD as a percentage of GDP dropped even further down to almost the same level it was in 2009 (1.46%). The business sector investment (BERD) as a percentage of GDP follows the same trend (as the cause is the same): it tripled in 2008-2011, slid back in 2012 and dropped further by about half in 2013 and further one third in 2014. The share of government sector investments (GBAORD) as a percentage of GDP has been growing steadily in 2009-2013 (from 0.69% to 0.82%), but also declined in 2014 to 0.71% (Eurostat, 2016).

Gross expenditure on R&D (GERD) in absolute terms has tripled in 2004-2010 and doubled in 2010-2011. As a percentage of GDP it was above the EU average in 2011-2012, but dropped back below EU average in 2013 as investments in shale oil refining ended. During the crisis in 2008-2009, R&D investments showed an increase as a percentage of GDP (as a consequence of the GDP decline) but had a slight decline in absolute terms. The relatively stable financing was due to the previously committed Structural Funds (GERD dropped by only 5%, while GDP changed by -14%).

In the business enterprise sector, investments dropped by 1.9% during the crisis, but doubled in 2011 compared to 2010, and in 2011 Business Expenditures on Research and Development (BERD) were 1.5% of GDP. In 2011-2012 one could note a significant growth in BERD, mostly due to big R&D investments in the shale oil refining industry. Although this effect faded and BERD declined to 1.24% of GDP in 2012 to 0.83% in 2013 and to 0.64% in 2014, BERD in absolute terms doubled from 2009 to 2013, but in 2014 (€124m) closes again to the levels of 2010 (€118m).

GBAORD as % of GDP is 0.71% in 2014, which is above the EU average (0.67% in 2014) and as a share of general government expenditure reached 2.12% in 2013 (EU28: 1.41%) but slide back to 1.96 in 2014 (EU28: 1.38). The higher education sector performed 44% of GERD in 2014 (EU28: 23.5%). From 2009 to 2011 the share of HEIs declined from 43% to 28%, but returned to 32% in 2012 and to 44% in 2014, as business sector investments declined.

The share of EU Structural funds has been growing remarkably from 2009 to 2013. In 2011 and 2012, 64% and in 2013 60% of all public sector RD&I funding was financed under Structural Funds (including co-financing from the state)(Ministry of Finance, 2012, 2013) and the ratio has been about the same in 2014 (ERC data, 2015). As the funding from the structural funds has been specifically targeted for infrastructure development, mobility schemes and internationalisation, the possibilities to use it for other general needs, such as researchers' salaries, maintenance costs and indirect costs was limited (ERAC, 2012).

During the European Union's multiannual financial framework 2007-2013, education, research and development were financed by a total of €763m, of which the support of the European Social Fund (ESF) was €159m and of the European Regional Development Fund (ERDF) €523m (MER official site, 2015). In Estonia, this funding was based on the Operational Programme for Human Resource Development. In the framework of the Operational Programme for the Development of Economic Environment, higher education and university infrastructure development, research equipment acquisition, and scientific centres of excellence were supported.

For three Operational Programmes (Human Resource Development - ESF; Development of Economic Environment - ERDF+CF; Development of Living Environment - ERDF+CF), the total structural support for Estonia was €3.4b. The share for R&D and higher education was 18.6% (data provided by RIO, 2016).

Support measures for enterprises to develop new products, services and technologies are financed from the Enterprise Estonia support scheme for R&D projects. The total budget of this measure was €60m for 2007-2013 (MER, 2013a).

Table 2 Basic indicators for R&D investments

Indicator	2011	2012	2013	2014	2015	EU average (2014)
GERD (as % of GDP)	2.34	2.16	1.74	1.46	NA	2.03
GERD (Euro per capita)	289.1	287.3	247	217.3	NA	558.4
GBAORD (as % of GDP)	0.77	0.83	0.82	0.71	NA	0.67
GBAORD (€m)	125.91	145.83	153.96	148	NA	92,828.15
R&D funded by BES (% of GDP)	1.29	1.11	0.73	0.54	NA	1.12 (2013)
R&D funded by PNP (% of GDP)	0	0	0	0	NA	0.03 (2013)
R&D funded by GOV & HES (% of GDP)	0.77	0.82	0.81	0.72	NA	0.68 (2013)
R&D funded from abroad (% GDP)	0.28	0.22	0.18	0.18	NA	0.2 (2013)
R&D performed by HEIs (% of GERD)	28	32	42	44	NA	23.5
R&D performed by government sector (% of GERD)	8	9	9	11	NA	12.5
R&D performed by business sector (% of GERD)	63	58	48	43	NA	64

Source: Eurostat (2015)

3.2 Smart fiscal consolidation²⁰

3.2.1 Economic growth, fiscal context²¹ and public R&D

Estonia has been strongly hit by the crisis, losing around 20% of its real GDP in 2008-09. However, its economic recovery was the strongest in the Baltics: during the subsequent three years the GDP grew by 15.5% due to handling of special fund stores and quickly regaining past volumes of exports, predominantly on the Finnish market. In 2014 real GDP grew by 1.9% driven mainly by consumption, while investment activity was affected by geopolitical tensions. In 2015 the economic growth slowed down to ca. 1% due to weakening investment and external demand. However, in 2016-17 growth is expected to rebound (2.1-2.3%) due to the strengthening trend of same factors.

The Estonian public finances are extremely sound. Although the crisis has turned into negative the pre-crisis budgetary surpluses (Figure 2, left), the headline deficit peaked at around 2.8% of GDP in 2008, which is still under the Maastricht reference level (3%). Since 2010 the general government budget has been balanced, thanks to the strengthened fiscal framework with the structural balance rule as its cornerstone that requires that annual state budgets ensure at least the balance of the structural budget²². During 2016-17 the headline deficit is projected to be in surplus close to balance (2016: 0.2% of GDP, 2017: 0.1%). Public debt increased significantly during the crisis, but with its 10% of GDP level it is the lowest in the EU and it is projected to reduce to 9.4% by the end of 2017.

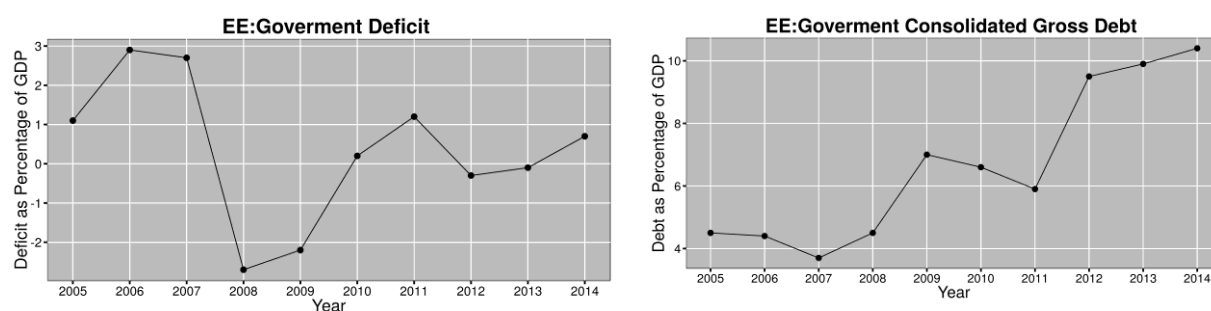


Figure 2 Government deficit and public debt
Data source: Eurostat

Total GERD in Estonia was 326.1 MEUR in 2013. There are three main sources of R&D funding: the business sector (137.1 MEUR), the government (154 MEUR), and foreign funding (33.7 MEUR). Direct funding from the government goes to business enterprises (15.8 MEUR), the government (23.5 MEUR) and the higher education sector (112.8 MEUR).

²⁰ Smart fiscal consolidation is defined as public budget cost-cutting programmes aimed at establishing a foundation for long-term growth. This public policy strategy is based on a trade-off between the need to safeguard growth enhancing elements (including R&D) from budgetary cuts and the need to reduce public spending in a context of economic crisis. For reference see Kolev, G. and Matthes, J.: Smart fiscal consolidation a strategy for achieving sustainable public finances and growth, Centre for European Studies, 2013; Veugelers, R.: Undercutting the future? Bruegel Policy Contribution Issue 2014/06, June 2014). The conclusions in our analysis focus only on the R&I aspect of Smart Fiscal Consolidation.

²¹ Sources: DG ECFIN, Country report for Estonia http://ec.europa.eu/europe2020/pdf/csr2015/cr2015_estonia_en.pdf, RIO

²² It is to be mentioned that the exclusive focus on the structural balance target bears some uncertainties in the medium-term, given that fast cyclical changes that may affect a small open economy undergoing fast transformation can make it difficult to plan the expenditures and the headline balance on the basis of a structural balance target.

Table 3 Key Estonian Public R&D Indicators

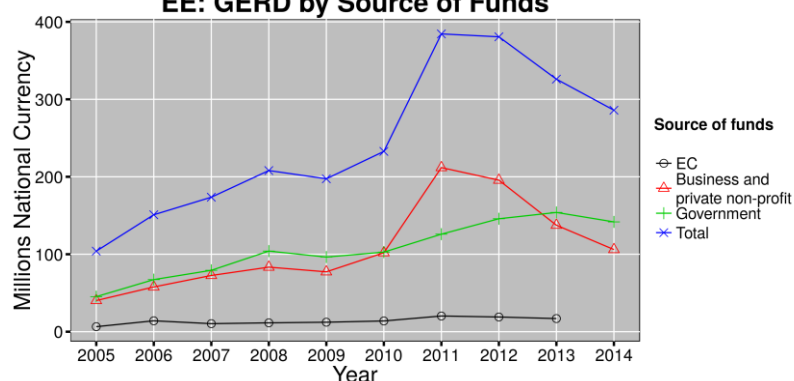
	2007	2009	2013
GBAORD, % of gov. exp.	1.41	1.52	2.11
GERD, % of GDP	1.07	1.40	1.74
out of which GERD to public, % of GDP	0.54	0.74	0.90
Funding from GOV to, % of GDP			
Business	0.05	0.07	0.08
Public (GOV+HES)	0.43	0.61	0.73
Total	0.49	0.68	0.82
EU funding, % of GDP	0.06	0.09	0.09

Source: Eurostat

3.2.2 Direct funding of R&D activities

The sources of R&D funding according to the Frascati manual are: Government sector (GOV), Higher education sector (HES), Business enterprise sector (BES), Private non-profit sector (PNP) and Abroad (including EC). In this analysis the public sector as source of funds is given by the GOV part of the total intramural R&D expenditure (GERD), whereas the public sector as a sector of performance is the aggregation of GOV and HES. Figure 3 below shows the evolution of GERD financing in current prices in Estonia.

Figure 3 Funding of the total GERD
EE: GERD by Source of Funds



Data source: Eurostat

Total R&D expenditure in Estonia in nominal terms increased during the period 2005 to 2011 with the only exception in 2009 (year of the crisis). The rise is much sharper between 2010 and 2011 and it has been mainly triggered by an increase in the part of GERD funded by the private sector (big one-off investment in oil shale refinery).

As the ERAC Peer-Review of the Estonian Research and Innovation System points out, the Estonian RD&I system has been characterised by government sector dominated funding and by the important role of higher education institutions (especially the four public universities²³) in performing research and innovation. The government sector dominance fell in 2011 as a result of a remarkably high peak of private R&D spending due to big investments in the oil shale industry. As Figure 3 shows, that peak was short lived while government funding continued increasing steadily. It must be noted that one important reason for the relatively stable R&D financing during the crisis years was the availability of previously committed EU structural funds. In 2014 government R&D funding decreased for the first time since 2009.

²³ University of Tallinn, University of Tartu, Tallinn University of Technology, Estonian University of Life Sciences

3.2.2.1 Direct public funding from the government

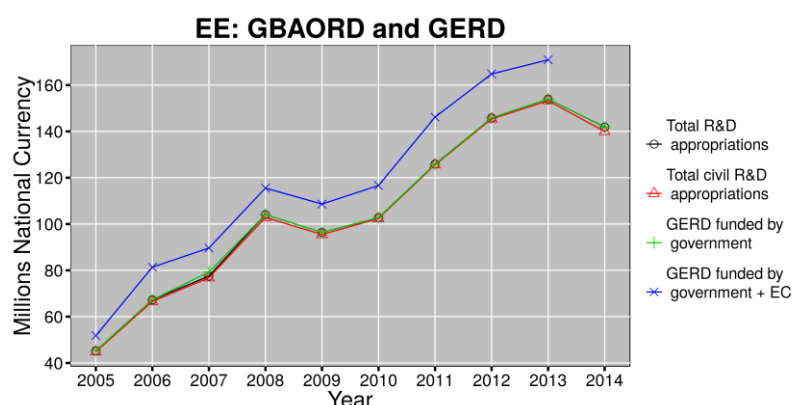


Figure 4 R&D appropriations and government funded GERD in millions of national currency
Data source: Eurostat

Figure 4 shows no gap between the actual government spending on R&D and the total R&D appropriations (GBAORD) which is caused by the method of estimation of GBAORD by Statistics Estonia. The overall trend of both GBAORD and GERD funded by the government is upward between 2005 and 2013 with a slight decrease in 2009 (crisis period) when measured in nominal terms (millions of national currency). When the national budget went into deficit in 2008 Estonia pursued austerity measures by raising taxes and cutting spending. The operating costs of establishments that received money from the state budget were decreased, including salaries²⁴. Indeed, GBOARD figures show some budget cuts for 2009 which were accompanied by a modest decrease in public R&D expenditure but that trend was quickly reversed already in 2010. In terms of percentage of GDP, R&D intensity did not fall because of the contraction of the economic output during the crisis years. In 2014 both the R&D budget and the actual government spending was reduced in comparison to the previous year.

One also observes that for the whole period analysed the difference between the total and civil appropriations is practically indistinguishable. This is not surprising as Estonia is a very small country without an extensive military base.

3.2.2.2 Direct public funding from abroad

Depending on the year, external funding for the Estonian R&D activities accounts for 9-12 % of the total GERD. Similarly to the other Baltic countries, most of the abroad funding comes from the European Commission through Structural Funds and participation in the Framework Programmes.

Table 4 Public Funding from Abroad to Estonian R&D (in millions of national currency)

Source from abroad	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total	17.74	24.57	20.27	19.48	22.36	26.64	45.59	37.98	33.73	35.59
BES	6.95	7.47	6.16	4.63	5.81	6.32	17.45	6.26	8.25	
EC	6.51	14.09	10.39	11.45	12.26	13.89	20.27	18.99	16.97	
Total as % GERD	17.06	16.28	11.67	9.36	11.33	11.45	11.86	9.98	10.34	12.45
EC as % GOVERD	14.39	20.94	13.1	11	12.72	13.52	16.1	13.02	11.02	

Data Source: Eurostat

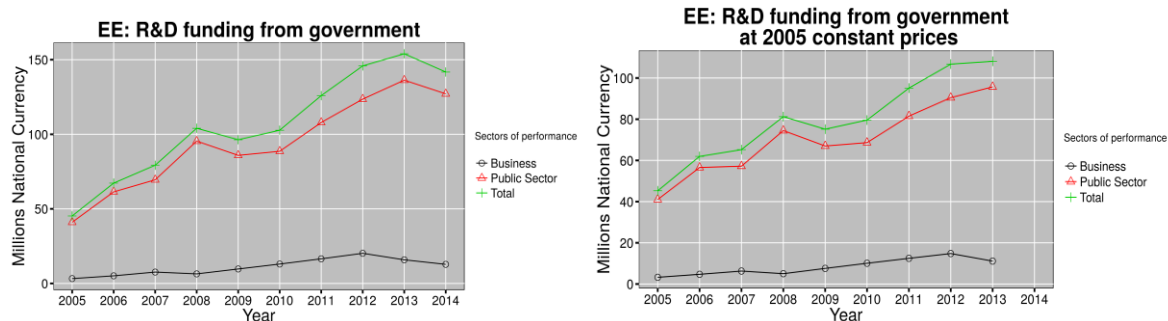
²⁴ http://www.estonica.org/en/Economy/General_overview_of_Estonian_economy/State_finances_and_economic_policy/

Table 4 shows that R&D funding coming from the EC has been increasing from 2008 to 2011. In 2012 and 2013 R&D funded by the EC dropped both in nominal and relative terms. The drop in relative terms can be explained by the big increase of the total GERD due to large R&D investments in the oil shale sector. As a Bruegel policy contribution²⁵ highlights, in most Central and Eastern European states Structural Funds for research and innovation are a significant component of national R&I budgets, and in some countries Structural Funds almost double the volume of government R&I funding included in GBAORD data. This observation is especially relevant for Latvia and Lithuania and although Estonia is not such an extreme case, funding from abroad is a significant source for the country.

Based on data from DG REGIO, the total Structural Funds for the period 2007-2013 for Estonia amount to 3.4 billion Euros of which 0.5 billion is dedicated to 'Core' R&D activities²⁶. In nominal terms the amount is not high but as a share of the total Structural Funds allocated in Estonia it is the sixth highest among the EU28.

Distribution of public funding

Figure 5 Government intramural expenditure by sectors of performance



Data source: Eurostat

Unsurprisingly, the public sector is the main recipient of government funded GERD. The importance of the business sector as a sector of performance increased, especially after 2008 (both in terms of absolute volumes and as a percentage of GDP). Figure 5 also shows that the decrease of R&D funding from government during the crisis has affected only the public sector as sector of performance but not the business sector. This may be due to the commitment of Estonia to increase research performance in the private sector²⁷ and due to the absence of indirect tax incentives to business R&D. However, the most recent data for 2013 and 2014 shows a reduction in the direct public support to business R&D for the first time since 2008.

3.2.3 Indirect funding – tax incentives and foregone tax revenues

Estonia has no tax incentives for R&D and innovation investments except that the companies' income is free of tax to the extent that they reinvest their profit. There are no specific instructions whether the reinvestment has to be made in R&D and innovation or anywhere else, the only criterion is for the investments to be made into the "development" of the company. The tax policy of the Government of Estonia follows the rule of taxing everything similarly and allowing as few exemptions as possible. Consequently, the idea of specific tax incentives for R&D and innovation expenditures has not been supported by the government so far.

²⁵ Reinilde Veugelers (2014), "Undercutting the Future? European Research Spending in Times of Fiscal Consolidation"

²⁶ The definition of 'Core' R&D activities is provided in the study "Cohesion policy and regional research and innovation potential" http://ec.europa.eu/invest-in-research/pdf/download_en/rkf5th_brochure.pdf

²⁷ Estonian RD&I Strategy 2014-2020

Government support to private sector R&D has mainly been in the form of direct funding via competitive grants. Support measures for enterprises to develop new products, services and technologies are financed via Enterprise Estonia. Examples of innovation-oriented support measures provided via Enterprise Estonia include the Competence Centre Programme and the Innovation Voucher grant.

3.2.4 Fiscal consolidation and R&D

Figure 6 below shows the scatterplot of the structural balance and GBAORD as % GDP (first panel) as well as GERD as % GDP (second panel)²⁸:

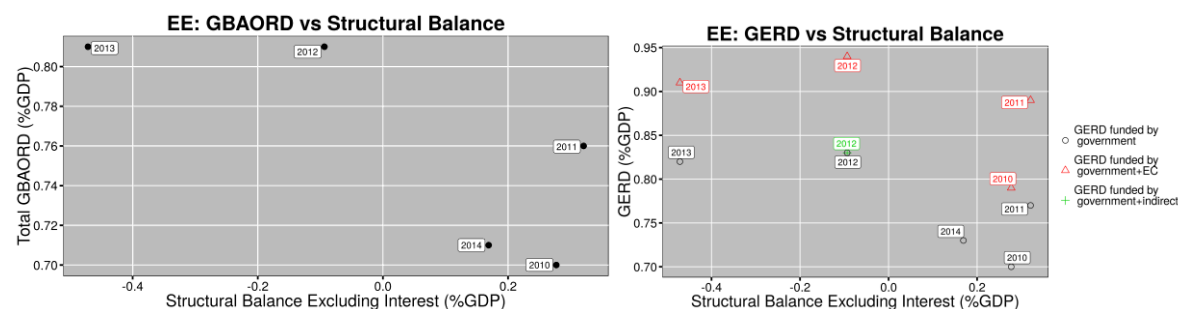


Figure 6 Fiscal consolidation and R&D
Data source: AMECO, Eurostat, OECD

Based on Figure 6, in Estonia there was no post-crisis fiscal consolidation in structural terms. As we have seen in section 3.2.1, fiscal adjustments in terms of GDP were the strongest during 2010-12. Regardless of these adjustments, both R&D appropriations as well as government financed GERD were on an increasing trend both nominally (Figure 4) and in terms of GDP (Figure 6) until 2013. In 2014 the structural balance becomes again positive but at the same time both GBAORD and GERD funded by the government decrease by about 0.1% compared to the previous year.

Based on the above analysis, we can argue that the post-crisis fiscal adjustment process has not come to the expense of public support to the Estonian R&D in the period 2010-2012. It is only in 2014 that the improvement of the structural balance had a negative impact on the public R&D expenses.

3.3 Funding flows

3.3.1 Research funders

The criteria for allocating funds for RDI institutions are set in the Organisation of Research and Development Act (introduced in 1997, last update in 2012). Baseline funding is allocated to R&D institutions if they have received a regular positive evaluation²⁹ (Riigi Teataja, 2010). Infrastructure expenses and institutional research funding are allocated to institutions whose research and development activities have received a regular positive evaluation in at least one field (see also ch. 3.4.2).

The Estonian Research Council (established in 2012) awards institutional and personal research funding (relevant amendments to the Organisation of Research and Development Act are in force since 2012). Institutional research funding (see ch. 3.4.3) is funding allocated for high level research and development and related activities (research topics) of a research and development institution and for ensuring the consistency of research and development in a research and development institution.

²⁸ Structural balance data comes from the AMECO database the other indicators were taken from Eurostat and OECD

²⁹ 50% in proportion with the number of high level publications in internationally recognised journals, the number of high level research monographs and the number of registered patents and patent applications; 40% in proportion with the amount of financing of research and development from other sources i.e. targeted research, commissioned by enterprises, municipalities, ministries etc; 10% in proportion with the number of Doctoral graduates.

Personal research funding is funding allocated for a high level research and development project of a person or a research group working in a research and development institution, including the research scholarship of Master's students and Doctoral candidates and funding allocated in support of research carried out by post-doctoral fellows.

The core set of measures to enhance competitive funding through calls for proposals and evaluations of research and development activities of R&D institutions has been in place since mid-1990ties³⁰. Involving foreign experts is a common rule in evaluating also personal research funding and institutional research funding.

The Estonian Research Council is the main funding organization of R&D, consolidating different grants and types of funding. The Archimedes Foundation is implementing agency for structural support in the field of R&D and administers schemes for improving mobility and marketing. The INNOVE foundation manages a range of programmes and support measures in the fields of lifelong learning and active labour market policies.

The main implementing body of MEAC is the Enterprise Estonia Foundation, which is responsible for managing business support, innovation and technology programmes. Foundation KredEx's mission is to facilitate the increase of competitive strength of Estonian companies by improving the availability of financing and managing credit risks.

The Development Fund (together with the private sector) performs risk capital investments into the starting and growth-oriented technology companies and carries out socio-economic and technology foresight activities.

Private not-for-profit funding of R&D is negligible in Estonia (0% of GDP).

3.3.2 Funding sources and funding flows

The share of EU Structural funds has been growing remarkably from 2009 to 2013. In 2011 and 2012, 64% and in 2013 60% of all public sector RD&I funding was financed under Structural Funds (including co-financing from the state) (Ministry of Finance, 2012, 2013) and the ratio has been about the same in 2014 (ERC data, 2015). As the funding from the structural funds has been specifically targeted for infrastructure development, mobility schemes and internationalisation, the possibilities to use it for other general needs, such as researchers' salaries, maintenance costs and indirect costs was limited (ERAC, 2012).

The overall absorption of 2007-2013 R&D structural funds is 100%, however some adjustments were made in funding areas: while absorption of support for infrastructure was over 200% and measures to stimulate research and innovation and entrepreneurship in SMEs 180%, the assistance to SMEs for the promotion of environmentally-friendly products and production processes was only 11%. (European Commission, JRC-IPTS, 2015b).

In the business enterprise sector, investments dropped by 1.9% during the crisis, but doubled in 2011 compared to 2010, and in 2011 Business Expenditures on Research and Development (BERD) results in 1.5% of GDP. In 2011-2012 one could note a significant growth in BERD, mostly due to big R&D investments in shale oil refining industry. Although this effect faded and BERD declined to 1.24% of GDP in 2012 and to 0.83% in 2013, BERD in absolute terms doubled from 2009 to 2013, but in 2014 (€124m) closes again to the levels of 2010 (€118m).

In terms of flows, almost all of the private funding was performed by the private sector itself.

³⁰ Relevant laws: [Organisation of Research and Development Act](#) (introduced in 1997) and [2014-2020 Structural Assistance Act](#) (introduced in 2004 for each programming period)

All public support measures to enterprises require co-funding by the applicant and it depends on the size of the enterprise and the support measure, but often the co-funding for enterprises is about 50%.

Estonia's inward FDI stock is large, accounting for roughly 90% of GDP in 2012 and a large share of inward FDI flows is directed towards financial intermediation. In 2014, Estonia attracted €15.9bn of foreign direct investment and 8.4% of it was made into professional, scientific and technical activities.

3.4 Public funding for public R&I

3.4.1 Project vs. institutional allocation of public funding

The main bodies through which RD&I is funded are MER and MEAC. MER is responsible for the funding of R&D (including applied and basic research) at R&D institutions and MEAC for funding applied research, technology development and innovation. The share of competitive versus institutional funding in the R&D national budget of MER was 69% and 31% respectively in 2011 (ERAC, 2012) and even 80% vs 20% more recently (Koppel, 2014).

Likewise, most of the R&D funding from the budget of the Ministry of Economic Affairs and Communication (MEAC) (12% of total R&D budget in 2012) is provided on a competitive basis and MEAC funding instruments include a very high share from the EU Structural funds (ERAC, 2012). The amount of funding of R&D through other ministries is small (5% in 2014).

Overall, the three largest RD&I funding instruments comprise ca 40% of total public funding. In absolute numbers, government funding increased from €103m in 2010 to €148m in 2014. The main RD&I funding instruments in MER are (Estonian Research Council, 2015):

- baseline funding of evaluated R&D institutions, based on R&D quality and outcome (7% of total government funding in 2014);
- institutional funding (targeted financing of research topics of evaluated R&D institutions, competitive institutional grant for research groups) (24% of total government funding in 2014 ³¹);
- personal research funding (individual R&D grants, competitive) (6% of total government funding in 2014);

This share of financing from MER budget has remained almost the same since 2007 when the 2007-2013 financing framework was approved by the Government within the state budget strategy. Although the titles of funding instruments were changed within the reform in 2011-2012, the shares have changed little.

The discontent with the very high share of competition-based funding (ca 80%) in the present model of financing has been aired since the new system was introduced in 2012. In the end of 2014, a working group was set up to formulate proposals for improving the R&D funding system. The proposals were presented in the beginning of January 2015 and suggest that the current "triple breakdown" into institutional research funding, personal research funding and baseline funding should be replaced by a "dual breakdown", which would consist of stable operating subsidies to research institutions and competition-based research grants. Their proportion should be shifted from the existing ratio of 20:80 to 50:50 (MER news, 05.01.2015) and even though the total R&D budget for 2016 is 5% smaller than in 2015 (due to the effect of declining support from Structural funds), the baseline funding from the state budget will grow with about 50% - from €9.2m in 2015 to €13.9m in 2016 (MER, 2015b).

³¹ After introducing the *institutional funding* scheme, infrastructure maintenance costs are allocated via that instrument.

3.4.2 Institutional funding

The criteria for allocating block funds (in the case of Estonia – baseline funding) for RDI institutions are set in the Organisation of Research and Development Act (introduced in 1997, last update in 2012). Baseline funding is allocated to R&D institutions if they have received a regular positive evaluation (Riigi Teataja, 2010) - 50% in proportion with the number of high level publications in internationally recognised journals, the number of high level research monographs and the number of registered patents and patent applications; 40% in proportion with the amount of financing of research and development from other sources i.e. targeted research, commissioned by enterprises, municipalities, ministries etc; 10% in proportion with the number of Doctoral graduates.

In addition, institutional research funding, including infrastructure expenses, is competitively allocated to institutions whose research and development activities have received a regular positive evaluation in at least one field. Notwithstanding its name, institutional research funding in Estonia is actually a project-based type of funding (see section 3.4.3).

To carry out regular evaluation of R&D institutions, the Minister of Education and Research shall form a 3-16-member evaluation committee consisting of foreign experts in the various fields and approve its working procedure (Riigi Teataja, 2012).

3.4.3 Project funding

Competitively allocated institutional research funding (relevant amendments made to the Organisation of Research and Development Act in 2012) is funding allocated for high level research and development and related activities (research topics) of a research and development institution and for ensuring the consistency of research and development in a research and development institution. Since 2014, infrastructure maintenance is also added here. The evaluation of the institutional research funding applications is organized by the Estonian Research Council. The assessment is performed by the Estonian Research Council's evaluation committee by means of international peer review. Institutional research funding as a new mechanism created confusion, because it consists of both an evaluation of institution and evaluation of research theme and its implementation has been therefore challenging (Koppel, A., 2014).

The Estonian Research Council (established in 2012) awards not only institutional but also personal research funding. Personal research funding is funding allocated for a high level research and development project of a person or a research group working in a research and development institution, including the research scholarship of Master's students and Doctoral candidates and funding allocated in support of research carried out by post-doctoral fellows. Applicants must be employees of an Estonian R&D institution.

In addition to implementing the national financial instruments, the Estonian Research Council also is responsible for project based funding programmes such as the Health promotion research programme TerVE and the Environmental protection and technology R&D programme KESTA, as well as Programme TeaMe for science popularization and the mobility programme for researchers Mobilitas. All of these programmes ended in 2015. Two programmes have follow ups: Mobilitas plus (follow up of the Mobilitas programme, with the aim to activate international exchange of researchers and knowledge, with total budget for 2015-2022 of €35.4m), and Programme TeaMe plus for science popularization (total budget for 2015-2020 €3.2m). In the end of December 2015, a new Programme for strengthening the sectoral research and development (in Estonian, Tegevus "Valdkondliku teadus-ja arendustegevuse tugevdamine (RITA)" with total budget for 2015-2020 of €28m) was approved. The programme includes funds for ministries for hiring R&D specialists, commissioning R&D studies from universities and developing information systems.

The core set of measures to enhance competitive funding through calls for proposals and evaluations of research and development activities of R&D institutions has been in place since mid-1990s³². Involving foreign experts is a common rule in evaluating also personal research funding and institutional research funding.

3.4.4 Other allocation mechanisms

To promote the productivity and international competitiveness of the best research groups working at the forefront of their respective fields, the programme of Centres of Excellence in Research was launched in 2001. A centre of excellence in research is a consortium of several research groups internationally recognised in their field of research.

The activity "Support for centres of excellence for promoting competitiveness and high quality of research" (in Estonian, Teaduse tippkeskuste toetamine teaduse rahvusvahelise konkurentsivõime ning tippkvaliteedi tugevdamiseks) is funded from the European Structural Funds (41.17m is allocated for 2016-2023³³). The managing authority is Archimedes Foundation.

The activities to be funded under the measure include research and development directly related to a centre of excellence, the acquisition of infrastructure and equipment, visits or work assignments carried out in other institutions, training, mobility of researchers, national and international cooperation relating to centres of excellence, the development and testing of innovative ideas, dissemination of information and popularisation of research findings.

3.5 Public funding for private R&I

3.5.1 Direct funding for private R&I

Two ministries are mainly responsible for RD&I. Funding streams cover the entire R&DI process from fundamental research to market innovation - in general, MER is responsible for research area and MEAC supervises support for and funding of business sector R&D and is responsible for funding applied research, technology development and innovation.

The main implementing body of MEAC is the Enterprise Estonia Foundation, which is responsible for managing business support, innovation and technology programmes. Foundation KredEx's mission is to facilitate the increase of competitive strength of Estonian companies by improving the availability of financing and managing credit risks, and the improvement of the energy efficiency of the housing sector by expanding financing possibilities and offering financing solutions aimed at promoting energy efficiency and increasing the use of energy from renewable sources.

Government support to private sector R&D is mainly direct funding via competitive grants. Support measures for enterprises to develop new products, services and technologies are financed from the Enterprise Estonia support scheme for R&D projects as follows:

Technological development centres for 2014-2020 (the 3rd consecutive programme, total budget €40m) – to develop the technologies, products and services necessary for increasing international competitiveness and smart specialisation; develop internationally high-level and competitive technological development centres that eventually will be independent of national financial instruments and provide Estonian entrepreneurs with opportunities for co-operation in the development of new technologies, products and services; increase qualified staff numbers in business-oriented R&D, and their movement between businesses and research institutions.

³² Relevant laws: [Organisation of Research and Development Act](#) (introduced in 1997) and [2014-2020 Structural Assistance Act](#) (introduced in 2004 for each programming period)

³³ 44.7m was allocated for 2008-2015 via the measure "Development of centres of excellence in research".

Cluster development Programme – aiming to increase the value added of the companies and the sales of the products/services and exports; to promote cooperation between companies of the same and different sectors, and companies and research institutions (2014-2020 total budget €10m).

Innovation voucher grant for SMEs for knowledge and technology transfer and co-operation with R&D institutions, including procurement of innovation services related to product or service or production or technology development, design, feasibility studies, standardisation and certification, patent registration, etc (2014-2020 total budget €10m).

The Enterprise Development Programme was launched in January 2016 which aims to support well-thought-out development, improved action planning, innovation implementation and product development. It targets industrial enterprises or companies in smart specialization fields operating for at least 3 years with more than 8 employees.

MER also launched the activity “Support for applied research in the areas of smart specialisation” (in Estonian, Rakendusuringute toetamine nutika spetsialiseerumise kasvuvaldkondades (NUTIKAS)). The aim is to support enterprises tendering applied research or product development from Estonian public R&D institutions. (2014-2020 budget from Structural Funds €26.6m + €15m co-funding from enterprises).

In addition, the Baltic Innovation Fund (BIF) is a Fund-of-Fund initiative launched by the EIF in close co-operation with the Governments of Lithuania, Latvia and Estonia in 2012 to boost equity investments made into Baltic Small and Medium sized enterprises (SMEs) with high growth potential. In 2013-2016 BIF invests €100m in private and venture capital investment funds (sub-funds) and investments from private investors and pension funds are added in at least the same amount. In addition, venture capital investments are made via the Estonian Development Fund (see more in section 5.4).

According to the Mid-term evaluation of innovation and enterprise support policies (MEAC, 2014)³⁴, these measures have been mostly successful and R&D grant was rated the most positive with the strongest effect and has enabled companies to reach commercialisation more easily. Innovation voucher recipients showed positive developments in employee numbers and labour costs. The importance of grant awards to company development was rated at 5.1 points out of 7 by recipients, but on the negative side, many pointed out that no follow-up projects were carried out after receiving the innovation grant, mainly because small companies do not have sufficient means to do so.

According to the Interim evaluation of the cluster programme (MEAC, 2013) both the cluster managers and enterprise managers gave a positive evaluation to the cluster programme. Of the enterprises in the cluster, 65% would not make any change to the cluster strategy. According to an enterprise that was not satisfied with the cluster strategy, the strategy should include more clearly measurable objectives and an action plan framework, a sharper focus, and could involve more enterprises as well as research and education institutions. During the review of cluster strategies, these proposals have been considered.

As cooperation with research institutions progresses slowly and is time-consuming, increase in cooperation may not be attainable through the development of the clusters, but rather with a combination of other measures in the field of innovation. R&D institutions mainly conducted surveys on the issues of common interest of cluster members.

³⁴ More on evaluations in section 2.2.1

Since 2001, public support given to develop innovation policy has been mainly given in the form of grants. The size of the grant varies according to the requirements and conditions of the measure and the legal status of the applicant. Almost in all cases the grants are subject to the European Union state aid rules, mainly de minimis or block exemption.

To date, no national target has been introduced on public procurement of innovative goods and services. Development of national procurement policy measures is addressed in the Implementation plan for the "Entrepreneurship Growth Strategy 2014-2020" (responsibility of MEAC). The Development of national procurement policy measures (total budget €40m) aims to increase the role of the public sector as the leader of innovation in enterprises under the fields of growth of smart specialisation, i.e. in commissioning and initiating R&D and innovation. The innovations include innovative procurements, development activities of enterprises under the leadership of the public sector, design of public services, public and private sector partnership, demonstration projects, as well as the infrastructure and information technology solutions required. In the framework of the general Development of national procurement policy measures a new measure "State as a smart customer" will be launched to improve demand-side innovation policies (total budget €20m). The conditions for the grant of support were specified in the first half of 2015 and during 2015 it was planned to start accepting applications for support and carry out pilot projects (see also section 3.6).

In Estonia, there is no one single act dealing specifically with public-private partnership (PPP) projects. PPP is regulated by the Public Procurement Act and the Competition Act. Besides the Guidelines on the Public Procurement Proceedings issued by the Ministry of Finance, no PPP administrative guidance, framework or policy has been adopted.

3.5.2 Public procurement of innovative solutions

Legal Public Procurement framework

The Estonian public procurement regime is governed by the Public Procurement Act³⁵ (adopted in 2007, last amendments in 2014) implementing the relevant European Community directives on public procurement (Directives 2004/17/EC, 2004/18/EC and 2009/81/EC). The standard national threshold for the publication of public procurement in Estonia is €40,000 in the event of a public supply contract, a public service contract and a design contest and €250,000 in the event of a public works contract and a public works concession, provided that the public procurement procedure has been launched in 2008 or later.

PCP/PPI landscape and initiatives in Estonia

Public procurement has already been successfully applied in the ICT domain in Estonia and has achieved moderate success in defence. In order to support modernisation of the private sector, a more generic policy targeting innovation in public procurements has recently gained interest in the country and it has moved away from a "no policy" policy (Lember, 2014).

As a result of two feasibility studies in 2012 and 2014, the development of public procurement for innovation policy measures is addressed in the Implementation plan for the "Entrepreneurship Growth Strategy 2014-2020"³⁶ (responsibility of the Ministry of Economic Affairs and Communications). The measure development of demand-side policies (total budget €40m) aims to increase the role of the public sector as the leader of innovation in enterprises under the fields of growth of smart specialisation, i.e. in commissioning and initiating R&D and innovation.

³⁵ <https://www.riigiteataja.ee/en/eli/530012014002/consolide>

³⁶ http://kasvustrateegia.mkm.ee/index_eng.html

The innovations include innovative procurements, development activities of enterprises under the leadership of the public sector, design of public services, public and private sector partnership, demonstration projects, as well as the infrastructure and information technology solutions required. In addition, as a result of the "Feasibility study for the Design and Implementation of Demand-side Innovation Policy Instruments in Estonia"³⁷ a new measure "State as a smart customer" will be launched to improve demand-side innovation policies (total budget €20m, co-financed by the ERDF). The conditions for granting support were specified in the first half of 2015 and during the end of 2015 and the beginning of 2016 it is planned to start accepting applications for support (grants) and carry out pilot projects with progressive procurers.³⁸ In addition, "soft" measures to generate change in behaviour concerning risk aversion (e.g. via awareness raising and sharing best practices) and to develop competencies (e.g. practical guides, trainings, consultancy) are envisaged.

The coordinating agency on innovation procurement is Enterprise Estonia. The Government Office also plays a key role in horizontal co-ordination – in 2016 the launch of a horizontal task-force is expected (on "public sector innovation") and the set-up of a numerical target for the share of innovation procurement is envisaged in the Government activity plan³⁹.

3.5.3 Indirect financial support for private R&I

No tax incentives have been given to the R&D and innovation investments except that the companies' income is free of taxation to the extent that they reinvest their profit. There are no instructions whether the reinvestment has to be made in R&D and innovation or into something else, the only criteria are for the investments to be made into the development of the company. The tax policy of the Government of Estonia follows the rule of taxing everything similarly and allowing as few exemptions as possible – consequently, the idea of specific tax incentives for R&D and innovation expenditures has not been supported by the government so far.

3.6 Business R&D

3.6.1 The development in business R&D intensity

As one can see from Figure 7, BERD intensity tripled between 2005 and 2011, with a high one-off peak in 2011 due to investments in the manufacturing sector and more specifically the manufacture of coke and refined petroleum products (C19) sector. Since 2011 BERD has been going down to 0.64% of GDP in 2014 which is close to the 2009-2010 pre-peak values and is below the EU-28 average. Figure 7 also shows that in Estonia until 2010 Services of the business economy (sectors G-N) had the highest R&D intensity but in 2010 and 2011 the Business R&D in Manufacturing (sector C) increased almost three-fold and became the most R&D intensive sector.

In 2013 this is no longer the case and the Service sector is again the most BERD intensive one. The spike in manufacture BERD is due to massive investments in the manufacture of coke and refined petroleum products (C19) which increased significantly in 2011 due to big investments in the oil shale sector (as will be discussed in more detail in Section 3.7.2).

The business sector is the main funder of the Estonian BERD and it has been the main driver of its changes (Figure 8). External resources, notably EU funding and public sector funding are relatively marginal throughout the whole period under scrutiny.

³⁷ https://www.mkm.ee/sites/default/files/final_report_part_1.pdf

³⁸ Ministry of Economic Affairs and Communications. <https://www.mkm.ee/en/objectives-activities/economic-development-and-entrepreneurship/innovation#state-as-a-smart-customer10>

³⁹ Ministry of Economic Affairs and Communications, Presentation delivered during the 2015 EU Innovation Procurement event , Paris, 27 October 2015

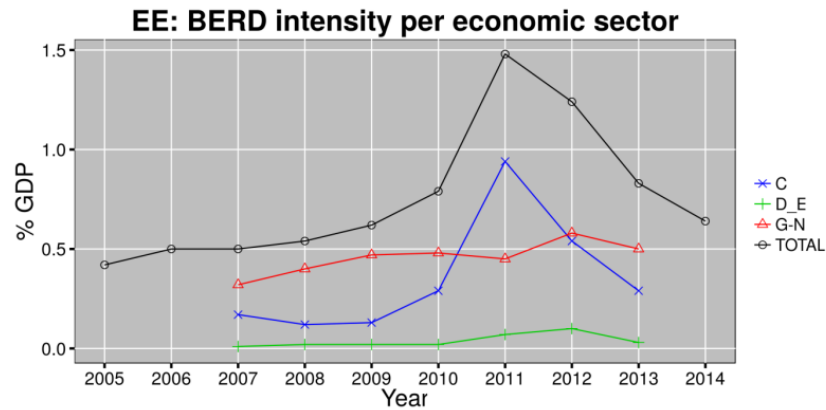


Figure 7 BERD intensity broken down by most important macro sectors (C= manufacture, D_E=electricity, gas, water supply etc., G_N=services).

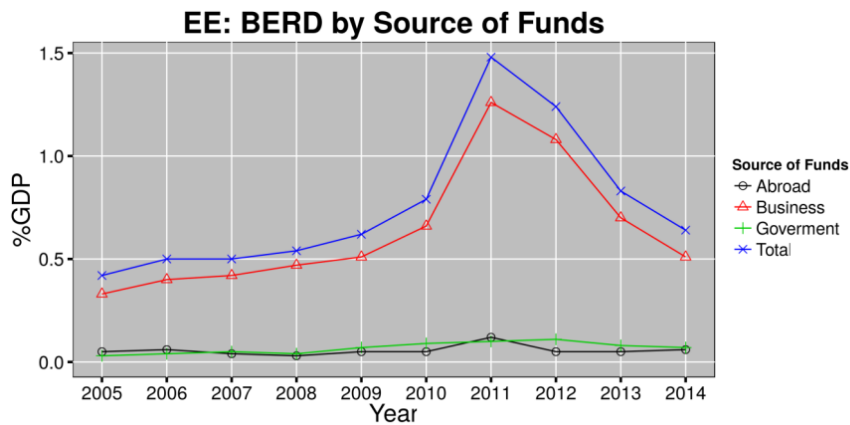


Figure 8 BERD by source of funds

3.6.2 The development in business R&D intensity by sector

Based on Figure 9, below, the highest BERD spender in manufacturing is by far the Manufacture of coke and refined petroleum products (C19), followed by manufacture of chemicals and computer, electronic and optical products with almost equal shares. None of them seem to be too strongly affected by the crisis in terms of R&D expenditure.

According to Statistics Estonia, "the remarkable growth of Estonia's expenditures on research and development (R&D) in 2010 and 2011 was the result of considerable investments in new technology in the oil industry⁴⁰. Estonia is unique among EU Member States in that its energy sector is dominated by one primary source of energy, oil shale⁴¹. The Estonian oil shale deposits account for just 17% of all deposits in the EU, but Estonia has generated most of its power from oil shale⁴².

⁴⁰ <http://www.stat.ee/65128>

⁴¹ Not to be confused with shale oil, oil shale is a sedimentary rock containing up to 50% organic matter rich in hydrogen, known as kerogen. The extracted rock can be used directly as a power plant resource or it can be processed to produce shale oil, which in turn can be refined into gasoline, diesel or jet fuels (International Energy Agency).

⁴² A study on the EU oil shale industry – viewed in the light of the Estonian experience. A report by EASAC to the Committee on Industry, Research and Energy of the European Parliament, March 2007

Eesti Energia Kaevandused, a subsidiary of the state owned electricity production group, Eesti Energia, dominates the production of oil shale⁴³. Given the small size of the country and its market, significant change in the R&D expenditure in one big company would be immediately reflected in the county's total BERD.

The present State Development Plan for the use of oil shale gives preference to the production of electricity from oil shale (due to the country's drive for self-sufficiency of energy supply and its competitive price), and in 2012, 70% of total primary energy supply was derived from this indigenous energy source⁴⁴. The other major government policy priority in the energy sector was to reduce its carbon intensity, which created the incentive for increased innovation expenditure in the oil shale sector in order to boost efficiency and to reduce the big carbon intensity of the sector. The research concentrated on two aspects: maximising the production of liquid fuel and reducing the carbon intensity of oil shale-based power and heat generation.⁴⁵

Consequently, the Enefit 280 oil shale plant was constructed. The 2011 peak, however, was a short-lived particular phenomenon and BERD returned to its pre-peak level in 2014. The fall in oil prices may also contribute to the future slowing down of the oil shale business.

As far as the chemical sector is concerned, several large-scale enterprises of the chemical industry are located in the industrial area of the North-Eastern Estonia and have found partners and markets abroad. Up to 85% of the chemical industry production is exported.⁴⁶ The largest factories include Viru Keemia and Velsicol in Kohtla-Järve and Silmet in Sillamäe. Velsicol is one of the world's few producers of benzoic acid, Viru Keemia makes different oil shale products (e.g. oil shale oil). Silmet is one of Europe's largest producers of rare earth metals.⁴⁷

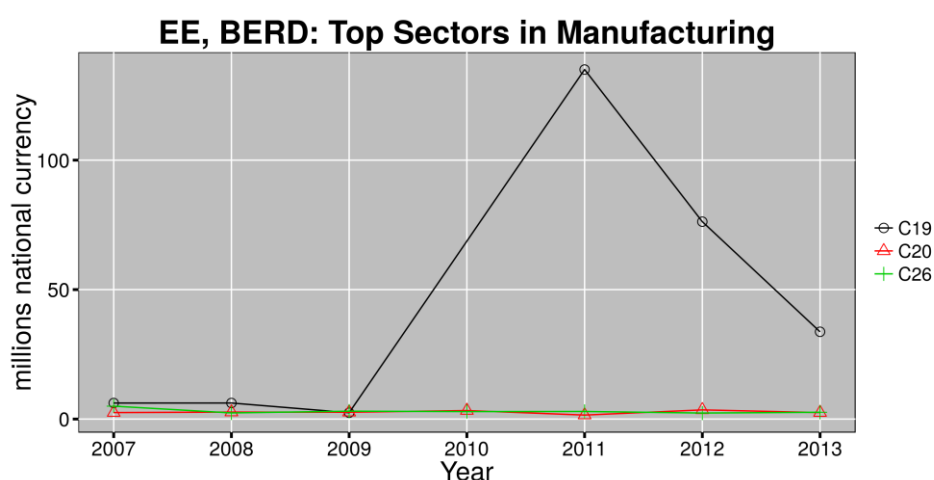


Figure 9 top sectors in manufacturing (C19=Manufacture of coke and refined petroleum products; C20=Manufacture of chemicals and chemical products; C26=Manufacture of computer, electronic and optical products).

⁴³ Estonia: Inventory of estimated budgetary support and tax expenditures for fossil-fuels 2013, OECD. http://www.oecd-ilibrary.org/environment/inventory-of-estimated-budgetary-support-and-tax-expenditures-for-fossil-fuels-2013/estonia_9789264187610-12-en

⁴⁴ Energy Policies Beyond IEA Countries, Estonia, International Energy Agency 2013. https://www.iea.org/publications/freepublications/publication/Estonia2013_free.pdf

⁴⁵ Ibid.

⁴⁶ <http://www.keemia.ee/en/chemical-industry-in-estonia>

⁴⁷ http://www.estonica.org/en/Economy/General_overview_of_Estonian_economy/Processing_industry/

In the business services sector ICT, professional, scientific and technical activities, and the financial and insurance activities sectors are the top R&D spenders (Figure 10).

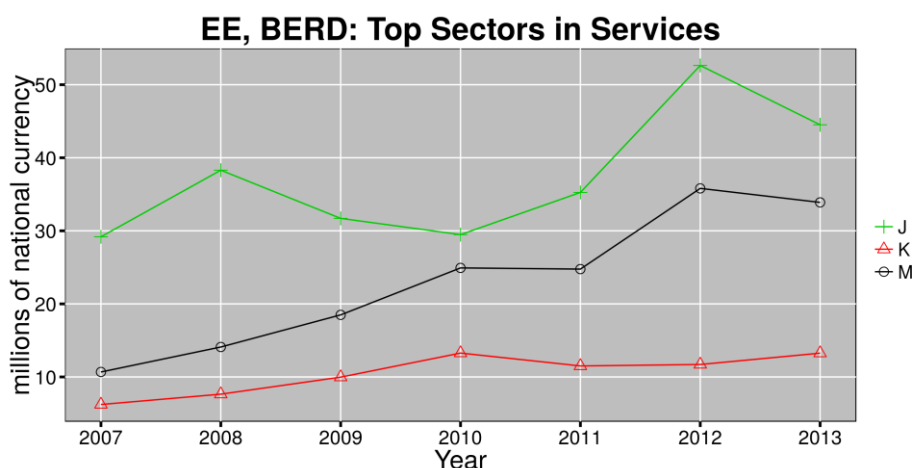


Figure 10 top service sectors (J=information and communication, K=Financial and insurance activities, M=professional, scientific and technical activities).

ICT is one of the fields that has had the fastest growth in the last 10-15 years in Estonia, and was not severely affected by the economic crisis. Computer programming, consultancy and related activities (J62) is currently the most innovative sector in the country after the oil shale R&D investment boom subsided. The mobile phone and Internet penetration rates are very high in the country and almost the entire population can access the web⁴⁸. More and more public services are offered through the Internet (e-ID cards, electronic voting, e-health, e-tax, etc). Skype remains the most prominent example of the innovative approach that typifies Estonian ICT.

The number of ICT enterprises is quite big (ca. 3,000 in 2013) and the majority of them are start-ups and SMEs that have less than 10 employees. In 2013, most of ICT enterprises provided programming and consultation services and only 2.4% of them were engaged in manufacturing.⁴⁹ Following initial technology transfers and learning from other countries, Estonian companies have themselves increasingly become creators of new solutions and content. In addition, the ICT sector witnesses the highest number of high growth innovative enterprises and the second highest number of employees among the most innovative sectors in the recent years.

Estonia's inward FDI stock is large, accounting for roughly 90% of GDP in 2012. A large share of inward FDI flows is directed towards financial intermediation. Almost 50% of FDI comes from Finnish and Swedish investors.⁵⁰ The banking industry is dominated by the Nordic players. The financial and insurance activities sector is among the top 3 R&D spenders in the services sector and its BERD expenditure hasn't been severely affected by the crisis.

3.6.3 The development in business R&D intensity and value added

Figure 11 shows the contribution of each economic sector to the total GVA in 2014 compared with the EU-28 as a benchmark. One can notice that manufacturing, wholesale and retail trade and real estate activities are the sectors with the highest GVA, which account for approximately 40% of the total Gross Value Added of Estonia.

⁴⁸

http://www.estonica.org/en/Economy/General_overview_of_Estonian_economy/Information_technology_and_telecommunications/

⁴⁹ Statistics Estonia

⁵⁰ Statistics Estonia, 2014

The percentages of GVA from wholesale and retail trade exceed the EU-28 figures and the manufacturing GVA is on par with the EU average. However, the R&D expenditure of these sectors is very limited. The ICT sector, although being the biggest R&D spender, is only 6th in terms of GVA contribution (a bit more than 5%) which may be due to the fact that the majority of the ICT companies in Estonia are quite small.

Figure 12 focuses on the economic sectors under Manufacture. Sector C16 - Manufacture of wood and of products of wood and cork is much beyond the EU-28 level and contributes the most in the GVA of Estonia followed by sectors C10-C12 - Manufacture of food products, beverages and tobacco products and C25 - Manufacture of fabricated metal products, except machinery and equipment. It is noteworthy that the manufacturing sector with the highest R&D investments, C19 - Manufacture of coke and refined petroleum products, accounts for less than 1% of the total GVA. The same is true for C20 – Manufacture of chemicals and chemical products. This means that there is no correlation between R&D intensity and GVA contribution.

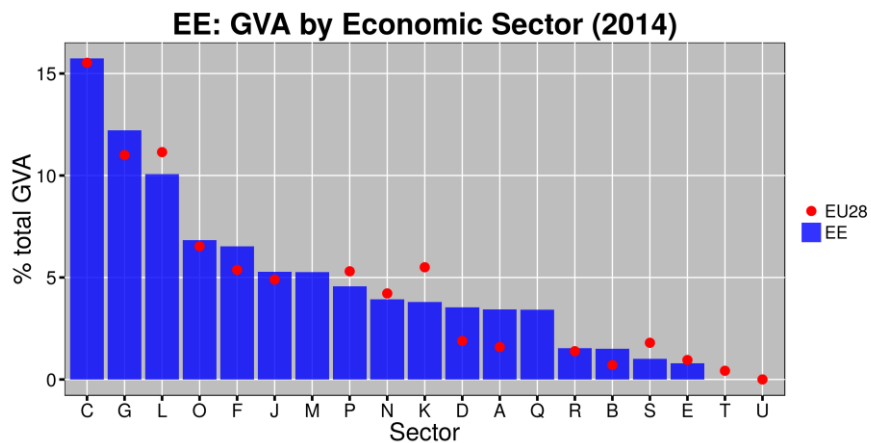


Figure 11 economic sectors as percentage of the total GVA. Top 6 sectors in decreasing order: 1) Manufacturing, 2) Wholesale and retail trade; repair of motor vehicles and motorcycles; 3) Real estate activities; 4) Public administration and defence; compulsory social security; 5) Construction; 6) Information and communication.

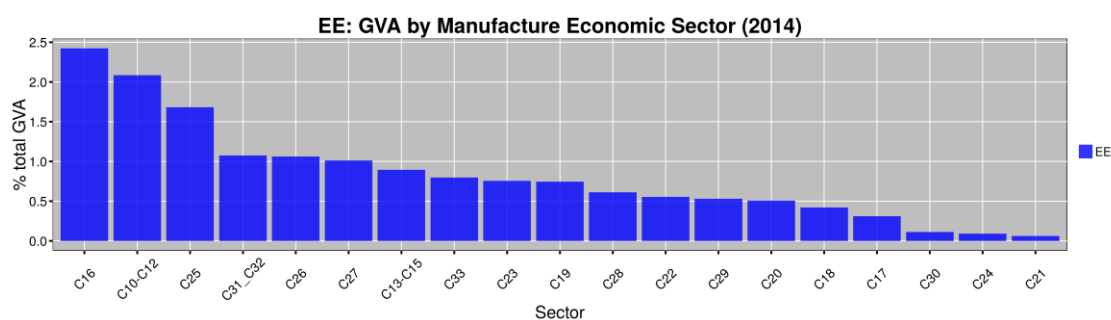


Figure 12 GVA in manufacturing. Top 6 manufacturing sectors: 1) Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; 2) Manufacture of food products; beverages and tobacco products; 3) Manufacture of fabricated metal products, except machinery and equipment; 4) Manufacture of furniture; other manufacturing; 5) Manufacture of computer, electronic and optical products; 6) Manufacture of electrical equipment.

Figure 13 shows the VA of the most BERD intensive manufacture and service sectors. ICT (J), professional, scientific and technical activities (M) and financial and insurance activities (K) are the most prominent sectors. Their VA showed a similar behaviour throughout the analysed period: ascending up until the crisis, decreasing (but not sharply) during the crisis and being on a recovering path afterwards and surpassing the pre-crisis levels (except financial and insurance activities). Unsurprisingly, financial and insurance activities (K) were hit the hardest during the crisis and recovered the slowest. Similarly, the most R&D intensive manufacturing sectors were also affected by the crisis and subsequently recovered (except the chemicals sector), as evidenced by their VA at factor costs.

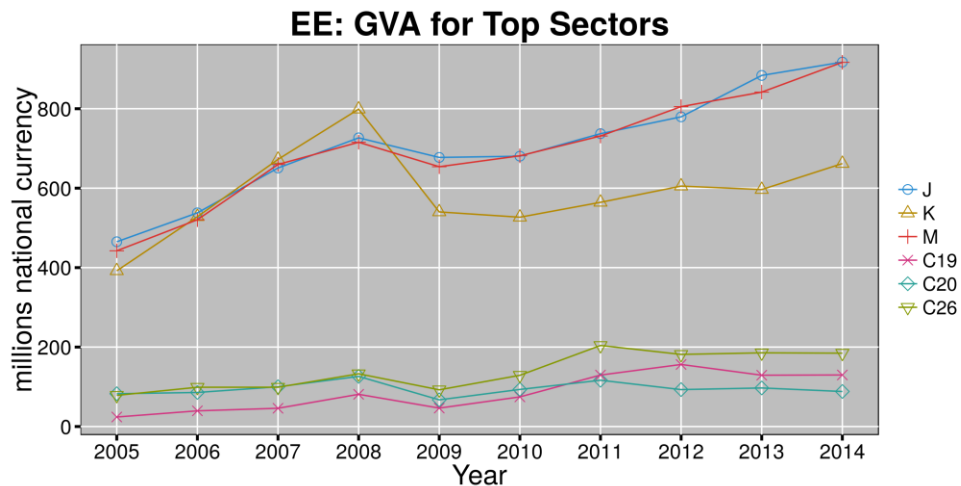


Figure 13 Value added for the leading sectors.

3.7 Assessment

The discontent in research community with the very high share of competition-based funding (ca 80%) in the present model of financing public R&D institutions has been aired since the new system was introduced in 2012. In the end of 2014, a working group was set up to formulate proposals for improving the R&D funding system. The proposals were presented in the beginning of January 2015 and suggest that the current “triple breakdown” into institutional research funding, personal research funding and baseline funding should be replaced by a “dual breakdown”, which would consist of stable operating subsidies to research institutions and competition-based research grants. Their proportion should be shifted from the existing ratio of 20:80 to 50:50. However, this reform depends on additional funding (about €30m per year) and is not approved yet.

The aim of project-based financing to set focus from process to output was justified in the mid- 90ties, while the whole system needed reform. For now it is clear that too many short-term projects create instability and do not contribute to long term research.

Public support to private sector R&D is mainly direct funding via competitive grants. MEAC plans to exit large-scale support schemes and considers the possibility to replace current direct support actions in business sector gradually with financing instruments.

The aim of public support to enterprises is to encourage innovation and increase productivity of enterprises and thus the innovation and entrepreneurship policies are focused on two strategic issues - *activity areas* with major potential (growth areas) and *enterprises* with major potential.

According to the new Entrepreneurship Growth Strategy for 2014-2020, the focus of new RDI support measures has been set on Smart Specialisation areas (ICT supporting other sectors; health technologies and services; resource efficiency). The set of new measures takes into account experiences from previous programmes and is better focused. New measures address the need to provide seed capital and offer consultations to start a business, to create conditions for the development of ideas and teams, and give access to venture capital. New measures also encourage product development via cooperation with R&D institutes. In addition, the role of the state as a customer for innovative solutions is enhanced by steering public procurements towards procuring more innovative solutions.

4. Quality of science base and priorities of the European Research Area

4.1 Quality of the science base

Estonia is small compared to most other EU countries, and this reflects on the size of its infrastructure and funding opportunities. Under the EU programming period 2007-2013 funding, research infrastructure was developed quite extensively. In general, present activities concerning infrastructure investments have been sufficient to cover the insufficient investments from the previous programming periods. In the future, the main focus will be on ensuring the sustainability of this infrastructure. In the 2014-2020 programming period, the main focus of funding will be on making social and economic effects of these capacities.

Estonia's innovation performance has been increasing at a steady rate until 2013, but declined in 2014. Estonia's performance relative to that of the EU has also been improving from 81% in 2007 to 94% in 2013 but strongly declined to 88% in 2014 (IUS, 2015). Estonia's relative strengths are in Finance and support (based on one indicator only) and Firm investments (although the decline in oil shale investments will probably have an impact). Estonia performs well above the average on International scientific co-publications, Non-R&D innovation expenditures and Community trademarks. Performance is well below the EU average for License and patent revenues from abroad and Non-EU doctorate students.

The biggest problem is still the economic effect of innovation, where Estonia holds the 22nd position. Considering the criterion of open, excellent and attractive research system, Estonia holds the 16th position and the same for the human resources criterion. Therefore, among the main challenges for Estonia is employment in medium and high-tech industry and knowledge-intensive services.

Trends for patenting and for scientific publications are positive. The number of international scientific co-publications per million of population increased from 500 in 2009 to 960 in 2013 and patents applications per million of population have been around 30 from 2009 to 2012 (32 in 2009, 28 in 2010, 30.5 in 2011, 32 in 2012; MER, 2015). Estonian universities have a big share (50%) of patent applications, compared to Finland and Sweden where enterprises apply for 94.5% of PCT applications (Mets, 2014). Patent application activity of Estonian scientists, compared to their scientific publications (two applications per 100 ISI articles), are on the same level with Swedish researchers. Problems can be seen, however, in IP transfer to industrial partners and also in the quality of patenting decisions, as well as in linking IP strategy and R&D strategy generally.

On average in 2013, Estonia produced 1.82 publications per 1000 inhabitants, slightly above the EU28 average (1.43). They are also internationally oriented with 52.8% of publications internationally co-published. In 2013, Estonia had about 0.96 international scientific co-publications per thousand population, which is almost 4 times more than in Latvia (0.24) and 3 times more than in Lithuania (0.33), but 1.7 times less compared to Finland (1.6). In the period 2000-2013, nearly 11% of the Estonian scientific publications were in the top 10% most cited publications worldwide in comparison with 11.29% of top scientific publications produced in the EU28 (RIO bibliometric indicators, 2015). The share of public-private co-publications in Estonia was 1.2% in the period 2011-2013 against 1.8% for the EU28 again signalling a science-industry cooperation challenge in the country.

All of the above indicators point out to a relatively high quality of the Estonian science base with a few persisting bottlenecks such as insufficient science-industry collaboration and a short supply of highly qualified human resources partially due to outward migration and lower attractiveness of research careers due to short-term funding models and lower than the EU average salary levels.

Table 5 Bibliometric indicators, measuring the quality of the science base

Indicator	Year	EU
Number of publications per thousand of population	1.82 (2013)	1.43 (2013)
Share of international co-publications	52.8% (2013)	36.4% (2013)
Number of international publications per thousand of population	0.96 (2013)	0.52 (2013)
Percentage of publications in the top 10% most cited publications	10.93% (2000-2013)	11.29% (2000-2013)
Share of public-private co-publications	1.2% (2011-2013)	1.8% (2011-2013)

Source: JRC IPTS RIO elaboration on Scopus data collected by Sciencematrix in a study for the European Commission DG RTD (Campbell, 2013). The share of public-private co-publications is derived from the Scival platform and is also based on Scopus data (September 2015). SciVal® is a registered trademark of Elsevier Properties S.A., used under license. The data on public-private co-publications is not fully compatible with the data included in the IUS, due to differences in the methodology and the publication database adopted.

4.2 Optimal transnational co-operation and competition

Increasing the participation and visibility of Estonia in international RDI cooperation is one of the key objectives in the new RD&I Strategy for 2014-2020, which also focuses on the three growth areas of Smart Specialisation (ICT supporting other sectors; health technologies and services; resource efficiency). The Implementation plan for the RD&I strategy includes the "Strategic framework for international co-operation and innovation partnership in the EU" (approved in February 2015).

The Implementation plan for RD&I strategy for "Knowledge Based Estonia 2014-2020" (MER, 2014b) includes specific actions to analyse options to ensure the openness of Estonia's research and development programmes for international cooperation and to develop cooperation opportunities with third country researchers and research institutions.

Most of the joint financing actions are regulated by the 2014-2020 Structural Assistance Act (Riigi Teataja, 2014b) and by the Organisation of Research and Development Act and related acts and procedures, designed for specific measures and funds. Regulations for allocating competitive public funds always define priorities, selection criteria and procedures, reporting requirements, eligibility criteria, definition of eligible costs, intellectual property rights, standards for proposal evaluation, funding rates, etc. Joint financing is welcome and project partners are selected based on excellence, not on country of origin. Universities and other R&D institutions are independent and can choose their partners from any country in the world.

Estonia's capacity (human and financial resources) to participate in different international initiatives is limited because of the size of the country; consequently choices have to be made for optimum use of those resources. Estonia is participating in international initiatives such as Joint Programming Initiatives (agriculture and food security, healthy and productive seas and oceans, water challenges, climate (as an associated member), antimicrobial resistance (as an observer), cultural heritage (as an observer), healthy diet for a healthy life (as an observer)), Joint Technology Initiatives (innovative medicines, hydrogen and fuel cells, nanoelectronics), Knowledge and Innovation Communities (raw materials, health), FET Flagships (graphene).

Funding of these activities is allocated in budgets of relevant ministries. According to the RD&I strategy Implementation plan, for the year 2015 MER has allocated €1.3m, Ministry of Environment €0.2m, Ministry of Defence €0.46m, Ministry of Agriculture €0.25m.

International co-operation projects are funded by the Estonian Research Council in the framework of either bilateral (the PARROT programme with France) or pan-European initiatives (EUROCORES, ERA-NET, ARTEMIS, EMBO). There are agreements in place with the Baltic and Nordic partners and several exchange programmes, such as and the Nordplus Programme of eight participating countries in the Baltic and Nordic regions.

RI roadmaps and ESFRI

The [Estonian Research Infrastructures Roadmap](#) (2014) itemises national interest in specific ESFRI projects, but does not deal with rules on access to facilities. Indirectly, mobility programmes provide access also to the infrastructure. While updating the RI Roadmap in 2013, Estonia had quite comprehensive consultations with Finland, as Finland also updated their Research Infrastructure Roadmap. Swedish experts were also involved in the process of selection of infrastructure objects for the Roadmap.

According to the [Estonian Research Infrastructures Roadmap](#), Estonia will participate in the following ESFRI projects: The European Life-Science Infrastructure for Biological Information (ELIXIR); European Spallation Source (ESS); Biobanking and Biomolecular Resources Research Infrastructure (BBMRI); Common Language Resources and Technology Infrastructure (CLARIN); European Social Survey (ESS ERIC); European Infrastructure for Translational Medicine (EATRIS ERIC).

According to the RD&I Strategy Implementation Plan, the budget for ESFRI projects for 2014-2017 is €13.35m. Under EU programming period 2007-2013 funding, research infrastructure was developed quite extensively and a number of labs are equipped on a high level - 18 R&D facilities of the R&D and higher education infrastructure investment plan (adopted by the Government of the Republic, total budget €127.4m) have been completed and most of them are also equipped and in use⁵¹. In general, present activities concerning infrastructure investments have been sufficient to cover the insufficient investments from the previous programming periods and in the future, the main focus has to be on ensuring the sustainability and effective exploitation of such infrastructure.

4.3 International cooperation with third countries

Estonia has over 20 bilateral agreements with third countries in the field of education and research. These are mostly framework agreements in which parties indicate a desire to cooperate. International co-operation projects are funded by the Estonian Research Council in the framework of bilateral memoranda, as e.g. with the Russian Humanitarian Scientific Foundation and the US Civilian Research and Development Foundation. There are also agreements in place with the Nordic partners and several exchange programmes, such as Norwegian-Estonian Research Cooperation Programme and the Nordplus Programme of eight participating countries in the Baltic and Nordic regions.

The RD&I Strategy implementation plan for 2014-2017 includes "analysis of possibilities for promoting cooperation with third countries".

⁵¹ Biggest investments were: buildings of the University of Tartu (UT)- Chemicum (€19.4m) and Physicum (€13.5m); research buildings of the Tallinn University of Technology (TUT) of the faculties of Mechanical Engineering and Chemical and Materials Technology TTÜ (€12.9m), and TUT Library (€10.8m). The list also includes following R&D objects: Tartu Observatory, Estonian Biocentre, Estonian Literary Museum, Science Centre for Renewable Natural Resources of the University of Life Sciences, National Centre for Translational Medicine.
Source: http://www.estlex.ee/tasuta/?id=e_getfile&syscmd=1&lisadid=22331

4.4 An open labour market for researchers

4.4.1 Introduction

Estonia's universities and other R&D institutions are relatively independent in forming their HR policies. The basic rules are set in the [Organisation of Research and Development Act](#) (introduced in 1997, last amendments in 2014⁵²) and the [Universities Act](#) (introduced in 1995, last amendments in 2014), as teaching and research positions in R&D institutions are, in general, subject to public competition and the selection process also involves evaluation of professional performance. Until the end of 2014, detailed conditions and procedures for organising a competition for research staff in a R&D institution which operates as a state agency or a local authority agency were established by the ministry or corresponding body of the legal person which governs a R&D institution, but since the beginning of 2015 all R&D institutions are free to establish their own procedures for the selection process.

In 2013, 20.1% of the total population or 49.5% of the active population (aged 25-64) is classified as human resources in science and technology activities (Eurostat 2014). The number of researchers was about 7,500 in 2013, which accounts for ca 0.57% of the total population (Statistics Estonia, 2014). The number of foreign researchers has grown from 58 in 2004 to 393 in 2013 (Statistics Estonia, 2015).

Researchers in Estonia still do not have competitive salaries compared to other European countries (average earnings in Estonia are in general about 2.4 times smaller than EU28⁵³). In order to tackle this problem, all state budget-financing instruments related to researchers' salaries were increased by 30% in the 2008 budget. However, the 2009 economic downturn led to salary cut-backs in the research sector (Technopolis Group, 2011) and low salaries are still a main problem.

Since 2004, considerable EU Structural Fund support has been directed to the development of R&D infrastructure, human capital and entrepreneurship which has helped to improve the conditions and has had positive effect on the number of foreign researchers (MER, 2014).

The new [RDI strategy for 2014-2020](#) (launched in January 2014) includes measures to further improve the migration policy to increase researcher mobility and to ensure integrated financing of the research groups led by top researchers.

4.4.2 Open, transparent and merit-based recruitment of researchers

The system for open, transparent and merit based recruitment of researchers has been in place since the beginning of the 2000's. There are no barriers to the application of open, transparent and merit based recruitment of researchers and such principles are applied in the recruitment of researchers of the higher education sector and R&D institutions. Estonia's law stipulates that research staff shall be elected by the research council or by the corresponding body of a legal person in public law or a legal person in private law by way of public competition. Universities and R&D institutions are very autonomous in their recruitment policies, but the basic rules are set in the Organisation of Research and Development Act.

⁵² The predecessor of this act "Organisation of Research Act" which included the basic principles, was introduced in 1995

⁵³ Eurostat (2016): Annual net earnings 2014: Estonia – €9915; EU28 – €23142.

From 2015 (relevant amendments in 2014) most of temporary (5-year) posts of research personnel (except research professors) are turned into permanent posts and therefore – as “evaluation by regular selection” disappears – the committee (formed by the R&D institution) must evaluate professional performance at least once in 5 years.

Until the end of 2014, detailed conditions and procedures for organising a competition for research staff in a R&D institution which operates as a state agency or a local authority agency were established by the ministry or corresponding body of the legal person which governs a R&D institution. From the beginning of 2015, R&D institutions will have even more autonomy, as according to amendments to the Organisation of Research and Development Act (relevant amendments made in 2014) they can establish their own conditions for the selection process.

Until the end of 2014, the regulations addressed the following aspects of researchers' recruitment (Riigi Teataja, 2001):

- The vacancy announcement includes the job profile, skills and competences required, and eligibility criteria;
- Information on the selection process and criteria is available for the candidates;
- A minimum time period between vacancy publication and deadline for application is defined;
- Applicants have the right to receive feedback on the results of the recruitment;
- Applicants have the right to appeal against the decision;
- Information on the rules for the composition of selection panels (e.g. number and role of members, gender balance) is available for candidates.

Regulations do not specify the need to include external members (national or international) to the selection panel. Language barrier is not a problem for English speaking researchers as most of the Estonian scientists are quite fluent in it. It might be a problem for lecturers, as the number of courses given in English is limited because Estonians have the right to obtain higher education in their mother tongue.

Higher education and research institutes also enjoy the necessary autonomy to organise their activities in the areas of education, research, and innovation, but they are dependent on largely (up to 80%) project-based funding and do not have many alternative sources of funding such as philanthropy etc.

The share of foreign university teachers was 5.1% in the academic year 2010/11 and the share of foreign full-time researchers was 6.7% of all researchers (MER, 2015). One of the main problems is that researchers in Estonia still do not have competitive salaries as compared to other European countries (average earnings in Estonia are in general almost three times smaller than EU27⁵⁴). Another obstacle to researcher mobility has been the difficulty to obtain Estonian visa/residence permit from countries where Estonia does not have a representation. Also, Estonia's research institutions not being sufficiently broadly known and unattractive conditions have proved to be higher obstacles than expected in bringing foreign top researchers and doctoral students to Estonia by using human capital development measures (MER, 2012). Since 2004 a significant proportion of EU Structural Fund support has been directed to the development of R&D infrastructure, human capital and entrepreneurship. This has helped to improve the conditions and has positive effect on the number of foreign researchers (MER, 2014a) which has grown from 58 in 2004 to 393 in 2013 (Statistics Estonia, 2015).

⁵⁴ Eurostat (2015): Annual net earnings 2012: Estonia – €4588; EU27 – €12697.

The [new RDI strategy for 2014-2020](#) (launched in January 2014) includes measures to further improve the mobility policy to increase researcher mobility and to ensure integrated financing of the research groups led by top researchers. [Estonian Research Council](#) offers grants for post-doctoral students via *Programme Mobilitas* (introduced in 2008), *post-doctoral research funding* (introduced in 2012) to support young researchers and also the *Start-up research grant* (introduced in 2012) to support promising young researchers to develop an independent research career.

A report "The career of scientists: Estonia in the international system" (Vadi et al, 2012) points out that scientific career is not particularly popular in Estonia because of low wages in the public sector and low demand in the private sector.

4.4.3 Access to and portability of grants

[The Estonian Research Council](#) (established in 2012) awards [institutional](#) and [personal research funding](#) (relevant amendments to the [Organisation of Research and Development Act](#) in force since 2012). Grant competitions are open to all permanent residents of the Republic of Estonia and to all citizens of a foreign country, if they have full-time job in an Estonian R&D institution (residency is not required as a pre-condition). Grants should be applied for through an Estonian R&D institution. Researchers affiliated in foreign institutions can not apply for Estonian grants, but the Implementation plan for the RD&I Strategy for 2014-2020 includes specific actions to analyse options to ensure the openness of Estonia's research and development programmes for international cooperation and to develop cooperation opportunities with third country researchers and research institutions.

Through the researcher mobility programme *Mobilitas plus* postdoctoral researchers and top researchers have a possibility to apply for a grant to carry out a research in Estonia or abroad.

As regards portability of national grants, The Estonian Research Council has signed up to the EUROHORCs Money Follows Researcher Letter of Intent and has agreed to finance research carried out in foreign institutes after it has been initiated in an Estonian R&D institution. Grant holders can apply to transfer their research grants only if the host country institution has also signed up to the Letter of Intent.⁵⁵

4.4.4 Doctoral training

Estonia's universities are very autonomous in developing doctoral training curricula. The Rectors' Conference, representing all public universities in Estonia and one private university, have signed a "Quality Agreement of Estonian Universities" (signed in 2011, in Estonian "[Eesti Ülikoolide Kvaliteedi hea tava lepe](#)") which specifies quality standards for doctoral studies and encourages international networking and interdisciplinary studies and research.

Doctoral study programmes usually include training in transferable skills to improve researchers' employment skills and competencies (based on the [Standard of Higher Education](#); introduced in 2008, last amendments in 2014). Doctoral schools, curricula development activities, lectures, seminars, practical training classes, laboratory work and individual classes can be developed by each institution with the aim of acquiring knowledge and achieving better learning outcomes for participants.

The [new RDI strategy for 2014-2020](#) (launched in January 2014) aims to pay increased attention to the systematic development of doctoral studies, and ensure competitive financing of doctoral studies.

⁵⁵ Researcher's Report 2014: Estonia.

http://ec.europa.eu/euraxess/pdf/research_policies/country_files/Estonia_Country_Profile_RR2014_FINAL.pdf

4.4.5 Gender equality and gender mainstreaming in research

The Estonian Government has not introduced specific policies to promote equal opportunities for men and women in the research area. The Gender Equality Act was adopted in 2004 and the latest amendments were made in July 2012.

At the same time, most indicators show that the situation in Estonia is better than in the EU27 on average. For the year 2010, throughout the EU27, on average 56.1 % of highly educated women in an S&T field were working as professionals or technicians compared with 54.6 % of men. In Estonia, the share of highly educated women in an S&T field who are working as professionals or technicians is 14 percentage points higher than that of men (50.3% of women; 36% of men). The average proportion of female researchers in Estonia was 42.4% in 2013. In 2010, the proportion of female scientists and engineers in the total labour force was 2% in Estonia (in EU27 it was 1.75%) and the proportion of men was 3% (3.65% in EU27). In 2009, women represented 46% of all researchers in the Higher Education Sector in Estonia (40% in EU27), 61% in the government sector (40% in EU27) and 28% in the Business Enterprise Sector (19% in EU27). The share of female heads of institutions in the higher education sector in 2010 was 21.2% in Estonia (15.5% in EU27), but the share of women in scientific and management boards was lower in Estonia (26%) than in EU27 (36%)⁵⁶.

4.5 Optimal circulation and Open Access to scientific knowledge

4.5.1 e-Infrastructures and researchers electronic identity

Electronic identification is widely applied in Estonia, both by the Estonian R&D organisations and the Estonian Research Portal. Remotely accessible services are also widely available and secure. The Programme of Electronic Scientific Information (in Estonian „[E-teadusinfo](#)”, launched in 2009) aims to supply Estonia’s R&D institutions with scientific information and to acquire access to scientific information and electronic publications for Estonia’s research libraries and organisations. The programme is implemented by the non-profit association Estonian Library Network Consortium, which is established in the collective interest of public libraries. The total budget (2009-2014) amounts to €8.1m.

The [Estonian e-repository](#) (launched in 2011) is an integrated e-environment created for long-term preservation and availability of digitized resources of the Estonian cultural heritage institutions: libraries, archives, and museums. The e-repository enables to link national heritage collections with the Pan-European library EUROPEANA.

The [Estonian Research Information System](#) (ETIS; established in 2006) is developed in a way that would allow it to be used as an open repository, so that the results of research that receive public funding are easily identifiable by appropriate technical means, including through meta-data attached to electronic versions of the research output.

In 2011, the Estonian higher education information and communications technology and research and development activities state programme 2011-2015 (in Estonian “[Eesti info- ja kommunikatsioonitehnoloogia kõrghariduse ning teadus- ja arendustegevuse riikliku programmi 2011-2015 \(IKTP\)](#)”) was launched. It is a cooperation programme between the universities, ICT sector, and the state, with the aim to increase the quality of ICT and develop cooperation between different partners.

The [Estonian Information Technology Foundation for Education](#) (HITSA) was established in April 2013⁵⁷. The mission of HITSA is to provide a high-quality national network infrastructure for Estonia’s research, educational and cultural communities.

⁵⁶ [She Figures 2012: Gender in Research and Innovation. European Commission. 2012](#)

⁵⁷ From May 1st 2013, the Tiger Leap Foundation and the Estonian Education and Research Network (EENet) were transferred to the Estonian Information Technology Foundation and the new name of established organisation will be Information Technology Foundation for Education (HITSA; www.hitsa.ee)

Its services include a permanent Internet connection as well as webhosting, e-mail, consultations in the event of security problems etc.

There is a big number of legislation and national projects on ICT. The [Electronic Communications Act](#) (introduced in 2004) implements the EU Regulatory Framework for Electronic Communications. The purpose of this Act is to create the necessary conditions to promote the development of electronic communications networks and communications services while ensuring the protection of the interests of users of such services. Challenges such as personal data security, the scope of personal data use, and identity validation and tracking are addressed in the following legislation: [Personal Data Protection Act](#) (introduced in 1996); [Copyright Act](#) (introduced in 1992); [System of security measures for information systems](#) (passed in 2007); [Public Information Act](#) (introduced in 2000); [Information Society Services Act](#) (introduced in 2004). [Digital Signatures Act](#) (introduced in 2000) and [Data exchange layer X-Road](#) (launched in 2001) support identification and interoperability.

4.5.2 Open Access to publications and data

Access to scientific information is facilitated by the [Consortium of Estonian Libraries Network](#) and the research libraries have created very good conditions and access to scientific journals and electronic databases for national researchers. This may be a reason why "Estonian researchers do not feel the need for specific open access policies" (European Commission, 2011).

The free access to the results of publicly funded research is stated by amendments (adopted in 2012) of the Organisation of Research and Development Act and measures have been taken to develop a variety of R&D e-infrastructures (MER, 2014c).

According to the EC report (2014) "[State-of-art analysis of OA strategies to peer-review publications](#)", Estonia has a majority (over 70%) of papers in OA. Estonia is publishing more in Gold journals (ca 13%) and less in Green journals (ca 9%), than the other states of Eastern Europe.

Electronic identification is widely applied in Estonia, both by the Estonia's R&D organisations and the Estonian Research Portal. Remotely accessible services are also widely available. The Programme of Electronic Scientific Information (in Estonian "[E-teadusinfo](#)", launched in 2009) aims to supply Estonian R&D institutions with scientific information and to acquire access to scientific information and electronic publications for Estonia's research libraries and organisations.

The [Implementation plan for RD&I strategy for "Knowledge Based Estonia 2014-2020"](#) encourages open access and includes the following measures:

- Continue the development of central research information systems and services with the objective of making these convenient for outside users (incl. state authorities and enterprises) and to allow fast access to research topics, performers and results.
- Encourage open access to publicly financed research results and research data. Support extensions to databases in research institutions and research libraries, and ensure access to the most important research databases.

5. Framework conditions for R&I and Science-Business cooperation

5.1 General policy environment for business

Estonia has a high ranking (rank 16 of 189 economies) on the World Bank Ease of Doing Business rank (World Bank, 2016). Estonia is ranked among the 38 freest countries in the world in most indicators, except Resolving insolvency (rank 40) and Protecting minority investors (rank 81). In general, the rules for starting up and running a business are simple (rank 15) and the legal framework is transparent and up-to-date.

In addition, Estonia's Small Business Act (SBA)⁵⁸ profile is generally strong. Estonia performs above the EU average in five SBA principles — it scores particularly well in 'responsive administration', access to finance, single market and internationalisation. Its scores for 'second chance' are below the EU average. The only issue for Estonia, therefore, is to work on faster insolvency procedures for a 'second chance' for entrepreneurs who may have failed the first time around.

5.2 Young innovative companies and start-ups

In Estonia, 99.8% of non-financial business sector enterprises are SMEs⁵⁹, so most of the support measures are targeting SMEs. To date, measures do not differentiate between SMEs and big enterprises. Support is mainly given via open calls and should be applied through an Estonian enterprise or R&D institution. A number of measures to facilitate knowledge transfer and the creation of university spin-offs are also under implementation since 2008-2009. The following measures are funded by MEAC and implemented by [Enterprise Estonia Foundation: Creative Business Incubation Programme](#); [Competence Centre Programme \(2014-2020\)](#); [Cluster development programme](#); [Innovation Voucher grant](#); [Enterprise Development Programme; Programme "Start-up Estonia"](#).

A measure especially useful for start-up companies is the programme "Start-up Estonia" (2011-2015, co-financed by ERDF), designed to develop a start-up ecosystem by providing training and mentoring to new start-up companies and by "activation" of business angels in Estonia. The programme was updated in 2014 and will run until the end of 2015. A start-up programme is also envisaged for the 2014-2020 programming period. In addition, in the framework of the Business Incubation Programme (2009-2014, €2.7m) the development of business incubation was supported, along with raising the competence level of service providers and the establishment of an investor network with both local and foreign partners. The general objective of the programme was to support the establishment of enterprises with growth potential, and their sustainable development, in order to ensure that they are viable and independent when leaving the incubator.

In the framework of the [Business Incubation Programme](#)⁶⁰, the development of business incubation is supported, along with raising the competence level of service providers, the establishment and development of cooperation partners and an investor network with both local and foreign partners. The programme is aimed at business incubators, but the end beneficiaries of the programme are the incubated entrepreneurs that are able to grow and to develop their competitiveness as a result of participating in the incubation process. The general objective of the programme is to support the establishment of enterprises with growth potential, and their sustainable development, in order to ensure that they are viable and independent when leaving the incubator.

⁵⁸ See http://ec.europa.eu/growth/smes/business-friendly-environment/small-business-act/index_en.htm

⁵⁹ European Commission (2014): [SME Performance Review](#); See also PRAXIS Survey (2012): [The development trends of small and medium-sized enterprises](#) (in Estonian)

⁶⁰ <http://www.eas.ee/en/for-the-entrepreneur/starting/business-incubation-programme>

In addition, the new [Enterprise development programme](#) targets ambitious enterprises with the readiness to invest and clear potential and desire to grow, to develop and launch new products and services. Participation in the programme is open to industrial enterprises or companies of the smart specialisation field that have been operating for at least 3 years (as of date of registration) with a minimum of 8 employees and that have obtained first experiences in export or management of fast growth. The total funding for the programme is €73m (co-funded by ERDF).

From the perspective of equity financing for young innovative companies, public-private venture capital investments through the [Estonian Development Fund](#) have given significant impetus for high-growth internationally oriented start-ups in Estonia. The [Baltic Innovation Fund](#) (BIF) is a Fund-of-Fund initiative launched by the EIF in close cooperation with the Governments of Lithuania, Latvia and Estonia in 2012 to boost equity investments made into Baltic Small and Medium sized enterprises (SMEs) with high growth potential.

In terms of impact of the above mentioned instruments, according to the "Enterprise policy's report" (MEAC, 2014a), during the programming period 2007-2013, 1861 enterprises were provided with Start-up support. As a result, the survival rate of support receivers (95.7%) was higher than average. For the same period, 1295 Innovation vouchers were granted which enhanced cooperation between enterprises and universities. Support was also given to 7 incubators which provided growth environment for 400 enterprises.

5.3 Entrepreneurship skills and STEM policy

According to the ERAC Peer-review (2012), a lack of educated and skilled labour is a major underlying constraint for growth of productivity and value creation in Estonia's economy, that should be addressed through policy coordination on multiple fronts, including education, particularly adult and secondary/vocational education beside tertiary education, as well as labour and immigration policy supporting RD&I policy.

To respond to the challenge, the *Implementation Plan for RD&I Strategy 2014-2020* includes the following sub-measures that target education⁶¹:

- Ensure a new generation of researchers and engineers, incl. paying increased attention to the systematic development of doctoral studies, and ensure the competitive-level financing of doctoral studies (incl. PhD grants), continue supporting doctoral studies, the position of junior research fellow and post-doctoral studies (Programme DoRa, Doctoral schools, about €8,500 per year).
- Encourage the mobility of researchers between the academic, public, and private sectors. As regards a researcher's career, place value on the time worked in other sectors and the results achieved there, as well as cooperation with enterprises. Continue supporting doctoral studies that are provided in cooperation with universities and enterprises (financing under 1.7 and 4.1).
- Review the motivation system related to commercialisation in universities, linking it with the main objectives and the financing of universities. Increase the professionalism and impact of commercialisation and reinforce links with other participants in the innovation system – investors, incubators, science parks, etc. Continue the development of competence in the field of knowledge transfer, incl. the training and bringing in of experts, the development of the organisation and quality of knowledge transfer, and the extension of the international contact network. Promote increasing awareness of intellectual property rights among researchers, students as well as the non-academic staff of universities (will be part of institutional development programme for HEIs which is in preparation; budget for 2014-2017 about €56,000).

⁶¹ For measures to improve doctoral training that are already implemented see ch.4.4.4.

- Support the development of entrepreneurship studies and new forms of acquisition of entrepreneurship experience by involving more enterprises than before - as lecturers, practice providers, etc (Measures in development - "Systemic development of entrepreneurship and entrepreneurial skills on all educational levels" and "Development of apprenticeship system in higher and vocational education")

The [Estonian Lifelong Learning Strategy 2020](#) (approved by the Government in 2014) aims to achieve the distribution of students 60/40 as regards general upper-secondary education and vocational education respectively by 2020; provide more work-based learning, including apprenticeships; and increase the proportion of vocational education students in apprenticeships from the current approximately 2.3% to approximately 7% by 2020 (European Commission, 2014d). In 2015, MER approved the "Programme for linking better labour market needs and training" (in Estonian, [Tööturu ja õppe tihedama seostamise programm](#), total budget €51m) which aims to link better the training and study opportunities with the labour market demand, and to increase the number of people of all age groups with professional qualifications.

In 2013, a new structure for vocational education and training programmes was introduced by the [Vocational Educational Institutions Act](#). New programmes are based on the national qualifications framework, introducing the learning outcome principle in designing study programmes (with, for example, the opportunity for employers to take part in the development of curricula), modernised management principles for vocational schools, and new accreditation requirements. In addition, the amendments (made in 2013) to the [Basic School and Upper Secondary School Act](#) aim to put general and vocational education at an equal footing, and provide primary school graduates with a clear choice between the two paths.

The national curricula for schools⁶² sets out cross-curricular topics which focus on equipping people with the capacity to learn and to develop transversal competences such as critical thinking, problem solving, creativity, teamwork, and intercultural and communication skills, and also science, technology, engineering and mathematics, ITC and entrepreneurship. Entrepreneurship education and training is also included in the curricula of universities, but it is not compulsory as for upper secondary schools.

5.4 Access to finance

No special tax incentives are given to the R&D and innovation investments or to venture capital funds except that the companies' income is free of tax to the extent that they reinvest their profit and there is no withholding tax for VC funds in Estonia. Foundation [KredEx](#) is improving the availability of financing and managing credit risks by providing credit guarantees. A special credit line was provided via KredEx in 2009-2011 to deal with the effects of the financial crisis. The total package (including funding from European Investment Bank) amounted to €124m of which €69m was covered by projects. Start-up loan guarantees for €7.7m were used by 304 enterprises in the 2007-2013 period (MEAC, 2014a).

The [Development Fund](#) (together with the private sector) performs risk capital investments into starting and growth-oriented technology companies. It invests together with private investors who have an in-depth knowledge of the specific field. Since May 2008, the Development Fund together with its daughter company SmartCap have made 18 investments into Estonian fast-growth companies with an innovative business model.⁶³

⁶² Here for example: [National curriculum for upper secondary schools](#)

⁶³ <http://www.arengufond.ee/en/investments/investment-success-stories/>

The fund invests into companies that comply with the VC profile, which is why many companies of the traditional economy or companies serving the local market have not met the investment strategy criteria. Examples of big successful investments, where the Development Fund has already exited partially or completely, include SmartPost (bought by a Finnish logistics company), Modesat Communications (bought by a US company), etc.

In addition, the [Baltic Innovation Fund](#) (BIF)⁶⁴ is a Fund-of-Fund initiative launched by the EIF in close co-operation with the Governments of Lithuania, Latvia and Estonia in 2012 to boost equity investments made into Baltic small and medium sized enterprises (SMEs) with high growth potential. In the years 2013 – 2016, BIF plans to invest €130m into private equity and venture capital funds to which an at least equal amount of investments shall be added by private investors and pension funds. Sub-funds invest into enterprises according to the investment policy of each particular fund, but the general target group includes Baltic companies with good international development potential. The following sub-funds have received an investment decision: BaltCap, BPM and Livonia partners.

The Estonian [Business Angels Network](#) (EstBAN) was founded in 2012. EstBAN is a full member of the European Trade Association for Business Angels, Seed Funds, and other Early Stage Market Players (EBAN) and the Estonian Venture Capital Association (EstVCA).

According to an analysis by the Global Entrepreneurship and Development Institute and The Estonian Development Fund⁶⁵ there are both supply side and demand side issues in access to finance in Estonia. They are partly driven by regulatory problems (e.g. constraining pension funds in funding the entrepreneurial finance sector), partly by lack of incentives (e.g. tax incentives) and partly by a general lack of equity culture in Estonia (small VC sector with underdeveloped VC networks, few patient and specialised investors).

5.5 R&D related FDI

Creating favourable conditions for FDI and openness to foreign trade have been key elements of Estonia's economic strategy. However, exports are concentrated in low and medium technological goods and FDI inflows in high value added activities have been small.

Estonia's inward FDI stock is large, accounting for roughly 90% of GDP in 2012. However, a large share of inward FDI flows is directed towards financial intermediation. Inward FDI directed towards manufacturing is low and concentrated on low-value added manufacturing goods (Masso et al., 2010). This is also reflected in low participation in global value chains compared to other small open economies (OECD, 2013a). In 2013, most of FDI was in finance and insurance, real estate, sales and wholesale and manufacturing. Almost 50% of FDI comes from Finnish and Swedish investors (Statistics Estonia, 2014).

Activities to attract foreign investments to Estonia constitute a part of the export and foreign investments action plan 2014-2017 Made in Estonia 3.0. The government agency promoting foreign investments in Estonia is the [Estonian Investment Agency](#) (EIA), a part of Enterprise Estonia. The agency assists international companies in finding investment and business opportunities in Estonia, but it does not focus specifically on R&D intensive FDI.

⁶⁴ http://www.eif.org/what_we_do/resources/BIF/

⁶⁵ Towards a More Entrepreneurial Estonia: Call for Action, 2014

In the coming years, MEAC plans to follow three main directions when attracting foreign investments to Estonia: movement towards attracting into the country foreign investments that offer higher added value, establishment of contacts and development of the image and environment of Estonia (incl. introducing Estonia as an attractive country for "smart workforce"). The measure Foreign investments into Estonia to attract FDI in Estonia is co-funded by the ERDF.⁶⁶

5.6 Knowledge markets

Estonia has a system of intellectual property rights that is well developed from a legal perspective. The legal protection of patentable inventions is regulated by the Patents Act. All universities have their own detailed IPR principles, stipulating also the rules of ownership, but the author has always the copyright of the work as of the creation of the work. Compliance related activities in Estonia are closely interlinked with those of the European Union and the EU's relationship with the WTO. The Agreement on a Unified Patent Court has been signed by the Government of Estonia in 2013, but not yet ratified by the Parliament. In January 2013, a new institution was started – the [Estonian Intellectual Property and Technology Transfer Centre](#), which took over the activities of the Estonian Patent Information Centre. The centre organises trainings and provides counselling, and also compiles annual IPR reports. A non-profit society, [Estonian National Group International Association for the Protection of Intellectual Property](#), was founded in 1992.

In 2004, the Republic of Estonia acceded to the protection systems of the Community trademarks and designs. The [Estonian Patent Office](#) takes part in several cooperation and convergence programme projects of the Office for Harmonization in the Internal Market (OHIM) and has joined the European Trade Mark and Design Network.

Estonia is also in the process of [renewing its patent and intellectual property rights system](#). The Ministry of Justice established an Expert Group on the Codification of the Intellectual Property Law. Although the initial plan was to create new laws, after thorough analysis the Expert group reached a conclusion that right now it is more feasible to wait and see what will be decided on the EU level and until then make some necessary minor amendments to the existing law (Ministry of Justice, 2015).

⁶⁶ See <https://www.mkm.ee/en/objectives-activities/economic-development-and-entrepreneurship/innovation#foreign-investments-into-estonia14>

5.7 Public-private cooperation and knowledge transfer

5.7.1 Indicators

Funding: BES-funded/publicly-performed R&D

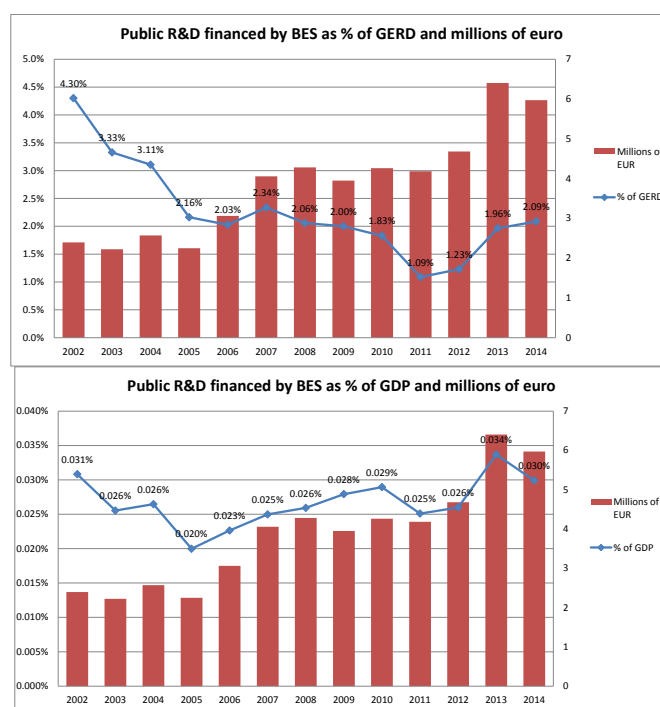


Figure 14 BES-funded public R&D in Estonia as % of GERD (in €MLN) and % of GDP

The level of privately-funded public R&D expenditure in Estonia is low compared to the other two Baltic states. In 2014 it was only 2.09% of the total GERD and 0.03% of GDP. Figure 14 also shows a significant drop in business funding over the period 2002-2011 when measured in terms of percentage of GERD (from 4.3% in 2002 to 1.1% in 2011). This is however due to the rapid growth of total GERD in Estonia during the whole period (from 0.72% in 2002 to 2.16% in 2012). BERD has significantly increased in 2011 due to big R&D investments in the oil shale industry but these investments were performed by the business sector so they did not trigger an increase of the business funding of R&D performed by the public sector. However, since 2012 the share of BES-funded public R&D has been growing. Indeed, when measured in absolute amounts, business-funded public R&D expenditure has increased from €2.25m in 2005 to €5.97m in 2014 without major fluctuations during the crisis.

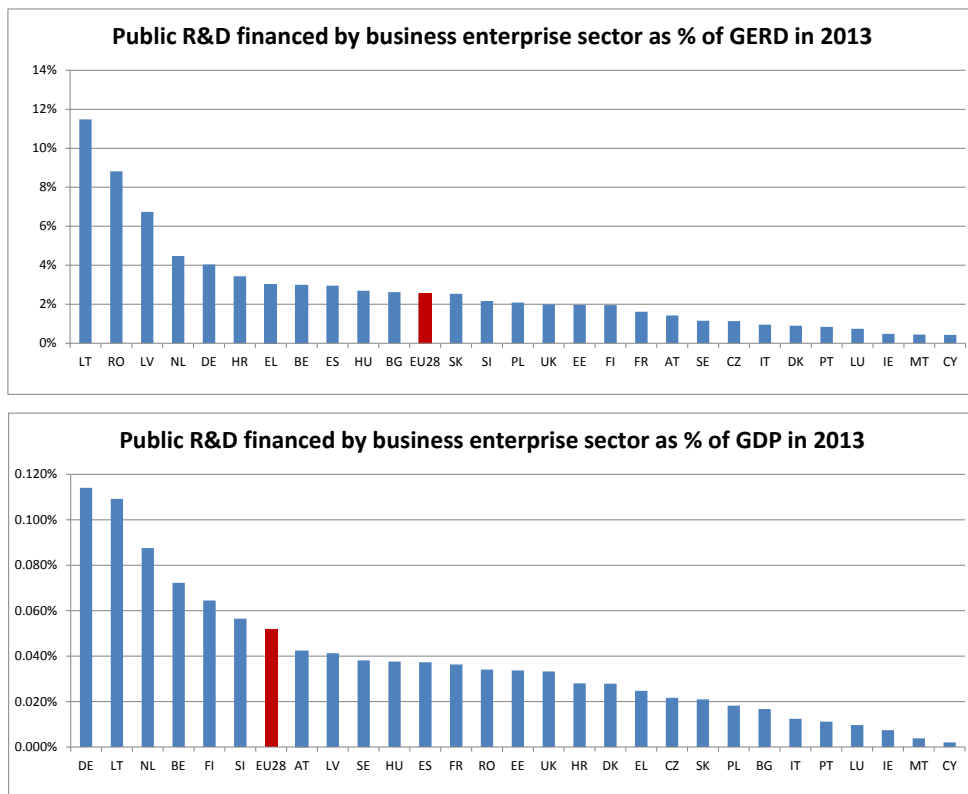


Figure 15 BES-funded public R&D as % of GERD and as % of GDP in 2013 in Member States⁶⁷

Estonia is below the EU-28 average of business funded public R&D both in terms of share of GERD and share of GDP. The other 2 Baltic countries, Lithuania and Latvia, have both higher shares.

The general low level of privately funded public R&D indicator is partially rooted in the structure of the national economy. The Estonian economy has a relatively low share of R&D spending high technology and knowledge-intensive companies⁶⁸. Also, the awareness of available R&D (including knowledge transfer) support grants among Estonian companies is relatively low.⁶⁹ In addition, there seems to be a mismatch between the needs of the business sector and the provision of knowledge from the public sector as a result of the R&D system being focused on areas other than those that dominate Estonia's economy today (OECD, 2013). Last but not least, Estonia is faced with significant human capital problems - business surveys point out that enterprises have problems finding RD&I competent talent.

⁶⁷ 2013 was chosen as the latest data series providing a full comparison within EU-28.

⁶⁸ According to the Estonian National Audit Office (2014), 90% of research and development expenses in Estonia are incurred by fewer than 100 companies.

⁶⁹ http://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/CE_RD_Estonia_2014.pdf

Funding: Structural funds devoted to knowledge transfer

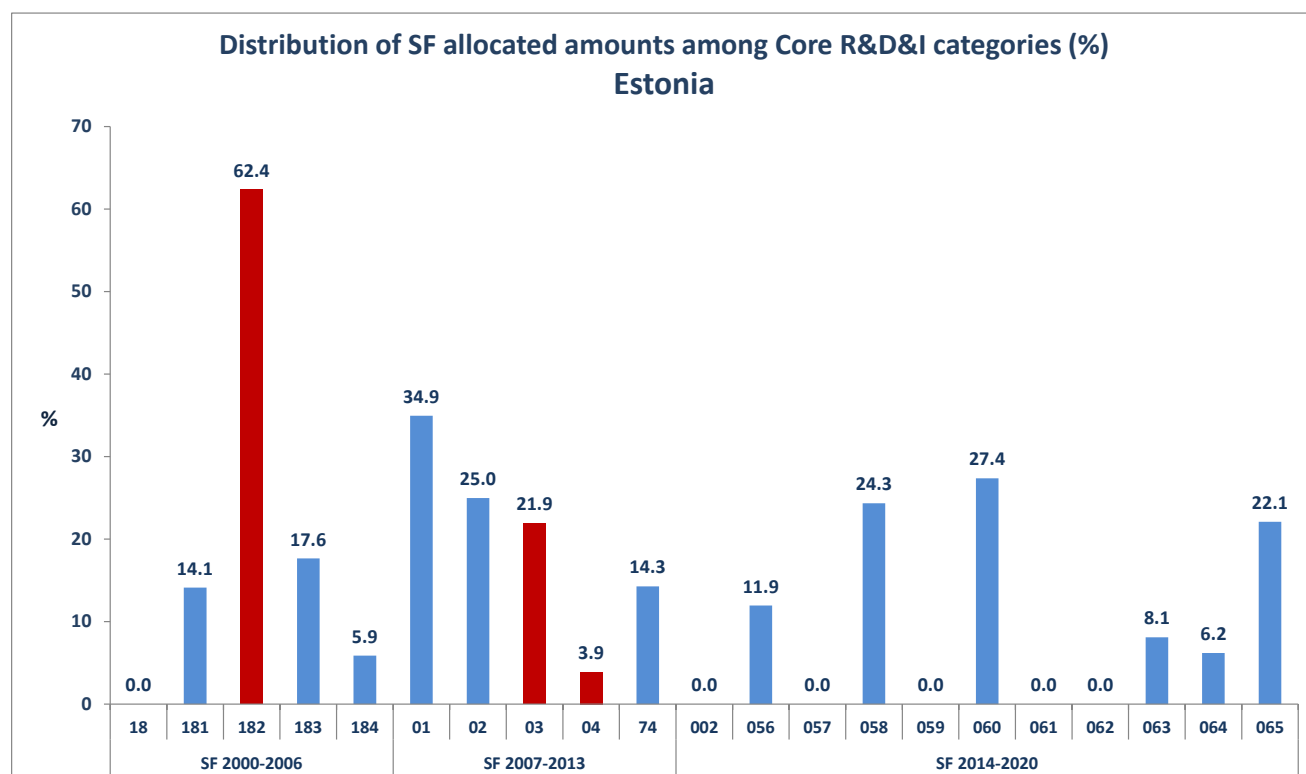


Figure 16 Structural Funds for core R&D activities 2000-2006, 2007-2013 and 2014-2020⁷⁰. We use the categories: 182 (2000-2006), 03 and 04 (2007-2013) and 062 (2014-2020) as proxies for KT activities.

⁷⁰ Figure 16 provides the Structural Funds allocated to Estonia for each of the above R&D categories. The red bars show the categories used as proxies for KT. Please note that the figures refer to EU funds and they do not include the part co-funded by the Member State.

The categories for 2000-2006 include: 18. Research, technological development and innovation (RTDI); 181. Research projects based in universities and research institutes; 182. Innovation and technology transfers, establishment of networks and partnerships between business and/or research institutes; 183. RTDI infrastructures; 184. Training for researchers.

The categories for 2007-2013 include: 01. R&TD activities in research centres; 02. R&TD infrastructure and centres of competence in specific technology; 03. Technology transfer and improvement of cooperation networks; 04. Assistance to R&TD particular in SMEs; 74. Developing human potential in the field of research and innovation.

The categories for 2014-2020 include: 002. Research and Innovation processes in large enterprises; 056. Investment in infrastructure, capacities and equipment in SMEs directly linked to Research and Innovation activities; 057. Investment in infrastructure, capacities and equipment in large companies directly linked to Research and Innovation activities; 058. Research and Innovation infrastructure (public); 059. Research and Innovation infrastructure (private, including science parks); 060. Research and Innovation activities in public research centres and centres of competence including networking; 061. Research and Innovation activities in private research centres including networking; 062. Technology transfer and university-enterprise cooperation primarily benefiting SMEs; 063. Cluster support and business networks primarily benefiting SMEs; 064. Research and Innovation processes in SMEs (including voucher schemes, process, design, service and social innovation); 065. Research and Innovation infrastructure, processes, technology transfer and cooperation of enterprises focusing on the low carbon economy and on resilience to climate change.

Estonia has not allocated any of its structural funds for core R&D activities to "Technology transfer and university-enterprise cooperation primarily benefiting SMEs" (compared to 62.4% for 2000-2006 and 25.8% in the 2007-2013 programming period). The EU averages for the respective periods are: 26.1% for 2000-2006, 30.1% for 2007-2013 and 15.7% for 2014-2020.

Cooperation: Share of innovative companies cooperating with academia

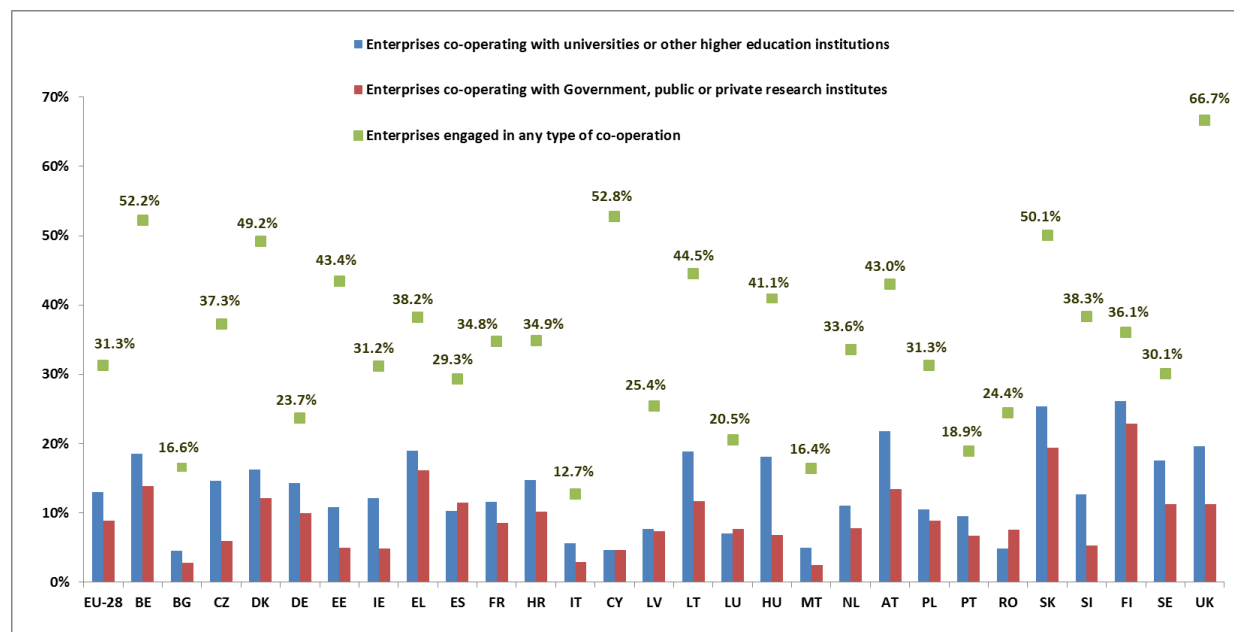


Figure 17 CIS survey 2012 – share of enterprises cooperating with academia

According to CIS 2012, in Estonia 43.4% of innovative companies are engaged in any type of cooperation. Yet, only one fourth of them (i.e. 10.8% of the total sample of innovative companies) cooperate with universities and higher education institutions compared to almost 18.9% in LT. Even less – 5% cooperate with government or public or private research institutes (compared to 11.7% in LT and 7.4% in LV). One could clearly see room for improvement considering that Estonia's neighbour and one of the innovation leaders, Finland, has the highest rate of cooperation, namely 26% of innovative companies that work with higher education institutions and 23% with government or public or private research institutes.

Cooperation: Technology Transfer Offices (TTOs), incubators and technological parks

Estonia has 18 technology clusters⁷¹, 8 competence centres (Competence Centre of Food and Fermentation Technologies; Bio-Competence Centre of Healthy Dairy Products; Estonian Nanotechnology Competence Centre; ELIKO Competence Centre; Competence Centre for Cancer Research; Software Technology and Applications Competence Centre; Competence Centre on Reproductive Medicine and Biology; Innovative Manufacturing Engineering Systems Competence Centre)⁷², 4 Science and Technology Parks (Tehnopol Tallinn, Tartu Science Park, PAKRI Science and industrial park, Incubator Tallinn)⁷³ and 9 Business Incubators (all the science and technology parks have incubators)⁷⁴.

⁷¹ <http://www.estonianclusters.ee/?lang=en>

⁷² <http://researchinestonia.eu/science-scene/competence-centers/>

⁷³ <http://www.workinestonia.com/living-in-estonia/science-technology/#articleblock-Scienceparks>

⁷⁴ <http://www.eas.ee/et/alustavale-ettevotjale/eas-i-lahendused-ja-toetusvoimalused/ettevtlusinkubatsiooni-programm/tule-inkubaatorisse>

Many of these facilities have been co-financed from structural funds. In addition, the Estonian Intellectual Property and Technology Transfer Centre (EIPTTC) was founded by the Estonian Chamber of Commerce and the Ministry of Economic Affairs and Communication in 2013. The predecessor of EIPTTC was the Estonian Patent Information Centre. EIPTTC offers a wide variety of intellectual property and technology transfer support services, training and education.⁷⁵

Cooperation: Share of public-private co-publications

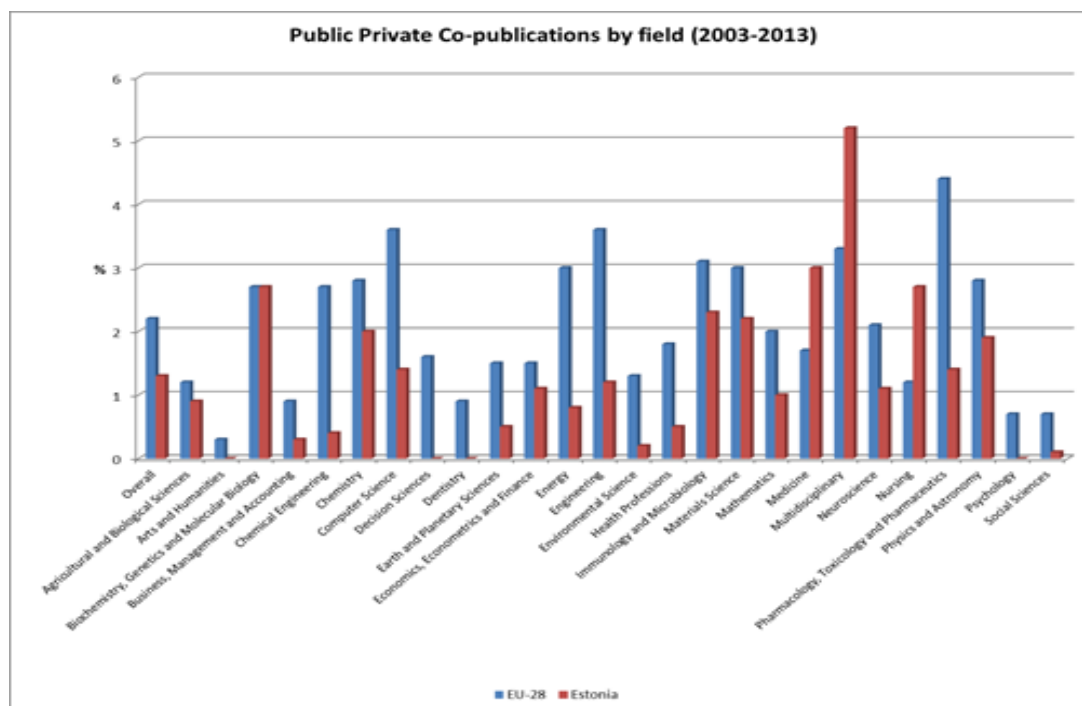


Figure 18 Co-publications by field 2003-2013 in Estonia. Scopus database

Figure 18 shows the 2003-2013 average percentage of academia-industry co-publications by field in Estonia compared to the European average. Scopus data indicate also that the percentage of co-publications has almost not changed in the last ten years (2003-2013), with 1.5% of academia-business publications in 2013 (lower than the EU average of 2.2%). In 2013 Estonia had 28 public-private co-publications per million of population which is on par with the EU-28 average of 29 (and much higher than the 5.7 for LT and 6.4 for LV)⁷⁶. The domains with highest percentage of co-publications (excluding multidisciplinary publications) are medicine, biochemistry, genetics and molecular biology, and nursing.

Cooperation: Patenting activity of public research organisations and universities together with licensing income

Estonian universities have a big share (approx. 50%) of total patent applications from the country, compared to Finland and Sweden where enterprises apply for 95% of PCT applications⁷⁷. Patent application activity of Estonian scientists, compared to their scientific publications (two applications per 100 articles), are on the same level with Swedish researchers.

⁷⁵ <http://www.eitk.ee/en/>

⁷⁶ RIO elaboration based on Scopus data.

⁷⁷ Mets, T. Kelli, A., Mets, A. Tiimann, T. (2014): TIPS, [Study 1.1 The intellectual property system and IP role in the framework of R&D of a small open economy country, comparative mapping of the situation and preliminary research.](#)

There is no aggregated data on licensing income from these patents. Only the University of Tartu reports that its licensing income from patents licensed or sold to industry in 2012 was circa €110,000.

The volume (profit from contracts) of "partnership" and joint collaborative research agendas signed between universities and enterprises was €6.2m in 2012.

Cooperation: Companies

In 2012 there were 19 spin-off enterprises stemming from public-private cooperation with the shareholding of the four largest Estonian universities (Tartu University, Tallinn Technical University, Tallinn University and Estonian University of Life Sciences). In 2012 their revenue was €11.7m⁷⁸. The percentage of researchers in public universities (the four largest) with a share in spin-off enterprises was 15% in the end of 2011.⁷⁹

5.7.2 Policy Measures

A number of measures to facilitate the partnerships and productive interactions between research institutions and the private sector are under implementation since 2008-2009: Competence Centre Programme (also referred to as Technological development centres), Cluster development Programme, Innovation voucher grant. All these measures are supported by the EU Structural Funds and managed by the agency Enterprise Estonia. A new instrument, Support for applied research in the areas of smart specialisation, managed by the MER entered the policy mix in 2015.

The Competence Centre Programme is the largest budget instrument that aims to facilitate knowledge circulation between public and private sectors. In the 2007–13, each of the eight centres could receive annually up to €1.28m, within a limit of 70% of their eligible budgets (for IPR related costs 50% of costs). The total allocated budget for 2007-2013 was €62.9m (co-financed by the European Regional Development Fund).⁸⁰ Competence Centres are structured, long term RTDI collaborations in strategic important areas between academia, industry and the public sector. Centres aim to bridge the gap between scientific and economic innovation by providing a collective environment for academics, industry and other innovation actors and creating sufficient critical mass. Centres are involved in multiple activities: pooling of knowledge, creation of new knowledge by performing different types of research, training and dissemination of knowledge, movement of qualified staff between businesses and research institutions. The new round of the competence centre programme opened in November 2014. The measure was updated as a result of the international competitiveness and smart specialisation objectives of the Estonian RD&I strategic documents. The total grants budget amounts to €40m.

The Cluster development programme is also co-financed by the European Regional Development Fund. The total budget of the programme in the EU financing period of 2007-2013 was approx. €6.8m.⁸¹ The objective of the cluster development grant is to increase the value added of companies and the sales of their products/services (including exports) and to promote cooperation between companies of the same and different sectors and companies and research establishments. In the period 2007-2013, 18 clusters in 8 business fields⁸² were established. According to the Interim evaluation of the cluster programme (MEAC, 2013a), both the cluster managers and enterprise managers gave a positive evaluation to the cluster programme. One of the greatest values and assets for an enterprise participating in the cluster programme are the cooperation opportunities it creates.

⁷⁸ Lukason et al. (2014), [Spin-off enterprises and their support systems in Estonia](#). TIPS programme report

⁷⁹ Ibid.

⁸⁰ <http://www.eas.ee/en/for-the-entrepreneur/innovation/competence-centre-programme>

⁸¹ <http://www.eas.ee/en/for-the-entrepreneur/development-of-the-company/cluster-development-programme>

⁸² Business fields of [clusters](#) are: Clean Technologies, Recycling; Creative Industries; Defence&Security; Finance; Forestry, Furniture, Wood processing; ICT; Logistics; Medicine, IT, Biotechnology http://www.estonianclusters.ee/?page_id=48

R&D institutions mainly conducted surveys on the issues of common interest of cluster members and cooperation between enterprises and universities has been in most cases sporadic. However, about a half of the cluster enterprises find that cooperation with universities through the clusters has contributed to the development of their organisation, and that such cooperation is expected to increase further in the future. The programme is continued in the new programming period and the new round of applications opened in June 2015. The planned budget is €10m.

The objective of the Innovation voucher grant is to increase the competitiveness of Estonian SMEs through transfer of knowledge and technology, expansion of cooperation with R&D institutions and increase of the capability to protect intellectual property. The grant is co-financed by ERDF and applications are accepted on an on-going basis. The grant is specifically targeted to SMEs and amounts to maximum of €4,000 per applicant to support costs related to the procurement of innovation services.⁸³ The programme will continue in the 2014-2020 programming period.

As far as new measures are concerned, the Ministry of Education and Research launched the new activity Support for applied research in the areas of smart specialisation in August 2015. The aim is to support enterprises tendering applied research or product development from Estonian public R&D institutions and about 1/3 of financing should come from enterprises. The total allocated budget is €26m.

5.8 Regulation and innovation

[Rules for Good Legislative Practice and Legislative Drafting](#) (passed by the Government in 2011) stipulate that any legislative intent, concept and draft Act is prepared, an impact assessment is carried out, a report on the impact assessment is prepared and an ex-post impact assessment is carried out in compliance with the [Methodology of impact assessment](#) (approved by the Government in 2012). The same principles and methodology also applies to strategies and other policy measures of all fields, including innovation policies.

MEAC regularly carries out feasibility studies and ex-ante and ex-post evaluations of policy measures and programmes⁸⁴ since the early 2000s and uses the results to improve policies and measures. There is no special government department responsible for overseeing the impacts of regulation on innovation. Evaluations are commissioned by MEAC to different institutions, depending on the issue and based on the expertise of evaluators.

5.9 Assessment of the framework conditions for business R&I

In general, the rules for starting up and running a business are simple and the legal framework is transparent and up-to-date. The only tax incentive for innovation is the special feature of corporate income tax in Estonia - only dividends are taxed. If earnings are re-invested into the company, they are tax-exempt. There is no other specific law or regulation to promote business investment in research and innovation, but there are a number of measures to support innovative enterprises (see 5.2-5.7). Estonia has a system of intellectual property rights that is well developed from a legal perspective (OECD, 2011). Estonia is also in the process of [renewing its patent and intellectual property rights system](#).

As demand-side innovation policy has so far not been actively pursued and implemented in Estonia, MEAC commissioned in 2014 the "[Feasibility Study for the Design and Implementation of Demand-side Innovation Policy Instruments in Estonia](#)", which analysed the feasibility of this new policy initiative in smart specialization areas. As a result, the concept of the application mechanism of a new measure "[State as a smart customer](#)" is currently being developed (total budget €20m).

⁸³ <http://www.eas.ee/en/for-the-entrepreneur/innovation/innovation-voucher>

⁸⁴ Policy evaluations, including innovation, commissioned by MEAC in [English](#) and [in Estonian](#)

6. Conclusions

6.1 Structural challenges of the national R&I system

According to the Report on the "Research and Development and Innovation Strategy 2007-2013" (MER, 2015), Estonia's RDI system has developed considerably. A lot has been achieved on the modernisation of infrastructure and technology, internationalisation of research (incl. researchers' mobility) and business, supporting of start-up companies, and developing cooperation between business and academia. The main challenge is to further develop the research and innovation system in ways that it will have bigger impact on the society. Policies should more strongly contribute to creating favourable business environment necessary for increasing export intensity and employment in medium and high-tech industry and knowledge-intensive services.

Country Specific Recommendations (EC, 2015) suggest focusing public support for research and innovation on a coordinated implementation of the limited number of smart specialisation areas. A number of measures has already been developed to promote R&D in the key areas of smart specialisation (see chapter 2.4).

6.2 Meeting structural challenges

The effort has been made to meet the challenges with appropriate measures. As new set of measures has just been launched in 2015, but its assessment would still be premature.

MEAC has launched programmes to increase competitiveness of enterprises in the areas of smart specialisation: [Cluster development Programme](#) (renewed in 2014) is aiming to improve the international competitiveness and to increase the sales and value added of the companies via cooperation between companies and companies and research institutions. Also a new measure "[State as a smart customer](#)" will be launched to improve demand-side innovation policies (total budget €20m).

MER launched the activity "Support for applied research in the areas of smart specialisation" (in Estonian, [Rakendusuringute toetamine nutika spetsialiseerumise kasvuvaldkondades \(NUTIKAS\)](#)), which has quite a big budget, constituting almost half of RDI measures launched so far (see Annex 2). So it deserves closer monitoring in coming years. The "Institutional development programme for research and development and higher education institutions" (in Estonian, [Institutsionaalne arendusprogramm teadus- ja arendusasutustele ja kõrgkoolidele ASTRA](#)) and "Allocation of support for R&D infrastructure (in Estonian, [Riikliku tähtsusega teaduse infrastruktuuri toetamine teekaardi alusel](#)) also consider among other criteria the principles of smart specialisation and aim to boost international competitiveness of Estonian R&D.

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Abbreviations

BERD	Business Expenditures for Research and Development
ERA	European Research Area
ERA-NET	European Research Area Network
ERAC	European Research Area Committee
ESA	European Space Agency
ESF	European Science Foundation
ESFRI	European Strategy Forum on Research Infrastructures
ESS	European Social Survey
EU	European Union
EU28	European Union including 28 Member States
FDI	Foreign Direct Investments
FP	Framework Programme
FP7	7th Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
HE	Higher Education
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
ICT	Information and communications technology
IP	Intellectual Property
IPR	Intellectual Property Rights
IPTS	Institute for Prospective Technological Studies
JRC	Joint Research Centre-Institute for Prospective Technological Studies
MEAC	Ministry of Economic Affairs and Communication (in Estonian "Majandus- ja Taristuministeerium")
MER	Ministry of Education and Research (Haridus- ja Teadusministeerium)

MF	Ministry of Finance (Rahandusministeerium)
MSTI	Main Science and Technology Indicators
PPP	Public Private Partnership
PPS	Purchasing Power Standard
PRO	Public Research Organisations
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
RD&I	Research, Development and Innovation
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
SF	Structural Funds
SME	Small and Medium Sized Enterprise
S&T	Science and technology
TTU	Tallinn University of Technology (Tallinna Tehnikaülikool)
UT	University of Tartu (Tartu Ülikool)
VC	Venture Capital
WIPO	World Intellectual Property Organisation

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Annex 1 – List of the main research performers

The total number of positively evaluated research and development institutions in Estonia is 19, so here are listed all. Official statistics or ranking of these R&D institutions is absent.

1. Universities

- University of Tartu
- Tallinn University of Technology
- Tallinn University
- Estonian University of Life Sciences
- Estonian Academy of Arts
- Estonian Academy of Music and Theatre

2. Public R&D institutions

- Estonian Biocentre
- Institute of the Estonian Language
- Estonian Literary Museum
- Tartu Observatory
- Estonian National Museum
- National Institute for Health Development
- Under and Tuglas Literature Centre of the Estonian Academy of Sciences
- National Institute of Chemical Physics and Biophysics

3. Private R&D institutions

- Estonian Business School
- Competence Centre for Cancer Research
- Competence Centre for Health Technologies
- Cybernetica AS
- Protobios LLC

Annex 2 – List of the main funding programmes

Name of the funding programme	Timeline	Budget	Target group
Cluster development Programme	2014-2020	€10m	Enterprises, R&D institutions
State as a smart customer	2014-2020	€20m	Enterprises, government
Innovation vouchers programme	2014-2020	€10m	Enterprises, R&D institutions
Start-up programme	2014-2020	€7m	Young, innovative enterprises
Support for applied research in the areas of smart specialisation (NUTIKAS)	2014-2020	€26m	R&D institutions, enterprises
Institutional development programme for research and development and higher education institutions (ASTRA)	2014-2020	€123m	Universities, public R&D institutions
Allocation of support for R&D infrastructure (for infrastructure roadmap objects)	2014-2020	€31m	Universities, public R&D institutions
Support for centres of excellence for promoting competitiveness and high quality of research	2014-2020	€41m	High level research groups, R&D institutions
Programme for science popularization TeaMe plus	2015-2020	€3.2m	Society in general, children etc
Researchers mobility programme Mobilitas plus	2015-2022	€35.4m	Post-doctoral researchers from Estonia, top researchers who come from abroad
Programme for strengthening the sectoral research and development (RITA)	2015-2020	€28m	Ministries (posts for R&D specialists); universities, R&D institutions, for open calls also enterprises
Enterprise Development Programme	2015-2020	€73m	industrial enterprises or companies of the smart specialisation field (operating for at least 3 years, 8 or more employees)
Technological development centres	2014-2020	€40m	Estonian enterprises and R&D institutions

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