Evaluation of the design and implementation of Estonian RTDI policy: implications for policy planning

Final Report

December 2005

Technopolis Consulting Group Belgium SPRL

Innovation studies

6 | 2006

Commissioned by Division of Technology and Innovation, Ministry of Economic Affairs and Communications of the Republic of Estonia
Financed by Ministry of Economic Affairs and Communications of the Republic of Estonia
Carried out by Technopolis Consulting Group Belgium SPRL
Designed by Kolm Karu
Layout by Katrin Leismann
Cover photo by Focus Database AS

Tallinn, 2006

Additional information is available on the Internet (http://www.mkm.ee)

ISBN 9949-10-630-3
ISSN 1406-7692

Authors:

Alasdair Reid *directs the Technopolis office in Brussels. He has fifteen years of experience in policy research and in providing advice to the European Commission services, national and regional authorities. His work has supported agencies and partnerships active in the fields of regional economic development, innovation and enterprise policies. Following a first two-years as an economist in Coopers & Lybrand's European office (Brussels), he gained a Masters and then spent three years as a researcher on regional innovation policies at the University of Louvain (Belgium). Subsequently, he managed the EU funded programme of regional innovation strategies from 1996 to 1999. He then led a range of multi-country evaluation and innovation related studies for the Belgian consultancy ADE S.A. Since 2004, he has been managing the European Innovation TrendChart's policy monitoring network. Current projects include support to the European Commission for the development of future 2007-13 EU Structural (regional) Funds actions in the fields of innovation and knowledge; and a two-year study on sectoral innovation systems in Europe. He has published widely on innovation policy in both books and journals. Alasdair holds economic degrees from Heriot-Watt (Edinburgh) and UCL (Belgium).*

Jacek Walendowski *joined the Belgium office of Technopolis in 2004, as a consultant primarily responsible for carrying out innovation and regional policy studies. Since 2003, he has been the country correspondent for Poland in the framework of the European TrendChart on Innovation project of the European Commission (DG Enterprise). Recently, he has been involved in various other European projects in the area of innovation. From May 2001 to August 2004, he worked for an international consultancy (ADE S.A., Belgium), where he took part in projects covering the areas of innovation, research and development in the SME sector (notably a study for DG Enterprise on Innovation Policy in seven candidate countries in 2002-2003). Jacek previously worked in DG Enterprise at the European Commission (2000-2001) in the unit dealing with innovation policy. He holds an economic degree from the Business and Administration School (Warsaw), as well as European studies degrees from College of Europe (Natolin) and Central European University (Budapest).*

Foreword

Dear reader,

Over the last years, Estonia has enjoyed very fast economic growth and social development. Sometimes we even might get the feeling that our economy is growing "by itself" without significant efforts and tend to forget that we are, in fact, only reaping the fruits of decisions and investments made quite a number of years ago. But one should not forget a simple fact – that the higher the economic development level will get, the harder it will become to sustain its pace.

There is today an ever-increasing consensus in Estonia that, in the long run, competitiveness of our economy can only be based on the innovative and unique qualities of products and services offered by our enterprises and public sector as well. This, however, calls for more sophisticated and smart public policies to help Estonia in becoming a truly competitive knowledge-based society.

Current study was aimed at assessing the adequacy and effectiveness of strategic goals and policy measures taken so far in the field of research, technological development and innovation, including also Estonia's first experiences with EU structural funds. But even more importantly, the study was meant to provide support for strategic policy planning, as Estonia is today in the process of drafting a new national research, development and innovation (RD&I) strategy "*Knowledge-based Estonia 2007–2013*" as well as a new *National Strategic Reference Framework for the use of structural funds in 2007–2013*.

I believe the study has succeeded in identifying valuable lessons from the past and present, pointing out most critical challenges facing Estonian economy and providing some provocative thoughts for the future. The results should be of interest to the international community of innovation policy makers, especially in transition countries. Above all, however, I hope the results will offer food for thought to key leaders both in business and academia, policy makers and others stakeholders in Estonia, to initiate fruitful discussions on the future of Estonia, to ensure that our strategic policy documents would be of highest quality and of wide societal acceptance. Only this way we can be sure that the benefits of current economic growth will, together with EU funding, be put into building a solid basis for the future.

Edgar Savisaar
Minister of Economic Affairs and Communications for Estonia

Table of Contents

1 Introduction: scope and methods of the study

This report brings together the analysis carried out during 2005 at the request of the Estonian Ministry of Economic Affairs and Communications (MKM) within the framework of the project "**Evaluation of the design and implementation of Estonian research, technology development and innovation (RTDI) policy: implications for policy planning**". The overall objective of the projects was:

"To assess the adequacy of the strategic RTDI policy goals and the measures taken by Estonia, in the light of most pressing challenges facing Estonia and in the context of recent strategic development directions in EU countries. To provide critical input for the upcoming Single Programming Document (SPD) 2007–2013, and national R&D&Innovation strategy (RD&I) 2007–2013."

In the context of on-going work by Estonian stakeholders to develop an updated national research and innovation strategy, the project was expected to contribute to a more effective use of both national and EU funds for raising the competitiveness of Estonian economy.

The specific objectives were:

- To assess the appropriateness and effectiveness of the Estonian current RTDI policy concept and measures;
- To make proposals for elaboration of RTDI strategy for 2007–2013, and for the RTDI chapter in the Structural Funds programme for 2007–2013;
- To assess the necessary budget for the RTDI policy in Estonia and its yearly distribution for 2007–2013, derived from both the need to boost innovation, and the absorptive capacity of the Estonian economy. In the framework of financing gaps (necessary resources cannot be gained from the state budget), to point out the utmost priorities.

In line with the terms of reference, the study team used three basic methods:

- Desk research using available studies, statistics, etc. A bibliography of documents examined and used can be found in appendix A;
- Interviews with key stakeholders. A list of people interviewed can be found in appendix B and a list of key interview questions in appendix C. Various presentations of the work were made notably to the R&D and Innovation sub-committee of the R&D Council.

This report, in line with terms of reference, is structured as follows:

- Section 2.1 offers an assessment of the adequacy of the Estonian strategic approach to RDTI policy in particular, the adequacy of strategic underpinnings laid down in the current RD&I strategy and the SPD 2004–2006;
- Section 2.2 provides an appraisal of the compliance of the implemented RTDI policy measures with the underlying strategic concept. In particular, the question of whether the measures have been effective in addressing the strategic goals;
- Section 3.1 proposes a strategic framework for a coherent approach to supporting research and innovation policy objectives, section 3.2 outlines a number of possible new or adapted measures for the innovation policy measures falling under the responsibility of the MKM, and section 3.3 concludes by outlining financial projections for research and innovation policy expenditure during the 2007–2013 period, based on current absorption capacities and future potential for growth of research and innovation expenditure in the public and private sectors.

The report was prepared by Alasdair Reid with the assistance of Jacek Walendowski. Thanks are due to Tea Danilov and Lauri Tammiste of the MKM for comments and suggestions throughout the course of our work.

2 Estonian RTDI policy 2002–2006

This section reviews the policy framework in terms of objectives, expected results, and planned policy measures for the current planning period. The aim is to provide a factual summary of the current Estonian RTDI policy framework and specific programmes. Subsequent sections of the report then appraise the relevance and effectiveness of the implementation of this strategic framework.

2.1 Strategic framework and goals of Estonian RTDI policy

Given the objective of this study outlined above, it is important to begin by outlining the national strategic approach to research and innovation policy with respect to which the Structural Funds support should be complementary and additional.

Estonian RTDI policy evolved rapidly in the early years of the current century from a position where this field of policy was given low priority to one where the objective of a 'Knowledge Based Estonia' (KBE) was adhered to, at least on paper, by the broader political and economic establishment. Two key strategic documents form the backbone of the RTDI strategy for the period 2002–2006:

- Knowledge Based Estonia: the Estonian Research and Development Strategy 2002–2006 (adopted by the Estonian Riigikogu on 6 December 2001);
- Measure 2.3 of the National Development Plan (NDP, or SPD) for the period 2004–2006.

The following two sub-sections provide a summary of the objectives, results and activities foreseen by these policy statements.

2.1.1 Knowledge based Estonia 2002–2006

The analysis under-pinning the KBE strategy centred on a number of key facts and notably highlighted:

- The low relative intensity of R&D expenditure (as share of GDP, 0.76% in 1999) allied to a modest growth rate in total expenditure (4.3% annually);
- The dominant position of the Government sector as a funder of R&D (76% of total R&D expenditure, in 1999) but with nevertheless a low relative share of GOVERD in GDP compared to other EU countries. Government expenditure was focused largely on basic research (half of GOVERD in 1999, with only 15.7% going to technological development);
- A decline in human resources for science and technology allied to an age pyramid of researchers, skewed towards the over 50 age group. These problems were compounded by a mismatch in terms of specialisations with a lack of highly qualified engineers;
- Very low levels of expenditure in the business sector on R&D and extremely low rates of employment of researchers and engineers in Estonian enterprises. This situation is compounded by the lack of government measures at the time to stimulate interest in and increased activities in favour of innovation;
- Poor links and low levels of co-operation between the higher education (research) sector and enterprises were also highlighted as a weakness. Commercialisation of high-quality research in certain fields of science in Estonia was not assured with low rates of patenting being an indicator.

In more qualitative terms, the strategy also outlined the organisation of research and development structures and highlighted both an effort to introduce more effective distribution of functions between part of the system but also the lack of public consensus and hence under-funding of RD&I system. The strategy noted that despite some efforts to improve the innovation support system (technology parks, innovation centres, etc.), "it can hardly be considered sufficient".

Faced with these challenges, the strategy set out two main objectives[1]:

- Updating pool of knowledge through "raising the quality and level of scientific research" notably in three key fields of technology: biotechnology, user-friendly information technologies and materials technologies. A main pre-condition was improving numbers and quality of highly qualified specialists;

[1] *It was foreseen that "the principles of the strategy will be reviewed and updated by the Government every three years, on the basis of proposals submitted by the Research and Development Council TAN". This process was begun in 2005 and the current study, as noted in the terms of reference, is expected to make a contribution to this strategy development.*

- Increasing the competitiveness of enterprises: the precondition being to develop an "integration mechanism between research and business sector".

The implementation of the objectives were foreseen through four key lines of actions:

- Financing research and development. The KBE strategy set out an objective to raise overall funding and to create a better balance between public-private and basic versus applied research. More specifically the following targets were set:
  - Increasing gross expenditure on R&D (GERD) to 1.5% of GDP by 2006;
  - To re-balance government expenditure on R&D (GOVERD), at the time, split 90% for basic research versus 10% for experimental development to a ratio of 60/40 by 2006.
- Development of human capital: the strategy proposed a series of actions aimed at reinforcing and complementing the national educational strategy (Learning Estonia) notably by actions aimed at life-long learning for engineers and other specialists as well as doctoral studies;
- Increasing the effectiveness of the research and development and innovation systems. Under this action line, a series of initiatives aimed at awareness raising, bridging structures between research and industry, spin-offs, etc. were mentioned as contributing to the objective;
- International co-operation: strengthening Estonian participation in international RD&I networks – both multilateral (EU RTD Framework programme, EUREKA, etc.) and bilateral.

The table below sets out the various initiatives mentioned under each action line of the KBE strategy.

Action line	*Type of programme/initiative*	*Responsible organisation*
Financing research and development	Targeted financing	MER
	Research grants	ETF
	R&D grants and loans for enterprises and research institutes & Innovation support programmes	ESTAG (EAS)
	R&D institutions infrastructure	Ministry responsible
	Risk capital scheme	MKM, ESTAG (EAS), KredEx
	National Research and Development Programmes	Not defined
Development of human capital	In-service training system for engineers and specialists;	MER
	Increased funding for Masters and Doctoral studies (including grants for training abroad)	MER
	Improved funding for university infrastructure and setting of minimum cost of student place at sufficient level	MER
	Scheme to involve PhD graduates and post-doctors in the RD&I system	
	Concept for involving centres of excellence and competence centres in post-graduate studies (2002)	MER
	System for multi-aspect courses and modules to increase capacity of university students and researchers to manage projects and acquire competence in management and business	MER / MKM; MER
Increasing the effectiveness of the RD&I systems	Regular collection, preservation and diffusion of scientific information	Not defined
	Innovation awareness programme	ESTAG (EAS)
	Competence (training programme) programme in RD&I management	Not defined
	Science and technology park development in Tallinn and Tartu plus incubators in regions	MKM/MER / local authorities
	Further development of Centres of Excellence	MER
	Competence Centre programme	MKM
	Research-industry liaison and research spin-offs	MKM/MER
International co-operation	Network of Estonian technological attachés (in countries of strategic importance	Not defined

Legend: MER: Ministry of Education and Research, ETF: Estonian Science Foundation, ESTAG (EAS): Estonian Technology Agency (Enterprise Estonia), MKM: Ministry of Economic Affairs and Communications.

A second manner of focusing the expected activities to be supported under the strategy was through focusing on a limited number of key areas of RD&I. The strategy explicitly foresaw that there would be "an increase in State resources (both human and material resources) allocated to these areas). These key areas were:

- User-friendly information technologies (IT) and development of the information society;
- Biomedicine;
- Materials' technologies.

These areas were defined "taking into accounting specific opportunities for development of Estonia, the existing research potential, the existing economic structure and international orientations in RD&I" (the latter referring clearly to the EU European Research Area and RTD Framework programme objectives). The strategy acknowledged however the need to be more precise about the best opportunities in each key area in order to ensure cost-effectiveness of investment. In particular, it was stated, "*the Ministry of Economic Affairs and the Ministry of Education, in cooperation with research development institutions and business representatives, will compile and launch national programmes for the development of key areas*".

A final key element of the KBE strategy was an annex that set out an ambitious financing strategy for research and development for the period up to 2006 in order to attain the target of spending 1.5% of GDP on R&D. The tables below summarise these targets.

Exhibit 1 Financing Strategy for Research and Development, 1998–2006 (Million EEK)

	1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
Total expenditure on R&D	450.9	572.8	600	704.3	815.2	1004.4	1343.1	1735.5	2185.5
Total expenditure on R&D % of GDP	0.61	0.76	0.7	0.75	0.8	0.9	1.1	1.3	1.5
Share of public sector in GERD	360.1	433.3	444	549.3	652.2	803.5	1007.3	1301.6	1529.9
Share of public sector in %	80%	76%	74%	78%	80%	80%	75%	75%	70%
Share private sector in GERD	90.8	139.5	156	155	163	200.9	335.8	433.9	655.6

Exhibit 2 State budget financing of research and development

	1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
Government budget appropriations for R&D	312.5	363.8	370.6	430.9	497.5	614	714	884	1014
of which Ministry of Education	278	331	329	357.3	413.3	430	460	550	600
of which Ministry of Economic Affairs	30	28	37	61.4	70	170	240	320	400
of which other Ministries	4.5	4.8	4.6	12.2	14.2	14	14	14	14

2.1.2 NDP RTDI measure 2004–2006

The NDP/SPD constitutes the essential operational programming document for support to RTDI in Estonia during the period 2004–2006, with the co-financing support of the EU's Structural Funds. The vast majority of support for RTDI was channelled through a single measure (or sub-programme) entitled "Promotion of Research, Technology Development and Innovation" (measure 2.3). Funding allocated to the RTDI measures for the period 2004–2006 (of which 75% from the European Regional Development Fund, ERDF)[2] amounts to 51.68 MEUR[3] or 53% of the total (public expenditure) for the Business development priority and 17.3 % of the total ERDF budget and 10.4% of the overall budget of the SPD.

The analysis under-pinning the SPD RTDI measure was more exhaustive than that presented in the Knowledge Based Estonia strategy[4] and used the framework of the European Innovation Scoreboard to facilitate comparison with other EU Member States. Succinctly the analysis provided compelling evidence of the need to

2 *According to the management principles of the Structural Funds, funding committed until 31 December 2006 is eligible for co-financing by the ERDF if it is disbursed before end 2008 (the so-called N+2 principle).*

3 *Or 808 million Estonian kroon (1 Euro equals 15.6466 Estonian kroon (EEK). Total public sector funding expressed in Euro has increased between 2003 and 2005 versions of programme complement from 42,873,000 (at 1999 prices) to 51,680,745 Euro (at current prices). The Estonian kroon equivalent is used in the rest of the report.*

4 *The technical details of the measure were prepared by the Ministry of Economic Affairs and Communication, Innovation and Technology with the support of EU experts funded through the PHARE programme. An analytical review of the strengths and weaknesses of the innovation system, a proposal for funding schemes and the operational details of such schemes were prepared and summarised in a report published by the Ministry of Economic Affairs: Alasdair Reid and Silja Kurik. Optimising the design and delivery of innovation policy in Estonia: an evaluation of policy instruments for intensifying business innovation. Ministry of Economic Affairs and Communications, Tallinn. Innovation Studies n°4, 2003*

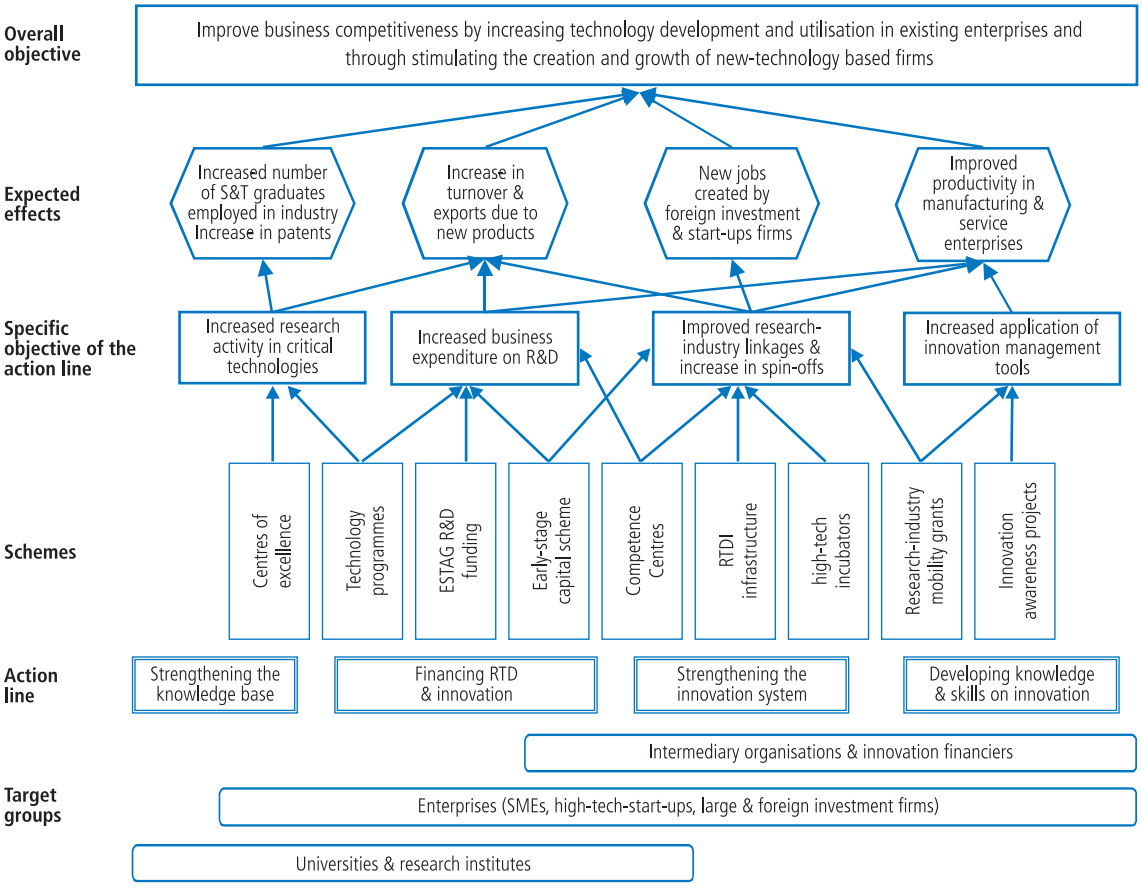
restructure the economy towards higher technology and value added content and to increase productivity, particularly in the manufacturing sector if it was to compete following EU accession. Moreover, surveys carried out during 2002[5] had underlined the weak financial and human capacity of Estonian firms to invest in technology and innovation and the weak co-operation between the research base and enterprises. While recognising under-investment in academic/non-profit research institutions by the Estonian State, the analysis highlighted the pressing needs to rapidly raise basic technology and innovation management capacities in the enterprise sector. Accordingly, the SPD foresaw therefore that the measure would "*focus on a number of actions and investment projects to increase the scale, competitiveness and innovative capacity of the country's businesses*".

Based on this analysis, the overall objective of the measure was defined at "***to increase the RD&I capacity in existing businesses and stimulate the creation and growth of new technology-based businesses***". A number of specific objectives were also defined:

- To create a critical mass of research potential in a number of technological fields vital for both existing industrial or service sector firms and the creation of new sectors of activity with higher technology content.
- To increase co-operation between the science and business sectors in applied research of strategic importance for the Estonian economy and to reinforce the capacities of R&D institutions to co-operate with businesses and to manage the innovation process;
- To stimulate an increased involvement of Estonian enterprises in funding and undertaking on a regular basis in research and development, technology transfer and development and innovation;
- To establish financially sustainable technology and innovation infrastructures and respective support services able support Estonian enterprises in their innovation activities;
- To generate a wide awareness of innovation as a key driver of economic growth and to strengthen the RD&I capacity and competence of businesses and research institutions.

Actions to be funded under the RTDI measures were then grouped under four broad objectives corresponding to an intervention logic summarised in a diagram annexed to the SPD and reprinted below.

Exhibit 3 SPD RTDI measure intervention logic



[5] *Notably the 2002 Community Innovation Survey (CIS III) results*

In more detail, the May 2003 Programme Complement proposed the following programmes per action line of the measure:

- Strengthening the knowledge base
  - Establishing and reinforcing a network of Research Centres of Excellence relevant to the Estonian enterprise sector (investments in R&D)
  - Modernising research equipment and providing specialized facilities tailored to new technologies – exclusively in designated Research Centres of Excellence
- Financing RTD and innovation
  - Support scheme for market oriented R&D projects
  - Advanced technology programmes in key areas
  - Pre-seed, seed and venture capital scheme for favouring technology intensive and/or innovative new entrepreneurship
- Strengthening the innovation system
  - Creation and development of innovation and technology infrastructures (single large scale investment projects incl. buildings, machinery and equipment)
  - Support scheme for technology transfer and high-tech incubation services
  - Competence Centres Programme (funding of staff and investments in machinery and equipment for industrially relevant R&D projects)
  - SPINNO program for creating Spin-off companies
- Developing knowledge and skills about innovation
  - Innovation Awareness & Competence Programme
  - Support scheme for science-industry human resource mobility

In terms of quantified objectives, the text of the measure is surprising vague with only output indicators expressed in terms of number of projects supported (100 in total, including 28 projects of enterprises, 15 of R&D and educational institutes, 32 joint projects (research-industry co-operation) and 25 projects of support structures. The results indicator is expressed in the form of created new jobs (gross) with a target of 800 fixed in the programme complement of August 2005.

2.1.3 To what extent was this strategic approach appropriate?

Most stakeholders interviewed concur that whatever the limitations that can be pointed out with hindsight, the KBE strategy can be considered as a watershed in Estonian RTDI policy. It contributed to shifting attention of policy-makers from a 'laissez-faire' (free-market) approach to economic policy towards the need to invest significantly greater public and private resources in boosting higher value added activities.

Nevertheless, the strategy did have a number of weak points or "missing links" which mean that it offered a partial set of solutions to the challenges faced by the Estonian innovation system[6]. Issues that can be raised include:

- Despite identification of key areas, mechanisms for prioritising research funding for R&D institutions were not clearly identified (beyond the centres of excellence) and the responsibility for pushing forward analysis on the key technology fields was ambiguous;
- The strategy argued clearly for the need to ensure support to the new and additional demands for RD&I not only in high technology sectors but also in traditional manufacturing sectors. Yet, on paper, the measures tend to focus on a small group of higher technology companies and there is no explicit sectoral actions foreseen. Given that differences in sectoral innovation systems are increasingly considered as important and often demand significantly different approaches in terms of support mechanisms this can be considered as a weakness;
- The strategy rightly identified increased numbers and quality of human resources for RD&I as a key element of success, yet the principle focus of most measures proposed was investment in infrastructure or specific projects. The relatively explicit assumption is that improved R&D infrastructure will attract young people to become scientists and favour return of scientists who have emigrated. The focus on improving infrastructure was undoubtedly justified but other factors such as national and international labour market dynamics for skilled scientists and engineers (notably competition nationally from industry and internationally from other research organisations notably in the Nordic area based on higher salaries) should also have been addressed. In this respect, the measures foreseen under the development of human capital appear were not sufficiently well connected with the measures aimed at boosting expenditure or the effectiveness of the R&D and innovation systems.

---

[6] *A national innovation system being defined as "the network of organisations, individuals and institutions which determine and shape the generation, diffusion and use of technology and other knowledge, which, in turn, explain the pattern, pace and rate of innovation and the economic success of innovation."*

More generally, while it was fundamental to include the funding framework annexed to the KBE strategy in order to justify the overall objective of increasing GERD to 1.5% of GDP by 2006, this approach has intrinsic weaknesses. A first weakness was that the planned increase in State budget financing of R&D was conceived to fit the target rather than constructed from a set of measures, which could be expected to actually leverage this additional investment. As has been noted in a recent review of Belgium's progress towards the 3% GERD/GDP target, such a target is "*an investment **cost** target. Equally important, if not more so, is the question what the results – in terms of efficiency and effectiveness – of such investments will be*"[7].

In the Estonian context, raising intensity of the public effort as a means of leveraging additional private investment in R&D appears more than justified. However, this does not absolve from the need to go beyond a relatively broad prioritisation of RTDI financing based on three key sectors, and to put in place operational mechanisms which ensure that public funding for R&D is allocated to 'best-performing' actors (whether they be researchers or enterprises). The box below summarises key trends and 'good practice' for research funding systems across OECD countries.

Exhibit 4 Reforms and changes in funding and funding mechanisms

- Funding of public sector research is increasing, but new funding is often attached to specific priorities or new schemes (e.g. centres of excellence).
- The proportion of funds distributed through competitive grants schemes is increasing relative to institutional funding.
- The use of institutional funds by public research institutions is increasingly evaluated with measurable performance indicators.
- Business funding of public research is increasing, giving rise to new relationships between funding sources and research performers.
- Public research institutes are looking for new sources of funding, including business, private charitable foundations, university tuition fees, overhead coverage for research funded with grants and contracts.

Source: Governance of Research, towards better practices. OECD 2005

In Estonia, the research funding system[8] has been the subject of several reviews[9] and an on-going effort by the responsible authorities (Ministry of Education and Research) and stakeholders (Academy of Science, universities) to introduce more competitive, transparent and strategic selection systems. However, a number of issues continue to give cause for concern notably the fragmentation of research funding across many small research teams and short-term criteria for funding decisions (targeted financing); allied to a tendency for a historical lock-in of funding (e.g. pre-defined proportions of Estonian Science Foundation (ESF) funding allocated to specific research areas, key for allocation of baseline funding which favours existing rather than emerging research poles). Most stakeholders interviewed argued that the major weakness of the current period was the failure to launch national research and technology programmes. Such programmes would allow for a more strategic orientation of Estonia research and should represent additional funding beyond the current funding streams. Finally, there remains the need for a fully-fledged research assessment exercise allowing for adjustment of prioritisation of funding for projects and doctoral studies towards those academic units, which are competitive at international level.

A second weakness of the strategy was the assumption of a rapid rise in private expenditure on R&D by enterprises both in relative share of total R&D expenditure and in absolute terms. However, this projected increase does not take sufficient account of the structure of Estonian industry and its current market orientations. Firms are not interested in increasing R&D expenditures just for the sake of it but because they expect that the new or improved production processes, technology concepts, or new products responding to market needs emerging from these activities, will improve their efficiency and hence their long term competitiveness. If at all possible, firms will try to license/purchase technologies or alternatively outsource at least part of the most expensive knowledge investments.

---

7 *High Level Group 3% Belgium. Report April 2005 to the Federal Minister for Science.*

8 *Government funding for R&D is provided in a set of funding streams determined in the Organisation of Research and Development Act. The Act (as amended in 2004) defines five sets of funding streams: 1) targeted financing; 2) research and development grants; 3) national research and development programmes; 4) infrastructure expenses; 5) base-line funding.*

9 *Assessment of the Estonian Research Development Technology and Innovation Funding System. Georghiou Luke and Nedeva Maria, PREST, Victoria University of Manchester (2003). The recommendations of this report were contested by most stakeholder who were met during the mission notably related to a proposal to introduce 'baseline funding' and create a 'Research and Innovation Funding Council'. The lack of discussion of the place of Estonian science in the wider Baltic and European Research Areas in the report was also criticised. Nevertheless, the report did provide an overview of a number of key issues that need to be addressed and baseline funding has been introduced since 2005 based on a set of weighted keys to organisations eligible under the Organisation of R&D Act for targeted financing.*

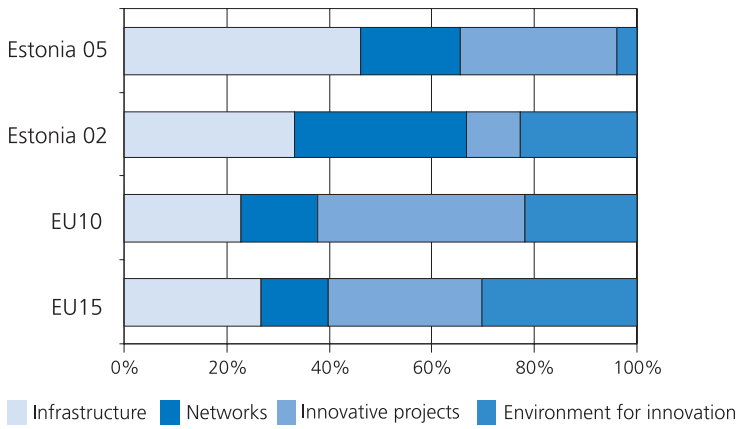
Indeed, from a small open economy perspective, in an increasingly global knowledge economy framework, the question needs to be raised whether a knowledge investment target, has a real economic significance if the local economy fails to appropriate this knowledge (i.e. even if the knowledge is codified and can be considered as a commodity it requires capacities within industry to integrate and exploit it, not to mention local finance for the product development phase). With increased globalisation, the relevant R&D which will act as driving force in a country might well come from abroad; at the same time domestic R&D activities might have little impact on the domestic economy in which such R&D activities happen to be located. This aspect of the innovation system remains relatively ignored by a strategy that remains essentially linear in approach (the hypothesis that increasing research funding in Estonia will automatically lead to increased growth and competitiveness in the country).

One additional element that is commonly used to encourage greater private sector investment is R&D tax credits. In the context of the flat rate and low level of corporate tax in Estonia, this option has not been considered. Yet as the TrendChart annual report for Estonia notes: "*Estonian corporate income tax system should foster the investments in enterprises as the reinvested profits are taxed with 0%. But this is not very helpful for smaller companies' innovation activities or specially for start-up high-tech companies who just do not earn any profit for first several years. So this measure still mainly supports the development of enterprises as a whole, rather than their innovation projects (at least till the company's profit has reached a certain level for additional investments)*". One option that might be worth examining are fiscal subsidies in the form of reductions on social security charges, etc. for the recruitment of additional personnel particularly given the focus of the Strategy.

Turning to the SPD RTDI measures, the ex-ante evaluation of the SPD concluded "*that the objectives of the priority, rational and reasoning of the measure have been presented better than in SPD, the specific objectives have been well formulated*". However, it needs to be underlined that since the SPD was adopted, the Programme Complement, which provides more details on the activities to be funded under each measure, has gone through several rounds of modification. This has led to a significant change in emphasis following several re-writings of the SPD RTDI measure. Comparing the text of the programme complement adopted in May 2003 with the most recent version (modified in mid-August 2005), it can be noted that while the overall objective remains the same, the balance in the mix of measures shifts quite markedly towards funding for R&D infrastructure.

This is particularly the case for the inclusion of the R&D infrastructure measure (essentially funding for university research activities) under the strengthening the innovation system action line (essentially aimed at actions designed to bridge the gap between the business and research communities as well as developing more advanced innovation services for enterprises). Under the original logic, investment in academic research infrastructure was foreseen for inclusion under the 'Strengthening the knowledge base' action line' with funding channelled through the pre-designated 'centres of excellence' (while in the final outcome the centres of excellence have in fact received a small proportion of funds). As a result of the insertion of the R&D infrastructure programme (developed during 2003) in the innovation systems action line, the emphasis on developing technology and innovation infrastructure and services (notably those related to the expected investment in Tallinn and Tartu technology parks which had benefited from EU Phare funding for design and preparatory works) was consequently reduced. The change in orientation of the RTDI measure is evident from the diagram below.

Exhibit 5 Focus of Estonian RTDI measure compared to EU15 and EU10



Calculations: Source: Working group report on RTDI, 7/3/05, European Commission, DG Regional Policy (except calculation Estonia 05, Technopolis).

Infrastructures (INF):
Business parks, Innovation centres, Incubators, Research Centres / Technological Parks, Clusters (infrastructure);

Networks (NET):
Development of clusters, Competence networks, Cooperation Universities / SME, Technology transfers

Innovative Projects (IP):
Applied research projects, technology transfer, Encouraging innovative spin-offs & start-ups, investment by SMEs in environmentally friendly technologies and modern IT,

Environment for Innovation (EFI):
Encourage innovation in SMEs in the fields of management, marketing, financing and human resources strategies, business advisory services, Financial engineering, Human Capital (ex Training in management, etc).

The basic choice of programmes to include in the measure was guided by a number of findings of the preparatory work undertaken in 2002:

- Given the lack of programme preparation undertaken by the Ministry of Education and Research (and limited human resources within the Ministry for this task), it was considered preferable to focus funding under the strengthening the knowledge base action line on the already identified and selected Centres of Excellence. Moreover, closing a funding gap for academic research institutes is not a sufficient rationale for Structural FundS, rather it required the development of a programme targeting funding going to non-profit (academic) research institutions towards fields of research and types of activities likely to have significant spill-overs into the broader economic development;
- In terms of the funding of R&D projects, a question mark existed over the absorption capacity of R&D grants/loans schemes of ESTAG/EAS for enterprises and R&D institutions. At the time the scheme was still facing difficulties to disburse the limited funds available from the Estonian budget. It was felt prudent to include this programme in the measure but not to allocate significant amounts of additional funding;
- A key criterion used for selecting other programmes for funding was the state of preparation of programme design. Hence, the existing SPINNO programme, the Competence Centre programme which in 2002 was being finalised after an intensive period of preparation, and funding for technology programmes in key areas (notably biotechnology/medicine and ICT fields where baseline studies existed or were being complete) were all expected to be able to absorb funds;
- Similarly under the strengthening the innovation system action line, RTDI infrastructure was expected to support the parks (already benefiting from PHARE support), while the incubation activities were the subject of programme design also with Phare support;
- Finally, the bottlenecks related to seed capital for high-tech (riskier) activities, the need to raise innovation awareness across society and the human capital bottleneck were identified and either initial preparatory design work was under way (innovation awareness) or technical specifications for such programmes had been drafted by end 2002.

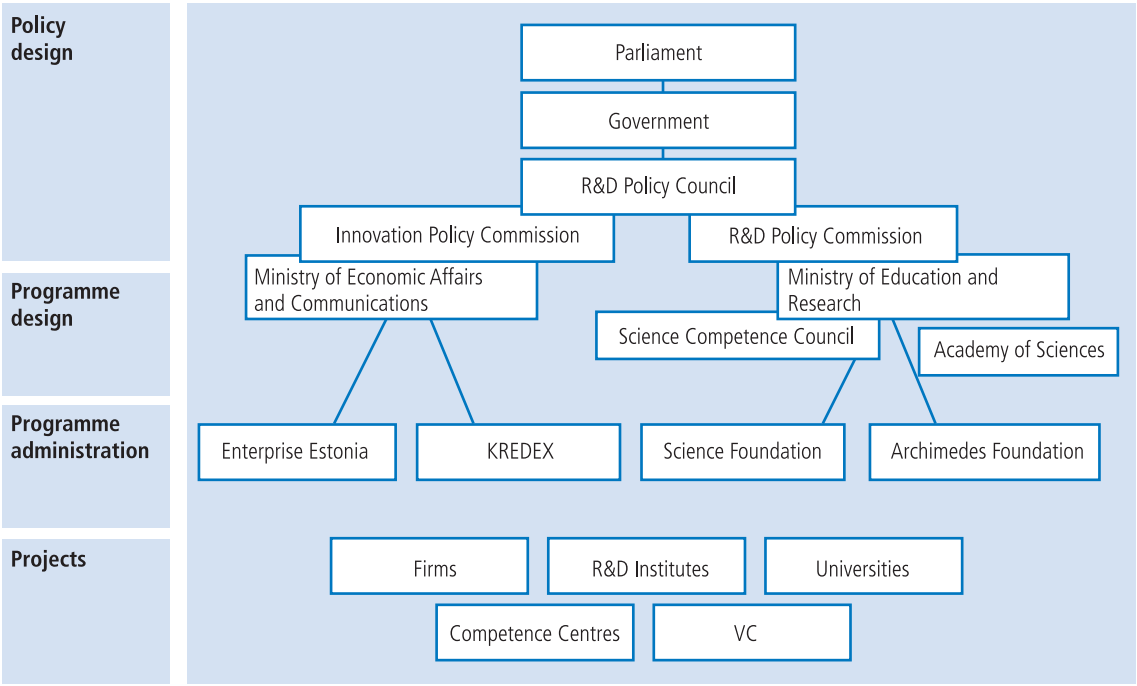
Another aspect, which changed from the original planning phase of the SPD and programme complement, was the adoption of a single result indicator of "800 new (gross) jobs". This analytical basis for this figure is missing and there is no explanation of which of the various programmes within the measure will contribute to this target.

2.2 Review of the implementation of the RTDI strategy

2.2.1 Implementing structures and procedures for the RTDI strategy

Given that this study is essentially aimed at informing on-going discussions in Estonia on the future RTDI strategy, this section is relatively short. However, given the possibility the report will be consulted by external readers (such as the European Commission services) an overview of the Estonian RD&I governance system is provided below[10]. The diagram below summarises the different levels of policy design, programme design (and evaluation) and administration.

Exhibit 6 Organisational chart of the innovation governance system



Source: Annual TrendChart Country Report for Estonia, 2005

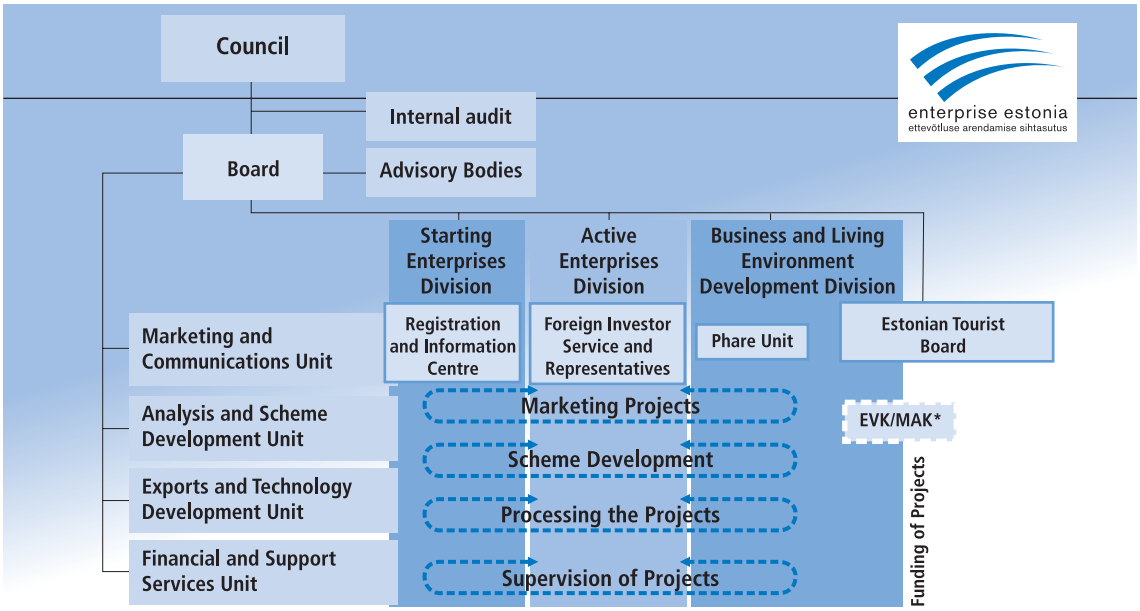
The implementation of the RTDI strategy in Estonia is the remit of essentially two Ministries and one government agency (at least as in far as the Structural Funds are concerned):

- Education and science policies fall under the responsibility of the Ministry of Education and Research. Within the Ministry, the Research Department under the a deputy secretary general is responsible for designing and developing scientific research policies;
- while the Ministry of Economic Affairs and Communication is responsible for innovation and technology policy. Within the Ministry, the **Technology and innovation division** of the Economic Development Department has line responsibility for the RTDI measure in the SPD

The agency responsible for administering funding from the Structural Funds for the RTDI measure is the **Enterprise Estonia** foundation (EAS), a non-profit legal entity established by the Government of the Republic. Prior to 2003, the Estonian Technology Agency existed within EAS as one of a number of agencies that were grouped into the foundation. Following a restructuring, which took place in 2003, EAS is organised as outlined in the diagram below in a "matrix format" with the RTDI measure programmes falling under the competence of the Active Enterprises division. The Exports and Technology Development Unit pools experts in different fields for consulting and project assessment including for the programmes of the RTDI measure.

[10] *Essentially based on reporting under the TrendChart project.*

Exhibit 7 Organisational chart of Enterprise Estonia



In Estonia the implementation of Structural Funds is based on Structural Assistance Act (SAA). All secondary legislation is derived from it. Most of the questions concerning implementation have been regulated in secondary legislation (with little room for flexibility). In practice, for each measure, the Ministry responsible is obliged to prepare a ministerial decree for implementation. In the case of the RTDI measure this has meant even adopting a decree for existing programmes such as the direct funding to enterprises and R&D institutions for applied research and product development projects. A survey of Structural Funds implementation in Estonia has acknowledged that these procedures have led to some delays in implementation. Moreover, according to the SAA, the managing authority (the Ministry of Finance) has to approve all conditions laid out in the decrees of ministers implementing specific programmes within each measure. This is foreseen to ensure "*homogeneous content and quality of the decrees and control eligibility, rights and obligations given to beneficiaries etc.*". This raises the question as to whether all beneficiaries can be considered homogenously within the diverse range of actions of the RTDI measure.

The table below summarises the state of play of implementation of the RTDI measure in terms of legal basis and application process for each measure.

Exhibit 8 Legal basis and application process for SPD RTDI measures

Programme	*Legal base*	*Application process*	*Eligible to participate*
R&D financing programme	Regulation of 9 May 2005 on R&D financing programme	Standard application forms for submitting proposals for feasibility studies, applied research and project development projects.	Depending on the type of project either R&D institutions or private enterprises.
SPINNO programme	Regulation of 3 May 2004 on the SPINNO programme of measure 2.3 of the SPD 2004–2006	Two-stage application process: ■ preliminary application ■ full application	State and public research and development institutions and state institutions of higher education.
Innovation awareness programme (Good Estonian Idea)	Regulation of 30 December 2004 on Innovation Awareness programme	Two-stage application process: ■ not foreseen in the regulation as separate stage, but is concurrent to both stages. ■ preliminary application ■ full application	Three types of applicants: ■ legal persons governed by public law; ■ State institutions; ■ legal persons according to private law

Programme	*Legal base*	*Application process*	*Eligible to participate*
R&D infrastructure development programme	Regulation of 18 March 2005 on Research and development Institutions' Infrastructure Development Programme	Two-stage application process: ■ preliminary application ■ full application	National or public R&D institutions.
Centres of Excellence programme	Regulation of 15 May 2005 on terms and conditions for providing Structural support for the Centre of Excellence of Estonian Science Programme".	Single-stage application process	Designated centres of excellence (R&D institutions)
Competence Centres programme	Regulation of 25 August 2005 on Competence Centres programme	Submitting an application on a current basis.	A consortium of partners led by either an R&D institution (including foreign registered institutes) or a private enterprise. The competence centre should be incorporated as a private company in order to sign the contract.
Business incubation programme	Regulation of 28 October 2004 on implementation of business incubation programme within the SPD RTDI measure	Application rounds in 2004 and in 2005	■ Legal person governed by public law whose main area of activity concerns minimising risk for entrepreneurs in start-up phase through offering incubation services. ■ Vocational and Higher Education institutions in case of carrying out preliminary study for starting new incubator.
Innovation audit programme	The beneficiaries of the Innovation audit programme should be in compliance with the requirements of the Regulation for Training Support (Regulation of 15 June 2004).	In Innovation Audit sub-programme of the training support scheme there was no application process as such. Rather direct contact was made with enterprises through pro-active marketing, where consultants contacted the enterprise to enquire if the were for willing to receive an innovation audit. The only form the company had to fill out was a feedback questionnaire (which was not always completed).	According to the Regulation for Training Support as follows: ■ Companies registered in the Commercial Register. ■ Sole proprietors registered in Estonia; ■ Associations of entrepreneurs (NPAs) ■ Professional associations (NPAs and foundations).

2.2.2 State of play of implementation of RTDI measure in the 2004–2006 SPD

This section reviews the extent to which the RTDI measure has been efficiently implemented in operational terms opening up the perspective of the activities funded leading to results and impacts in a short to medium term time frame. As of September 2005, for the majority of programmes within the measure, efforts were still focused on completing the initial operational stages in terms of the process of selection and then launching of projects (see exhibit below).

Exhibit 9 State of play implementation RTDI measure as of mid-2005

Programme	*Selection and application process*	*State of play of implementation*
R&D financing programme	Application rounds opened on annual basis and closed once sufficient applications received.	■ Upwards of 135 MEEK of projects selected from 1 January 2004 to mid-2005, representing roughly 50% commitment of allocation through SPD ■ Little or no actual expenditure incurred during 2004.
SPINNO programme	Deadline for preliminary applications was 15 June 2004; and 15 September 2004 for full applications.	■ Seven projects selected for a total funding of 60.37 MEEK, representing full commitment ■ Little or no payments made. ■ Implementation period 15 June 2004–30 June 2007.
Innovation awareness programme (Good Estonian Idea)	Two rounds for submitting applications in 2005 for projects aimed at: ■ students and teachers ■ policy makers and opinion leaders and entrepreneurs.	■ In process of selecting first projects
R&D infrastructure development programme	Deadline for preliminary application was 1 August 2005.	First projects selected in September 2005
Centres of Excellence programme	Deadline for call was 16 September 2005	In process of selecting first projects
Competence Centres programme	■ First call in February 2003 for short proposals. Fourteen short proposals submitted. ■ Full proposal negotiations with six applicants as of February 2004.	■ Five projects currently underway for a total funding of 42.66 MEEK in first year (from EAS reserves). Further support totalling 100 MEEK to be disbursed via SPD; ■ Implementation period: 2004-2007 (2–3 years from date of signature of contract)
Business incubation programme	■ First round finished on the 24th of January 2005. ■ Second round is intended to take place during Autumn 2005.	3 projects selected in 2004 for a total funding of 1.64 MEEK.
Infrastructure development programme for Science and technology parks	At this stage no call for proposals have been launched.	■ Tartu Science Park still implementing projects under Phare pre-Structural Fund support; ■ Development of strategic partnership by Tallinn Technology Park with Finnish investor ■ Need to clarify how planned Structural Fund support can be most effectively used – for developing services or infrastructure.
Innovation audit programme	Programme was launched as Pilot project in April 2005 with the aim to map innovation potential and needs at least in 60 enterprises and accordingly design activities to raise their competitiveness.	■ Audits currently being carried out by Estonian consultants on the basis of a methodology proposed by a UK consultancy ■ 30 audits carried out by mid-2005, notably in more traditional industrial sectors.

Efficiency is generally judged in terms of the extent to which a programme succeeds in achieving the desired effects at a reasonable cost; or the best relationship between resources employed and results achieved. This clearly includes the efficiency of programme management as well as the time dimension (delays can be considered as incurring opportunity costs).

In this respect, while a full review of procedures for implementing the programmes has not been carried out, the weight of bureaucracy of the programmes was a recurrent theme in the interviews carried out with stakeholders by the study team. The principal difficulties highlighted included:

- Micro-management of planning and implementation of projects by EAS staff allied to insufficient technical expertise in-house on project contents;
- Use of experts with insufficient knowledge of field of technology or sector, or with conflict of interest to select projects;
- General risk aversion culture which limits additionality of public funding (preference for funding existing successful companies as to higher commercial or technological risk or less well-known firms);
- Design of applications forms which respond more to control requirements of EAS than to needs or capabilities of applicants;
- Non-transparent and subjective criteria for project selection (e.g. avoidance of giving funding to certain sectors – such as software);
- Lack of understanding of EAS staff about other support schemes within EAS;
- Heavy financial control and audit requirements (e.g. six-monthly audit of competence centres).

Such remarks and criticisms need to be taken with the proverbial pinch of salt. Programme beneficiaries tend to always cite complex application procedures or long payment delays as a difficulty. However, in this case these remarks tends to back up conclusions of other previous studies: this issued was highlighted in the 2002 review of ESTAG funding schemes, the State Audit office report, and the recent PRAXIS survey of companies on business support measures for 2007–2013. Beyond the time taken to adopt Ministerial Regulations, the process of selection and contracting allied to the payment and financial control procedures appear to lengthen the time required for implementing even relatively small projects.

This is important as the financial absorption of a programme and its sub-measures (in terms of commitments and payments against total planned funding) is generally used by the European Commission as a key indicator of management efficiency. Moreover, while a narrow focus on financial absorption capacities is not sufficient as a basis for strategy design, this indicator does tend to highlight particular bottlenecks or potential focus areas for future financial planning.

The two financial tables below sums up firstly key data on trends in planned funding for RTDI under the series of measures managed by the MKM, and secondly financial commitments patterns for 2004 under the SPD RTDI measure. The first table summarises available information gathered from the MKM concerning planned budgets for the various RTDI measures contained in the Structural Funds. Detailed breakdowns suggest that the planned national budget contribution to RTDI measures which were approximately standing at 120 MEEK in 2002 and 2003 (before Structural Funds) briefly rose in 2004 (to 132.5 MEEK) before dropping back to just over a 105 MEEK in 2005 and then tailing off progressively. The rather stark conclusion is that net financial additionality, if the current planned budget levels for 2007–2008 (i.e. only necessary State budget co-financing for Structural Funds) is maintained, would actually be negative (approximately 6.8 MEUR per year for 2004–2006 compared to 2002–2003 (7.6 MEUR on average).

Exhibit 10 summarises the commitments made during 2004. The overall commitment level is below that attained in certain other measures of the SPD, but is close to the average for the period up to 28 February 2005 according to official figures).

Exhibit 10 RTDI measures of MKM – evolution of planned budgets 2002–2008 (as of mid 2005)

	2002 Total (incl. Phare)	2003 Total (incl. Phare)	2004 SF+EB* (75*+25%)	2005 SF+EB* (75*+25%)	2006 SF+EB* (75*+25%)	2007 SF+EB* (75*+25%)	2008 SF+EB* (75*+25%)	TOTAL 2004–2008
R&D Financing programme	90,400,000	62,800,000	135,000,000	60,000,000	49,000,000	****	****	397,200,000
SPINNO Programme	16,300,000	16,300,000	61,000,000	0	0	****	****	93,600,000
Innoawareness programme	3,000,000	7,700,000	6,000,000	3,000,000	10,400,000	****	****	30,100,000
R&D infrastructure development programme	0	0	5,000,000	100,000,000	84,500,000	****	****	189,500,000
Centres of Excellence programme	0	0	0	75,000,000	0	****	****	75,000,000
Competence Centres programme	0	25,000,000	48,000,000	47,000,000	35,000,000	****	****	155,000,000
Business incubation programme	0	0	8,000,000	3,000,000	2,000,000	****	****	13,000,000
Infrastructure development programme for Science and technology parks	1,650,000	0	0	33,000,000	31,000,000	****	****	65,650,000
Other ad hoc support measures (IRC, FP, etc)	9,300,000	5,200,000						14,500,000
Innovation audit programme	0	0	0	2,550,000	3,000,000	****	****	5,550,000
Promoting R&D&I TOTAL***	120,650,000	117,000,000	263,000,000	323,550,000	214,900,000	95,700,000	33,244,667	1,039,100,000

NB: darker highlighting indicates additional Estonian budget funds on top of necessary 25% co-financing of Structural Fund support. In 2004, reserve funds of EAS of 41 MEEK were used for funding R&D projects – to avoid double counting the total for 2003 has been reduced accordingly.

Exhibit 11 Commitments for RTDI measures under SPD, end 2004

	2004 Estonian budget	2004 Structural Funds	2004 Reserves (EAS)	2004 TOTAL	Measure 2,3 Plan 2004–2006	Measure 2,3 Committed plan
EAS Funding for R&D projects	39,080,923	13,026,975	35,265,549	87,373,447	250,160,000	34.9%
SPINNO Programme	45,277,500	15,092,500	228,340	60,598,340	60,300,000	100.5%
Innoawareness programme	–	–	109,367	190,367	22,030,000	0.9%
R&D infrastructure development programme	–	–	43,769	43,769	229,570,000	0.0%
Centres of Excellence programme	–	–	–	0	100,000,000	0.0%
Competence Centres programme	–	–	44,228,991	0	100,000,000	0.0%
Business incubation programme	–	–	–	0	13,000,000	0.0%
Infrastructure development programme for Science and technology parks	–	–	–	0	34,000,000	0.0%
Innovation audit programme				0		
Other ad hoc support measures (IRC, FP, etc)			2,240,931	2,240,931		
Promoting R&D&I TOTAL***	84,358,423	28,119,475	82,197,947	150,446,854	809,060,000	18.6%
Explanatory notes				EUR 9,615,306		

Source for 2004 data: Budget performance 2004 by source of financing, Division of Active Entrepreneurs, EAS
Commitment for competence centre programme is set at 0% since 44 MEEK is from reserves and additional to 100 MEEK

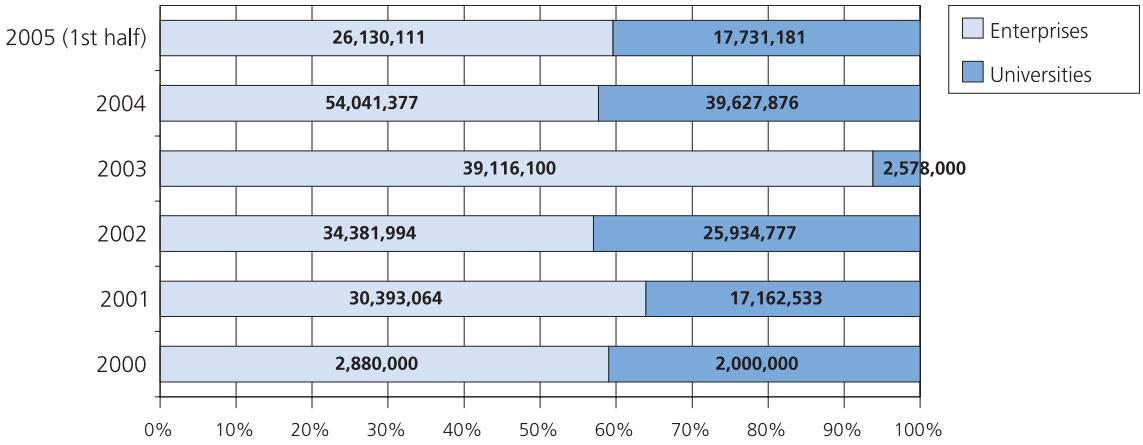
2.2.3 Appraisal of effectiveness of current RTDI policy measures

Given the review of implementation in the previous section, a first conclusion would be that at this stage of the programming cycle it is still relatively early to analyse the results of the RTDI measure in any meaningful way.

Programme	*Synthesis appraisal of effectiveness of measures*	*Results identifiable*
R&D financing programme	■ Significant leap in demand for financing from enterprises and universities ■ Programme could probably absorb funds.	■ Enterprise Estonia considers it too early to judge results since most projects are not completed; ■ State Audit Office report found limited evidence of results in review carried out in 2004;
SPINNO programme	Projects launched and apparently functioning correctly.	■ Positive evaluation of previous round (non-Structural Fund supported); ■ Second round of funding appears to be leading to greater sophistication in terms of services provided.
Innovation awareness programme (Good Estonian Idea)	Good response to first calls from range of beneficiaries.	Projects in process of being launched
R&D infrastructure development programme	■ Programme appears to be over-subscribed in terms of funding applications ■ Difficulties over financial issues such as VAT reimbursement;	First projects only selected in September 2005
Centres of Excellence programme	As for R&D infrastructure development likely to be oversubscribed	First projects only selected in Autumn 2005
Competence Centres programme	■ 2004 essentially used to launch and establish legal structures and for initial strategy building by selected centres ■ Difficulties with bureaucracy and financial rules act as a brake on development;	■ Initial series of research actions being launched within established centres ■ Still need to clarify strategies for end of initial funding period and for IP management and self-financing.
Business incubation programme	■ Relatively sub-critical investments made at this stage, some difficulty to self-finance private share. ■ Need to link more effectively with Science & Technology Park development.	Initial projects in start-up phase.
Infrastructure development programme for Science and technology parks	■ No funding yet committed within SPD; ■ Small amounts allocated under SPD seem to make significant additional infrastructure investment problematic.	Gradual development of services within S&T parks in part due to PHARE funding, but also through use of INTERREG, etc. funded projects.

As can be seen from above, it is essentially the R&D financing and SPINNO programme which have been running since prior to the Structural Funds programmes where initial results could be expected to be identified in near future. Concerning the R&D financing programme, and based on the data received from Enterprise Estonia, exhibits 5 and 6 provide a summary of recent trends in absorption of funds.

Exhibit 12 R&D financing programme – share of funding between enterprises and R&D institutions



Source: Enterprise Estonia (data received on 4 August 2005).

Exhibit 13 EAS Funding for R&D projects in Enterprises and Higher Education research institutes, 2002–2005 (EEK)

	2000	*2001*	*2002*	*2003*	*2004*		*2004*	*2005 (part year)*
	EB	*EB*	*EB*	*EB*	*EB*	*SF*	*Total*	*EB/SF*
Enterprises	2,880,000	30,393,064	34,381,994	39,116,100	23,372,350	30,669,027	54,041,377	26,130,111
Universities	2,000,000	17,162,533	25,934,777	2,578,000	11,381,005	28,246,871	39,627,876	17,731,181
Total	4,880,000	47,555,597	60,316,771	41,694,100	34,753,355	58,915,898	93,669,253	43,861,292

Source: Enterprise Estonia (data received on 4 August 2005). Data for 2005 is not split between Structural Funds and Estonian budget so assume 25/75 ratio.

A number of conclusions can be drawn from these figures:

- Considering that 2001 was first year of operation of the R&D financing schemes (feasibility studies, applied research and product development) following the creation of ESTAG and that until 2003 the programme was based on a mix of loans/grants (depending on the nearness to the market principle), the funding of projects in enterprises picked up steadily growing from 30 MEEK in 2001 to 39 MEEK in 2003;
- The progression of funding allocated to R&D institutions (essentially university institutes) has been patchier with a significant share of funding in 2002 but less in 2001 and 2003;
- Following the change of procedures (switch to grants only) to fit Structural Funds programming needs, 2004 has witnessed a sharp rise in demand for the scheme from both enterprises and the university sector. Initial data for 2005 suggests this trend has continued;
- In terms of concentration of funding, 24 companies benefited from more than one grant or loan during the period out of a total number of about 110 companies receiving support during the period 2000–2005. This suggests a relatively wider spread of funding than might have been expected at first, with companies drawn from a range of sectors at first sight. Further analysis of sectoral, technological field and geographical spread of projects is still required;
- However, in financial terms the top 20 projects (which were awarded to 20 different companies) consumed 57.7% of funding (or roughly 108 MEEK). Indeed, the largest single project accounted for 9.2% of total funding. This means that the remaining 116 projects (in the listing provided) received an average financial support of 682,000 EEK (or roughly 43500 EUR) compared to an average of 5.4 MEEK (or 344,500 EUR) for the 20 largest;
- The financial concentration of funding for R&D institutions projects is also important with 10 projects out of 53 (2000–2005) accounting for 63% of total funding (105 MEEK), with seven out of 10 allocated to Tartu University or associated institutes. The majority of these 10 main projects and hence of the funding allocated is focussed on biomedicine (gene technologies), other projects include biotechnology for food processing, material technologies and waste water treatment.

At this stage, EAS does not apparently carry out a detailed monitoring of project results, which suggests the need to foresee a full evaluation in the coming years. Beyond classic indicators in terms of employment, sales, etc. generated by the results of the R&D projects, a key element of such an evaluation is the extent to which the projects have led to behavioural additionality (the difference in firm behaviour resulting from the intervention and in particular how support provided has interacted with strategies and capabilities of firms).

2.2.4 Overall objectives: can targets be met by 2006?

As noted in section 2.1 of the report, only a limited number of quantified targets were set by either the KBE strategy or the SPD RTDI measure. The table below summarises the current outcome in terms of the KBE strategy-financing plan for the latest available data (September 2005, data available to 2004).

Exhibit 14 Target versus outcome for financing Strategy for Research and Development, 1998–2006 (Million EEK)

	1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
Total expenditure on R&D									
Target 2002	450.9	572.8	600	704.3	815.2	1004.4	1343.1	1735.5	2185.5
Outcome (2005)	451	572.8	579.4	763.5	871.5	1046.2	..	..	..
Total expenditure on R&D % of GDP									
Target 2002	0.61	0.76	0.7	0.75	0.8	0.9	1.1	1.3	1.5
Outcome (2005)	0.58	0.70	0.62	0.73	0.75	0.83	..	..	..
Share of public sector in GERD									
Target 2002	360.1	433.3	444	549.3	652.2	803.5	1007.3	1301.6	1529.9
Outcome (2005)	362.2	435.8	449	506.7	604.3	691.7	789.8	..	..
Share of public sector in %									
Target 2002	80%	76%	74%	78%	80%	80%	75%	75%	70%
Outcome (2005)	80%	76%	77.4%	66%	69%	66%	..	..	..
Share private sector in GERD									
Target 2002	90.8	139.5	156	155	163	200.9	335.8	433.9	655.6
Outcome (2005)	88.8	137.0	130.4	256.7	267.1	354.5	..	..	..

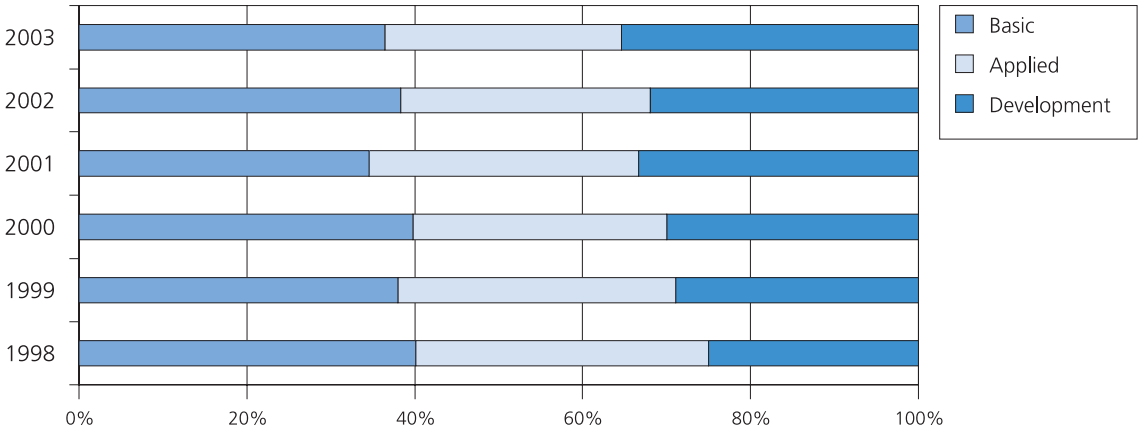
Source: all data for outcome, Statistical Office of Estonia (http://www.stat.ee)

Nb: differences for years 1998–2002 between target and outcome are due to statistical revision which occurred in 2004.

Despite a positive trend, the outcome is in overall terms rather mixed:

- The overall target in terms of absolute total expenditures on R&D has been surpassed (4% more than target in 2003), however as GDP growth has been sustained the outcome in terms of the GERD/GDP target is still significantly below the hoped for figure of 0.9% by 2003. It appears unlikely on current trends that the 1.5% target will be met by 2006;
- This growth in total expenditure is due in relatively equal part to the business (BERD) and government (GOVERD, including government, higher education and non-profit institutions) sectors. However, a large jump (doubling) of BERD between 2000 and 2001, not visible in 2002 at time of strategy drafting, somewhat changes the original scenario. Indeed, BERD stagnated in 2002 before jumping forward again by over 32% in 2003. This cycle of significant jumps in expenditure year-on-year is difficult to explain and merits further analysis particularly as it leads to a rapid rise in the share of BERD in GERD;
- What is equally striking is that the expected rise in GOVERD has remained consistently below target. There is clearly a significant 'funding gap' up to 2004. Moreover, the original scenario foresaw that the targets for public funding did not include "***the EU pre-Structural Funds and Structural Funds and the State's co-financing***". In the event, the Estonian State's co-financing of ERDF funding has been included making the total public funding gap larger (effectively the co-financing is not additional funds as originally foreseen). Moreover, between 2002 and 2004, there was a large jump in foreign funds as a source of financing for the higher education sector, which may be in part attributable to EU funding from the RTD Framework Programme. In contrast, the business sector's contribution to research in higher education has risen to 38 MEEK in 2003.

Exhibit 15 Share of total expenditure by category of R&D (1998–2003)



Source: Statistical Office of Estonia (http://www.stat.ee), calculation Technopolis

A second objective of KBE was to arrive at a better balance of public funding between research expenditure and support for experimental development. The diagram above suggests that there is a broad trend in terms of a shift towards more experimental development in the total of R&D expenditures (not only government funded). The total funding allocated to experimental development has risen from 112 MEEK in 1998 to some 369.7 MEEK in 2003. However the absolute value of direct government sector funding for experimental development (industrial technologies, etc.) has hardly shifted from 2002 to 2004 (about 13 MEEK), the main source of additional experimental funds coming from the higher education sector (although de facto this is equivalent to public funding in Estonia) rising from 31 MEEK in 2001 to roughly 70 MEEK in 2003 and 2004. The business enterprise sector has therefore been the main contributor to this rise in development funding with a large jump between 2000 (106 MEEK) to 2006 MEEK in 2001 followed by steady rise to 290 MEEK in 2003.

Going beyond this financial analysis, and faced with the question of to what extent can the KBE strategy be judged a success in terms of meeting the objectives, the conclusions of the interviews carried out were not emphatic. Stakeholders from the research community underlined that a number of initiatives have been pushed through under the developing human capital action line (including the creation of doctoral schools through the SPD measure 1.1.1, European Social Fund co-financed). More generally, a relatively important number of the planned initiatives for boosting R&D expenditure have been launched now and these could be expected to bear fruit in terms of multiplier effects on private and higher education research activities in a three to five year time table.

Aside from the aforementioned public funding gap with respect to targets, the main and glaring omission in terms of implementation is the failure to launch national technology programmes in the key sectors identified by the strategy despite some initial preparatory work carried out from 2002–2003. Most observers put this failure down to a range of factors some more political in terms of changing ministerial or government priorities, others in terms of capacity within the Ministries involved to develop the necessary procedures (given limited human resources and a significant workload on other programmes).

However, the failure to launch such programmes perhaps needs to be view in a more strategic sense, since it suggests that the understanding of the concept is still not clear enough on the policy making side and that neither the business and research sectors have given these programmes sufficient priority to ensure an early launch. What purpose will the technology programmes serve, what technological or sectoral fields will they focus on and what are the risks of such a choice? These and other questions need to be addressed in more detail by all stakeholders. To date, Estonian RTDI policy has tended to avoid prioritisation of funding towards sectors or technologies, technology programmes would de facto represent a shift in policy perhaps more fundamental than simply raising levels of expenditure on R&D infrastructure or for business R&D projects.

At this stage, it appears too early to analyse whether the broad macro employment objective fixed for the SPD RTDI measure will be met. This would require a detailed analysis of all project proposals in order to analyse net jobs created by additional funding for research institutions and innovation intermediaries and extrapolations based on declared expected turnover/employment effects of R&D financing for enterprises.

As noted earlier, this single indicator in itself, while important in a context of high unemployment and a need to increase technology intensity of jobs, is a very crude proxy for the more subtle and longer-term structuring effects the SPD RTDI measure could be hoped to have on the national innovation system.

The table below gives a summary of indicators and possible targets proposed during the preparation of the RTDI measure during 2002 but not retained in final programme complement. In addition, the various programming documents produced have now established a set of additional indicators, which need to be monitored on a more thorough basis. The establishment of a correct and properly resourced monitoring framework seems essential and this should ideally be done at Ministry level where policy planning is carried out.

Exhibit 16 Indicators proposed for the SPD

Indicators	*Target*
Measure/Priority level indicator: increase in business expenditure on R&D as a percentage of GDP	Baseline 0.15% (2000) Doubled by 2006
OUTPUTS	
% of supported R&D projects in higher-education and non-profit research institutes meeting technical objectives	75% benchmark may be available
Firms receiving financial support for RTDI projects	Estimate based on ESTAG clients 2001–2002, number of firms in competence centres, etc.
Square metres of technology related business space created	Estimate to based on future business plans of tech/science parks, centres, incubators, etc.
Number of new research-industry collaboration projects (COE, CC, mobility grants, national technology programmes)	60 (+/– 20 per year)
RESULTS	
Number of technology outputs achieved (patents, prototypes) by R&D projects	No quantification possible at this stage
Number of new (improved) products or processes introduced by assisted firms	Quantification may be possible on basis of ESTAG data
Number of new technology based firms / spin-offs from higher-education and research institutes	8 (2 per year)
Volume of funding disbursed by assisted early-stage capital funds to new technology based firms	€2.5 million = ~10 investments of ~€250,000
IMPACTS	
Total net additional jobs in assisted firms, Of which high and medium-high technology employment	Baseline = ESTAG schemes for 2001–2002
Total net new jobs in technology related business space Of which high and medium-high technology employment	80 (average 10 people per start-up by 2006)
Total net new (science and engineering) jobs generated in higher education/not-for-profit research institutes	No quantification possible at this stage
Number of new technology based start-ups/spin-offs surviving after 3 years	75%

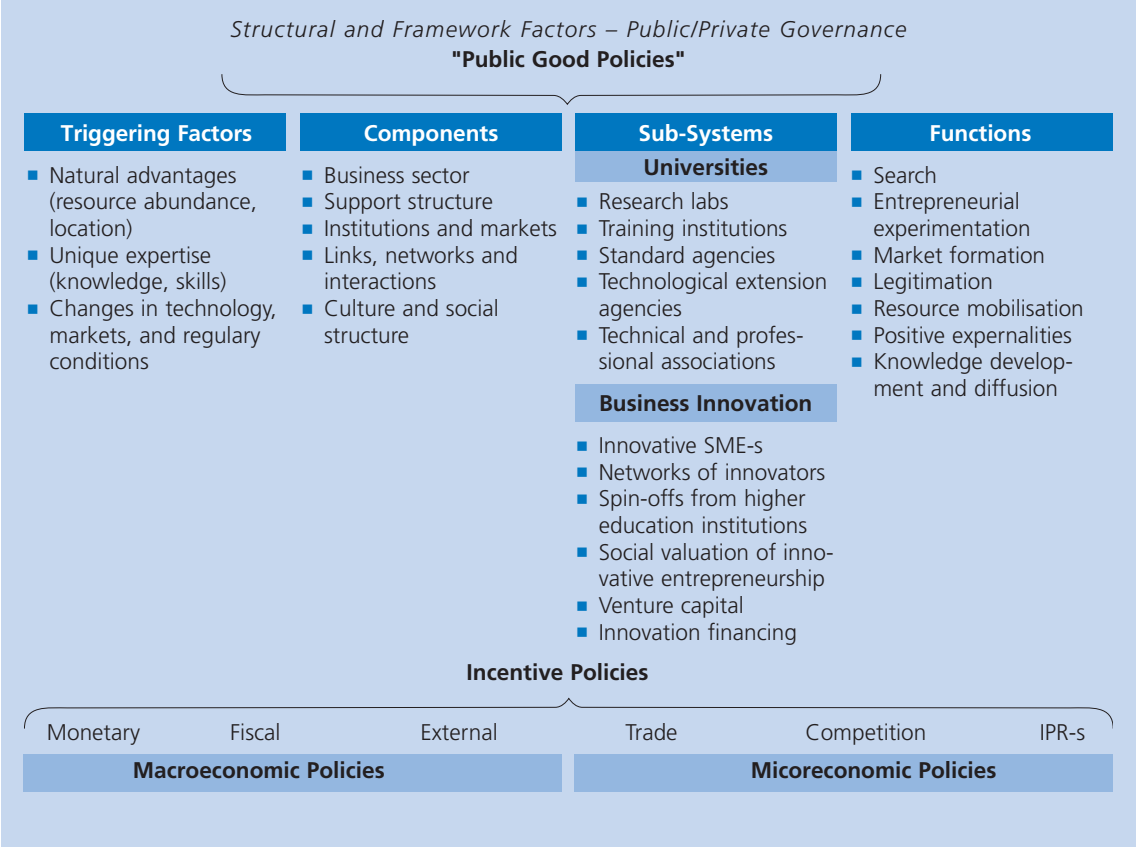
3 Proposals for innovation policy for 2007–2013

Based on the analysis conducted in the previous section, this section of the study identifies a number of main challenges for business innovation, as well as related challenges concerning the research, or knowledge, system in as much as knowledge creation and diffusion is a key factor for future innovation. A series of challenges are identified and an on this basis an overall framework for innovation policy is then proposed including a number of proposals for new and re-designed measure. The objective of the proposed framework is to achieve an appropriate balance between research policy and innovation policy measures in the future Structural Funds period.

3.1 Main challenges and priorities for 2007–2013

This section seeks to distil available quantitative and qualitative indicators pertaining to the main strengths, weaknesses, opportunities and threats of the Estonian innovation system as a basis for establishing a hierarchy of identified challenges and hence facilitating priority setting. While, this report focuses on the incentive policies which could be applied to boost business innovation, there is a need to align these policies with a wider view of the structural and triggering factors of the broader 'knowledge economy' or national innovation system (see exhibit below).

Exhibit 17: the innovation system from a policy perspective



Source: UNIDO Industrial Development Report 2005

The triggering factors are clearly fundamental since they represent the key elements of a standard SWOT analysis. The remit of this evaluation did not extend to a detailed analysis of these factors, however in analysing the challenges facing the two 'sub-systems' knowledge and business innovation, a number of such triggering factors are identified. The role of government and the public sector is also crucial since the support structure and incentive policies depend on the strategic management and intelligence capacities and capabilities within the relevant ministries and agencies. Hence, a third set of challenges are identified in the policy field which could be the target of a dedicated sub-programme aimed at enhancing policy governance in the field of research, technological development and innovation.

3.1.1 Challenges for knowledge creation and diffusion

In Estonia, following the reforms of the 1990s, research capacities are essentially located in universities and research institutes closely related to universities. They provide the main environment to carry out basic and applied research, and have a key role in training researchers and thus in ensuring the future foundations of research and knowledge generation.

High quality scores received by a number of Estonian research teams as a result of international evaluations of research areas indicate a potential of Estonian research to achieve top results in forefront research and to participate in EU level 'technology platforms'. Indeed, Estonia is successful in developing foreign cooperation with 12.7% of research funding sourced from abroad, the corresponding EU average being 7.7%. This success is related to the active participation of Estonian researchers in the EU RTD Framework Programme, with a success rate of close to one quarter of all proposals submitted.

Nevertheless, the results of evaluations of international research have also highlighted weaknesses in the financing system of Estonian R&D activity, poor condition of research apparatus and infrastructure, and problems related to producing a new generation of researchers.

This mixed situation can be in part explained by the fact that Estonia continues to under-invest in research and development, compared to other EU Member States. While total R&D expenditure has grown by approximately 3.7% a year during the 1999–2003 period, reaching 0.83% of GDP in 2003, Estonia still lags far behind the EU25 average (1.93%). Moreover, as noted previously, the planned objectives of the KBE strategy (0.9% by 2003 and 1.5% by 2006) were not achieved.

The overall orientation of research activities has evolved over the period 1999–2003, with funding for social sciences and humanities growing most rapidly (105.9% and 90.4%, respectively), while financing of agricultural and natural sciences has grown most slowly (17.6% and 44.4%, respectively). This has led to a consequent shift in terms of shares in total funding for these fields. Technical and medical science fields have grown marginally faster than total funding with their share of total funding remaining relatively constant.

There has also been a significant shift in terms of the relationship between basic and applied research, and technological development activity but these have not yet achieved the proportions common in more advanced countries. In 2003, basic research comprised 36.4%, applied research 28.2% and the costs of testing and development work 35.4% of the total R&D volume. The reasons include low levels of investment in more applied research and development activity and limited cooperation between research institutions and enterprises. At the same time, it should be noted that the trend is positive – the share of testing and development work in 1999–2003 has grown 23.7%, while the share of basic research has decreased 4.1%.

Research potential is also strongly inter-linked with the creation of new skilled graduates in specific scientific fields. Currently the scope of doctoral studies and its division by areas do not meet the needs of society. To achieve the EU level, the scope of doctoral study must be at least doubled, while the number of doctoral degrees defended per year need to be increased at a higher pace in the fields of natural and exact sciences, medicine and engineering sciences. The Estonian higher education system produces proportionally less graduates of natural and exact sciences and engineering sciences than in the EU. In 2001, graduates of natural and exact sciences and engineering sciences in Estonia accounted for 18% of all the graduates at higher education level. The corresponding EU average was 24%, and even 28% in Finland.

In terms of productivity of the research system, publications are one of the most important tools for measuring performance. Estonian research is characterised by a multiplicity of successful research areas. On the basis of publication data, physics, clinical medicine, chemistry, geography, botany and zoology may be considered to be extensive and successful research areas. Relatively new and quickly developing areas are biology, biochemistry, environmental sciences, ecology, and engineering sciences.

Citation data allow an appraisal of the quality of published materials. Of the articles published by Estonian researchers, the most cited ones are those concerning the areas of chemistry, clinical medicine, physics, biology, biochemistry, botany and zoology. Comparison of citation frequency per published material in specific research areas highlights molecular biology, neurosciences and behavioural sciences, pharmacology, toxicology, biology, biochemistry and astronomy.

Another indicator of research productivity, and particularly of the potential for commercialisation, is patenting activity. Compared to developed countries, Estonia is lagged behind in terms of patenting activity. Per million inhabitants, annually 3.7 patent applications were filed with the European Patent Office and 11.6 US patents

were received. Compared to the EU average, Estonia's patenting activity in Europe and in the USA is lower 9.6 and 16.7 times, respectively. Compared to Finland, our condition is even worse. In Europe the Finns are 46.4 times and the Americans are 40.4 times more active in.

Finally, in terms of outputs, and as might be expected by the figures on investment in research and trends in orientation of research activities, Estonia is not producing an adequate number of new qualified scientists and engineers to sustain a knowledge-based society. While the relative importance of researchers and engineers in the total working-age population has increased to some extent during the 1999–2003 period (shifting from 4.3 in 1999 to 4.6 researchers and engineers per 1000 people), the EU average is 5.8; while in Finland the figure is 15.8!

Challenge 1: to adopt a long-term financial perspective that provides a stable environment for research activity

Over the last five years, despite the financial commitments of KBE, the actual amounts invested in research have varied on an annual basis depending on budgetary agreements. This has negative effects both on the creation of new highly skilled human resources which is necessarily a long process, (it takes more than ten years to raise a secondary school graduate to a researcher), as well as on the possibilities for researchers to pursue a stable career in Estonia (long-term research requires a more stable environment than financing based on annual budgetary rounds). In short, it should be recalled that research and development activity has a long-term impact on economy and the development of a national research and innovation system cannot be accelerated rapidly since the development of human capital as the most important component is a very time-consuming process.

The oft-quoted example of Finland where all political parties and groups in society agreed on the need for a long-term financial plan to raising research intensity can serve as a model. Hence, there is a need to reaffirm a long-term agreement of all political parties on Estonia's future priorities for a knowledge based development strategy, in which the general public believes and supports. In a first instance, this necessarily requires agreeing on stable financing principles for research and innovation based on a targeted and growing percentage of GDP.

Challenge 2: to pursue reforms to create an internationally competitive research and education system

The Estonian academic and non-profit research sector has undergone significant transformation over the last decade. Research potential has been consolidated and today is largely concentrated in the university sector and associated research institutes. Government funding for research is provided in a set of funding streams determined in the Organisation of Research and Development Act, which provide notably: targeted financing for research projects of academic research teams, Estonian Science Foundation grants funding to individuals for doctoral and post-doctoral research and baseline financing open to all academic institutions eligible for targeted financing. Funding for the first two streams is provided through peer review selection based on academic excellence (bibliometric results, etc.), while baseline funding is open to all institutions eligible for targeted funding on a weighted basis (number of students, etc.). This system works relatively well although observers note that more could be done to move towards a selection system which encourages the development of new areas of advanced research.

Moreover, two main gaps have existed in the research financing system compared to other EU Member States. The first relates to improving research infrastructure to meet minimum requirements for carrying out forefront research in Estonia and participating in EU research consortiums. This has been partly resolved during the current 2004–2006 period through funding for R&D infrastructure and centres of excellence. However, estimates of required future infrastructure investment needs suggest much more needs to be done notably in developing centres of excellence competitive at European level. Secondly, strategic longer term research priorities of relevance to the Estonian economy and society need to be supported through broader State technology programmes. A pre-condition for the launch of such programmes is further work on technology foresight and assessment to enable a suitable prioritisation. In short, future action needs to be structured around two pillars: additional infrastructure and equipment support for a select number of centres of excellence of excellence; medium-term funding for State programmes in strategic research fields important for country

Even with the best infrastructure, high quality research cannot be achieved without the essential ingredient: skilled and motivated people. Currently, the education system is fragmented and unbalanced: the higher education system is over-sized and does not sufficiently take into account the needs of labour market. Over production takes place in the so-called soft areas (economy, law and management education) while specialists in physical sciences or engineering lack. Recent statistics and debates highlight the lack of skilled labour not only in the research sector but also in enterprises. The education system must be re-focused on to the needs of research, innovation and the labour market in general and this necessarily involves a much greater investment in science education from the earliest age (primary school onwards). The continued pursuit of higher quality and a greater range and number of doctoral study programmes with appropriate post-graduate possibilities to continue research needs to be assured.

Challenge 3: to reinforce aspects of the research system that provides solutions to the needs of Estonian society.

Research in Estonia is necessarily influenced by developments at the European level (the priorities of and the co-operation possibilities provided by the European Research Area and the EU's RTD Framework Programme) but fundamentally must also provide a response to pressing issues related to the needs of Estonian society. The Estonian demographic situation is characterised by an aging and diminishing population, with large disparities in income levels of different groups in society. Research and education in the field of health care and social needs can lead to improved well-being of Estonian citizens and increase the ability of the population to remain in productive employment longer as one solution to mitigate demographic processes.

Energy resources are another area where research is required to safeguard future interests of society. In Estonia, the resources of oil-shale energy production are being gradually exhausted. Therefore, it is necessary to have a long-term strategy of energy in place, which rely less on oil shale. Therefore it is necessary to provide education and undertake research on alternative energy or to train relevant specialists abroad, for example in nuclear energy, thermonuclear energy, hydro- and other forms of renewable energy etc.

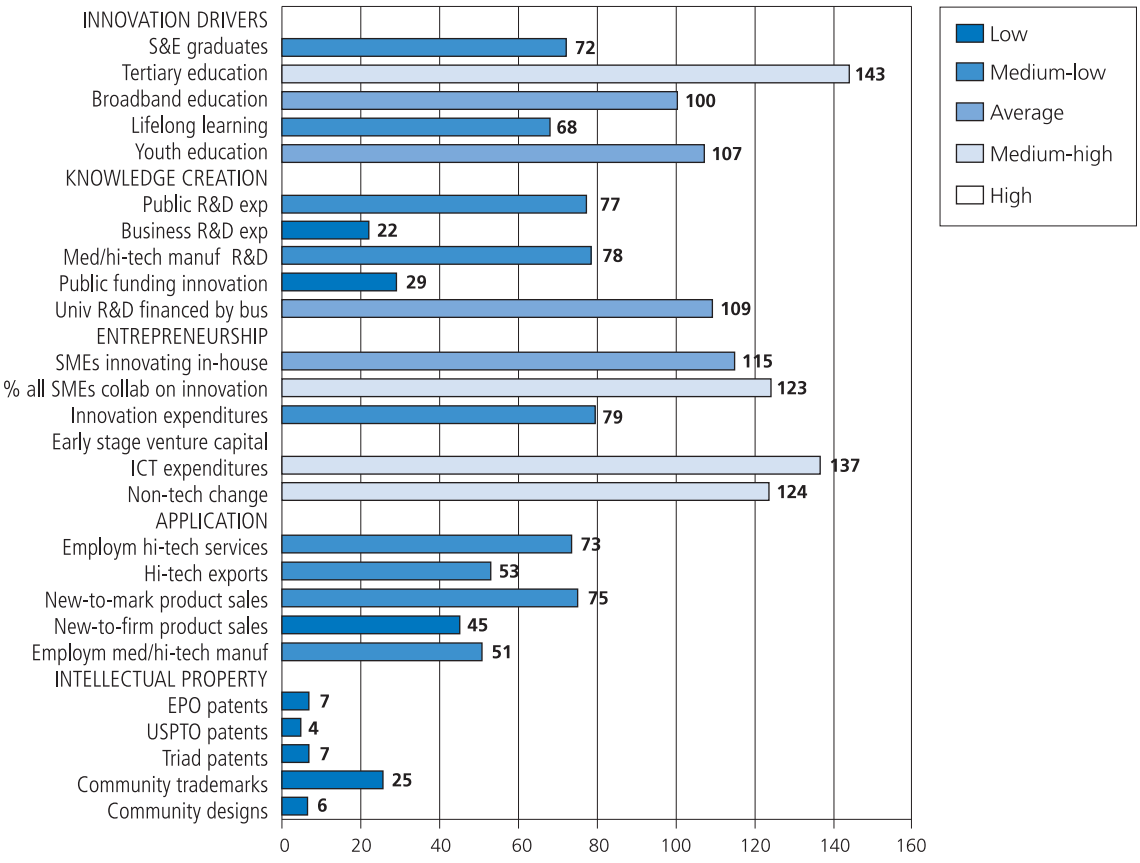
Finally, in an uncertain global environment, Estonia has to maintain a capacity to protect its citizens and interests within the common security policy of the EU. Reinforcing defence and security related research capacities in specific niche (for instance, information security) are vital.

In short, healthcare, energy and the environment and security are strategic areas of life where the development of national research priorities and their integration in the Estonian research and education landscape need to be seriously considered.

3.1.2 Challenges for business innovation

Innovation in the enterprise sector is a complex process which is not always easily captured by statistics. The most complete basis for international comparisons is the European Innovation Scoreboard. The results for 2005 are presented in graphical format below.

EIS 2005 Innovation performance (relative to EU average) – ESTONIA



These recent results suggest that Estonia performs best in terms in terms of the innovation drivers group of indicators, which essentially refers to human resource potential (in addition to the broadband penetration rate used as a proxy for technology diffusion). However, the overall positive picture in terms of human potential for innovation needs to be nuanced by low rates of life-long learning (suggesting that there is insufficient investment in training and re-training of the work-force). Indeed, observers, including the Bank of Estonia[11], point to a structural imbalance in the labour market as a bottleneck to growth. This seems particularly the case for highly skilled technologists and technicians, although there are positive trends in both the number of R&D personnel (FTE) (2001–2003) in the overall working population[12] and in share of science and engineering graduates in the 21–29 year old age group. However, Estonia still lies well below the European average for both these indicators.

A second major weakness is clearly related to raising business expenditure on R&D as a percentage of GDP, which is only 22% of the EU25 average (2004). This is particularly true since the overall extremely low figure for business R&D expenditure hides significant sectoral differences (with R&D expenditure in firms concentrated in a few sectors such as oil/chemicals, financial services, etc.). Furthermore, a high share of the existing BERD is funded from abroad (notably in trade & financial services sector). This situation clearly reflects the Estonian economic structure, where small and medium-sized enterprises in 'low technology' sectors prevail and where hi-tech business sector capable of undertaking R&D activity is largely absent.

Paradoxically, low relative levels of public funding for enterprise innovation activities (29% of the EU25 average) may be one explanatory factor, although, since 2001, Enterprise Estonia support for product development has improved the situation to a small extent. Nevertheless, low rates of investment in more radical innovation seem likely to continue undermine the potential for the application of knowledge in the economy. Current data on the main indicators for innovation activity and outputs in enterprises[13] suggest that while Estonian enterprises are relatively active in terms of in-house innovation and co-operation for innovation, product development across the economy is insufficient to sustain growth and competitiveness in the face of increasing competition and rising costs. The explanation seems to lie in a majority of innovation expenditure (60%) being used for the acquisition of machinery and equipment (coherent with the 'investment phase' of the economy and other indicators such as the high rates of expenditure on ICT) rather than more radical innovation.

It is clear that a research and innovation strategy needs to be tailored to some extent to maximising the potential for innovation in each sector. Available analysis[14] of value added, profitability and innovation trends in specific Estonian sectors suggests that there is a pressing need to take account of these sectoral differences, with major sources of employment such as wood processing, furniture, textiles, clothing and radio, TV and communication equipment all losing competitiveness rapidly.

Challenge 1: Closing the productivity gap through increased innovation

Firstly, productivity is the main determinant GDP growth and of regional growth differentials in the EU25. As a 2003 report to the European Commission concluded: "*if competitiveness has any meaning then it is simply another way of saying productivity; growth in national living standards is essentially determined by the growth rate of productivity*"[15].

The authors of this study found that regional convergence in terms of GDP per capita in the then candidate countries region was converging slowly but essentially focused on growth peaks around capital cities. They argued that while productivity and the employment rate are the two components most closely (and positively) associated with rising levels of competitiveness, when growth of GDP per capita is analysed it becomes clear that only productivity is important. This supports the view that, in the long term, it is technological progress that drives growth while bringing more people into employment can only provide a temporary effect.

---

[11] *Labour market may still turn out to be the bottleneck, restricting Estonia's long-term economic growth. The risks arise from the fact that Estonia's labour market is moving towards full employment and the disparity between free jobs and the skills of the unemployed is quite big. Although such shortcomings have already appeared in single sectors, the same cannot be said about the economy at large. Economic Forecast of Eesti Pank for 2005-2007.*

[12] *There has been an increase in R&D personnel FTE from 3 745 in 2001 to 4 144 in 2003.*

[13] *Available for the period 1998-2000 from the 3rd Community Innovation Survey, CISIII. CIS IV results should soon shed further and more up to date light on innovation dynamics.*

[14] *See for example the presentation of Prof. Urmas Varblane of the University of Tartu, Knowledge-based economy and the competitiveness of Estonian economy. November 2005*

[15] *A Study on the Factors of Regional Competitiveness. A final report for The European Commission Directorate-General Regional Policy, November 2003, Cambridge Econometrics & Ecorys*

A variety of indicators were assessed for association with productivity to provide an explanation for performance. Among those most positively associated were catching-up effects (i.e. a low level of starting productivity leads to faster growth rates), R&D intensity, specialisation in high-tech activities, spillover effects, and the level of workforce education. Importantly, "***infrastructure effects and investment showed little or no correlation with productivity levels, suggesting that they are a necessary but not sufficient condition for regional success***".

In this context, Estonian labour productivity has been rising rapidly and closing the gap with the EU25 average. However, this essentially seems to be due to the 'catching-up effect' referred to in the Commission study due to short-term labour cost competitiveness factors, which are being slowly eroded. A second influence has clearly been the higher productivity of foreign owned firms in Estonia, whether they are serving domestic or export markets. Without suggesting that Estonia could copy the Irish model, a focus on attracting strategic foreign investment with a higher value added and stronger product development element, which could be linked to emerging research excellence poles may be appropriate.

Most observers argue that the Estonian economy will continue to benefit from sustained investment (notably via the Structural Funds and from foreign investment) which should maintain growth of productivity from its currently low position[16]. While in the short-term the current labour cost advantage is only eroding gradually and capital formation continues to be supported by foreign investment and the Structural Funds, in the medium term the risk of a loss of competitiveness is significant. Moreover, some sectors are losing competitiveness already, such as clothing and textiles and furniture. In short, technical progress and innovation are required to sustain long-term growth of the Estonian economy

Targeted support for technological upgrading, organisational innovation, improved innovation management, etc. is required. Improving the possibility for Estonian firms to access, adapt and train their staff in new technologies invented both in Estonia and internationally needs to be facilitated. European experience suggests that sectoral or regional technology centres (making available advanced equipment for training, testing and prototyping) can play a role in sustaining innovation and productivity growth.

Challenge 2: Increasing exports of new innovative Estonian products

As noted above, the economy remains dominated by labour intensive sectors of production, which are already losing competitiveness (textiles, furniture). Low value added intermediate products dominate Estonian exports unlikely to creating sustaining longer term growth due to the relatively low importance of medium and high-technology sectors (both manufacturing and services), this is evident in terms of employment figures. A cause for concern is that exports of medium & high technology products as a share of total exports has been declining (2001–2003).

Business R&D rates remain well below what is required to generate new product development. This will involve raising R&D expenditure across all existing sectors aimed at product development is fundamental while ensuring that new and novel activities also emerge in new technology and business fields. A more complete toolbox of support mechanisms is now required expanding support from the basic R&D grants system for enterprises currently in place to additional forms of support (equity, guarantees, follow-on funding) to ensure that industrial research becomes a marketable and marketed product or service!

Increasing wealth (wages and profits) and employment in Estonia is only possible in the long-term with the sale of innovative products and services to foreign markets. To achieve this, Estonia must break out of the stereotypes associated with transitional countries and make itself known in the world as an innovative country. The development of a reputation for Estonia as an innovative country will, in turn, provide momentum for innovation, and an increase in the development-based foreign investments arriving in Estonia, and the international acceptance of Estonian companies and R&D institutions, as well as an increase in the belief of the Estonian people in themselves and their initiative.

[16] *Despite recent strong productivity growth, Estonia still had the 3rd lowest labour productivity in the EU25 in 2004 (50.6% of EU25 average) just ahead of its Baltic neighbours. Part of this is due to the structure of the economy but it remains the case that faster technology diffusion (acquisition of advanced equipment, related training of workforce, etc) could be expected to raise productivity, notably in manufacturing. Foreign investment plants show high rates of productivity, according to Eesti Pank, suggesting that under investment in technology by local smaller firms is partly responsible for productivity gap.*

Challenge 3: Improving networking and co-operation for the knowledge economy

Attempts to stimulate co-operation and interactions between enterprises and between enterprises and the research community in Estonia have been launched during 2004–2006 and include competence centres,

However, more needs to be done to extend and deepens the mechanisms of knowledge transfer and exchange. At the enterprise level, the key bottleneck is clearly human resources, not enough Estonian firms employ staff with a background that enables them to communicate with the research community, manage technological based development activities or develop a longer-term innovation strategy.

The research sector has been assisted to structure its intellectual property management through licensing or spin-offs. Yet, a more structured and radical effort to boost research commercialisation is now required, this could take the form of commercialisation companies or support for 'proof of concept' (additional funding to take an idea from the laboratory to the stage a company can be launched) or enterprise fellows (researchers assisted to develop their research into a viable new enterprise).

3.1.3 Challenges concerning the governance of research and innovation policy

The public sector has a multi-faceted role to play in the development of a knowledge-based economy. The state can be an investor, regulator or creator of the environment, decision-maker, and a consumer of research results and innovative products. The contemporary treatment of innovation policy views innovation as a horizontal subject, which requires more multi-faceted and more exactly focused intervention than previously. Similarly, research is becoming increasingly inter-disciplinary and social issues such as ethics; environmental protection, etc. need to be integrated at an early stage. The need to develop a long-term vision of research priorities requires more than the individual actions of dedicated researchers, the involvement of policy-makers, civil society, enterprises, etc. is required in developing 'road-maps' or prospective visions of the future technology needs of the economy and society.

Challenge 1: Creating and applying strategic intelligence on Estonia's research and innovation potential

During the implementation of KBE in 2002–2006, Estonia's RD&I policy measures have remained primarily non-specific, that is all field of activity have been treated equally. The preferential treatment for the three key fields of activity mentioned in the strategy (biomedicine, user-friendly information technology, and materials technology) has not been realised to date. For a small country, this approach is not sustainable, and specialisation and creation of unique competitive advantages are essential for both the research community and enterprises.

The aforementioned key fields of activity need to be supplemented from the aspect of greater enterprise potential. Within the aforementioned three key fields of activity, Estonia must also find more specialised niches and concentrate on improving its core strengths. It is also important to keep up with developments elsewhere in the world, to be capable of getting involved with new directions of research or innovation, notably through EU level co-operation platforms.

The making of such strategic choices assumes important detailed information on the Estonian economy and global trends, than is available in Estonia today. Accordingly, technology assessment and foresight and thorough sector-/cluster-based studies need to be launched. Such 'strategic intelligence' should enable all stakeholders to identify and agree on the common elements of Estonia's and the world's technological development, as well as the most promising field and sectors to which preferential treatment could be given. Equally, this type of analysis should facilitate linkages between innovation and inward investment policies and notably when to purposefully attract foreign investments which can create high added value.

Monitoring and studies not only provide knowledge for making smart decisions and making national choices, but also act as an awareness-raising measure. Taking into account the fact that politicians, opinion makers, and decision makers have a relatively low awareness of the nature of innovation and its role in economic development and of the state's opportunity to help in the improvement of innovation capabilities, great emphasis needs be placed on the **introduction of study results and the launch of a broad-based discussion.** The objective of seminars, training, publications, and other awareness-raising activities is to reach the point where a shared understanding develops among Estonian politicians, opinion makers, decision makers, and the general public that innovation is the engine of Estonia's sustainable development and the public sector has an important role to play in directing economic development.

Challenge 2: Government as a catalyst for research and innovation developments

The role of Government as a consumer and user of research and innovation needs to be strengthened (a good existing example is the e-voting and e-tax systems which give Estonia a leading place in European rankings of e-readiness). In the case of public procurements, in today's Estonia the only criteria for choosing among bids is price, which leads to barriers to selection based on quality and innovativeness, since the entrepreneur will naturally do everything to keep productions costs to a minimum. When developing an innovative economy, the State must set an example and be a conscious innovation consumer, in whose orders the important emphasis is based on innovation and design. To raise the value of innovation (including design) in public procurements, the decision-making criteria applied for public procurements must be reviewed and the participation of companies offering innovative products and services supported.

Challenge 3: Fiscal environment that promotes research and innovation

Finally, through taxation, the state can very significantly influence the environment promoting enterprise and economic development. Estonia's current taxation policy has been very successful in promoting company investments. At the same time, the taxation policy has not differentiated between economic activities or investments that create more or less added value. Such a taxation policy is justified in the investment-based development phase, but does not actively support leading companies into knowledge-based field of activity and bring the economy to the innovation-based development phase.

Apart from some exceptions, almost all European countries have adopted fiscal measures to support research and development activities. By providing tax exemptions/incentives on expenses incurred for research and development work or personnel expenses for research and development work, countries have promoted the development and entry into the market of innovative products, services, and processes, and thereby the increase of companies' competitiveness. Taking into consideration Estonia's current tax exemption on a company's reinvested profits, in order to stimulate Estonia's innovation, it would be more useful to use incentives on labour-related taxes, which make it significantly less expensive for companies to hire the necessary specialist and to realize innovative ideas.

3.2 Specific proposals for innovation policy measures

The challenges outlined above concern the overall research and innovation system. The specific objective of this report is not to outline in detail the measures for research policy. Specific advice and guidance was provided to the working group on the new research and innovation strategy in terms of a balance of funding and types of measures related to the broader set of challenges. In particular, there is an undeniable case for the need to raise public investment and leverage additional private or charitable funds into the Estonian academic and public/non-profit research institutions. The financing gap in terms of investment in infrastructure and machinery has been estimated to be as much 500 million EEK per year over the coming five years.

From the point of view of efficiency and effectiveness of such research policy expenditure and indeed from an economic development point of view, there is however a need to focus and target investment much more on specific poles of excellence bringing together the best of academic and public research efforts and linking them much more closely to longer-term economic and societal issues of Estonian development. The research effort remains too fragmented at national level and competitive bidding for funds needs to be reinforced. The extent to which investment in basic research infrastructure should be the subject of Structural Funds support remains debatable, it should not be the role of the EU regional policy to substitute for the basic necessary investment in public education and research sectors. The Estonian Government needs to significantly increase its own investment and only in such a context should Structural Funds money be used to develop and further strengthen Estonian research excellence poles and/or multi-disciplinary research teams with a view to strengthening Estonia's position in the European Research Area.

Turning to innovation policy per se, Estonia can only prosper if it creates, attracts and retains enterprises that use knowledge and technologies created or mastered locally. A strategic aim should be to facilitate the transition of Estonian enterprises, whether in new or traditional sectors and whether foreign or locally owned, towards higher skilled- and technology-intensive products and services. Moreover, ensuring employment and increasing wealth across Estonian society is only possible if Estonian products and services become increasingly recognised as innovative on foreign markets.

The following sub-objectives are proposed (quantified targets need to be set):

- Achieve an increase in business R&D expenditure across all economic sectors in order to increase the share of GDP spent on R&D by 2013;
- Sustained growth of the relative importance of high-technology sectors (manufacturing and services) in total employment and exports;
- Increase the number of knowledge or R&D intensive investments as a share of total foreign investments;
- Increase the number of internationally recognised Estonian brands and trademarks;
- Improve the participation of Estonian enterprises in international co-operation programmes or networks for R&D or innovation to facilitate knowledge transfer.

Priority 1: New technology based enterprise programme

- Continued support for high quality infrastructure (laboratories, etc.) for high-tech starters enterprises, notably in science & technology parks and incubators targeting high-growth potential firms (so called 'gazelles'). This will be based on an evaluation of the existing support for incubators programme.
- Creation of a 'Proof of concept' programme, to replace SPINNO, aimed at supporting the pre-commercialisation of leading-edge technologies emerging from Estonian universities and research institutes. This programme could be linked to the Estonian Development Fund initiative in as much as it could provide a deal-flow.
- Reinforcing existing (e.g. in Science & Technology Parks) or new industrial prototyping, product development, testing and certification centres in co-operation with specific groups of companies. This could involve, for instance, a search for synergies with the funding provided for the innovation co-operation networks (under priority 3). Future development of testing, product development, technology watch and training services by Science & Technology parks or centres should be ideally based on a more intensive 'demand' analysis of the needs of group of enterprises.
- Promotion campaign by Enterprise Estonia towards research-intensive inward investment companies in association with research centres and science and technology parks. This could include development of joint marketing materials for international fairs, road shows, etc. for specific Estonian research poles (e.g. bio-technology, etc.). Based on results of this campaign, specific one off grants could be foreseen from 2009 onwards aimed at encouraging FDI to invest in R&D related infrastructure.

Priority 2: Enterprise innovation finance programme.

- Innovation audits and technology counselling: extension of current pilot initiatives with aim of developing a skilled group of intermediaries able to counsel enterprises on improving innovation strategies and productivity.
- Continuation of R&D financing programme but restricted to proposals from enterprises only and extended to provide a 'tool-kit' for equipment purchase, licensing and patenting, design and commercialisation costs, etc. related to innovation activities including investments aimed at raising productivity through process and organisational innovation;
- Funding of preparatory costs of proposals to the EU RTD Framework programme or provision of guarantees required by Estonian enterprises for participating in projects.
- Launching of sector or thematic specific R&D and innovation financing calls (for enterprises). To be launched based on results of foresight or sectoral studies. These calls could be complementary to State technology programmes aimed at more basic research.

Priority 3: Technology and innovation collaborative networks

- Funding for a limited number of 'Innovation co-operation networks' on the basis of a call for proposals aimed at fostering the development of joint actions between companies and relevant innovation support organisations at regional or sectoral level. The activities of these networks could include develop joint industrial technology training programmes, collaborative export actions (joint development of products, etc.). The network could also be supported to carry out technology road mapping under priority 4.
- Continuation or extension of **Technology Competence Centres** based on evaluation of results of initial projects. Compared to the Innovation co-operation networks the networks position is further from the market but the results of the industrial R&D from the Competence Centres could be diffused towards the networks as a broader platform of associated enterprises.
- Creation of an industrial innovation and research recruitment scheme, **'Innovation Scouts'**, with aim of increasing number of skilled technologists or innovation managers in Estonian enterprises. Part of this scheme could involve enterprise fellows who would prepare a spin-off project to be developed further under the proof of concept funding.

Priority 4: Strengthening strategic intelligence and governance of the Estonian innovation system

- Funding of a Technology Foresight programme aimed at developing a medium-term vision of technology priorities and to support the development of strategic thinking in the private sector as well as in the public sector;
- Continuation of activities under the **Innovation Awareness Programme** after an evaluation of current results;
- Funding for a series of **Innovation Studies** and surveys at sectoral level to analyse specific needs of Estonian enterprises for innovation;
- Commissioning of regular **Evaluations** of innovation programmes by both the Ministry of Economic Affairs and Communication and Enterprise Estonia;
- Funding to support the involvement of Estonian governmental and non-governmental institutes in international and **European innovation networks** (ERA-NET, PRO-INNO, etc.).

The operational logic behind these four priorities and the main recommendation of the evaluation is not to dramatically change the current range of innovation policy measures but to rather broaden or extend a certain number of measures and in only one or two cases to introduce new measures as complements to the existing framework or in one case a replacement for current measure (SPINNO being phased out to be replaced by proof of concept/commercialisation fund inspired by the Scottish or Irish models).

Priority 1 brings together all actions aimed at support the creation or attraction (inward investment) or high technology or research-intensive enterprises. This involves necessarily a mix of infrastructure related investments and specific incentive policies notably related to research commercialisation. Investment in science and technology parks should be continued but should be structured along two main lines of action: developing specific joint technology development facilities for new or technology based enterprises; part-funding of specific industrial research facilities for inward investment companies committed to working with Estonian research base on a specific programme of research.

Based on a final evaluation of SPINNO still to be carried out, it is proposed at this stage to phase out the current range of actions under SPINNO (related essentially to developing valorisation and intellectual property portfolio management competencies in academic research institutions). A shift towards a scheme, which would aim to generate a higher rate of research commercialisation, is proposed modelled on the successful Scottish and Irish proof of concept schemes (see appendix D).

The possibility of creating thematic programmes for industrial R&D was discussed. However, the view taken by the evaluation team was that the current R&D financing programme of Enterprise Estonia could rather be strengthened in terms of financial resources and extended in terms of scope of coverage of expenditure (eligibility for marketing and intellectual property management costs, design and acquisition of new technologies related to product development or process innovations, etc.). The innovation audit scheme should be integrated as a preliminary step in the process of generating new ideas within enterprises, notably those which have not yet been clients of Enterprise Estonia innovation and R&D support, in order to maintain a steady flow of proposals in the project pipeline.

Specific thematic (technology specific, sectoral, etc.) calls with fixed deadlines could be introduced once or twice a year with a set budget, while continuing an open call procedure currently functioning. These thematic calls could be based on the results of consultations with specific sectors or the outcome of technology foresight actions funded under priority 4 or the sectoral/regional cooperation networks proposed under priority 3.

The more design and process innovation related costs and investments could be captured under a productivity grant scheme similar to a scheme currently operating in Ireland and co-financed by the Structural Funds (Enterprise Ireland Productivity Improvement Fund). This could include support for technology upgrading including support for computer aided manufacturing/design (CAD/CAM), etc. Ideally, these grants would be linked to training support through the existing EAS training grant scheme.

Finally, the evaluation team considers that there is a need to strengthen the potential for Estonian enterprises involved in R&D and innovation to recruit specific additional expertise for short-term periods. These could be of two types, additional support to company management for implementing specific innovation projects (in this case the recruits would not necessarily have a technical background); experts with a technical or scientific background responsible for the technical implementation of the project and acting as 'gate-keepers' towards academic or other research organisations involved in part of the R&D or transferring technology (see appendix D for an outline measure fiche).

Under priority 3, while the evaluation team considers that Estonian policy makers have been right to eschew the fad for "clusters policies", the development by enterprises of joint actions related to training, product development, marketing and joint promotion of new technologies and products, etc. at sectoral or regional level should also be considered, particularly where these actions are linked to building up specialised facilities at science and technology parks, life-long learning centres or other intermediary structures. Indeed, a key criterion for investments in buildings or equipment in the support infrastructure should be the association and active participation of enterprises as users in order to ensure a demand driven approach. Examples of such innovation co-operation networks in the EU include the Swedish VINNVAXT model, Flemish VIS programme, etc.

The Competence Centres programmes is still in an early phase but after initial teething problems due to administrative and strategic issues, most centres now appear to be developing a coherent range of activities. A full evaluation of the initial set of competence centres should be undertaken and on this basis further funding for existing centres or a new call for additional centres should be launched during 2007–2013.

Priority 4 is in financial terms marginal, see below, but in terms of developing an improved capacity to design, deliver and evaluate innovation policy is fundamental. A range of EU and international studies (OECD, etc.) in recent years have underlined that the most successful countries and regions in terms of innovation policy tend to be those which have developed sophisticated, well-equipped, evidence-based policy processes normally constructed around long-standing partnership arrangements between the public and private sectors. Estonia has built up since 2000, the foundation for such a strategic governance approach to innovation policy but more resources need to be committed to ensure long-term effective policy development.

Appendix D includes three summary policy measure fiche for enterprise innovation financing, proof of concept and innovation scouts/recruitment proposals. These measures obviously require further reflection and development but good examples of relevant programmes exist in a number of other EU Member States.

3.3 Financial projections

The final requirement of the terms of references of the study was to provide a set of monetary estimates for the RTDI policy budget in Estonia and its yearly distribution for 2007–2013. Based on the analysis and suggestions for policy improvements, the analysis with regards to budgeting of research, technological development and innovation measures for 2007–2013 has taken into account the following aspects:

- The need for significantly boosting innovation in the Estonian economy;
- The absorptive capacity of Estonian enterprises based on the current period and information on future needs;
- The administrative and absorptive capacities of Enterprise Estonia and the Ministry of Economic Affairs and Communications;
- Funding levels and absorption capacities of similar innovation policy actions supported in other countries under the Structural Funds.

The final and most important parameter is of course the EU financial perspective in terms of budget allocations to Estonia for the 2007–2013 Structural Funds period. Clearly this will be a key factor in respect of the possible budget lay-outs for innovation and technological development. At the time of writing this report, this financial framework was still uncertain, hence the first three parameters have taken precedence.

Exhibit 18: financial projection for innovation measures for 2007–2013 (kEUR)

Priority & measures		2007	2008	2009	2010	2011	2012	2013	Total	% of total
Priority 1:	**New-technology based enterprises Programme**	7750	7750	7750	7750	7750	7750	7750	54250	28.4%
ERDF	High tech starters (incubators & related services)	1000	1000	1000	1500	1500	1500	1500	9000	4.7%
ERDF	SPINNO+ : commercialisation / proof of concept fund	2500	2500	2500	2500	2500	2500	2500	17500	9.2%
ERDF	Science & Technology Parks / Centres	4000	4000	4000	6000	6000	6000	6000	36000	18.9%
ERDF	Strategic innovation investments (FDI)	250	250	1500	1500	1500	1500	1500	8000	4.2%
Priority 2:	**Enterprise Innovation Finance Programme**	7000	7500	9000	9500	9500	9500	9500	61500	32.2%
ERDF	Productivity & technology upgrading projects	2000	2500	2500	3000	3000	3000	3000	19000	10.0%
ERDF	Product development financing	3750	3750	5250	5250	5250	5250	5250	33750	17.7%
ESF	Innovation scouts (placement/recruitment scheme)	1250	1250	1250	1250	1250	1250	1250	8750	4.6%
Priority 3 :	**Innovation co-operation Actions**	8250	8250	10250	10250	10250	10250	10250	67750	35.5%
ERDF	Innovation co-operation networks (sectoral/regional)	1250	1250	1250	1250	1250	1250	1250	8750	4.6%
ERDF	Competence Centres (TAK) (incl. Design centre)	7000	7000	9000	9000	9000	9000	9000	59000	30.9%
Priority 4:	**Future needs of Estonian research & innovation system**	1400	1100	700	950	700	1100	1350	7300	3.8%
ESF	Innovation Awareness Programme	1000	1000	1000	1000	1000	1000	1000	7000	3.7%
ERDF	Technology Foresight and Assessment	750	750	350	350	350	750	750	4050	2.1%
ERDF	Innovation Studies	350	250	250	350	250	250	350	2050	1.1%
ERDF	Evaluation (research and innovation programmes)	300	100	100	250	100	100	250	1200	0.6%
	TOTAL	**24400**	**24600**	**27700**	**28450**	**28200**	**28600**	**28850**	**190800**	**100.0%**

It is the view of the evaluation team, that **the budget of 25 million EUR on average over the 2007–2013 period for innovation policy is the strict minimum required** if Estonia is to truly aspire to meet both its own policy objectives in terms of boosting enterprise development, growth and jobs, as well as meet its obligations under the Lisbon Strategy of the EU. This assumes a minimum commitment from Estonian funds of about 6.25 million Euro per year complemented by Structural Funds support through either the ERDF or the ESF. Such an investment does not seem unreasonable given the challenges that need to be met to ensure Estonian competitiveness over the coming decades.

Appendix A | Selected bibliography

Assessment of the Estonian Research Development Technology and Innovation Funding System. Final Report, PREST, Victoria University of Manchester, UK, Maria Nedeva & Luke Georghiou (2003)
Competitiveness and Future Outlooks of the Estonian Economy, R&D and Innovation Policy Review, Marek Tiits, Rainer Kattel, Tarmo Kalvet, Rein Kaarli (2003)
Establishing the basis for the elaboration of the Estonian design policy measures Mollerup Designlab A/S (2003)
Evaluation of the SPINNO Programme (report to Enterprise Estonia), SQW, 2003
Access of Enterprises to Venture Financing in Estonia: Feasibility Study of Government Support Scheme; Lex de Lange, Ger De Bruin, Bart Kleyn, Alessandro Favalli, Eri Vázquez Muñoz, Andrea Di Anselmo (2004)
Overview of RTDI Policy in Estonia (2003). Ministry of Economic Affairs and Communications (K. Mannik)
Research on the Estonian biotechnology sector innovation system. Fraunhofer ISI (2002)
European TrendChart on Innovation, Country report Estonia, 2005
Centres of Excellence of Estonian Science (Association of the Centres of Excellence of Estonian Science (Tallinn, 2004)
Development of the physical Infrastructure of research and development activities. Programming Document. Draft. Ministry of Economic Affairs and Communication. 2003
Akadeemilist kõrgharidust, teadust ja innovatsiooni toetava infrastruktuuri kaasajastamise strateegilised alused. Ministry of Economic Affairs 2004 (Only in Estonian. Strategy for R&D infrastructure)
Assistance on the Draft of the R&D Infrastructure Development Programme. Luke Georghiou, December 2003;
Marek Tiits et al, Made in Estonia (only in Estonian), 2005

Appendix B | List of interviewees

(In chronological order)

Ms Kristi Hakkaja – State Chancellery, R&D Council Secretariat, advisor
Mr Rein Vaikmäe – Ministry of Education and Research
Mr Madis Võõras, Director technology & innovation, Enterprise Estonia
Mr Renaldo Mändmets, Ministry of Finance,
Dr Erik Terk, Institute of Future Studies
Mr Pirko Konsa, Head of Enterprise Division, Ministry of Economic Affairs and Communications
Mr Marek Tiits, IBS/Archimedes
Mr Indrek Ruiso, Competence Centre Electronics
Mr Ardo Reinsalu – CEO of Doc@Home.
Mr Eiko Keerman, manager R&D infrastructure and centres of excellence programmes, Enterprise Estonia
Mr Indrek Kelder, development manager for business development unit, Enterprise Estonia
Mr Ilmar Pralla, operational management of R&D schemes. Enterprise Estonia
Mr Raivo Vilu – Director of Competence Centre of Food and Fermentation Technologies.
Mr Raivo Tamkivi – President, **Mr Kaupo Pastak** – CEO, **Mr Olav Anton** – Executive Board and
Mr Hannes Ojangu – Project Manager of Tallinn Technology Park Tehnopol
Prof Rein Vaikmäe – Vice Rector, **Mr Indrek Jakobson** – Head of the Technology and Innovation Centre at Tallinn University of Technology
Prof Kiira Parre – Director of R&D Department of Tallinn University of Technology
Mr Tarmo Pihl – National Contact Point for IST, eContent and eTen programmes, Archimedes.
Mr Erki Mölder, Quattromed
Mr Andrus Tasa, Tartu Biotech Park
Prof Richard Villems, President Academy of Sciences.
Prof Ain Heinaru, Ms Karin Jaanson, Tartu University
Mr Kristjan Haller and **Mr Indrek Reimand**, Ministry of Education and Research
Mr Teet Jagomägi, REGIO
Mr Erik Puura, Tartu Technology Institute (Tartu University).
Mr Toivo Träss – Chairman of the Board, Baltimere Invest Ltd.
Prof Rainer Kattel – Professor of Public Administration and European Studies and Director of Department of Humanities and Social Sciences, Tallinn University of Technology.
Mrs Katri Ristal – Director of Design Innovation Centre, Estonian Academy of Arts.
Prof, Dsc, Dr.h.c. Jüri Engelbrecht – Vice President of Estonian Academy of Sciences.
Mr Tõnu Hein – Partner and **Mrs Viivika Remmel** – Consultant, HEIVÄL Consulting Group.

Appendix C | Interview guide

Lists of key questions for interviews of RTDI stakeholders

Ministry of Education and Research (Research department), Enterprise Estonia (R&D infrastructure coordinator) & members of R&D Strategy working group

- To what extent can the current Knowledge Based Estonia strategy be judged a success?
- What evidence (quantitative indicators or cases) can you offer to back up this judgement?
- With hindsight, what were the weak points or "missing links" in the strategy?
- To what extent has EU funding (Phare and Structural Funds as well as the Framework Programme or other funds) contributed to implementing the strategy?
- How has EU accession contributed (or not) to creating greater linkages and networks of Estonian researchers with other EU research teams?
- What do you consider to be the main challenges facing Estonia in terms of intensifying and optimising the R&D effort of the higher education and not-for-profit sectors?
- More generally, what in your opinion are the main bottlenecks or weaknesses in the national innovation system? (industrial structure, business R&D and innovation trends, interest of foreign investors to undertake R&D in Estonia, access to finance, legal framework, etc.)?
- What in your opinion are the most promising areas of fundamental and applied research in Estonia? And to what extent does this offer short or medium term potential for commercialisation in the economy?
- In your opinion, what should be the priorities (broad objectives and targets) for Estonia in the field of R&D and innovation during the coming programming period?
- To what extent should (existing or additional) funds be targeted on specific fields or poles in order to create critical mass in terms of R&D infrastructure or equipment?
- Are there specific issues or difficulties in terms of implementing current or existing programmes and measures in favour of R&D and innovation (organisational structures, delivery mechanisms, legal obstacles, etc.)?

Managers of competence centre projects

- Please describe briefly the history of the partnership implementing the competence centre project (interests/priorities of specific partners, contributions expected, short and medium term objectives, etc.)?
- What are your views on the procedures for the selection and funding of the competence centre programmes? And the role of various actors in the process of launching the competence centres (Ministries, Enterprise Estonia, etc.)?
- What specific difficulties (legal obstacles, financial issues, partnership dynamics, etc.) have you encountered to date in establishing the competence centre?
- What are the short term (1–2 year horizon) operational objectives of the competence centre?
- Taking a longer-term view, what are the expected achievements in a three to five year timescale?
- To what extent do you expect the results of the competence centre to be diffused to a wider number of industrial partners than those directly involved at the present time? How will you assure this?
- To what extent do you expect to contribute to setting longer-term fundamental or applied research priorities in higher education or research institutes (e.g. via road mapping, etc.)?
- What forms of international co-operation do you expect/plan to develop in order to access required knowledge or resources (human, financial, etc.)?

Managers of Spinno projects and/or vice-rectors R&D of universities (or similar)

- Please describe briefly the history of the SPINNO project led by your university (initial analysis of potential for improving contract research/commercialisation funding received, staffing, etc.)?
- What are your views on the procedures for the selection and funding of the SPINNO projects (including the role of Ministries, Enterprise Estonia, etc.)?
- What specific difficulties (legal obstacles, financial issues, availability of expertise, etc.) have you encountered to date in implementing the SPINNO project?
- How has the project contributed to improving the general attitude of academics towards co-operation with business and management of the intellectual property portfolio and its commercialisation more specifically?
- What tangible achievements have been realised to date (e.g. new industrial contacts, licensing agreements and spin-outs, increase in contract research income, etc.)?
- What linkages or co-operation have you created, or do you intend to create, with similar research commercialisation initiative?
- To what extent (or when) do you expect or consider it possible for the research commercialisation activities of your university to become self-financing and what form will this take (e.g. creation of a quasi independent commercialisation company, etc.)?

- What are the short term (1–2 year horizon) operational objectives of the SPINNO project?
- Taking a longer-term view, what are the expected achievements in a three to five year timescale?

Managers of science & technology park & technology incubator projects

- Please describe briefly the history of the science & technology park (technology incubator) project.
- What is the profile/objective of the park/incubator (target companies, specific sectors, existing firms versus start-ups or spin-offs, attraction research intensive FDI, etc.)?
- What phases have been completed and what remains to be done (masterplan, basic infrastructure, specific infrastructure (laboratories, advanced IT networks, etc.) marketing and promotion, development of service package to hosted companies)?
- What are your views on the procedures for the selection and funding of technology parks/incubator projects (and specifically the role of Ministries, Enterprise Estonia, etc.)?
- What are the financial plans/needs (expected public/private contributions) with a view to achieving full operating capacity (and in what timescale)?
- What strategic partnerships have been developed at regional (Baltic/Nordic area) and international level to develop and promote the park ? Are you involved in any EU funded projects with a view to the development of R&D and innovation activities of the park or associated companies?
- What are the short term (1–2 year horizon) operational objectives of the technology park/incubator project?
- Taking a longer-term view, what are the expected achievements in a three to five year timescale?

Representatives of industrial federations and business leaders (e.g. those who have received grants/ loans from EAS)

- Please describe briefly the history, structure and activities of your company (or organisation in case of industrial federation or chamber of commerce)
- For individual companies: What specific activities are undertaken in the field of R&D and innovation? What type and quantity of support have you received from public authorities in Estonia? Are you also involved in EU funded R&D/innovations projects?
- For the Chamber of Commerce/Federations: what actions or initiatives have you taken to improve understanding of the needs of your members in the field of R&D and innovation (e.g. a technology road map, innovation awareness activities)? Are you involved or have you received funding to develop specific support projects in this field?
- On the supply side, which universities (faculties, departments or individual researchers) or other organisations (research centres, training institutes or business schools, etc.) do you consider have a credible strategy for co-operation with the business sector?
- What is your opinion on the current range of public support measures for business R&D and innovation in Estonia (gaps in support, etc.)?
- How effective, in your opinion) is this range of measures in responding to the needs of enterprises (both high-tech and "low-tech" companies) in innovating (product development, industrial design and marketing, productivity improvements through organisational innovation, etc.)?
- What are your views on the procedures for the selection and funding of the enterprise R&D and innovation projects by Enterprise Estonia (including the role of Ministries, Enterprise Estonia, etc.)?

Appendix D | Outline measures for innovation policy

1 Title of measure Enterprise Innovation Funding

2 Rationale

Technical progress and innovation are required to sustain long-tem growth of the Estonian economy. With low business R&D rates, Estonia needs to raise expenditure across existing fields while at the same time ensuring that new and novel activities also emerge in new technologies and business fields. The overall goal of the Enterprise Innovation Funding programme is to stimulate the innovation performance (both technological & non-technological) of Estonian companies with a view to promoting new product development and productivity improvements through organisational and process innovations in the enterprise sector,

The measure therefore seeks to commercialise the results of industry led projects in product and process development; increase the number of companies undertaking innovation for the first time; improve the efficiency and effectiveness of the innovation process in those companies already undertaking product development and achieve value added R&D by capturing the creative potential of employees.

Overall the scheme will support commercially focused, industry led projects in product and process development as well as projects aimed at productivity, organisational change and design related improvements. The type of interventions supported may include one or more of the following:

- the purchase of technology, licences, patents, know-how improving the quality of providing services or enabling providing services;
- purchase of new or second hand (not older than 5-years old) capital equipment including installation costs necessary for undertaking innovation (product or process development), or for productivity improvement projects;
- cost of implementation of the quality control systems and certification systems (such as ISO, TQM);
- cost for hiring external experts (business advisers), e.g. strategic consultancy, marketing experts, technology audit;
- cost for prototyping and industrial design.

Overheads costs are not supported, including the cost for project management.

3 Target group and final beneficiaries

Single enterprises or group of businesses of any size based in Estonia can participate.

4 Selection criteria and implementation procedures

The selection process will take account of a number of factors:

- conformity with the objective and the scope of the measure;
- the minimum own contribution required is ensured;
- assessment of applicant's financial condition;
- significant technical or market risks are associated with the innovation or productivity improvement project;
- the company owns, or have the rights to exploit, the intellectual property needed to undertake the project;
- the proposed project will represent a significant technological, organisational or design related advance for the Estonian enterprise concerned;
- for innovation projects, the commercialisation prospects of the end product or process should be good and the production of the good or service should take place in Estonia for at least a three year period after the end of the project;
- for productivity improvement projects, the project will lead to a sustainable improvement in productivity within the company;
- the necessary management and technical expertise and resources to ensure that the project is brought to a successful conclusion are either available "in-house" or will be bought-in.

For innovation projects the maximum grant will cover up to 45% of all eligible costs, up to maximum grant of EUR 350.000. Funding in excess of this amount may be awarded in the form of a repayable interest-free loan, the repayment will be conditional on the successful completion of the project and the achievement of agreed business targets for the company.

For productivity improvement projects (capital equipment and technology acquisition), the maximum funding will amount to €150,000 in the form of a grant, of which 50% will be in the form of a repayable grant, repayable 3 years after each grant is paid.

All cost properly incurred and defrayed on the project including:

- the purchase of capital equipment essential to the project (justification to be provided);
- external expertise (consultants, studies, etc…);
- market research, product trials/market assessment, establishing links with potential joint venture partners, cost analysis, financial projections);
- intellectual property costs/process licensing;
- travelling (e.g. travel to monitor trials, market assessment visits);
- fees for trial and testing

The duration of a project may vary between 6 months (notably for productivity improvement projects) and 3 years.

There will be an open call for proposal, subject to a competitive evaluation process. Projects requesting funding in excess of 100,000 will be approved quarterly on a competitive basis; projects requesting funding below this amount will be approved monthly on a non-competitive basis.

5 Indicators

- Number of subsidised firms (divided into small and medium and large firms);
- Sustainability and growth in R&D expenditure in enterprise as % of sales;
- Growth in the number of innovative enterprises;
- Improvement in productivity rates in supported enterprises;
- Share of new SMEs, which received financial support, still operating after 1, 3 and 5 years from the date the support was granted (%);
- Growth in turnover of companies, still operating, which received financial support 1, 3 and 5 years after the date the support was granted (%);
- Number of new jobs created 2 years after the date the support was granted;
- Average size of enterprises in the SMEs sector by employees number.

1 Title of measure Proof of Concept – Commercialisation fund

2 Rationale

Estonian research potential today is significant in a number of fields but in a world with increasing international competition productivity of the research system is paramount. One indicator of research productivity, and particularly of the potential for commercialisation, is patenting activity.

The Estonian research sector has been assisted to structure its intellectual property management through licensing or spin-offs. Yet, a more structured and radical effort to boost research commercialisation is required. This could take the form of support through the "proof of concept" model (additional funding to take an idea from the laboratory to the stage a company can be launched).

A range of support designed to improve the level and quality of commercialisation through the provision of the fund for early stage development activity within Estonian Universities and Research Institutes, to encourage and facilitate high quality applied research aimed at the commercial exploitation of knowledge, and to contribute to the longer-term development of a strong knowledge-based economy in Estonia.

The expected outcome of the projects should be licensing deals for new technology, spin-out companies from universities or institutions, or new high growth start-up companies. To achieve this the fund will support following intervention measures:

- Business consultancy in support of reviewing the commercialisation strategy and identifying and helping with tasks that result in a robust commercialisation proposition, such as identifying potential customers and developing leads;
- Legal advice regarding issues of Intellectual Property Rights (IPR): Patents, Copyright, Registered Design, Trade Mark, Protection of Software;
- Direct cost incurred with registration of IPR;
- Applied R&D and prototyping costs.

3 Target group and final beneficiaries

- Academics and researchers employed full-time in the third level sector, teaching hospitals and non-profit research agencies/organisations (higher education institutions research units/centres);
- Co-operation/networking is optional (e.g. associating SMEs as users).

4 Selection criteria and implementation procedures

- The proposals are evaluated through a two-stage process. The first stage determines the technical merit. Those reaching acceptable high standard in the first stage are then evaluated and ranked on the basis of commercial potential. The evaluation process will be based on the following criteria (example taken from Enterprise Ireland);
- Technical merit, are the design methods and analyses well thought out, developed and relevant to the aims of the project, can the goals set out be achieved and are there suitable indicators that will be used to confirm the feasibility, the benefits from the technology and how the technology is superior to the market trend;
- Project management, is the work plan realistic and compatible with the resources, are the costs justified and relevant to work outlined;
- Track record, expertise and competence of applicant to carry out the proposed project;
- Commercial potential, identification of a commercialisation route, market prospects for the technology, transfer of existing industry, potentials for new business, does the project address sectoral threats or opportunities.

The grant will cover up to 100% of all eligible costs, up to maximum grant of EUR 25.000. All cost properly incurred and defrayed on the R&D project including:

- equipment essential to the project (justification to be provided);
- consumables/materials;
- travel cost (conferences, to meet with industry representatives);
- external expertise (consultants, studies, etc…);
- market research, product trials/market assessment, establishing links with potential joint venture partners, cost analysis, financial projections;
- product/process licensing;

- training (business);
- collaboration (may be supported where the experience and expertise of two or more institutions will bring significant added value of an output from the project that would not otherwise be possible).

The period is typically up to 12 months but can be extended to 18 months under certain conditions, subject to a competitive evaluation process.

There will be an open call for proposal. Projects will be approved twice times a year in Spring and Fall. Application that can not be processed before the next evaluation will automatically be carried forward to the subsequent evaluation period.

5 Indicators

- Number of applications per subject area;
- Number of awarded applications per subject area;
- Value of applications per subject area;
- Value of awarded applications per subject area;
- Additional attracted private and public investments per subject area;
- Total number of projects supported by the programme;
- Number of patents registered/licensed;
- Number of products marketed/ per project (total/ average);
- Number of products or processes on the market after one, three and five years;
- Number of companies still existing after one, three and five years.

1 Title of measure Recruitment of innovation staff in enterprises

2 Rationale

Sub-measure: Recruitment of researchers in enterprises

The rationale of the sub-measure Recruitment of researchers in enterprises is to promote exchanges between the scientific and industrial communities, through the recruitment of the researcher by an enterprise on temporary basis. It is expected that the measure should lead to the increase of interactions between universities (including other research entities) and enterprises.

A subsidy is provided for the enterprise to recruit the researcher to undertake R&D project within the company. The research project should have as an objective the development of a new product, process or service. Besides, R&D project must have a potential to be commercially exploitable.

Sub-measure: Recruitment of innovation managers in enterprises

This sub-measure aims to encourage enterprises to undertake product development, undertake an industrial design project, and implement a process innovation, etc. by facilitating the recruitment of a specialised innovation manager. The manager should work inside the company on a project aimed at the development of a new product, process, research and technological analysis, etc.

The rationale is to reduce the technological and financial risks for enterprises to undertake innovation activities by enhancing in-house capacities of the company through financially supporting the recruitment an innovation manager.

3 Target group and final beneficiaries

The measure (i.e. two sub-measures) is open to any enterprise with an establishment in Estonia.

4 Selection criteria and implementation procedures

Selection criteria (technical) for Sub-measure: Recruitment of researchers in enterprises

- conformity with the objective and the scope of the measure;
- A minimum own contribution of the enterprise to the salary costs of 20% is required;
- the company should be in a healthy financial situation;
- the researcher should have relevant qualifications and experiences responding to the needs and nature of enterprises' activities; and
- the researcher should have industrial engineering or university degree in science.

Selection criteria (technical) for Sub-measure: Recruitment of innovation managers in enterprises

- conformity with the objective and the scope of the measure;
- A minimum own contribution of the enterprise to the salary costs of 20% is required;
- the company should be in a healthy financial situation;
- the innovation manager should have qualifications and experience relevant to the needs and nature of enterprises' activities; and
- the innovation manager should have a third level education degree or certificate in technology, innovation or quality management, industrial design or an equivalent qualification.

Implementation procedure: Recruitment of researchers in enterprises

- Any enterprise with an establishment in Estonia can submit an application for the grant which should cover the salary costs of the researcher in enterprises;
- The subsidy rate is 50 percent of salary costs of the researcher in large company, and up to 80 percent in the case of SMEs (EU definition);
- The project should take between a minimum of 6 months and a maximum of 24 months; and
- Within 5 years the project should be commercially exploitable.

Implementation procedure: Recruitment of technology innovation managers in enterprises

- Any enterprise with an establishment in Estonia can submit an application for the grant which should cover the salary costs of technology and innovation manager in enterprises;
- The subsidy rate is 50 percent of salary costs of the manager in large company, and up to 80 percent in the case of SMEs (EU definition);
- The duration of financial support should be between a minimum of 6 months and a maximum of 24 months.

5 Indicators

- Number of enterprises which benefited from financial support;
- Number of financed R&D projects;
- Number of financed technology and innovation manager posts;
- Number of new products placed on the market by assisted companies;
- Growth in the percentage of innovative enterprises, which undertook R&D projects, in co-operation with other national scientific institutions; and
- Growth in the share of the sales value of new products in the total sales value.