Optimising the Design and Delivery of Innovation Policy in Estonia:

an Evaluation of Policy Instruments for Intensifying Business Innovation

Alasdair Reid
with the assistance of Silja Kurik

Tallinn 2003

Innovation studies

4 | 2003

Commissioned by the Division of Technology and Innovation, the Ministry of Economic Affairs and Communications of the Republic of Estonia
Financed by the European Commission, under the Phare 2001 project no ES.01.07.01
Designed by Kolm Karu
Layout by Katrin Leismann
Cover photo by Tiit Veermäe (all rights related to the photo are reserved by AS Oiliken)

Tallinn, 2003

ISBN 9949-10-012-7
ISBN 9949-10-011-9 (print version)

ISSN 1406-8958
ISSN 1406-7692 (print version)

Authors:

Alasdair I. Reid *holds a MA in Economics. He is sector manager for innovation and enterprise policy with ADE S.A. Amongst other recent projects, he has led two major multi-country policy studies on innovation policy in candidate countries on behalf of the European Commission during the period 2000–2003 and is a member of the European Trend Chart on Innovation policy monitoring network.*

Silja Kurik *holds a BA in sociology. Works as project manager in Estonian Institute for Futures Studies. She has recently been involved in several projects on innovation issues.*

Foreword

There is a growing consensus in Estonia for the pursuance of a knowledge-based economy. The realisation of this goal requires much more active use of knowledge throughout our economy and society. In the context of Estonia's imminent accession to the European Union this is more important than ever. Estonia's existing competitive advantage lies mainly in the low cost of workforce. We will find that in the EU this advantage will deteriorate quickly. A knowledge-based innovative economy is therefore crucial to ensure our future competitiveness and welfare.

Positive examples from countries like Finland and Ireland demonstrate that the public sector has a decisive role to play in the creation of a basis for the knowledge-based society. By providing a modern education system, high-quality research at the universities and public R&D institutions, by creating favourable conditions and appropriate mechanisms to promote technology transfer between the research community and the industry and by using instruments targeted at changing the behaviour of the business community and society at large to embrace a more innovative and knowledge intensive approach, the public sector's role is indispensable.

In order to design appropriate policies and deliver them efficiently and effectively through a variety of policy instruments we need to regularly monitor the development of the existing system of innovation policy creation and implementation and identify the new challenges. This report focuses on the evaluation of the structures and policy instruments for intensifying business innovation.

The report is one of the outputs of work carried out under the Phare 2001 project "Evaluation and design of business support measures" which included two subcomponents: business (SME) development and R&D and innovation. The latter includes this independent assessment of the current support instruments' portfolio in the Estonian R&D and innovation policy. In addition the expert team contributed to the Estonian preparation for the EU Structural Funds.

We would like to thank all of the experts for their work on this report. Our special gratitude goes to Alasdair Reid whose effort and expertise gave a very significant input to the work that is being carried out in the Ministry of Economic Affairs and Communications on innovation policy. In addition we would like to express our gratitude to the business leaders as well as the officials in the ministries and agencies who took time and effort to participate in the study by giving interviews and providing relevant information to the expert team.

Division of Technology and Innovation
Ministry of Economic Affairs and Communications
April 2003

Table of Contents

List of Tables

List of Figures

Executive Summary

This report summarises the work carried out during the period July to November 2002 to evaluate and redesign the current policy of the Estonian Government in favour of research, technological development and innovation.

In evaluating the current context and policy framework, some 40 people were interviewed by the expert team. An in-depth examination of the current business support measures administered by the Estonian Technology Agency (ESTAG) was undertaken providing a first insight into the efficiency and effectiveness of these schemes since the creation of the agency in 2001. In addition, a number of presentations of the preliminary conclusions were made to key stakeholders (government, industry, universities, etc.), in both Tallinn and Tartu, enabling a debate on the findings. Two working groups were also organised to discuss the findings of the specific analysis carried out with respect to support for the venture capital industry and business incubators.

The response of the expert team to the key questions posed by the terms of reference can be summarised as follows:

Is the current portfolio of instruments appropriate taking into account the characteristics of Estonian enterprises?

The analysis carried out by the project has clearly identified a number of inconsistencies, or gaps, in the current portfolio. Almost all existing measures are targeted at 'research-intensive enterprises' (those with an R&D unit) or at best technologically competent firms (those with a number of engineers able to co-operate with external experts). The current focus of schemes being delivered by ESTAG is largely on product development, while the most common form of innovation of enterprises, according to the results of the Community Innovation Survey carried out in Estonia for the period 1998–2000, was process innovation (through the acquisition of equipment and technologies and related training). The result is a mismatch between the short-term needs of enterprises to improve their productivity through process (technology transfer) and organisational innovations; and the focus of ESTAG funding on applied R&D (and product development).

Accordingly, the Ministry of Economic Affairs and Communication needs to work towards a better balance in the portfolio of measures for promoting an increased innovation activity in enterprises. This could be achieved by extending the scope of the current feasibility grant scheme to cover preliminary work on innovation management or aspects related to organisational innovation; this type of small grant could become a form of 'innovation cheque' which could be prescribed directly by a network of innovation intermediaries. This cheque could be used for funding technology audits or assistance for the design of a technology and innovation strategy for enterprises (which however in turn requires the precondition that a number of consultants or experts are trained and accredited).

Which complimentary measures need to be developed in the R&D and innovation field?

The analysis has pointed to the need to develop at least three types of additional measures:

- Increasing the in-house capacities of enterprises to develop and manage innovation projects by part-financing the recruitment of additional staff in order to undertake the design, development and implementation of applied R&D, product development, process technology innovation and organisational innovation.
  - The expert team re-drafted terms of reference for a feasibility study for such a scheme.

- The absence of early-stage capital for new technology-based firms, the so-called 'equity gap', has been analysed in a separate analytical paper prepared as part of this project. The Government should seek to leverage additional private equity towards research-intensive start-ups through reducing the cost or the risks of capital and due diligence activities.
  - The expert team prepared terms of reference for a study setting out options for government intervention and the design of such a scheme.

- The lack of sufficient intermediary organisations, both private and public, providing direct services to enterprises in relation to innovation is a major gap in the current system. There is need for further public support with a view to increasing the range of innovation related functions and services provided to enterprises. In particular, consideration should be given to expanding training and accreditation of a network

of consultants or experts with a view to increasing pro-active consulting and advice to enterprises on technology and innovation.

- The expert team did not have the resources to develop this issue further and it deserves attention during 2003. Potentially part of the solution could come through the actions to be funded under the Innovation Awareness programme being designed in the last quarter of 2002 and expected to be launched in 2003.

Which are the inter-related policies and instruments that must be focused on?

Institutions providing training in new technologies for workforces of enterprises undertaking technology transfer/purchase are a crucial element in well-functioning innovation system. No analysis was conducted with respect to the range, supply of services and competence of such organisations (vocational, continuing and specialised training institutes). This is an issue that deserves more attention in future policy-related analysis (possibly in connection with the development of the Innovation Awareness Programme).

Appropriate linkages with export promotion and inward investment policies also need to be developed more strongly. Exporters are amongst the most innovative of Estonian firms, according to the CIS results, while foreign investment firms are 1.5 times more innovative than purely Estonian owned firms.

Which of the instruments currently in the ESTAG portfolio are eligible for EU Structural Funds

Given the analysis developed in this report, it is fundamental that ERDF Structural Fund financial support should be prioritised towards the objective of increasing the competitiveness of enterprises. Schemes which contribute to the second key objective of 'updating the knowledge pool' should only be considered for eligibility for Structural Fund support in so as far as they lead to the creation of new knowledge and know-how (human resources) contributing to the primary objective of the RTDI measure through the transfer of knowledge and new technologies to the business sector. Funding of infrastructure or equipment for higher education or research institutes related to their teaching or fundamental research missions should not be eligible for Structural Fund support.

Conclusions and recommendation concerning the future RTDI measure in the SPD:

1) Funding targeted at developing the research base leading to the availability of new knowledge should be concentrated on a limited number of 'Centres of Excellence' relevant to the Estonian enterprise sector. The current Centres of Excellence initiative of the Ministry of Education needs to be re-designed in terms of objectives, delivery mechanisms, selection and evaluation procedures before it can be co-funded in the RTDI measure of the SPD.

2) Given the expected funding to be made available (approximately 50 MEUR over three years ERDF and national co-financing combined), the RTDI measure should focus on a limited number of schemes and major investment projects. The prospects for the effective disbursement of the additional funds made available through the SPD appears adequate; notably through: a number of major RTDI infrastructure projects for which preliminary design work has been carried out (Tallinn Technology Park, etc.); the ESTAG grant and loan schemes to enterprises and R&D institutes for applied R&D and product development; and the launch of the new Competence Centre programme[1]

3) A principle objective of the RTDI measure should be to increase the number of enterprises benefiting from direct support (grants, loans or equity financing) or indirect support (advisory and consulting services, etc.) provided through ESTAG schemes. A broader sectoral coverage with an increasing penetration of leading enterprises in each of the main industrial sectors should be encouraged through the development of a sector/cluster technology diffusion and innovation scheme.

4) The minimum institutional capacities necessary for the effective implementation of the measure are present and the schemes will essentially be administered by ESTAG, which as part of the Enterprise Estonia Foundation, will act as implementing agency. There is a need however to continue to reinforce capacities (number of persons) and capabilities (know-how) on specific issues such as monitoring and evaluation. On-going programme and project design will continue to require considerable financial and human resources during 2003–2004 in order to enable an effective and rapid disbursement of the expected ERDF support from mid-2004.

[1] *The word centre is a misnomer since the programme concerns collaborative R&D programmes involving a consortium of enterprises and research centres)*

1 Introduction

This report summarises the work carried out by a team of experts, funded under the Phare programme, to evaluate and design business support measures with a view to the preparation of the Single Programming Document and Programme Complement for European Union Structural Fund support to Estonia.[2] The overall objective of the project was: optimal planning of measures eligible for co-financing from EU Structural Funds. The specific objectives required that R&D and innovation policy instruments should be assessed, adapted and prepared for the EU Structural Funds.

The Structural Funds are the main EU funding instrument aimed at closing the gap in economic and social development (or cohesion) between the less-favoured (poorer) and more-developed (richer) regions of the European Union. Estonia will become eligible for assistance as an Objective 1 region as of accession to the European Union (currently expected date being 1 May 2004). The Single Programming Document (also called National Development Plan) 2003–2006 is a framework agreement between the Estonian Government and the document setting out the overall strategy for the use of the available co-financing from the Structural Funds[3].

More specifically, the terms of reference split the work to be carried out by the expert team into two main phases. In the first assessment phase, the expected outputs were as follows:

- Synthesised gaps analysis of Estonian Innovation System presented;
- Relevance of current and planned policy instruments evaluated;
- Recommendations for additional support instruments presented;
- Basis for selection by decision-makers of measures for EU funds presented;
- Recommendations for R&D and innovation support instruments eligible for co-financing from EU Structural Funds determined.

In the second 'design' phase, the terms of reference requested the following support to be provided:

- Selected R&D and innovation support instruments adapted and prepared for co-finance from EU Structural Funds including recommendations for the changes in the procedures of the selected support instruments;
- Selected investment projects prepared according to the EU requirements.

The activities carried out under sub-component 2 project were implemented from 15 July 2002 to end November 2002. The assessment phase was concluded provisionally at the beginning of September 2002, however assessment work continued during October and November notably in relation to the background analysis for specific schemes (venture capital and incubators). A large part of the time input of the expert team from early September to end November concerned on-going support to the Ministry of Economic Affairs and Communication for the (re)drafting of the RTDI measure sheet for the SPD and the Programme Complement, including financial planning. Moreover, a set of indicators (output, result and impact levels) including suggestions on quantifications was proposed.

In terms of the second phase work, the main activities focused on a preliminary analysis of the need for Government intervention in favour start-up firms, notably new technology based firms, through intervention in the form of 'incubators' and in stimulating the availability of early-stage capital. Two separate pieces of analysis were carried out involving interview, collection of background data and working-groups with a view to providing the Ministry of Economic Affairs with a baseline document for developing a scheme. Alasdair Reid carried out the analysis on the venture capital demand and supply situation in Estonia; while Vincent Rouwmaats with the support of Silja Kurik and Alasdair Reid undertook the analysis of existing incubators and drafting of proposals for additional government support.

In addition, Alasdair Reid provided advice on re-drafting of the call for proposals for the new Competence Centres programme, including with respect to state aids rules. A presentation was also made at Tartu University, on 7 October 2002, to a group of regional stakeholders with a view to raising awareness about the Single Programming Document and the RTDI Measure.

---

2 *The project entitled "Evaluation and design of business support measures" was funded by the EU PHARE programme: Structures and Instruments for Implementation of Business Support measures (ES01.07.01). This report concerns work carried out by the 2nd sub-component of the project. The other sub-component carried out a similar analysis on business (SME) development schemes including training support, advisory services, start-up aid and export support schemes managed by the Enterprise Estonia Foundation.*

3 *Available at: http://www.fin.ee/eng/index.html?id=5119*

This report presents the findings and conclusions of the expert team regarding the innovation system 'gaps analysis' carried out, on the basis of available documents (see list of references at end of report) and a series of interviews (see annex 4), during the period July to October 2002. On the basis of initial discussions with the Ministry of Economic Affairs, an more in-depth evaluation of policy schemes was limited to three grant and loan instruments administered by the Estonian Technology Agency (ESTAG, part of the Enterprise Estonian Foundation), which have been operational since 2001. Other schemes are still in the design phase or have been operating for a too short a period to make an assessment pertinent.

The report has been prepared by Alasdair Reid, lead expert, with the assistance of Silja Kurik, local expert, notably for the analysis of ESTAG schemes. It is structured as follows:

- Section 2 provides a summary of the gaps analysis building on three main components – an appraisal of the current strengths and weaknesses of the Estonian innovation system making use of available indicators and data; an overview of policy developments and the governance system for RTDI policy; and an appraisal of the extent to which the current policy
- Section 3 provides an in-depth analysis of the three ESTAG funding schemes targeted at research institutes and enterprises. It includes an examination of decision-making procedures and an analysis of data on projects funded to date under each of the three schemes. Initial conclusions on efficiency, effectiveness, impact and sustainability are presented as well as recommendations for changes to the current procedures or objectives of the schemes;
- Section 4 summarises the main conclusions arising from the appraisal and makes a series of recommendations for the content and design of the research, technological development and innovation measure of the future SPD. This includes proposals for a framework for indicators and monitoring and evaluation of the RTDI measure.

Thanks are due to Kitty Kubo, Katrin Männik, Ott Parna and Enn Metsar of the Ministry of Economic Affairs & Communications for the cordial and professional working relations maintained throughout the project. The advice and support of the other members of the expert team, Charles Monck, Valerie McDonnell and Vincent Rouwmaat, is also acknowledged.

2 Appraisal of Gaps in the National Innovation System

2.1 Trends in key indicators of R&D and innovation in Estonia

A review of the main indicators of the innovation performance of Estonia was carried out by adopting the methodological framework of the European Innovation Scoreboard (see annex 1)[4]. This framework was used in order to facilitate future updating and monitoring of these key context indicators. This review was used to expand and restructure the SWOT analysis for the RTDI measure of the SPD. Accordingly, this section only includes a summary of this analysis. The EIS indicators are divided in four categories and the following key conclusions can be reached:

- Human resources (educational levels of economically active population, education expenditures, educational level of entrepreneurs);
  - The share of employment in high-tech manufacturing employment is approximately half the EU average and is allied to a low ratio of science and technology graduates suggesting the threat of a skills mismatch;
- Knowledge creation (expenditure on R&D; research output – patents):
  - Business expenditure on R&D was only 0.15% of GDP (2000) compared to an EU average of 1.2%. It is concentrated in a few large and foreign owned companies; however SMEs that do innovative do so more intensively than large firms;
- Transmission and application of knowledge (innovation activities in firms):
  - Some 36% of Estonian companies declare themselves to be innovators (CIS III survey); however one fifth declared they had no expenditure on innovation in 2000; and only 21% had expenditure in excess of 1 million EEK (~63000 EUR).
- Innovation finance, output and markets:
  - Only one sixth of Estonian manufacturing sales is due to new or improved innovative products (two times lower than EU average); indicating a gap in potential for developing new higher value added products.

It is crucial to understand the link between this overall weak innovation performance, productivity growth and the overall goal of improving competitiveness (defined as a sustained increase in real incomes and in the standard of living with jobs available for all those who wish to find employment)[5], of the Estonian economy. Despite rapid growth in productivity since 1995, labour productivity in the Estonian manufacturing sector was only 27% of the EU15 average in 2000[6].

Productivity growth depends, amongst other factors, on research, technology development and innovation[7], information communication technologies (ICT) creation, up-take and diffusion and the match between skills base of the workforce and new types of jobs being created. The CIS results for Estonia, indicate that the productivity focus of innovation activity is lower than in the EU.

Moreover, in terms of the structure of Estonian manufacturing industry, the specialisation pattern is the most labour intensive, the least capital intensive, and has the lowest scale intensity compared to the other leading central and eastern European candidate countries (Czech Republic, Hungary, Poland, Slovenia and Slovak Republic). All of this would suggest that Estonian industry is faced by significant challenges in terms of raising value added and productivity. Indeed, data would suggest that productivity growth has been mainly driven by capital deepening (explaining in part employment losses) with for instance, a rate of Gross Fixed Capital Formation (GFCF) of 27% for the period 1995–99 which is the second highest of the candidate countries (Eurostat, 2001).

---

4 *As part of their contribution to the SPD design, the expert team produced a revised draft of the Research & Development Activities and Innovation socio-economic analysis chapter of the SPD (section 1.1.3 of the Estonian National Development Plan – Single Programming Document 2003-2006 Strategic Document.*

5 *The definition of Competitiveness used is that adopted by the European Commission in its Communication on Productivity: the Key to Competitiveness of European Economies and Enterprises (21/5/2002).*

6 *See Eurostat. Statistics in Focus Theme 2 n°13/2001: Value added, employment, remuneration and labour productivity in the candidate countries.*

7 *In OECD countries, a 1% increase in business R&D expenditure has been estimated to generate on average a 0.13% increase in total-factor productivity. Figure based on an econometric analysis of 16 OECD member countries. See OECD: Science, Technology and Industry Outlook 2001. Pg 55.*

The important role of foreign direct investment (FDI, which accounted for 23.4% of GFCF between 1995–99) in new capital investment could be an indicator of a positive effect in terms of new technologies. Openness towards trade and FDI is an essential feature of catching-up process. However, it is not openness by itself that matters but how a country uses inward investment as way to upgrade in technological and organisational practices and thereby increase it's long run-competitiveness.

As economic growth is strongly linked to export performance, the share of high-tech exports in total manufacturing exports is clearly an important indicator, Estonia (with 13.4% in 1999) fares well amongst candidate countries (second only to Hungary). However, 50% of the total export volume is made up of sub-contracting machinery and equipment (intermediary goods) suggesting that high-tech exports are of lower R&D intensity. Import penetration of the Estonian market and competitiveness of Estonian firms serving the national market is also an issue requiring support for technology upgrading, manufacturing productivity and logistics if accession is not to result in a further hollowing out of local production in certain sectors.

In section 4 of this report, a link is drawn between the SWOT analysis of Estonian innovation performance and the schemes and actions proposed for inclusion in the SPD RTDI measure.

Summary of issues arising with respect to Structural Fund programming

Estonia's innovation performance suggests a number of consequences for the design of RTDI policies:

- the Estonian governments objective of raising business expenditure on R&D is a correct policy response. However, RTDI measures should not only concentrate on the limited pool of research performers in the private sector; but also target more intensively companies whose capabilities and needs are more oriented to technology transfer, adaptation with a view to improving productivity performance improvement in existing manufacturing and tradeable service sector.
- There should be a strong synergy between inward investment policies and RTDI measures in order to encourage foreign investment companies to locate R&D and product development activities in Estonia; and to encourage structured interaction in the field of technology and innovation between foreign owned companies and local sub-contractors.
- There is also need for a strong complementarity between export promotion activities (marketing, market identification) and research and innovation support funding for design and development of new (higher-tech, higher value added) products and services. Given the lower innovation activity in non-exporting firms and the increasing threat of import penetration, there should also be a better linkage between standard business support measures and actions designed at raising awareness and instigating organisational and technological change in non-export based firms.

2.2 Objectives and instruments of Estonian RTDI policy

R&D and innovation policy in Estonia has gained increased prominence since the end of the 1990s as policy makers and other stakeholders began to realise that longer-term growth prospects were dependent on fostering a "knowledge-based Estonia". This strategy sets out a number of ambitious goals but remains somewhat thin in terms of linking quantifiable targets to instruments and to stated objectives. Two main objectives were set out in Knowledge-based Estonia strategy:

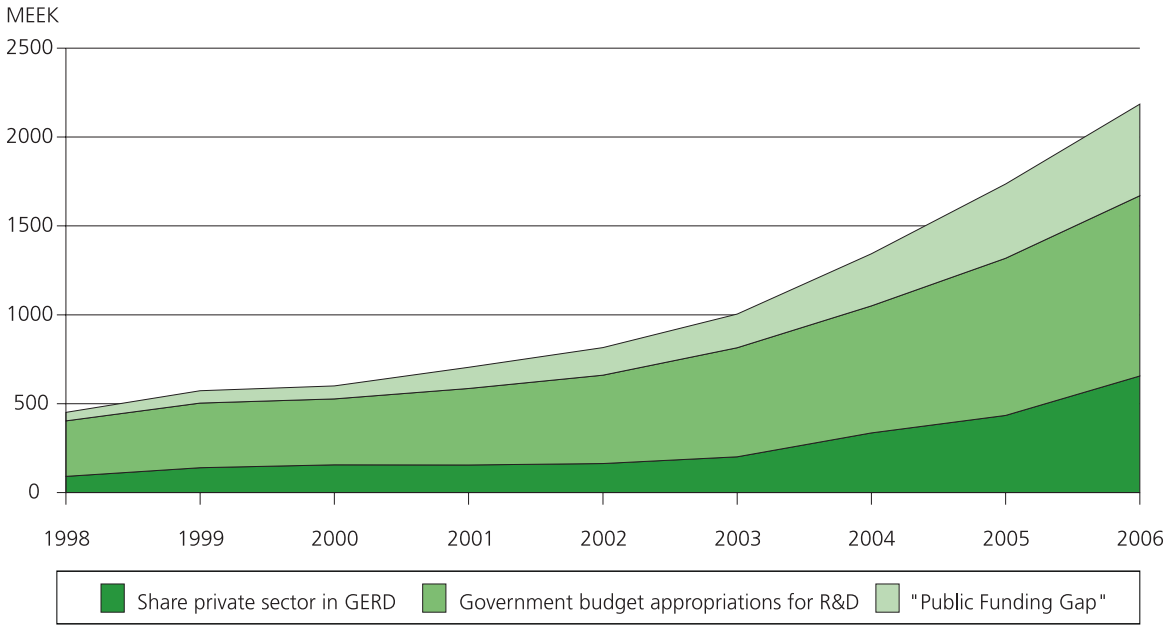
- Updating pool of knowledge – "raising the quality and level of scientific research" – notably on three technology areas: biotechnology, information technology and materials;
- Increasing the competitiveness of enterprises – the precondition being to develop an "integration mechanism between research and business sector".

The main targets related to these objectives were:

- Increasing gross expenditure on R&D (GERD) to 1.5% of GDP by 2006;
- A better balance between basic and applied research activities in government funding of R&D **(no quantification of this objective was proposed**).

The projected growth of R&D expenditure (which is the only real quantified target included in the strategy) between 2000 and 2006 would appear over optimistic, particularly as concerns growth of business expenditure on R&D but also what is termed as the 'public financing gap' in the diagram below. The expected rise in business expenditure in R&D (BERD) is not quantified in the strategy but assuming that the decomposition of total expenditure on R&D is the standard one between Public R&D (government expenditure, GOVERED, plus higher education expenditure on R&D, HERD) and BERD, then it is possible to calculate the expected rise in the private sector contribution.

Figure 1 Government financing strategy for R&D



Conclusions and issues arising with respect to Structural Fund programming:

- The RTDI measure is being designed in the context of a national R&D Strategy adopted by both the Government and Parliament. This strategy provides a framework for the design of a coherent group of schemes in favour of research, technological development and innovation which could be eligible for ERDF support under the Structural Funds.
- The main target of the Government strategy is a sizeable increase in gross expenditure on R&D (as a percentage of GDP between 2000 and 2006). However, the growth in business expenditure on R&D required as of 2003 onwards in order for the overall target increase in research intensity (GERD/GDP) to be reached would not appear to be based on any plausible scenario. There are no indications that BERD has begun to increase significantly in 2002.
- In addition, the difference between the expected growth in public R&D (to include government expenditure and higher education expenditure on R&D, GOVERD and HERD) and 'State budget allocations' grows throughout the period. The underlying assumption would appear to be that EU (pre-) Structural Funds plus, possibly, additional expenditure by the higher education sector (but for which revenue sources are not made explicit) will fill this 'funding gap' (which amounts to 515 MEEK by 2006).

2.2.1 Policy-making and delivery institutions

Studies on National Innovation Systems (NIS) tend to highlight two models: a dominant player model (such as the UK, Ireland or Sweden) where one government Ministry or Department is responsible for policy making across the breadth of science, technology and innovation issues; and "bi-polar" set-ups where separate ministries of science/education and economy develop policy for their respective fields of competence. Estonia clearly falls into the latter category with the **Ministry of Education** being responsible for research and education policy; while the **Ministry of Economic Affairs and Communications** is responsible for industrial (applied) research and innovation. At the present time, the level of policy co-ordination is relatively good with both Ministries participating in the development of the national R&D strategy and with regular consultation on developing measures. However, the institutional capacities of the ministries in terms of developing programmes and projects, which could be eligible for Structural Fund support, are not equal. The Ministry of Education currently is not as advanced in developing policy schemes and appraising existing funding mechanisms for academic research; as the Ministry of Economic Affairs and Communication is with the development of an overall policy framework for technology and innovation and appropriate schemes.

The role of the reformed **Research and Development Council**[8], which was split into two committees in 2000, one for research policy and the other for innovation, is essentially as a consultative body or 'sounding-board' for proposals being brought forward by the respective ministries. The Research policy committee is composed largely of representatives of the universities and academy of sciences; while the Innovation Policy committee brings together representatives of leading high tech firms, private investors, ESTAG, and the universities. Given the limited human resources available (two people), the secretariat of the Council, which is a unit of the State Chancellery, concentrates on producing an annual report (which can be considered of good quality) and providing a secretariat to the meetings of the committees. Their direct role in policy development is more limited and this remains the task of the Ministries.

The diagram below summarises the current situation in terms the organisational structure of the "**innovation governance system**" in Estonia. In terms of delivery of funding schemes, it is immediately clear that the Ministry of Education does not have an implementing agency able to manage co-financing of schemes or investments supported by the Structural Funds. The Science Competence Council is an advisory body (peer review) while the Estonian Science Foundation currently provides small research grants to individual researchers.

From the perspective of support for industrial (applied) research and innovation, the creation of the **Estonian Technology Agency**[9], in 2001, has significantly improved the capacity of the Ministry of Economic Affairs and Communication to implement innovation policy. ESTAG is one of the seven agencies that together form the Enterprise Estonia organisation. The stated aim of ESTAG is "***to develop Estonian business through the support of technological and innovative projects***" (2001 Annual Report). The tasks related to this objective are:

- Participation in the planning of innovation policy and enactment thereof;
- Preparation of financing and coordination of technology programmes in areas that are of priority to the State;
- Financing research and product development projects;
- Coordination and national financing for international technological co-operation;
- Consultation in the area of technology transfer;
- Increase of awareness in the areas of technology and innovation;
- Management of Estonia's image in the field of technology and innovation.

The creation of ESTAG is a good example of international policy learning since the strategic and operational planning of ESTAG was supported by a senior director of the Finnish Technology Agency (TEKES). At the present time, Estonia is the only candidate country, aside from Turkey, to have a dedicated governmental agency with a mission to provide support to enterprises for product and process development and innovation. **This can be considered as a significant advantage with respect to the prospects for an effective implementation of a coherent RTDI measure within the future Structural Fund programme.**

In the first 18 months of operation, a main focus of activities has been the third point of this list of tasks, namely the launching of three types of funding schemes: feasibility study grants, applied research loans & grants; and product development loans and grants. In addition, some initial awareness raising activities have been undertaken notably the development of a technology management guide for enterprises.

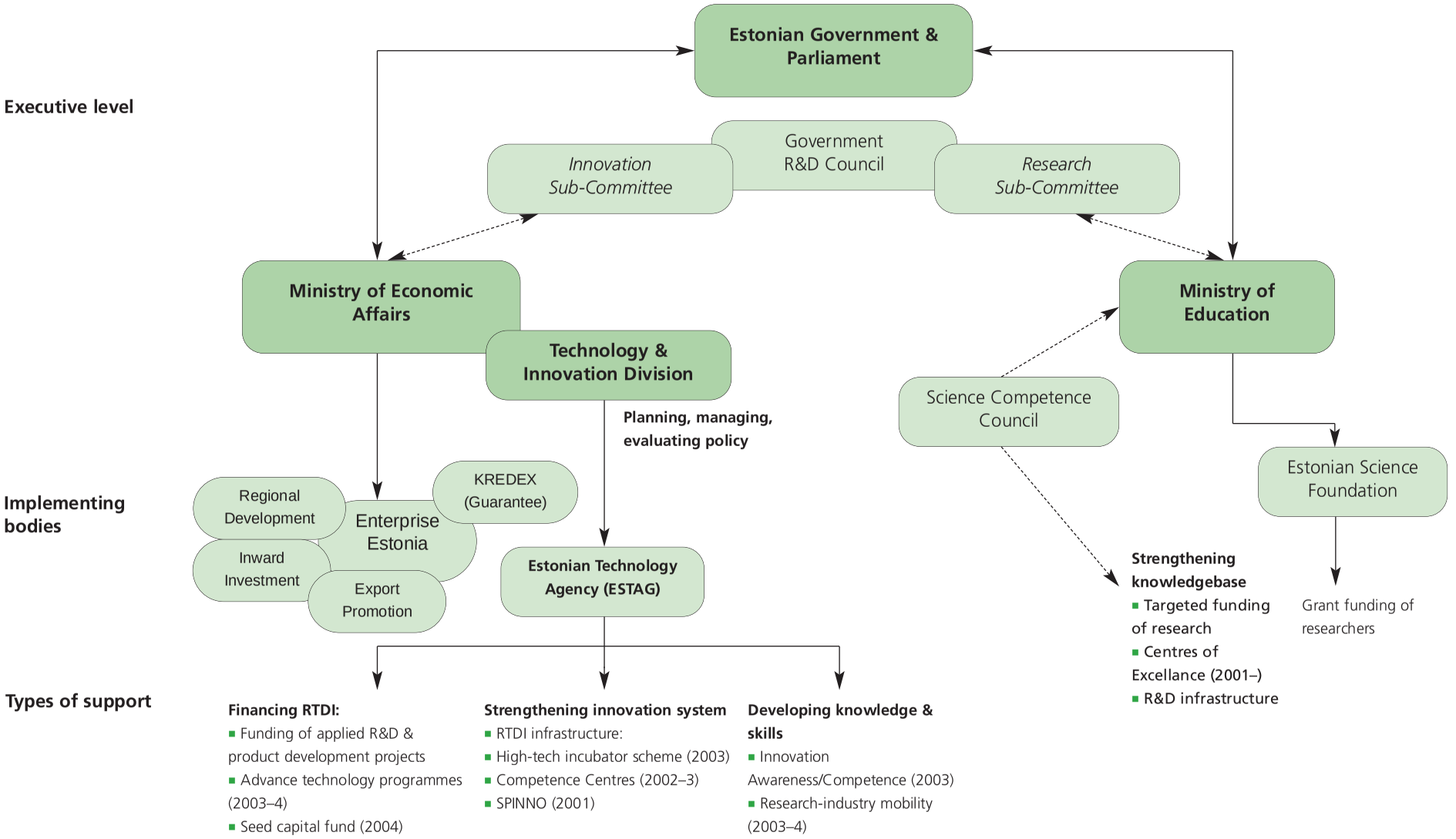
In operational terms, ESTAG took over the functions of the former Innovation Foundation but has radically changed procedures for awarding grants and loans to enterprises and research institutes. ESTAG staff and management met during the course of the assessment work were open about the fact that there is still a learning process going on within the organisation and that procedures and practices are still being formalised. Nevertheless, the overall impression gathered was one of a professional set-up which had received effective technical advice from TEKES in developing its overall strategy and procedure; and which works closely with policy advisors in the Ministry of Economic Affairs and Communication's Technology and Innovation Division.

---

8 *www.tan.ee*

9 *www.estag.ee. The web-site of ESTAG has recently been expanded and much information is available in English including the 2001 Annual Report. The site is clear and well-presented with clearly identified headings outlining financing procedures, FAQ (including a well-though out series of "myths"), manual concerning technology management (in Estonian) can be downloaded, etc. Applications forms can be downloaded from the web-site.*

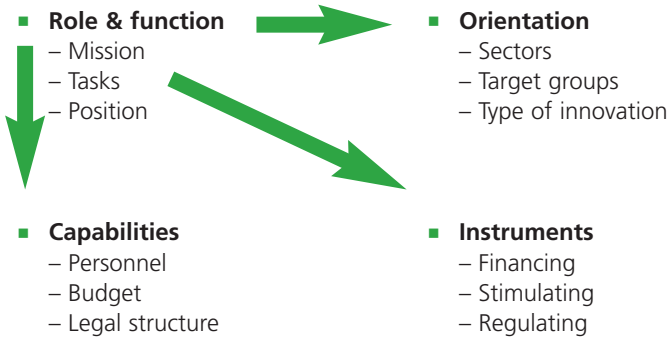
Estonian institutional framework for RTDI Policy



Specific issues arising with respect to the operational procedures and the three funding schemes of ESTAG are discussed in more detail in section 3 below.

Analysing in more detail the organisations active in the 'National Innovation System' and their place in the system requires an analytical framework. One approach is to structure the characteristics of each organisation into four categories:

NIS: Organisational analysis



Role and objectives – the mission statement of the organisation, reporting obligations, etc.;
- Capabilities (staff, annual budget, source of funding and legal structure);
- Orientation (specific emphasis of organisation with respect to industrial sectors, target groups, (universities, SMEs) or type of innovation);
- Instruments describe the means that an organisation uses to reach its goals (programmes, projects, etc.).

The table below summarises the available information for the main organisations identified in the course of the assessment work.

Table 1 Main organisations active in Estonian Innovation System

Organisation	*Role and objectives*	*Capabilities*	*Orientation*	*Instruments*
Estonian Technology Agency	Implementation of Government innovation policy Reports to Ministry of Economic Affairs	- Staff: 10 - Budget: 128 MEEK (2002) - Agency within Enterprise Estonia	- Financing applied research and product development - Developing innovation system measures - Implicit focus on certain technology fields	Grants & loans to enterprises and R&D institutes Grant support for strengthening innovation system
Science Competence Council	Consultative body supporting implementation of research policy Reports to Ministry of Education	- Staff: no secretariat - Budget: 183 MEEK (2002) - Government appointed committee	- Financing fundamental research in universities and research institutes	- Recommendations on disbursement of Targeted research and infrastructure fund of Ministry of Education
Estonian Science Foundation	Promoting basic research in universities and research institutes	- Staff: 2 - ca 80 MEEK (2001) - Independent Foundation	- Financing research projects proposed by individual scientists	- Grant scheme allocated on basis of annual proposal round assessed by peer review
Archimedes Foundation	Foundation supporting higher education and research system	- Staff: 35 - Budget: 32 MEEK (2002) - Independent Foundation created by Min. Education	- Focused on soft projects in fields related to innovation - Current focus on mobility issues	- NCP 5th FP - IRC - Involvement in various studies and projects in field of innovation

Organisation	*Role and objectives*	*Capabilities*	*Orientation*	*Instruments*
TTU Innovation Centre	Supporting the development of start-ups from the university	- Staff: 4.5 - Budget: 1.4 MEEK (2002) - Foundation created by City of Tallinn, TTU and Ministry of Economic Affairs	- Currently main focus is on incubation services for spin-offs	- Management of Incubator to be funded by Tallinn City
Tartu Science Park	Supporting growth of innovative companies through incubator and related services	- Staff: 6 - Budget: 4 MEEK (2002) - Foundation supported by government, university and local authorities	- Shared work-space and technical centre - Promotion of innovation in Tartu county (S-E Estonia)	- Approx. 3000 m² - Currently hosts approx. 25 firms - CAD-CAM centre and Laser Job Shop - Some technology training - EU funded projects (Tartu RIS, IRC etc.)
Tallinn Technology Park	Reduce risk of innovative business development by offering high-quality infrastructure and value added services	- Staff: 6 (as of 2005) - Budget: operating budget of 15 MEEK (as of 2005) - Foundation created by City of Tallinn, TTU and Ministry of Economic Affairs	- Technology related real estate development - Attraction of R&D intensive FDI & support to high-tech start-ups	Business plan foresees: - 40,000 m² of rental area - Incubator & services - Services to tenants includ-ing business development Detailed design to be funded under PHARE 2003 First phase construction works and equipping to be done by 2005
Tallinn Business Incubation Centre	Reduce risk of technology start-up businesses by offering work places and consultancy how to establish a business and how to develop it.	- Staff: 2 - Budget: 1 MEEK (2002) (Tallinn City) - In future will be under Tallinn Technology Park	- Technology related start-ups - Incubation of firms for Tallinn Technology Park	- Business plan foresees: - 2000 m² of rental area - Services to tenants including business development
Bio-technology Devel-opment and Incubation Centre	Effective biotechnology innovation system supporting the creation of new highly value-added jobs and economic competitiveness Aim to increase bio-tech spin-offs and patents by 50%	- Staff: n.a. - Budget: initial investment approx. ~6m - Structural unit of Estonian Biocentre	- Development and transfer of new technologies from research institutes to firms in biotech field	- 3000 m² of new facilities by 2005 - Pre-incubator core facility. - Incubation centre with equipped laboratory for biotech start - Core facilities and equipment - Related services
Tartu Biotechnolo gy Park	Provide infrastructure for established Estonian and foreign biotech firms	- Staff: 2 - Budget: n.a. - Limited liability company	- Technology-related real estate development	- Feasibility study completed - Provision of workspace - Related services
Ida-Virumaa Innovation Centre	to support the competitive and sustainable development of enterprises and to create new jobs of high qualification	- Staff: 1 - Budget: n.a. - Recently absorbed into TTU Virumaa College	- studying needs and opportunities for innovation and technology transfer in region - developing a net-work of universities / R&D institutes in Ida-Virumaa	- Conferences, seminars & info-days - Consulting and practical help on regional innovation projects - Support to enterprises for development of R&D and innovation projects - Etc.

Organisation	*Role and objectives*	*Capabilities*	*Orientation*	*Instruments*
			- diffusion of information and know-how to enterprises and public sector	
ESTIRC	Facilitating technology transfer (offers and proposals)	- Staff: 6. - Budget: ~0.5 MEUR for 2002–2004. - Consortium of ESTAG, Archimedes, Tartu Science Park, TTU Innovation Centre	- Technology transfer / brokerage services	- Member of EU IRC network - Facilitating sending of technology offers from Estonian firms and brokering contacts with EU technology suppliers

Other initiatives that were presented to the team during the round of interviews included **TTU Engineering Centre** and **Tartu University Institute of Technology**. Both would still appear to be at the state of initial planning development and although investment figures were presented for the latter, there is a large gap between 'back-of-the-envelope' figures and a budgeted and well designed investment plan clearly linked to a sustainable 'business plan' concept.

ESTAG has funded a feasibility study in 2001 with a view to the establishment of the **Tartu Biotechnology Park.** The market analysis together with the business plan development is ongoing. Idea of TBP is to provide infrastructure and development services for established biotechnology related businesses from Estonia and also to attract respective foreign investments into the region.

Institutions and intermediaries
Summary of issues arising with respect to Structural Fund programming

- The creation of ESTAG has led to a major improvement in the capacity of the Estonian government to implement its RTDI policies. However, the organisation is still on a relatively steep section of the learning curve with a limited number of, relatively young, staff. Participation in EU level networks such as TAFTIE and benchmarking exercises such as the Trend Chart should enable ESTAG to continue to improve its procedures and effective delivery of schemes. (Other aspects of ESTAG functioning are addressed below in section 3).
- The major projects currently under development concerning RTDI infrastructure are the Technology/Science Parks in Tallinn and Tartu; and the Biotechnology Park and Biotechnology Development and Incubation Centre projects in Tartu. During 2002, applications for Phare funding for completing the design or initial construction phases of these projects were prepared and discussed with the Commission. It is likely that certain of these initiatives may be co-funded by PHARE up to 2005. The Structural Fund programme could ideally provide additional funding for subsequent phases of these infrastructure projects in order to optimise the effectiveness of EU funding through a focus on a limited number of capital investment projects.
- There are very few public or non-profit organisations currently active in supporting enterprises in assessing R&D or innovation potential and developing competence related to business RTDI projects. The financial and human resources of the these organisations is also extremely limited and hence the level of direct services to enterprises in the field of innovation and technology advice is low. Although no data is available on private sector consulting in this field, anecdotal evidence suggests that the access of enterprises to Estonian based expertise in innovation management or technology related issues is extremely limited. There is also a lack of 'innovation projects' in the sense of actions aimed at developing knowledge, skills and methods in intermediaries concerning innovation management or technology transfer or intelligence.
- The Tartu Science Park and the TTU Innovation Centre are both 'micro' organisations in terms of the full-time executive staff actually working within the organisations. In the North-East of Estonia, the Ida Virumaa Innovation Centre, supported by pre-accession funds, is the only other centre outside of the two 'research and technology poles' of Tartu and Tallinn.
- Industrial and sectoral business associations, generally, do not seem to be active in promoting or developing projects for members at the moment limiting the possibilities for developing sectoral technology diffusion or watch services, 'technology cluster' type policies, etc.

2.2.2 Research policy (Ministry of Education)

The Research and Development Law divides responsibility between basic research – Ministry of Education; and technology/innovation – Ministry of Economic Affairs – however, all ministries retain responsibility for research in their area of activity. The Ministry of Education is responsible for research funding at universities and associated research institutes. The latter, created during Soviet times under Academy of Science, were previously dominant with university research capacity rather low. In early 1990s, this system was reformed and the research institutes were either joined to universities, retaining a degree of independence, or became state research organisations.

The priorities of the Ministry of Education appear to be orientated towards:

- Overcoming the current dispersion of research funding through research grants and creating a critical mass of research capacity in a number of areas where Estonian science has or could develop a comparative advantage, essentially through the concept of Centres of Excellence;
- Renewing research infrastructure and related scientific infrastructure (libraries, research collections and museums).

State funds for scientific research funding are theoretically allocated through three mechanisms (Organisation of Research and Development Act, 1997):

- Targeted funding,
- Research Grants, and
- National technology programmes (this concept is dealt with under innovation policy).

The objective of the Targeted Funding is to promote research in specific "research topics". Funding is provided directly by the Ministry of Education from a State budget line however the Science Competence Council (SCC, found in 1997) has the role to make recommendations to the Minister of Education about target funding of research topics of R&D institutions; and recommendations for funding for both infrastructure of R&D institutions, falling under the competence of the Ministry of Education, and research related to doctoral studies.

Research grants are allocated by the Estonian Science Foundation whose "main goal is to support the most promising research initiatives in all fields of basic and applied research" (www.etf.ee). The ETF uses State budget appropriations to award peer-reviewed research grants to individuals and research groups. The ETF grants annually about 70 MEEK (4.5 MEUR) for the funding of research, this sum represented about 22% of total Estonian government research funding in 2000.

The total sum is divided between the expert commissions according to the proportions ratified in Science and Development Council in 1995. Since the structure of the science base is likely to have changed, this fixed envelop for each of eight science fields appears likely to reduce the relevance and efficiency of the funding mechanism[10].

Despite a policy change in 1999 aimed at reducing the overall number of grants and to be more exacting on quality and efficiency of research, a relatively low percentage of proposals were still rejected in 2000 (962 applications versus 763 awards). However, this is explained by the fact that half of the applications are ongoing projects, which apply for continuing financing. Projects may last up to four years but funding is decided annually. As far as entirely new applications are concerned about 50% are rejected. In 2001 the average success of new applications was 54% (74% for exact sciences and 40% for social sciences).

[10] *In 2001 the money was divided between 8 science fields accordingly: Exact sciences, 14%, chemistry, molecular biology 10%, Biogeosciences, 11%, Technical sciences, 17%; Medicine, 17%, agriculture, 11%, social sciences, 10%, humanities, 10%.*

Table 2 Estonian Science Foundation applications and grants in 2001

Science field	*Total sum of applications (1000 EEK)*	*Number of applications*	*of which new*	*Total sum of financing (1000 EEK)*	*N° of awarded grants*	*Of which new grants*	*Average grant funding (1000 EEK)*
Exact sciences	14710	100	39	10139	90	29	112,65
Chemistry, molecular biology	13869	81	33	7303	65	17	112,35
Bio-geosciences	14710	103	45	8083	76	19	106,36
Technical sciences	24720	162	72	11710	139	48	84,24
Medicine	26745	145	73	11982	103	33	116,3
Agriculture	14861	90	45	7799	71	27	109,85
Social sciences	19617	142	85	6652	88	34	75,59
Humanities	16200	138	69	6806	112	44	60,77
Total ETF	144432	961	461	70474	744	249	94,72

81 of the awarded projects were inter-disciplinary in 2001, such projects typically involving funding from two to five ETF sub-commissions. According to the Head of ETF, the interdisciplinary applications on average form up to one-third of all project applications.

While the average size of research grants has increased, from 73000 EEK in 1997 compared to 93000 EEK (or 5880 EUR) in 2000 and 95000 EEK (6090 EUR) in 2001, the level of funding would still seem sub-critical. Another issue is the age structure of the grant holders with only two percent under 30 (1999) and 4.1% younger than 35; while 31% of holders were in the age group 51–60 and 25.3% were over 60. This age structure appears to reflect the negative age pyramid of Estonian scientific personnel. The expert commissions are allowed to keep some of the funding money in reserve for giving it in the second half of the year to the young researchers involved in the grant projects (usually for travelling to the science actions). In 2001 only two commissions used that opportunity.

A separate budget line of the Ministry of Education provides for expenditure on research infrastructure (on recommendation of Science Competence Council) to research institutions. However, the level of funding for research infrastructure would appear to be sub-critical having risen from 34 MEEK in 1996 to 54 MEEK in 2002. The issue of R&D infrastructure funding has been discussed in R&D Council, both in terms of buildings and equipment/analytical instruments. In addition, to the limited government funds invested in infrastructure over the last few years, a few major projects have been supported with international assistance, notably a World Bank loan for the Tartu University Medical Faculty's study and research building (total cost of over 270 MEEK), the investment made by the UK private foundation CITRINA for a laboratory building of the Estonian Biocentre (Tartu), and foreign funds raised with respect to the Estonian Genome Project.

Finally, the Centre of Excellence Programme[11] (COE) was launched in 2001 with the aim of establishing conditions for high-level research and "*to create a mechanism for elaborating, developing and implementing innovative ideas*". In December 2001, the Ministry of Education selected six centres of excellence and allocated additional funding. Applications under the scheme have come from both single university research groups as well as some from research teams at both Tartu and Tallinn Technical universities. However, the additional funding is on a very modest scale with some 4 MEEK in 2002 and 15 MEEK planned for 2003. With this level of funding, the COE scheme does not at the present time provide more than 'top-up' funding for leading research groups. Over the medium term, the objective is to overcome the dispersion and small scale of current research projects and achieve critical mass in research. An earlier attempt to develop Centres of Strategic Competence would appear to have borne little fruit and it is unclear to what extent the lessons of this experience (supported by PHARE funds) have been taken into account.

Generally speaking the Ministry of Education considers that the current research funding system is relatively efficient, however they intend to contract with an international expert to undertake an evaluation of the funding system for fundamental research during spring 2003. The various research laboratories and institutes are assessed by a peer review system. It recognises that while the needs of universities and research institutes for additional funding for infrastructure are real (e.g. this is an issue raised in the peer review evaluations); there is a need for such requests to be formulated on the basis of a prior appraisal of the efficiency of the investment.

[11] *This scheme is complementary to the EU INCO funding under which funding from the EU was secured for two COE in Estonia in 2001 (Estonian BioCentre received 850,000 EUR for 18 month project and a project within the Institute of Physics received 0.7 MEUR (about 10.95 MEEK); and a further four Estonian centres were recognised in 2002 (including in social sciences e.g. social/population studies).*

Given the size of the country, one option is clearly to develop "core facilities" which could be used by several research groups from different institutions, with a need to focus funds on centres of excellence and competence as they develop. The pressing need to increase the critical mass of research groups is underlined by the recent paper for the new Competence Centres programme (see below), it notes that "*out of 38 R&D institutions applying for special purpose financing 17 have less than 20 scientists, 13 have less than 10 scientists, which shows the fragmentation of research activities in Estonian universities and in research institutions related to them*".

Summary of issues arising with respect to Structural Fund programming

- The current funding system for fundamental research in Estonia is composed of two grant based instruments essentially focused on financing personnel costs and related expenditure of research groups related to either specific research topics or individual research grants. The funding levels are sub-critical and the dispersion of funds between a large number of small projects or research groups sub-critical.
- Levels of funding for infrastructure and equipment funding have been clearly insufficient over the last decade (and this is reflected in the findings of the peer review research evaluations). A limited number of cases of more significant infrastructure investment have occurred, part funded by international institutional or private funds. Plans for additional major projects require further feasibility and design preparation work.
- The Centres of Excellence programme is currently little more than a mechanism providing 'top-up' funding – at current levels of funding and vague procedures the programme can clearly not contribute to giving a strategic orientation to research in Estonia. A redesign of this scheme will be required in order to include it in the SPD;
- Procedures: the selection process for the current schemes is based on peer reviews. A positive aspect of this system is the inclusion of international (notably from Nordic countries) experts. A rolling programme of peer review evaluations of academic and public research organisations has been established but with a focus on research excellence as opposed to socio-economic spillovers.
- Delivery of funding: the Ministry of Education disburses directly funding aside from the small grant scheme of the ESF. There are no organisations linked to the Ministry that could act as final beneficiaries/implementing agencies to the standards required by the Structural Funds.
- Technical capacities within the Ministry of Education in relation to research policy, programme and project management and Structural Fund processes and procedures requires reinforcing.

2.2.3 Innovation policy (Ministry of Economic Affairs and Communication)

Innovation policy is the competence of the Ministry of Economic Affairs & Communication[12]. The Ministry has been particularly active in the last three years in developing a series of policy instruments many of which are discussed in other sections of this report. In order to do so the Technology and Innovation unit of Ministry has participated actively in European level policy benchmarking networks such as the Commission's European Innovation Trend Chart programme. At the current time, the unit is staffed by four executive officers; a fifth was being recruited end 2002. Certain of the officials have undertaken traineeships with the Commission (DG Enterprise Innovation Division in Luxembourg) and the others are all involved in on-going training or policy learning initiatives. During the current period of relatively intensive programme preparation, the resources of the unit are relatively strained. Even once, programme preparation has been more or less completed, the workload of the unit is likely to remain intense if appropriate monitoring and evaluation of the programmes being launched is to be ensured (this is likely to be the next stage of 'policy learning' required by the unit).

In addition, to its own staff, the unit has also made use of international expertise, with and without Phare funding, to develop a series of schemes and initiatives (notably the Competence Centre Programme). The table below summarises the state of play of innovation policy measures developed by the Ministry of Economic Affairs since 2000. Certain measures are still under development

Aside from the three funding schemes for feasibility studies, applied R&D and product development currently delivered by ESTAG to enterprises and R&D institutes (see section 3), the major measures designed and implemented of the last two years have been the SPINNO and Competence Centres schemes. Both these schemes have been developed in co-operation with ESTAG officials (who become ultimately responsible for

[12] *See: http://www.mkm.ee*

their implementation) and with the support of international experts who conducted feasibility studies. During the course of the assessment work carried out by this project, work was also underway on developing the first technology programmes (for the biotechnology sector)

The SPINNO scheme was the first additional scheme targeted at developing[13] the innovation support system as opposed to direct funding support to enterprises or R&D institutes. SPINNO has the aim of developing "the entrepreneurial activity-oriented supportive role of universities and R&D institutions by supporting related activities, with the emphasis on development of knowledge-intensive entrepreneurial activities." More specifically, the objectives of the programmes are:

- Increase the exploitation rate of Estonian universities and R&D institutions R&D results in business;
- Developing an environment favourable for entrepreneurial activities in Estonian universities and R&D institutions;
- Developing co-operation between Estonian universities and R&D institutions in supporting knowledge-intensive entrepreneurial activity.

At the current time there are only two SPINNO projects running: one at Tallinn Technical University; and another in Tartu bringing together Tartu University and other regional actors. The aims of the TTU project include arriving at a better understanding of current levels of service provision to enterprises by university staff (currently a sort of "grey" market). According to the text of the 'call for proposals' mandatory activities of the project include: development of legal framework within universities and R&D institutes which influence application of research results; creation (and sustainable development) of spin-off enterprises; patenting and licensing policy development; activities related to financing and access to capital markets; enhancing of contract research and R&D related co-operation; improving exchange of information and co-operation between local and international partners.

The first phase of the SPINNO programme is running between 3 October 2001 and 31 December 2003. ESTAG covers up to 75% of eligible costs with a government budget of 6 MEEK in 2001, 11 MEEK for 2002 and 12 MEEK for 2003. ESTAG is responsible for the management of the programme including evaluating on a twice-yearly basis the progress of the projects. An external evaluation by foreign experts is foreseen at the end of the project.

The second major scheme developed during the course of 2002 has been the Competence Centre programme. This scheme has been the subject of a more in-depth feasibility study[14] and in particular by an intense phase of design work undertaken by the staff of the Technology and Innovation Unit of the Ministry of Economic Affairs and Communications, who have participated in international policy networks exchanging experience on competence centre type programmes in other countries (Austria, Australia, etc.). The programme was recently approved (November 2002) by the Government and it is expected that the first projects will be funded as of the second half of 2003 on the basis of a call for proposals. ESTAG will manage the implementation of the scheme for which an annual budget of 25 MEEK is foreseen from 2003 onwards. The basic rate of financing granted to the competence centre by ESTAG is 50% of the costs related to the research programme.

The Competence Centre programme has the overall objective improving "the competitiveness of enterprises through strategic cooperation between the science and industry sectors in Estonia". A competence centre is created for strategic cooperation between science and industry partners based on existing R&D competence and conducted in a specific field of technology or in cooperation between different fields. The science and industry partners should participate jointly in the planning, launching and implementation (including financing) of the competence centre. In short, a Competence Centre is effectively a consortium of research centres and enterprises working together on a programme of applied (industrial research). The Consortium should include at least one science partner registered in Estonia and three industry partners registered in Estonia. In addition the Consortium may include science and industry partners registered abroad.

It is likely that the funding provided through the programme will displace some of the current activities, notably of R&D institutes, funded through ESTAG grants/loans for applied R&D. On the one hand, the programme is likely to increase synergies and improve critical mass of research by replacing individual projects involving one or two organisations with a programme of research carried out by a broader partnership; on the other, it is likely to further reduce the level of disbursement of existing funds available for supporting R&D in ESTAG.

---

[13] *A feasibility study for the SPINNO programme was carried out by Technopolis (UK and Netherlands) and experts from the university commercialisation service of the Catholic University of Leuven (KU Leuven). On the basis of the documents available, the term feasibility study is probably not appropriate, the work carried out by the international experts was more a review of what existed and outlining some basic principles on "high-tech venturing". A more complete approach would have involved a "commercialisation enquiry" targeted at all universities and R&D institutes scientific personnel.*

[14] *Again carried out by Technopolis (Netherlands).*

Table 3 Current and planned measures in favour of innovation and business R&D

Measure	*Objective*	*Type of support*	*Funding levels*	
Feasibility Studies.		■ Initial studies and preparation for applied research / development projects; ■ Also funding of feasibility studies for RTDI infrastructure.	Grant 75% of eligible costs (up to EEK 100,000) Larger sums for RTDI infrastructure studies on case by case basis.	1% of funding in 2001 = 476,000 EEK.
Support for Applied Research and product development in enterprises.		Applied research in companies: ■ Testing of product/service; ■ Introduction and positioning of product in market.	Applied research grant – 50% of total costs; Product development grant – 25% of total costs. Loan finance – 1–5% annual interest rate, 8-year term; up to 75% of costs.	Grants/loans= 6% of funding. Grants/loans = of funding in 2001. Loans accounted for 39% of total funding in 2001.
Applied research project grant for research institutions.		■ Development of technology towards product/ process application.	50% applied research by R&D institutions; 25% product development for enterprises.	17.1 million EEK in 2001 (36% of tot.
SPINNO programme (launched 2001).		■ Supporting development of university & research institutions industrial interface structures and for the provision of spin-off support.	75% of eligible expenses.	6 million EEK – 2001. 11 million EEK – 2002. 12 million EEK – 2003.
Competence Centre programme (Approved by Government, first call for proposal due by end 2002, first centres funded as of mid 2003).		■ Increase the exploitation of scientific knowledge in the market; ■ stimulate R&D concentration in specific technological areas; ■ stimulate mid-term planning and management in science and industry; ■ stimulate the mobility of R&D specialists between academy and industry.	■ Up to 50% of eligible expenditure for each centre (consortium of R&D organisations and private enterprises).	Expected 25 million EEK annually from State budget (and from 2004 onwards the SPD).
Innovation Awareness/Competence Programme (Under preparation – launch expected in 2003).		■ To persuade entrepreneurs to consider innovation as a cornerstone of competitiveness; ■ Improve capabilities and competencies within enterprises to carry out RTDI projects.	Programme preparation under way in last quarter of 2002.	Planned 3 million EEK for 2003 for initial year of programme.
Research-industry mobility scheme.		■ Increase the number of specialised graduates/engineers available to industry; ■ Strengthen research-industry co-operation on developing skills of human resources for RTDI.	Feasibility and preparation study to be co-financed by Danish Government co-operation 2003.	Possible launch in 2004.
Technology Programmes (Under preparation –-possible launch 2004).		■ Encourage strategic research programmes in a number of thematic fields.	Programme preparation under way for first pilot programmes in fields of biotechnology and IT.	Funding for 2004 launch of programmes to be decided by spring 2003.
Early-stage equity investment scheme.		■ Increase the availability of equity financing for new technology based firms	Feasibility study planned for first quarter 2003.	No current estimate of funding required.
Incubation scheme.		■ Support the creation and development of (high-tech) start-ups and spin-offs.	Initial design work being carried out last quarter 2002.	No current estimate of funding required.

Summary of issues arising with respect to Structural Fund programming

- The Ministry of Economic Affairs has made good progress since 2000 in developing a coherent framework of public intervention in favour of technology development and innovation. The balance of measures between stimulating demand through direct funding and supporting the development of the innovation system is broadly correct. However, there is a strong bias at the current time towards 'research-performers' as opposed to a broader target group of enterprises more interested in technological upgrading and organisation forms of innovation. This needs to be corrected in the coming two years through the re-design or design of direct funding schemes to firms.
- The Competence Centre programme, which should give an additional impetus to stimulating research-industry co-operation on applied research and generate a greater expenditure by the private sector in support of these programmes. Since, it is also likely to displace funding currently provided by ESTAG through its Applied R&D grant/loan scheme, there is a need to reflect on how to re-target these available funds more directly on enterprises
- The Innovation Awareness programme, currently being designed, will be vital to increasing the uptake of available funds for the other main ESTAG schemes. The activities and performance targets of this programme should be directly orientated towards improving the uptake by enterprises of available ESTAG funding in order to improve disbursement rates and increase the effectiveness of ESTAG's support.
- Support for research, technology diffusion and innovation related to information and telecommunication (ITC) technologies in the enterprise sector should not be separated from the RTDI measure. The concept of technology development programmes for the three key technologies identified in the Knowledge Based Estonia strategy is a coherent part of the RTDI policy implementation system.

2.3 How well does RTDI policy respond to the needs of firms?

In order to try and summarise the current state of play of development of policy instruments in support of R&D and innovation two types of matrix analysis were used. The first matrix attempts to analyse the relevance or targeting of current schemes, of the Ministry of Economic Affairs, with respect to a classification of enterprises (in terms of their 'technological competence')[15]. In order to maintain some coherence with previous studies, the classification adopts that used in the Feasibility Study report for the Competence Centre scheme.

Table 4 Targeting of current or proposed RTDI and business support schemes

Type of intervention / Type of firm	*Micro/Low-tech*	*Minimum capability companies*	*Technological competent*	*Research performers*
ESTAG Grants & loans		Feasibility studies		
Competence Centres				
SPINNO				
Technology Development Programmes				
Technology Parks & Incubators				
Mobility schemes				
Venture capital				
Awareness & innovation management				
KREDEX				
Business Services: start-up, advisory and training grants (ERDA)				Spin-offs

LEGEND
- Not usually relevant for this type of company
- Certain companies possibly targeted
- Intervention relevant for type of company

15 *In order to keep some coherence with other recent studies, the classification of enterprises used by the Competence Centre feasibility study is adopted. See De Jager et al (Technopolis) Competence Centre Programme Estonia. Feasibility Study. Innovation Studies 1/2002. Foundation Enterprise Estonia. A research performer is a firm with a research department or equivalent; technological competent firm have multiple engineers and are able to participate in technology networks, minimum-capability firms have one engineer and are able to adopt packaged solutions; low-technology SMEs have no meaningful technological capability.*

The issue here is to understand the reach of current schemes in terms of their target populations of enterprises. It is self-evident that micro-enterprises and minimum capability enterprises are unlikely to be concerned by a fair number of the schemes offered by ESTAG. Given the objectives of the schemes, this is even the case for some of the group of technologically competent firms who would be interested in technology transfer or 'softer' innovation but who are not able to co-operate fully with research institutes in applied research.

Synergies and coherence between the business development schemes listed at the bottom of the matrix (loan guarantees of KREDEX, general business support services), analysed under sub-component 1 of this project, should clearly be sought in the extent to which business support measures enable certain companies to move up the 'competence ladder' and become potential clients for ESTAG schemes. An obvious **indicator** of how well these synergies are being exploited would be the number of cross-referrals between ESTAG and its sister agencies within Enterprise Estonia (e.g. ESTAG sending an enterprise whose project is not sufficiently 'innovation intensive' to ERDA or KREDEX).

Given the focus and scale of current ESTAG schemes, see section 3 below, it seems fair to conclude that currently the main clients of ESTAG are those located in the right hand column of the matrix (research performers). Indeed given the breakdown of the total financing by type of project, it would seem that most funding under the grants and loans schemes received by enterprises would be targeted at the top right box and on a group of companies numbering at the present time no more than 30.

According to ESTAG's 2001 Annual Report only 6% of total funding (enterprise and research institutes combined) was aimed at "technology development/transfer in small and medium sized enterprises" (equivalent to ESTAG financing of 3.1 MEEK). The challenge for ESTAG therefore is to increase the share of technologically competent firms participating in its schemes; and even, in the longer run, to begin to involve some minimum capability firms perhaps through their involvement as sub-partners or 'users' in R&D projects led by technologically competent or research performing firms or R&D institutes. This could be done for instance by technology development/transfer projects aimed at a sub-sector or group ('cluster') of companies.

It would appear from the matrix, that the current portfolio of ESTAG schemes is strongly orientated towards the limited number of research performers in the Estonian economy able to co-operate with research institutes. Technology transfer, adoption and adaptation of existing technologies, organisational innovations, production process innovations all of which lead to increased productivity are as important, given the SWOT analysis, as the introduction of new products (which accounts for 45% of ESTAG funding in 2001 according to the Annual Report).

The Competence Centres programme could potentially lead to the development of a number of programmes of applied research and related commercialisation projects of relevance to a larger group of firms. However, in selecting projects under the forthcoming call for proposals there will be a need to ensure that the programme is not dominated by research institutes and related research performing firms with already strong relations (e.g. in the biotechnology field this is a likely outcome) if new forms of co-operation between research and industry are to develop.

Table 5 Fields of intervention (Structural Fund classification) and policy objectives – gaps analysis

Field of intervention / Policy Objective	*Support of R&D*	*(Risk) capital markets*	*Improving absorption capacity*	*R&D co-operation*	*Knowledge diffusion*	*High-tech starters*	*Human mobility*	*Improving exploitation of knowledge*
Research projects based in universities and research institutes	ESTAG applied research grants			Competence Centres, Technology Programmes				SPINNO
Grants and loans to enterprises (state aid)	ESTAG product development grants/loans	Equity grants	ESTAG Inno-Awareness	ESTAG grants/loans		ESTAG grants/loans ERDA Start-up grants		
RTDI Infrastructure	Ad hoc funding from Min Educ.			Centres of Excellence		Biotech Development & Incubation Centre		
Innovation and technology transfer, networks&partnership between industry/research			TTU IC CARIN, TRIS, etc.	Competence Centres	ESTIRC	SPINNO		SPINNO
Training (for researchers)			ESTAG Inno-Awareness					
Shared business services (incubators)		Funds linked to incubators		Technology Parks Tallinn, Tartu, Biotech		Incubators – e.g. Tallinn City, Tartu Biotech Development & Incubation Centre		SPINNO
Financial engineering (Guarentee schemes, risk capital)	Kredex	Venture Fund				Kredex		

Concept / policy development stage
Design / project development
Instrument operating
No specific schemes/instruments

The SPINNO programme can also be expected to lead to a greater interaction between the universities and research institutes involved and industry. Again the type of activities aimed at improving university R&D departments and related commercialisation activities is however likely to be focused on research performers or the leading "technological competent" firms.

The second matrix attempts to map the current policy initiatives with respect to the categorisation of forms of intervention foreseen by the Structural Fund and a standard set of innovation policy objectives. The left hand column structures the schemes according to the classification of fields of intervention used by the Structural Funds (the Commission requires that all schemes be categorised with respect to this classification in order to facilitate cross-country analysis of spending patterns). The top row classifies the schemes with respect to the objectives pursued from the point of view of a relatively classic series of innovation policy objectives.

Summary of issues arising with respect to Structural Fund programming

The main gaps in the current "innovation system" are as follows:

In terms of the **research funding system**

- A programme driven approach to research funding which would focus limited resources on a smaller number of larger research programme clustering projects with respect to common objectives. This approach should also encourage a greater rate of inter-disciplinary research and increased co-operation amongst research laboratories and institutes. At present the Centres of Excellence programme does not have sufficient funding to play this role.
- There is a lack of a strategic framework to guide investment in R&D infrastructure related in the higher education sector and related research institutes. There is a need to develop a longer term view on the investment required in order to overcome the current situation. A scheme supporting universities and research institutes to assess needs, prepare investment plans linked to research strategies is required in order to allow Government to select those proposed investment projects with the greatest impact on the Estonian R&D performance; and where necessary attract international financial institutions such as the EBRD and in the future the EIB to contribute to raising the level of investment.

In terms of the **funding of technology development and innovation**:

- Current schemes and financial resources are over concentrated on the limited number of research performers and on product development. There is a need to increase support for enterprises working on process innovations linked to technology transfer and adaptation of such technology to Estonian conditions.
- The expansion of assistance and advice services, as well as measures designed to improve human resource capacities (mobility but also training) for innovation in enterprises should be a main priority in the coming years. Without such an investment, the major ESTAG funding schemes are unlikely to expand their coverage or increase their disbursement due to blockages on the demand side.

3 Appraisal of ESTAG Grant and Loan Schemes

On the basis of the inception mission, it was agreed to limit the appraisal of current schemes to the grant and loan funding provided by ESTAG. In order to ensure coherence between the SME and R&D and Innovation sub-components of this project, the basis for undertaking the initial assessment of the ESTAG instruments adopts the same criteria as those used for the SME schemes, namely:

- **Relevance**: to policy objectives, to the objectives of the SPD, in terms of the design of the scheme with respect to target groups (types of firms, etc.): eligibility, delivery mechanism, level of assistance.
- **Efficiency**: The efficiency criterion evaluates the transformation of inputs into outputs, both in quantitative (where feasible) and qualitative terms. These relate to such issues as the rate of disbursement, the number of people/organisation who have received the input (finance or know-how) in relation to the public sector costs involved. Three main aspects are considered in the analysis which follows: uptake (number of firms requesting/receiving aid); the cost of scheme, the application process and selection.
- **Effectiveness of the scheme**. Effectiveness assesses the extent to which outputs contribute to immediate objectives. Thus for financial projects or technical assistance (in terms of advice, training or information provision) to what extent did the support result in improved performance of the organisation that received the aid.
- **Impact** (demonstration and spill-over effects). Impact assesses the extent to which outputs contribute to wider objectives. In what measurable ways did the improvements in the recipients' performance result in wider; spill over effects, such as providing a demonstration effect, raising awareness.
- **Sustainability**. This criterion assesses the extent to which impact is sustainable over a longer time horizon, particularly when technical or financial assistance has come to an end.

Following initial meetings with ESTAG during the first mission in July 2002; a request was made in early August 2002 for more detailed data on the current portfolio of ESTAG funding for R&D projects including all on-going Innovation Fund (which operated until mid-2000) projects which were handed over to ESTAG. The latter providing some comparison over time even if IF and ESTAG projects were selected and funded under different rules and procedures.

ESTAG was requested to to provide wherever possible the following information in the form:

- Project type (applied research, product development, etc.);
- Title/objective (technology field);
- Name of company(ies)in project or University Dept. / R&D institute participating;
- Size of company (by employees/Turnover);
- Geographical location;
- Sector;
- Financing mode (grant/loan);
- Amount of funding support (in EEK);
- Time period (date of beginning and end of project);
- Indication of effort (in person/months of time) or allocation of resources between equipment, labour costs, etc.;
- the baseline performance data for enterprises required in application forms;
- information on number of applications received/rejected/approved.

Due to the lack of a functioning management information system, the information made available by ESTAG was collected in a database by the local expert for the project.

3.1 ESTAG funding schemes for R&D

The diagram below is used by ESTAG to summarise the functioning of the three related funding schemes and provides a good overview of the logic of intervention. In principle, the scope of the intervention also differs according to the size or type of organisation. ESTAG is ready to "finance the entire cycle of technology development i.e. up to the successful entry into the market" in SMEs; while in large entreprises "the objective is to promote applied research activities".

Figure 2 Financing of R&D in ESTAG

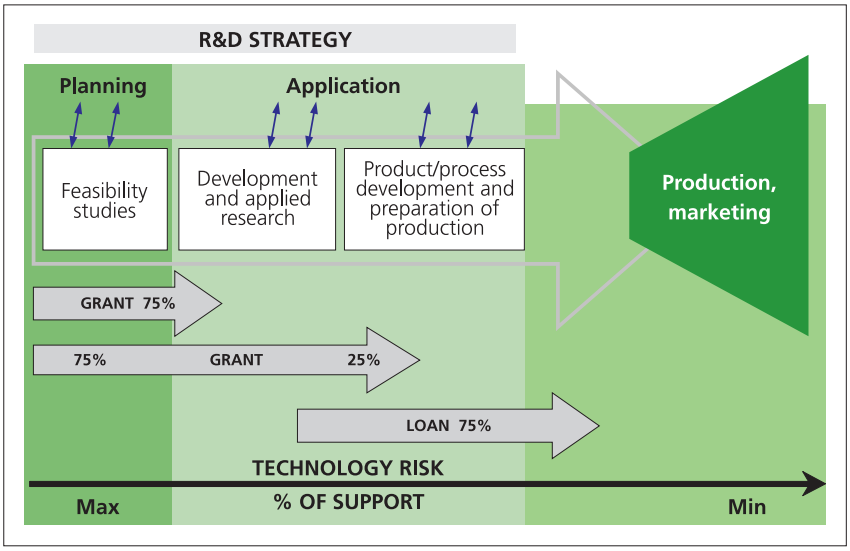


Table 6 Comparison of main objectives ESTAG and Innovation Foundation

	Innovation Foundation (until 2000)	*Estonian Technology Agency (since 2001)*
Objectives	- Financing of R&D projects	- Implementation of state innovation policy and financing of programmes and projects needed for the technological development of Estonian economy; - Support for internationally competitive product, process and services development.
Direction	- Projects that are directed to increase the technological level of manufacturing and competitiveness; - Technical and technology related research and development projects; - Innovation supporting infrastructure, incl. science and technology parks development.	- The financed technology and/or innovative projects should be implemented in businesses; - Attention to the projects technological and innovative quality, but also to the possibilities to implement them in Estonian business sector.
Financing		- Applied research projects; - Product development projects; - Programmes and projects needed for technological development of Estonian economy.
Co-financing principle	- Grants up to 50% of the project costs (exceptions to R&D institutions up to 100%) - Loans up to 75% of the project costs (average loan interest rate 12%) Enterprises were mostly given loans and R&D institutions got mostly grants.	- Pre-survey support for R&D institutions up to 75% of the project costs; - Applied research grant for R&D institutions up to 50% (exception up to 100%); - Pre-survey support for enterprises up to 75%; - Applied research grant for enterprises up to 50% (exception up to 75%); - Product development grant for enterprises up to 25% (exception up to 50%); - Applied research loans for enterprises up to 75%; - Product development loans for enterprises up to 75%; - (Loan interest rate 1–5% per year/ loan remains; deadline – max 8 years; payment rest – max 3 years).
Financing decision	Every applied project was appraised by technical-economic expertise before the decision in Foundation's council.	- Projects up to 350000 EEK – ESTAG working group (5 members); - Projects 350001-10000000 EEK – Financial Committee (7 members); - Over 10 million EEK - EAS council (10 members). Financial decisions are based on expert estimations made by agency's technology and economic experts. Decision making takes up to 3 months from the beginning of the procedure process.

	Innovation Foundation (until 2000)	*Estonian Technology Agency (since 2001)*
Selection criteria	There was no clear system or set out criteria.	A licence for a technology rating (Techrate) system has been purchased and this tool, comprising of 5 modules is used to assess projects. Project quality, expected socio-economic impact of the project, financial liability and economic indicators of the organisation behind the project.
Sectors and activities not funded	(a) food and beverages producing, (b) clothing manufacturing, (c) furniture manufacturing. These are traditional and developed industries. The R&D in these sectors doesn't make the notable share of the product turnover and these sectors are well financed by banks. (IF assessment report, 1997, p. 8). IF was concentrated on product and very few projects concerned new services.	(a) Basic research projects, (b) Non-innovative or not technology related projects, (c) Project's output is not realisable in business, (d) The applicant is insolvent, (e) The purpose of the project is to refinance the loans taken somewhere else but ESTAG, (f) The purpose is the buildings' maintaining works. ESTAG does not finance the following project costs: - Expense account, - Stipend (scholarship), - Donations, - Advertising and marketing costs, - Capital costs, - Manufacturing liquidation costs.
More active sectors	Approximate statistics show that (period 1991-1998) 25% of Foundation's portfolio was for agricultural, foodstuff industry and foodstuff machinery production; 20% to energy industry, 1/6 to medicine and biotechnology projects.	According to the 2001 annual report of ESTAG, the total funding disbursed of 47.6 MEEK was divided as follows by 'industry sectors': bio- and food technology (36%); Product and Material Technology (22%); Chemical Technology (11%); Information and Communications Technology (9%); other areas (22). In fact, ESTAG monitors projects more by field of technology than industry sector making it difficult to identify support being given to key industrial sectors in the economy.

Source: IF –-"Tooteinnovatsioon ja innovatsioonisüsteemid", pages – 209–210;
ESTAG web site and project application forms.

The basic principle underlying the current functioning of the three ESTAG schemes is that "*the higher the technology risk, the higher the maximum financing rate applicable by ESTAG. Close to market development projects are financed primarily by loans*". Table 6 summarises the main differences between the former Innovation Fund schemes and the current schemes of ESTAG.

Some main differences are immediately apparent:

- notably the introduction of the feasibility grants scheme. This new schemes is clearly aimed at improving the quality and number of full applied R&D and product development projects. The objective being to enable the enterprise to obtain information on the practicability of the planned applied research or product development;
- A second notable difference is that the Innovation Foundation specifically excluded three main sectors of activity of the Estonian economy classified as being "traditional", namely food and beverages producing, clothing manufacturing and furniture manufacturing. The rational given was that the "R&D in these sectors does not account for a notable share of the product turnover and these sectors are well financed by banks". This discrimination is no longer present for ESTAG schemes and, for instance, at least one furniture maker has received a grant and loan for product development so far.
- A third change, and indeed improvement, has been the introduction of a rigorous selection procedure and evaluation criteria for selecting projects. This change, and the severity of the application of the new procedures, was considered as a necessary condition by the senior management of Enterprise Estonia in order to clearly indicate a break with the previous system which was highly informal and open to abuse.

3.2 Appraisal of project selection and management procedures

A first measure of efficiency is the performance of the project application process and selection procedures. ESTAG has set itself a quality target of replying to all applications within 3 months. According to ESTAG officials this target is "usually met", however companies interviewed reported longer delays – due to lack of data in ESTAG, it was not possible to come to a firm conclusion on this issue.

In terms of the number of applications received versus projects accepted for funding the ratio is 74% for enterprise proposals (46 applications received 34 projects accepted during 18 months); and 85% for research institute proposals (23 out of 27 proposals accepted). The low rate of rejection could be due to the relatively extensive 'coaching' time provided by ESTAG project managers ensuring that non-relevant or low-quality proposals are filtered out before reaching the decision phase.

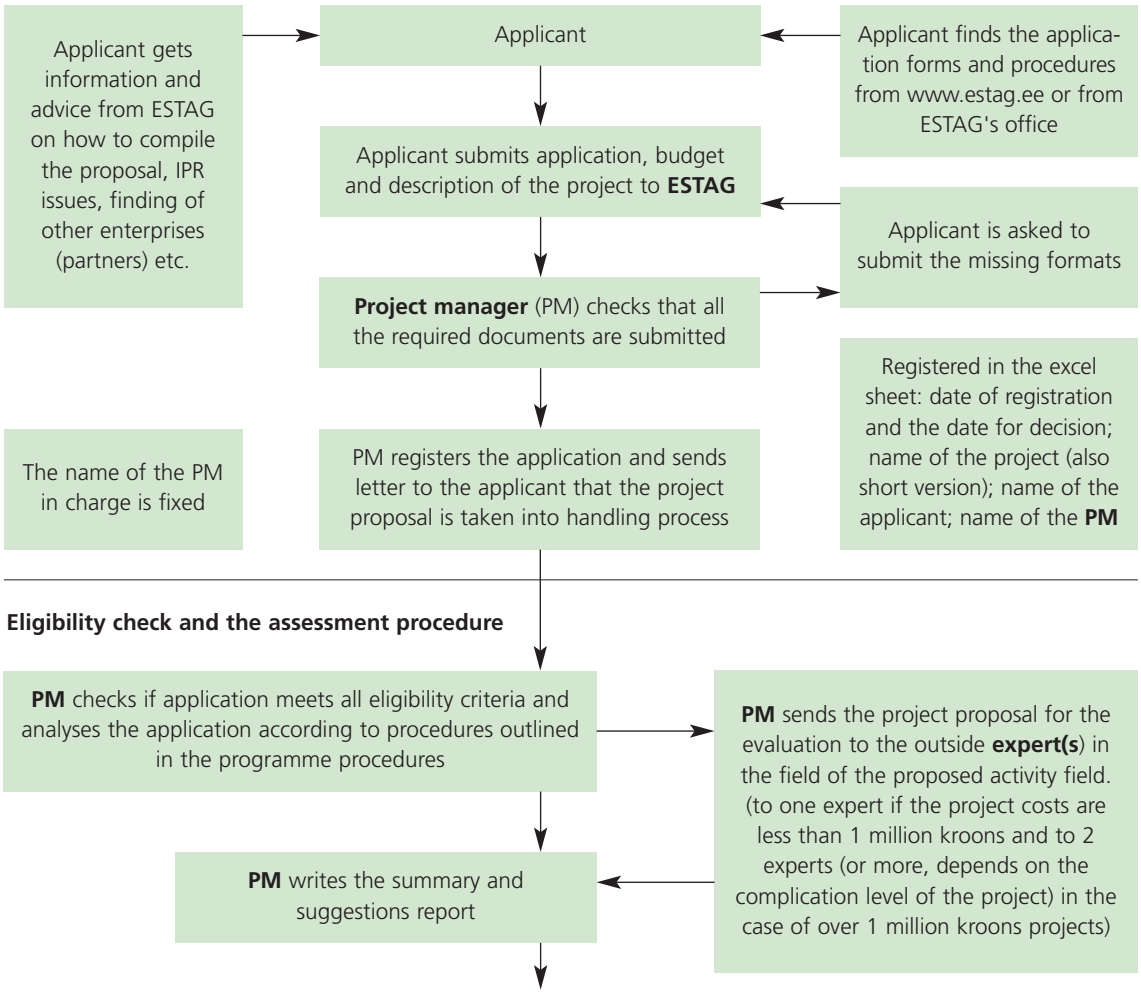
In the case of ESTAG, interviews with various stakeholders including members of financial committee of ESTAG (responsible for final decision on projects) would appear to confirm the impression left by discussions with ESTAG of a relative improvement, compared to the Innovation Fund period, in the professionalism of the selection process and procedures. The application forms and procedures of the ESTAG schemes are inspired by those of the Finnish agency TEKES with only the addition of an obligation for cash flow estimates added reflecting the greater uncertainty over the financial viability of enterprises in Estonia.

The diagram on the following two pages summarises the proposal / project cycle for applications received by ESTAG. A few remarks should be made:

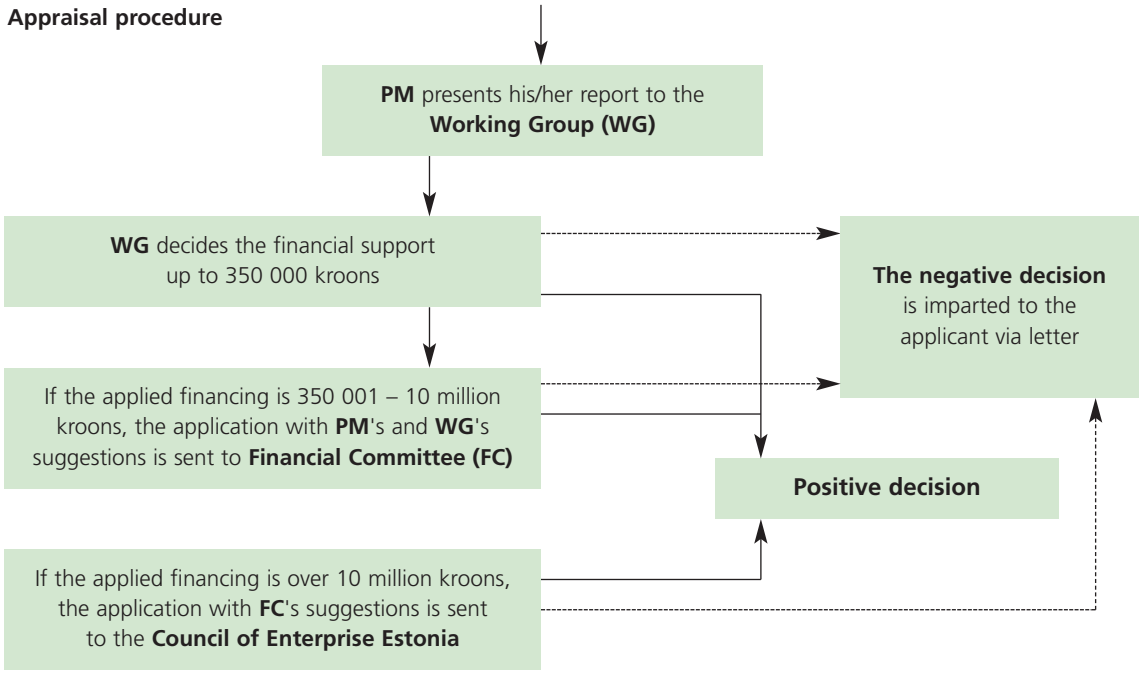
- The procedures described relate to all three schemes including the feasibility study scheme. Particularly for the latter this appears over-complex given the limited sum of grant funding provided to each individual project (100,000 EEK maximum);
- The work-load of the ESTAG project managers is added to by certain procedures and their involvement in certain tasks which could potentially be carried out by other 'intermediaries'. In particular, the early stage advisory prior to the proposal submission could be "sub-contracted" to regional offices or external consultants;
- The system of approval of projects after the end of each stage by the various committees appears unnecessarily burdensome and risks delaying research particularly when a 'market window of opportunity' is being chased by a company.

Figure 3 ESTAG procedures for project applications and selection

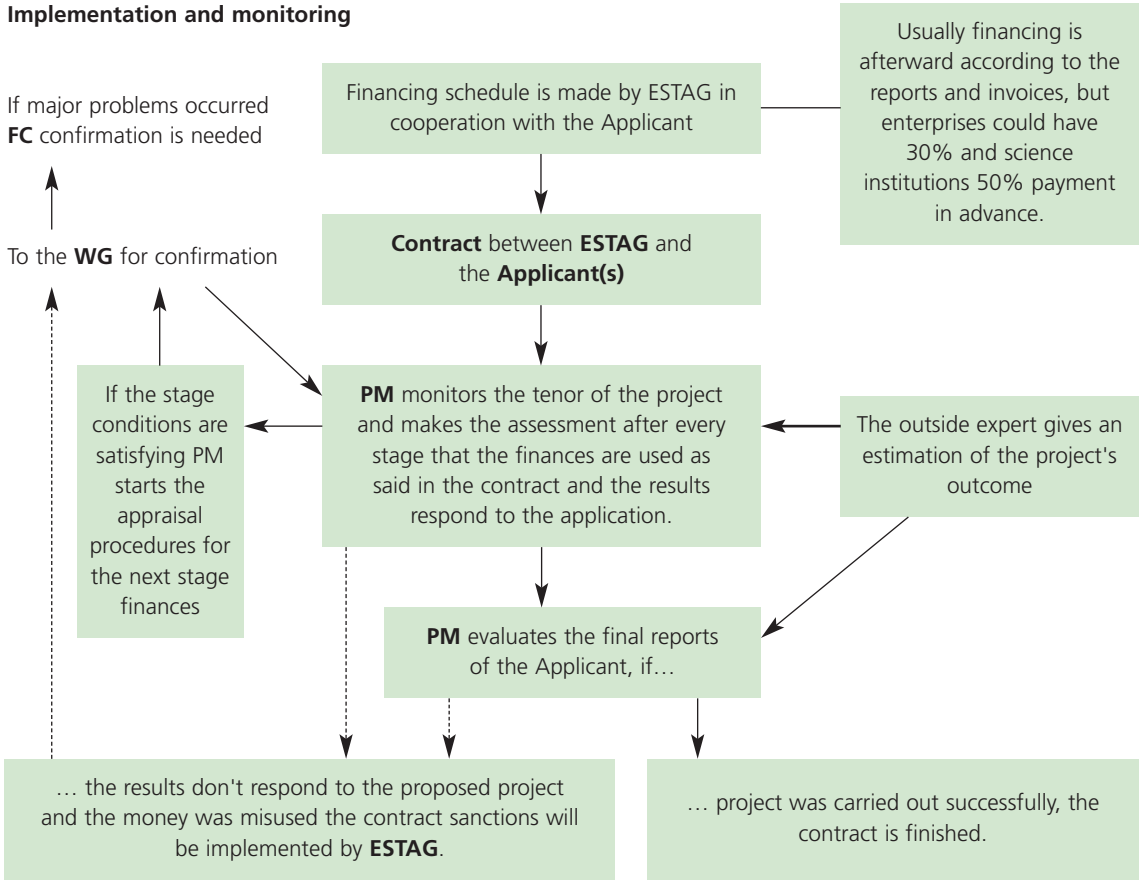
Pre-consultation and registration procedure



Appraisal procedure



Implementation and monitoring

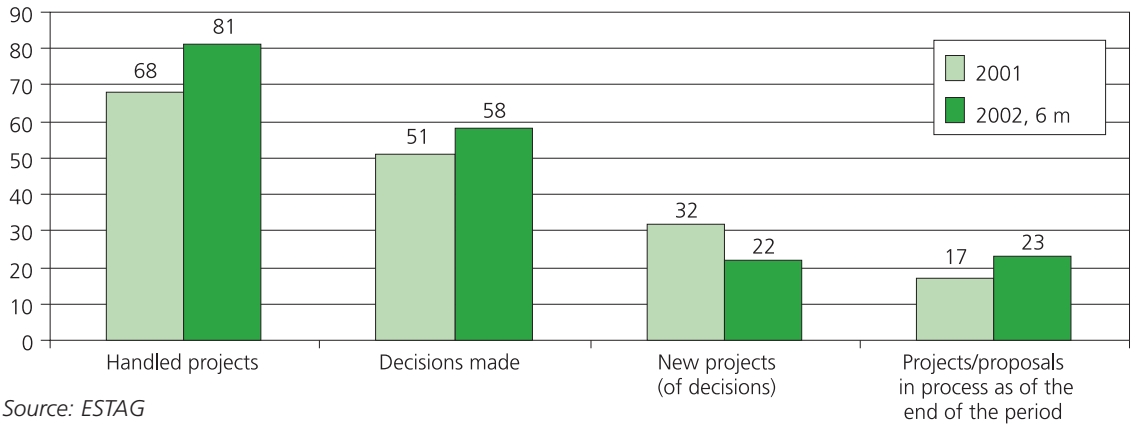


3.3 Overview of ESTAG funding during period 2001 – mid-2002

ESTAG began providing funding to enterprises and R&D institutions from 1 January 2001 (although the schemes seem to have been launched effectively as of the second quarter of 2001). The analysis of the data presented here therefore covers the year 2001 and the first six months of 2002. Accordingly, it is difficult to say anything meaningful about trends in ESTAG financing activities as the period covered is only 18 months.

The number of projects and the volume of financing was very hard to follow because of the lack of an integrated database within ESTAG (improvement in management information systems is a current priority of the organisation). The main difficulties occur with the projects that receive funding at the end of the project according to the actual costs on the bases of invoices. As a result, the funding applied for, accepted by ESTAG; and actually paid may be three different figures. Therefore, some degree of caution is required in interpreting the figures presented below. Moreover, given time constraints, **the gathered database is not perfect,** it could include some missing data and it is not harmonised with ESTAG internal accountancy numbers.

Figure 4 Number of 'projects' handled by ESTAG



Source: ESTAG

The figure above summarises the projects and proposals the ESTAG 'project working group' has dealt with since beginning 2001. The data is somewhat confusing since the **term 'project' here includes**:

- New proposals,
- Earlier projects (IF projects taken over by ESTAG) with difficulties,
- Proposals for changing the financed projects' contract conditions,
- Monitoring the ongoing projects for the next stage of financing.

In other words, a 'project' can be also a proposal or a current project requiring revision. The data indicates that the four project managers in ESTAG (one in Tartu and three in Tallinn) had a 'project workload' of 68 projects (about 17 projects per year per person) during 2001 and 81 during the first six months of 2002. In 2001, the 68 'projects' led to 51 recommendations for decisions being made with 32 new project decisions being amongst this total (the other decisions relating to changes to contracts conditions, etc.). A total of 17 decisions regarding projects were pending at the end of the year. It is quite clear from the figure that the workload in terms of projects/proposals has increased in 2002 with 58 decisions having been made in the first six months alone, leading to 22 new projects; 23 decisions were still pending from the first semester's activity. The lower ratio of new projects/decisions might suggest an increased workload in terms of modifying conditions, etc. of ongoing projects.

The above figures do not take into account the time required to deal with informal contacts, letters, requests for information or preliminary proposals which the ESTAG project managers underlined are an additional important task.

Table 7 Project financing – comparison ESTAG & Innovation Foundation

	IF 2000	*ESTAG 2001*	*ESTAG 2002 (Half-year)*
No of new projects	18	32	22
Project costs	39,200,900	124,945,294	62,126,425
Average cost	2,177,828	3,904,541	2,823,924
IF/ESTAG financing	12,546,800	43,381,439	31,329,510
% of total costs	32	35	50
Loans	7,753,600	17,800,100	2,693,600
Grants	4,793,200	25,581,339	28,635,910
% of loans of total	62	41	8,6

Source: calculations expert team on basis of ESTAG data.

In terms of the overall funds disbursed, table 7 underlines that **the advent of ESTAG appears to have led to a sizeable increase in funding levels and number of projects** with respect to the last year of Innovation Fund activity. However this comparisons is somewhat misleading since it is clear from the trend figures for the IF over the period 1991–2000 that the last year of operation was one of exceptionally limited activity, due no doubt to uncertainty over the future of the Foundation.

Between 1993 and 1997, the IF was paying out an average annual total of 20 MEEK in grants and loans to on average 33 projects (hence an average level of financing per project of 625,000 EEK). In 1998, project financing jumped to a level (close to 46 MEEK disbursed to 53 projects) in excess of the ESTAG result for 2001; the reasons for this exceptional result are not known and funding levels fell back to 20 MEEK in 1999. The average annual activity for the period 1998–2000, gives an average number of projects per year of 32 with an annual average payout of 26 MEEK. Hence, the conclusion that the creation of ESTAG has led to an increase in State support for applied R&D and product development seems justified.

Most significantly, the average level of support per project has increased by 39% in the first year of ESTAG operation; compared to the average for the IF during the period 1998–2000. It would seem a fair conclusion that **this has allowed those enterprises and R&D institutes supported to undertake projects with a greater critical mass of resources and/or at a faster rate**.

As far as enterprises are concerned, the client-base of ESTAG is composed of mainly small and medium sized enterprises with only 2–3 large companies, the same pattern was visible within the client base of the IF. Importantly, on the basis of the data for the first 18 months, **it cannot be concluded that certain enterprises or institutions have monopolised the schemes**; only approximately one third of applicants have had previous contracts with ESTAG or the IF.

In order to consider, whether the creation of ESTAG has led to a change in focus or targeting of activity, the table below provides a breakdown of financing decisions by activity field.

Table 8 Financing decisions by activity field

	IF 2000	*%*	*ESTAG 2001*	*%*	*ESTAG 2002, (half-year),*	*%*
Bio-, foodstuff technology	2,150,000	17,1	17,000,000	36	6,882,030	22
Product-, material technology	4,748,600	37,9	10,300,000	22	14,415,400	46
Chemical technology	1,860,000	14,8	5,400,000	11	56,250	0,2
Info-, communication technology	1,236,000	9,9	4,500,000	9	2,050,000	7
Other	2,552,200	20,3	10,400,000	22	7,925,830	25

Source: ESTAG annual report 2001 and calculations expert team on basis of ESTAG and IF data.

Once again the comparison is not ideal, it would be more relevant to compare the average for the IF over the period 1998–2000, however, it would suggest that ESTAG funding in the initial 18 months of operation has been more dominated by projects in the field of biotechnology (food technology being relatively unimportant within the category). Product and material technologies have however increased their funding significantly notably during the first semester 2002; chemical technology appears to be taking a somewhat lower share while ICT is holding steady in terms of share. A breakdown of this data by NACE (industrial sector) code of participating enterprises as opposed to technology field would be instructive in terms of ESTAG penetration into specific sectors of importance for the Estonian economy (in terms of employment, etc.) and this data should be collected and presented in future ESTAG reports.

The efficiency of ESTAG in delivering the grant and loans schemes can be measured in a number of ways the most directly being the **uptake** or disbursement available project funding. The table below summarises the situation in terms of budget utilisation for the year ending 31/12/2001 and the half-year until 30/6/02.

Table 9 Breakdown of budget by type of support and take up rates

Budget utilisation	*2001*	*2002*
Total budget		As of 30/6
Available	81,400,000	97,636,000
Utilisation (EEK)	47,555,647	31,329,510
Utilisation rate	58.4%	32.1%
Product development of enterprises		
Available	57,400,000	39,054,400
Utilisation (EEK)	30,139,389	5,671,625
Utilisation rate	52.5%	14.5%
Applied research		
Available	21,000,000	56,628,900
Utilisation (EEK)	17,062,533	24,512,385
Utilisation rate	81.3%	43.3%
Feasibility study grants		
Available	3,000,000	1,952,700
Utilisation (EEK)	353,725	1,145,500
Utilisation rate	11.8%	58.7%

Source: ESTAG data – calculations study team

As can be seen from the above table, the average utilisation rate of the ESTAG budget for project financing in 2001 was 58%. However, there was a significant difference between the relatively good utilisation rate of the budget for applied research funding for R&D institutes; the lower rate of utilisation of the available budget for product development in enterprises (approximately half the available budget); and the extremely low rate of utilisation of the feasibility grants scheme.

The half-year figures for 2002 are not particularly encouraging. A number of remarks are worth highlighting:

- a significantly larger overall budget (20% increase on 2001) is distributed amongst the three types of instruments in a markedly different manner: some 60% of funding is allocated to applied research of scientific institutions in 2002 compared to only 26% in 2001 and some 40% to product development in enterprises compared to 71% in 2001.
- Compared to the funding disbursed in 2001, the amount available for product development of enterprises has increased by 30%; while the amount available for applied research by scientific institutes has increased by 232%. The increase in the amount available for product development would seem reasonable given that 2001 was the first year of operation and hence an increase could be expected as the agency became more visible to enterprises. The 'dramatic' change in the funding available for applied research is apparently due to known project applications in the pipeline at end 2001.
- In terms of utilisation rates, by the mid-point of the year, only 14.5% of the budget for product development of enterprises had been consumed; while some 43.3% of the applied research in scientific institutions had been spent. In the latter case this already represents a 44% increase on the funding allocated for the same purpose in 2001. The very low rate of utilisation of product development funds was explained in interviews by ESTAG as being due to enterprise activity being more intense in the second semester of the year. However, the half-year figures for 2002 do give cause for concern in terms of absorption capacity.
- The most encouraging trend that can be seen between 2001 and 2002 is the sizeable increase in both total expenditure and the utilisation rate (close to 60%) for the feasibility study grants scheme. After a very low level of funding of such grants in 2001, the level of funding is already some 224% greater at the half-year point in 2002 than for the full year 2001. This is positive in terms of the number, and one would expect quality, of projects that will then be presented for full funding under either the product development or applied research schemes if not in the second half of 2002, then by 2003.

3.4 Appraisal of individual support schemes

As the period of 18 months does not allow a relevant comparative analysis by year the support schemes are described on the basis of the whole sample of possible data.

3.4.1 Feasibility studies

As mentioned above feasibility study grants are more and more favoured by ESTAG. If we look at ESTAG's budget utilisation then in 2001 only 12% of feasibility study finances were used, but in the first six months of 2002, some 59% of the available annual funds have been used. This means that one third of proposals in the first semester of 2002 were financed by feasibility study grants – half of these grants were applied for by clients themselves, half were imposed by ESTAG with a view to improving the quality and design of proposed projects. It is too early to be certain about the effectiveness of the feasibility grant scheme in raising the quality and capacities of enterprises to submit full proposals; but in 2002 out of five proposals of the enterprises' with previous contracts, three were feasibility grants from previous year.

Most of the feasibility grants are smaller than 100,000 kroons and financed after completion on the basis of invoices. However, the feasibility study grants provided for technology park creations are included in the total, and these have much higher costs. During the period examined, 12 feasibility grant applications were handled (8 from enterprises and 4 from institutions) and 9 were accepted for funding. The average funding per project was 100,747 kroons; if the 620,000 kroons grant for the bio-technology park feasibility study is not included. In addition to the applications submitted, 10 more proposals for applied research or product development were obliged to pass by an initial feasibility stage with funding up to a maximum of 100,000 kroons.

3.4.2 Grants and loans for enterprises

In total there were 46 new project applications from enterprises during the period January 2001 to 30 June 2002[16]. In this total of 46 application are included the 8 feasibility grant applications and also one applied research and one product development research proposal applied for additional feasibility study funding. The other applications were divided as follows between the types of projects: 5 for applied research, 16 for applied and product development, and 17 for product development project financing. There was 4 joint applications, all the mixed type (applied research and product development) projects and from 2001. In these cases the co-applicant was the research institution and the work was divided roughly so that research part was done by institute and product development part by the enterprise.

Table 10 Applications from enterprises handled by ESTAG

Type of project	*Feasibility grants*	*Applied research*	*Applied research & product dev.*	*Product development*	*Total*
Number of applications (AP)	**8**	**5**	**16**	**17**	**46**
Total costs of AP	2,501,016	45,211,000	88,444,200	70,334,203	206,490,419
Sum applied from ESTAG as grant	1,388,550	15,798,000	26,954,250	12,548,631	56,689,431
% of total costs	56	35	31	18	28
Sum applied from ESTAG as loan	–	5,500,000	17,918,000	16,533,195	39,951,195
% of total costs		12	20	24	19

Source: ESTAG data – calculations study team

Considering the scale of project proposals by type (applied research, applied & product development, product development), then while the average cost for all projects was 5.4 MEEK, the most costly projects were applied research projects with 9 MEEK on average; followed by mixed projects, 5.5 MEEK; and then product development projects with 4.1 million EEK on average.

[16] *Applications concerning the requests for the changes in the previous contract conditions are not analysed here.*

Turning to the ratio of selected to rejected proposals: six out of eight feasibility grant proposals were accepted, while no applied research projects were selected (one proposal was given a feasibility grant). The highest ratio of applications to approvals was for joint applied research and product development support projects (15 out of 16) perhaps suggesting that ESTAG views this combination (where enterprises are working with a research institute) as the 'safest' option, or simply reflecting a greater involvement of research institute staff in preparing proposals.

Table 11 Enterprise led projects approved by ESTAG

Type of project	*Feasibility grants*	*Applied research*	*Applied research & product dev.*	*Product development*	*Total*
Projects approved (PA)	**6**	**1**	**15**	**11**	**34**
Total costs of approved PA	2,267,683	12,043,000	87,637,900	62,535,865	164,484,448
ESTAG financing grants	1,037,975	65,512	14,819,600	3,122,075	19,045,162
Share of total costs of PA %	46	0,5	17	5	12
Share of applied sum, %	75	0,4	55	25	34
ESTAG financing loans	–	–	13,148,600	8,045,100	21,193,700
Share of total costs PA, %			15	13	13
Share of applied sum, %			73	49	53
Companies own financing	270,668	–	23,826,450	24,917,424	49,014,542
Share of total costs, %	12		27	40	30
Co-financing	800,000	5,145,000	26,408,500	12,940,000	45,293,500
Share of total costs, %	35	43	30	21	28

Source: ESTAG data – calculations of study team

A partial explanation for part of this gap is that some of the projects were given feasibility grants, and later they may receive funding for the next stages of the project leading to a rise in the ESTAG contribution. Moreover, the effect on the overall scale of the projects due to the gap between requested and actual contributions is very limited. The ratio of total cost of all approved projects compared to budgets of proposals is 80%; and is significantly lowered by the few applied research projects accepted. Indeed, **the average cost of approved applied research/product development and product development has actually risen after acceptance of the projects** (5.8 MEEK and 5.6 MEEK respectively).

The table below summarises the actual 'aid intensity' (this should be taken as an approximate calculation and does not necessarily correspond to the net grant equivalent as defined under EU State Aid rules) with respect to the maximum possible aid intensity under the schemes. The highest aid intensity is for feasibility studies amounting to 46% of eligible cost of approved projects however this falls far short of the potential level of support.

Table 12 Possible versus actual aid intensity of ESTAG financed projects

Scheme	*Maximum aid intensity*	*Aid intensity 2001–02*
Feasibility studies	75%	46%
Applied R&D/ product dev.	Applied R&D loans up to 75% Applied R&D grants up to 50% (exception up to 75%).	32%
Product development	product development grant up to 25% (exception up to 50%) product development loans up to 75%.	18%

Source: calculation of study team

As might be expected, applied R&D / product development projects receive a higher level of aid (these projects being considered as being further from the market commercialisation) than pure product development funding. However, in both cases, the level of funding is well below the maximum allowable aid intensity[18].

[17] *Feasibility grant was given; also to 4 product development projects.*

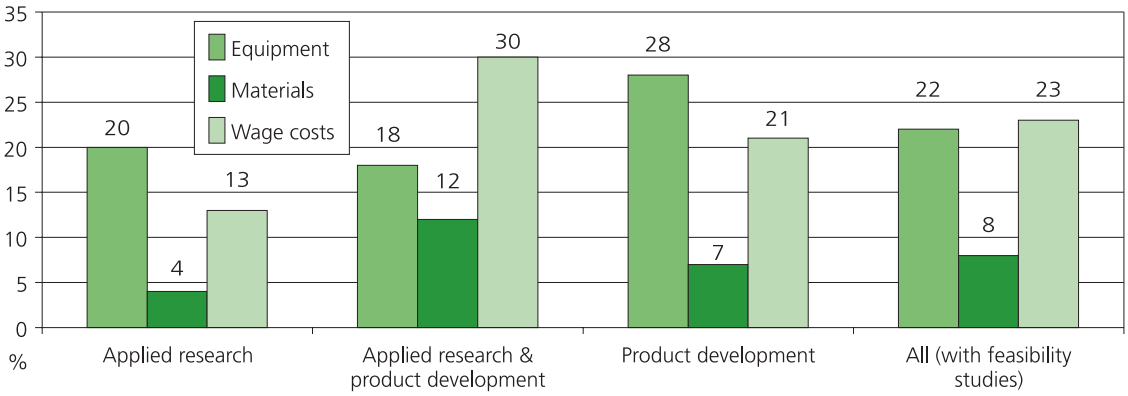
[18] *Some applied research loans could be included in the total volume of given loans, as many projects have characteristics of both type of projects The database does not distinguish properly the money given to applied research from the one given to product development.*

In line with ESTAG's policy, applied research/product development projects receive a higher share in the form of grants; and pure product development more in the form of loans.

One third of enterprises had co-financing partners (bank loans or other companies) with such co-financing accounting for 28% on average of total costs of the approved projects. Accordingly the own financing capacity of the enterprises was on average 30%.

Considering the cost breakdown, the largest share of project costs (see figure below) were divided between wage costs (with taxes), equipment and bought services (respectively 23%, 22% and 25% of total costs). Almost half of services were bought from R&D institutions. The share of equipment costs was highest among mixed projects and lowest among applied research, feasibility studies did not include expenditure on equipment. Expenditures on materials are rather low compared to the other costs, whereas expenditure on equipment seems rather high.

Figure 5 Distribution of project costs – Enterprise led projects



Source: ESTAG data, calculations by study team, Data according to the project applications (not financed projects).

Some three-quarters of the applicant firms were small with less than 50 employees; moreover, two-thirds of the small firms had less than 20 employees. Only three enterprises had more than 250 employees. One-third of the applicants had previous contracts with ESTAG or IF, some of them were finished and some of them were still ongoing (at least the payment). All five applicants of the 2002 who had previous contracts, have had these with ESTAG from 2001. Two of these had been the feasibility study grants, which were finished successfully and had developed into full-scale project proposal. Three were ongoing applied research projects.

The applicants of 2001 had previous applied research projects from 1999 and product development projects from 1995, 1998. The database is so small to conclude anything about firm's absorption capacity in terms of the capacity to complete projects on time and begin new projects. However, if the applications that deal with the changes of the payment conditions are considered, it is evident that a number of companies are finding the loans a burden since they are requesting a longer stay before beginning repayment or lower interest rates. This is particularly true of the interest rates of the former IF projects which are relatively high (10%); even compared to current commercial loan conditions. The same does not seem to be true for the new ESTAG projects where the average repayment period of the loans was 4.7 years with the stay before beginning repayment of capital being on average 17 months. The average interest rate of the ESTAG loans was 3.4%, which is below current commercial rates.

3.4.3 Grants and loans for science institutions (universities, institutes)

ESTAG handled 27 new project proposals of science institutions during 2001 and first half of 2002: 4 of them applied finances for feasibility study, 18 for applied research, 4 for applied research/ product development projects and one for product development. Out of this total, six of the applied research proposals were application for funding for the next stage of a previous project; and altogether 16 applicants had former contracts with ESTAG or IF. So it could be concluded that grants for science organisations are more occupied by certain clients than enterprises' grant schemes.

The dates of the former projects varied a lot – from 1996 to 2001, but most often year 1999 emerged. In many occasions the previous project contracts concerned the previous stages of the study. As some projects (like plant biology and related issues) require long time horizons (4–6 years), the projects are divided into stages and after every (or some) stages new proposal will be applied.

There were 2 joint project applications, one of them international.

Table 13 Science institutions' applications handled by ESTAG

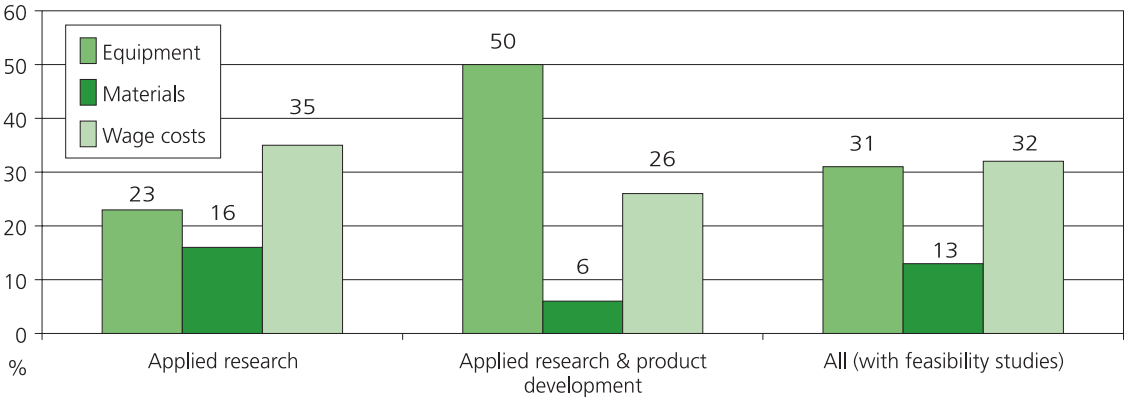
Type of project	*Feasibility grants*	*Applied research grants*	*Applied research & product dev. grants*	*Product development*	*Total*
Number of applied projects (AP)	**4**	**18**	**4**	**1**	**27**
Total costs of AP	3,654,634	92,387,125	29,154,100	245,000	125,440,859
Sum applied from ESTAG	988,000	47,939,741	15,484,500	160,000	64,572,241
% of total costs	27	52	53	65	52
Nr of AP-s approved by ESTAG	3	17	3	0	23
Total costs of approved AP-s	**547,000**	**91,773,125**	**27,169,600**	–	**119,489,725**
ESTAG financing	**388,000**	**28,960,011**	**13,203,830**	–	**42,551,841**
Share of total costs of approved AP-s, %	**71**	**32**	**49**		**36**
Share of applied sum, %	39	60	85		66
Applicant's own financing	159,000	6,817,840	1,363,600	–	8,340,440
Share of total costs, %	29	7	5		7
Co-financing	–	39,881,214	11,710,000	–	51,591,214
Share of total costs, %		44	43		43

Source: ESTAG data, calculations by study team

The average cost of applied projects was 4.6 million kroons and from ESTAG 52% of the expenditure coverage was asked. ESTAG financed 65% of applied sum, and 23 projects. But some of the applied research projects got the feasibility grants (5 cases).

In the case of science institutions the mixed type projects are more expensive on average than only applied research projects (it is not possible to compare product development as only 1 application was in the list). One third of the project costs concerns wage costs and another third of expenditure was on equipment (see the figure below). If enterprises spent 25% of the project's budget on services from other companies and organisations, then science institutions' budgets include only 8% costs for bought services.

Figure 6 Distribution of project costs of science institutions



Source: Data according to the project applications (not financed projects).

Also science organisations spend a lot of money on the new equipment. As to the smaller share of equipment costs and higher materials costs of the applied research projects, it can be explained by the circumstances that this type of projects included very many proposals from different institutes of Estonian Agricultural University that dealt with plant breeding.

3.5 Overall appraisal with respect to evaluation criteria

Relevance to policy objectives

The objectives of the three schemes are clearly linked to the overall policy objectives of the Government and Ministry of Economic Affairs to increase business expenditure on R&D and achieve a better balance of ratio of basic/applied research. However, the scope of the three schemes remains rather focused on 'research performers'. There is a need to widen the scope of public funding for business RTDI projects towards enterprises more involved in technology transfer than technology development. The latter involves a requirement for training of staff in companies, which may require a greater linkage with human resource development measures under the European Social Fund (ESF).

The inclusion of the schemes, including additional or complementary funding schemes such as mobility measures, with in the RTDI measure can be recommended but absorption of the additional funds thus made available will require some widening of eligibility criteria and focus of schemes.

Relevance of the design

The **eligibility criteria** are relatively standard and leave a fair amount of flexibility for the enterprises as to what can be funded under the schemes, from equipment to labour costs. The analysis suggests that a fair amount of expenditure goes on equipment underlining the importance of technology transfer/acquisition of equipment within the innovation practices of Estonian firms.

The delivery of the schemes through ESTAG is relatively well managed although the workload of the project managers would seem to be added to by a certain degree of 'micro-management' of the projects.

The main weakness of the delivery system is the absence of pro-active knowledge 'scouting' in firms. Neither ESTAG or the few existing "innovation centres" appear to have the staff numbers or capabilities (trained personnel) to effectively organise in-company visits, technology audits, etc.. The result is that both public agencies and existing and potential innovation intermediaries have little grasp of the needs of firms beyond the few 'high-tech' start-ups and major firms already undertaking some R&D activities. This situation needs to be modified if the uptake of the schemes is to improve and one option for the Structural Fund measure would be to fund an expanded feasibility study programme. The 'scouting' role is one not necessarily best incorporated in the central offices of ESTAG and could be 'sub-contracted' to a network of accredited innovation intermediaries part funded to carry out a certain number of company visits-per-year (with appropriate performance indicators such as number of proposals for ESTAG funding arising).

Efficiency:

In terms of the uptake of the scheme, the main conclusions are as follows:

- The creation of ESTAG has led to a sizeable increase in funding levels and scale of projects for both research institutes and enterprises;
- However, with respect to the available budget, there has been a significant under-spend in the first 18 months. Moreover, research institutes (81% of total funds available disbursed) have been absorbing funds faster than enterprises (52.5%);
- An encouraging trend is growth in spending on feasibility grants (+224% in 2002): should lead to knock-on effect on R&D projects;
- In terms of geographical spread, (ESTAG annual report 2001) Tartu County followed by Tallinn clearly dominate. This is an expected result given the concentration of research institutes in this area however it is unlikely to change the current pattern of innovation in enterprises where there is a clear performance lag of enterprises in the other regions of Estonia.

In terms of procedures:

- The rate of projects selected to proposals received is relatively important: 74% for enterprise projects; and 85% for research institute projects. This would appear to be due to filtering of some projects to other schemes within Enterprise Estonia but also reflects the relatively low number of project proposals received with respect to funds available;
- ESTAG aims to provide a reply on a decision following proposal submission within three months – this would seem to be an average with some projects taking longer and does not include the time to negotiate contracts;

Effectiveness:

Effectiveness assesses the extent to which outputs contribute to immediate objectives; or to put it another way **the performance of scheme in meeting targets**. This can be assessed in terms of the number of completed projects or the immediate results achieved in terms of improved performance of the organisation that received support.

The main indicator used by ESTAG in assessing its performance is the ratio of ESTAG project financing to co-financing it 'leveraged' out of private sector. In its' 2001 Annual report ESTAG claims that "every 32 cents given by ESTAG brought 1 kroon to the project" from other sources. This was for all projects (R&D institutes and company led).

Two questions can be raised with respect to effectiveness:

- How strong is additionality? This can be looked at in terms of aid intensity (are the maximum thresholds being applied, how much funding is being leveraged by the ESTAG contribution). In this respect, the figures presented above are positive to the extent that the question of whether ESTAG could not be investing more is raised;
- The ratio of normal versus high risk (but equally potentially high return) projects? This is more difficult to assess but the incentive effect of schemes is a key criteria of the EU State Aid Framework for R&D. There is some hint from the figures that the riskiness of the projects is not necessarily very high since enterprises appear to have access to private co-financing of on average 28%. High risk projects would most probably find it difficult to raise such capital.

The somewhat conflicting conclusion that arises is that ESTAG is achieving a good rate of leverage of non-public funds but that this may be the result of the acceptance of "lower risk" projects (as was indeed suggested in some interviews).

The analysis also suggests that ESTAG funding supports 'technology transfer' (equipment acquisition) in enterprises and to some extent this should be a more explicit objective of the funding schemes given the needs of Estonian industry to raise productivity.

Impact and sustainability:

At this stage, after 18 months, there is no possibility of assessing impact of the ESTAG schemes on the performance of the companies assisted. ESTAG requires firms to provide in the application forms, baseline data on business performance and to make an estimation of the expected impact (turnover, exports, jobs). This should facilitate tracking of performance impact in the coming years. Sustainability of the impacts will depend on:

- Expanding the current client base which is too limited (the ratio of new to existing clients being a key indicator – currently relatively positive with only a third of existing clients in total);
- Increasing average size of projects. The analysis above suggests that the creation of ESTAG has had a positive effect on the scale of projects being funded (compared to the previous Innovation Foundation);
- Increasing the absorption capacity of existing client firms (in terms of the frequency of 'repeat business' from companies which have previously received grants or loans from ESTAG);

All of the above requires support in the form of training, consulting for the integration of new technologies, certification procedures, etc., which on the basis of interviews appear to be in short supply in Estonia.

It would be useful in order to obtain a benchmark for measuring impact for ESTAG, or an external expert, to carry out an in-depth assessment of the IF projects in the portfolio most of which it can be assumed will be concluded in the coming year or so.

In terms of the applied research projects of research institutes, the obligation for universities and research organisation to have at least two industrial partners seems most likely to lead to demonstration effects and an improvement in the relevance of applied research being carried in the scientific community. However, a number of research projects appear to fall into a grey-zone between fundamental and applied research.

Summary of assessment: ESTAG Feasibility Grants

Evaluation criteria	*Key findings*	*Rating*
Efficiency	■ Procedures for scheme are too heavy with respect to level of funding provided (de minimis, up to 100,000 EEK)	Weak
Effectiveness	■ Feasibility grants have led to a reasonable number of full proposals for R&D funding	Satisfactory
Impact/spill over effects	■ The number of feasibility grants is at present too limited to generate a real demand for other ESTAG schemes	Weak
Sustainability	■ Without a pro-active marketing of the scheme and a simplification of procedures the scheme is likely to remain known to only a limited number of firms	Weak
Relevance	■ Highly relevant to current innovation policy objectives aimed at increasing research intensity ■ Potential to extend the scope to tackle broader range of innovation related issues in companies	Good

Summary of assessment: ESTAG Grants & loans to enterprises

Evaluation criteria	*Key findings*	*Rating*
Efficiency	■ Uptake of available funding well below budget ■ Co-financing rates are lower than maximum thresholds ■ Limited number of clients at present time although no evidence of 'monopoly'	Satisfactory
Effectiveness	■ Additionality and incentive effects may be low given enterprise to ESTAG financing ratio ■ Increase in scale of individual projects	Satisfactory
Impact/spill over effects	■ Too early to estimate impact ■ Currently little possibility of demonstration or spill-over effects given limited number of clients	Weak
Sustainability	■ Co-financing capacity of companies (own or partners contribution) appears sufficient.	Satisfactory
Relevance	■ Main focus is on applied research/product development projects – objective of increasing co-operation between research and industry ■ Limited focus on technology transfer/development linked to process and productivity improvements	Good

Summary of assessment: ESTAG Grants and loans to R&D institutes

Evaluation criteria	*Key findings*	*Rating*
Efficiency	■ Much higher aid intensity than for enterprise led projects ■ Share of equipment is relatively high in project costs	Satisfactory
Effectiveness	■ High share of equipment costs in projects of R&D institutions suggests ESTAG is acting as surrogate financier of R&D infrastructure	Satisfactory
Impact/spill over effects	■ The obligation introduced by ESTAG for each project to be supported by at least two industrial partners is a significant improvement ■ Number of applied research projects leading to commercialisation of results & product development projects to be monitored	Weak
Sustainability	■ Very low co-financing capacity of R&D institutes	Weak
Relevance	■ Scheme is relevant to policy objectives but duration of certain projects would suggest they are closer to fundamental than applied research	Satisfactory

Summary of issues arising with respect to Structural Fund programming

- The current uptake of available funds for the ESTAG grants and loan schemes would not appear to give much scope for a major increase in funds through co-financing under the future SPD. The absorption capacity of the current client base is rather low but there appears to be a larger pool of companies investing in research or innovation which ESTAG is not currently reaching.
- The levels of uptake may at least in part be due to the capacity of ESTAG to administratively deal with more projects. Four project managers being responsible for all phases of the project cycle and with extensive 'coaching' of projects being carried out.
- This supply side element is allied to the absence of any awareness raising, guidance or competence raising activities in enterprises, which clearly means that there is little stimulation of demand. So the development of the Innovation Awareness Programme in the coming years may assist in generating greater demand.
- Equally, the creation of a scheme enabling enterprises to hire additional personnel specialised in technologies or management of innovation projects could also generate a greater uptake of the existing grant and loan schemes. Plans for such a scheme could be ready by end 2003.
- Although ESTAG claims to focus on product development, a large share of costs do seem to be going to equipment. This may be partly explained by relative costs of labour (Estonian cost) versus equipment sourced on international markets at international rates. It may also suggest that a larger amount of funding is actually being directed towards technology transfer. This would be in line with the Estonian CIS results which found that most of the innovation activities of the enterprises are on the implementation of new technologies. If this is the case, an additional scheme aimed at financing the purchase and implementation of 'new' technologies – embodied technology transfer may be an option.

4 Conclusions and Recommendations: Structural Fund Support for RTDI

The conclusions and recommendations of the Report are structured in two sections. In the first, the conclusions with respect to each of the main questions posed in the terms of references are summarised and recommendations proposed to the Ministry of Economic Affairs and Communications and other authorities.

4.1 Response to the questions set by the terms of reference

Questions from Terms of Reference:
- Whether the current portfolio of instruments is appropriate and takes into account the characteristics of the enterprise sector in Estonia?
- Which complimentary measures need to be developed in R&D and innovation field to guarantee the full services package for enterprises and R&D institutions?
- Which are the inter-related policies and instruments that must be focused on?
- Which of the instruments currently in the ESTAG portfolio will be eligible for EU Structural Funds?
- Which kind of adaptations must be made in the portfolio of instruments in relation to EU requirements?

Is the current portfolio of instruments appropriate taking into account the characteristics of Estonian enterprises?

The analysis carried out by the project has clearly identified a number of inconsistencies, or gaps, in the current portfolio. Almost all existing measures are targeted at 'research-intensive enterprises' (those with an R&D unit) or at best technologically competent firms (those with a number of engineers able to co-operate with external experts). The current focus of schemes being delivered by ESTAG is largely on product development, while the most common form of innovation of enterprises declared through the CIS was process related innovation (through the acquisition of equipment and technologies and related training). The result is relative mismatch between the pressing needs of enterprises to improve their productivity through process and organisational innovations; and the focus of ESTAG funding on applied R&D (and product development).

The fact that the number of individual enterprises benefiting from support (all three types of schemes) from ESTAG under the current financing schemes was only 26 by mid-2002 is symptomatic of this mismatch between orientation of the schemes and needs of the enterprises. Aside from the planned Innovation-Awareness Programme which can be expected to target enterprises which so far are not investing intensively in innovation, there are no planned schemes which in their current form would target enterprises who current in-house know-how limits their innovation activities to organisational or process issues.

Recommendation:
The Ministry of Economic Affairs and Communication needs to work towards a better balance in the portfolio of measures for promoting an increased innovation activity in enterprises. This could be achieved by decoupling the current feasibility grant scheme from the obligation to prepare an applied R&D or product development project. Extending the scope of the scheme to cover preliminary work on innovation management or aspects related to organisational innovation would be one option; this type of small grant could become a form of 'innovation cheque' which could be prescribed directly by a network of innovation intermediaries. This cheque could be used for funding technology audits or assistance for the design of a technology and innovation strategy for enterprises (which however in turn requires the precondition that a number of consultants or experts are trained and accredited as being expert enough in this field).

Which complimentary measures need to be developed in the R&D and innovation field?

The analysis has pointed to the need to develop at least three types of additional measures:
- Increasing the in-house capacities of enterprises to develop and manage innovation projects by part-financing the recruitment of additional staff in order to undertake the design, development and implementation of applied R&D, product development, process technology innovation and organisational innovation. A range of existing 'mobility' schemes in EU countries can be built on and there is a need to define

the scheme with the current capacities of enterprises, and resources of research institutes, in mind in order to avoid too narrow a focus on doctoral level scientists or engineers being encouraged to work in industry. On the contrary, the scheme needs to take account of the limited number of young scientists in Estonia and be flexible to allow masters level graduates to act as "knowledge carriers".

- The absence of early-stage capital for new technology-based firms, the so-called 'equity gap', has been analysed in a separate analytical paper prepared as part of this project. The scale of the Estonian economy and the estimates of the number of NTBFs likely to be spun-off from higher education or research institutes between 2002 and 2006 (approximately 50) means that any measure developed needs to be modest in ambition. The main objective should be to leverage additional private equity towards research-intensive start-ups through reducing the cost or the risks of capital and due diligence activities.
- The lack of sufficient intermediary organisations, both private and public, providing direct services to enterprises in relation to innovation is a major gap in the current system. There is need for further public support with a view to increasing the range of innovation related functions and services provided to enterprises. In particular, consideration should be given to expanding training and accreditation of a network of consultants or experts with a view to increasing pro-active consulting and advice to enterprises on technology and innovation. This network could play the role of programme promoters for the various ESTAG schemes at regional or sectoral level. In order to avoid creating costly and not-necessarily sustainable 'innovation centres', a cost-efficient approach could be to part fund technology guidance experts attached to existing organisation such as regional offices of Enterprise Estonia, industrial sector associations, higher education and research institutes, vocational schools, etc.. The funding should be provided in the framework of a contract with clearly specified targets in terms of number of enterprises visited/audited per year, number of project proposals prepared and submitted to ESTAG, etc..

Which are the inter-related policies and instruments that must be focused on?

Institutions providing training in new technologies for workforces of enterprises undertaking technology transfer/purchase are a crucial element in well-functioning innovation system. No analysis was conducted with respect to the range, supply of services and competence of such organisations (vocational, continuing and specialised training institutes). This is an issue that deserves more attention in future policy-related analysis (possibly in connection with the development of the Innovation Awareness Programme).

Which of the instruments currently in the ESTAG portfolio are eligible for EU Structural Funds

Following a review of procedures and operating rules, the expert team considers that all the current instruments in the ESTAG portfolio correspond to the requirements of EU Structural Funds. The issue is therefore more related to the criteria for selecting certain schemes for co-financing by the ERDF. A number of criteria can be proposed

- Contribution to policy priorities notably raising competitiveness of firms (value added, productivity, exports, growth, jobs).
- Additionality with respect to current framework, notably in terms of the additional expenditure which ERDF support can leverage from the Estonian public and private sector;
- Capacity of ESTAG (or other implementing agencies) to manage additional or expanded schemes;
- Simplicity and stability of support system (from business point of view);
- Complementarity (influence on spend rates of existing instruments).

Given the analysis conducted to date, it is fundamental that ERDF Structural Fund financial support should be prioritised towards the objective of increasing the competitiveness of enterprises. Schemes which contribute to the second key objective of 'updating the knowledge pool' should only be considered for eligibility for Structural Fund support in so as far as they lead to the creation of new knowledge and know-how (human resources) contributing to the primary objective of the RTDI measure through the transfer of knowledge and new technologies to the business sector. Funding of infrastructure or equipment for higher education or research institutes related to their teaching or fundamental research missions should not be eligible for Structural Fund support.

Recommendation:
Funding targeted at developing the research base and indirectly leading to knowledge creation related to economic development should be concentrated on a limited number of 'Centres of Excellence'. The current Centres of Excellence initiative needs to be re-designed in terms of objectives, delivery mechanisms, selection and evaluation procedures before it can be included effectively in the future RTDI measure of the SPD

The issue of which organisation will act as implementing agency for RTDI infrastructure projects should be addressed. Currently, ESTAG is the only organisation able to fulfil this role but this is not its main mission and could lead to limited human resources being diverted from enterprise orientated RTDI project funding.

4.2 Recommendations for the RTDI measure

4.2.1 Intervention logic

Recommendation:
Given the expected funding to be made available (approximately 50 MEUR over three years ERDF and national co-financing combined), the RTDI measure should focus on a limited number of schemes and major investment projects. The need for such schemes to be operational and ready to absorb funds before the advent of ERDF funding is primordial. Similarly only those RTDI investment projects which have already completed a feasibility study, corresponding to EU requirements for cost-benefit analysis should be considered, and with design work far enough advanced to begin construction works from 2004 onwards should be selected.

The expert team has worked closely with the Ministry of Economic Affairs and Communication in drafting the SPD SWOT, strategy and programme complement sections for the RTDI measure. On the basis of the analysis undertaken, a redefinition of the RTDI measure was proposed based on four main action lines each containing a number of potential schemes or investment projects:

Strengthening the knowledge base
- Establishing and reinforcing a network of research centres of excellence;
- Modernising research equipment and providing specialised facilities tailored to new technologies – exclusively in designated centres of excellence;

Financing RTD and innovation
- Support scheme for market oriented R&D projects;
- Advanced technology programmes in key areas;
- Seed and venture capital favouring technology intensive new entrepreneurship.

Strengthening the innovation system
- Creation and development of innovation and technology infrastructures;
- Support scheme for technology transfer and high-tech incubation services;
- Competence Centres Programme.

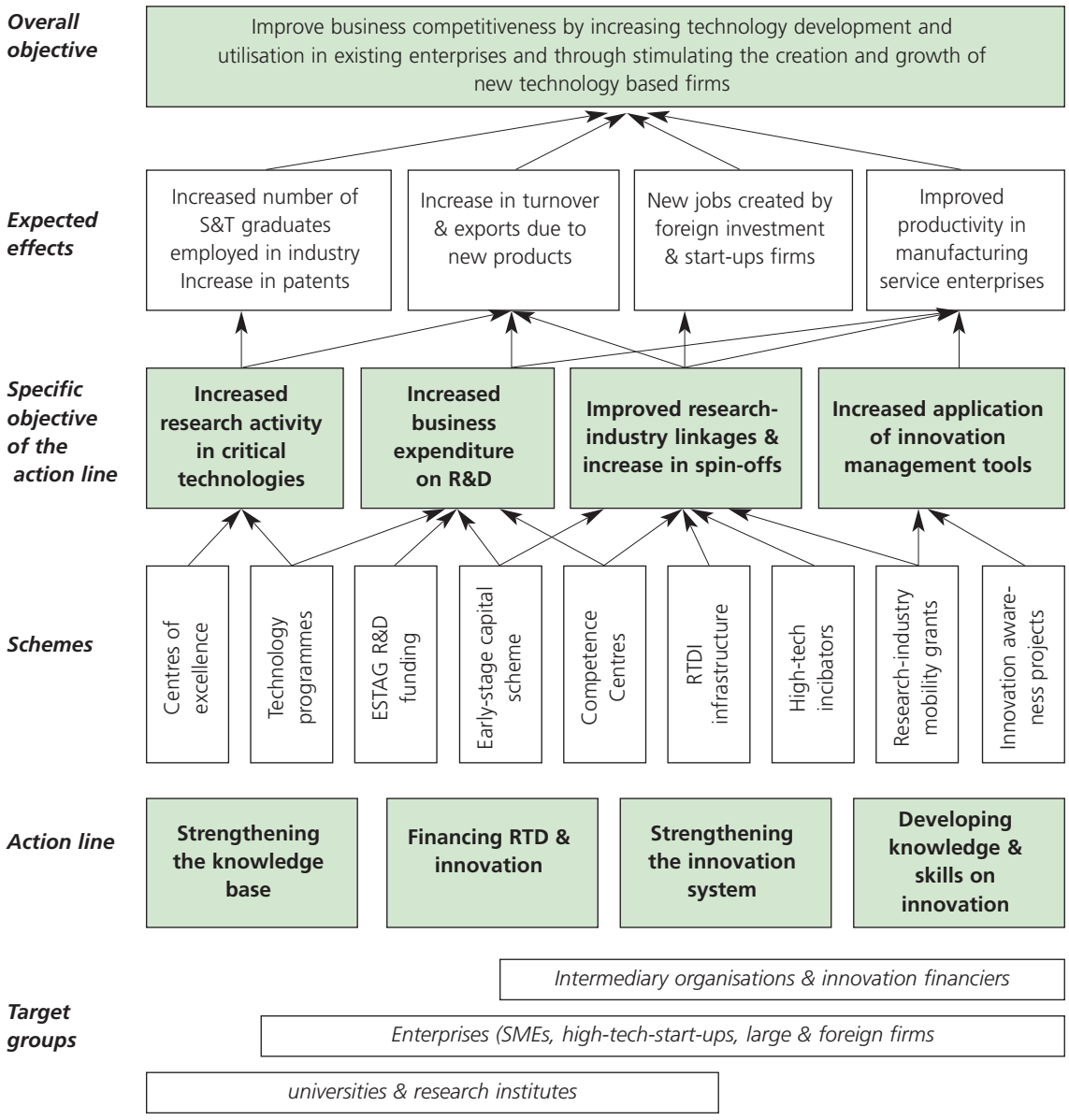
Developing knowledge and skills about innovation
- Innovation Awareness & Competence Programme;
- Technology diffusion and innovation guidance network;
- Support scheme for industry-research human resource mobility.

The intervention logic of measure, or the t**he link between the SWOT analysis and the proposed schemes and projects, is summarised in the table and diagram on the following pages.**

Relationship between SWOT analysis and measure and programme objectives for RTDI measure

Strength *What is the situation?*	***Opportunities*** *How can it be exploited?*	***Strategic Response*** *How will the measure address it?*	***Objective*** *Contribution to measure / SPD objectives*
Internationally recognised research excellence in a number of fields (e.g. biotechnology, materials, etc.).	Reinforce critical mass of human resources and research infrastructure in selected fields through inter-institutional and inter-disciplinary research programmes.	Targeted funding for Centres of Excellence Creation of targeted technology programmes.	Increase in high-level research activity, involvement of Estonian research teams in European Research Area and transfer of scientific results to economy.
Good share of 'innovative firms' in economy (CISIII survey) but still below EU average and with low rate of expenditure on innovation.	Leverage additional and faster growth of business expenditure on R&D.	Increase funding available from ESTAG to business R&D projects for product and process innovation.	Increase in number of research intensive enterprises in the economy / Improved rates of productivity and of sales from new-to-market products.
High rate of foreign direct investment (as % of GDP).	Assist FDI enterprises to develop or create R&D activities in Estonia and to establish co-operation in field of innovation with Estonian R&D organisation and enterprises.	Increased funding available to business R&D projects and creation of targeted technology programmes.	Increase in number of research-intensive enterprises. Increase in number of researchers and engineers in labour force.
High rate of expenditure on Information and Communication Technologies (ICT) (as % of GDP).	Need to further stimulate diffusion of ICT in enterprises and research on ICT products and solutions.	Development of targeted technology programmes.	Increase productivity in enterprise sector through integration of ICT in products and production processes.
Outdated scientific infrastructure and equipment and low level of scientific and engineering graduates.	Difficulty to participate to EU research projects and to attract or retain scientists and engineers in Estonia.	Selected support for a number of 'core' R&D infrastructure which can be exploited by research teams from more than one institution.	Increased quality of scientific output and attraction of additional research funding and researchers to Estonia / Improved qualifications in workforce.
Very low rates of co-operation between universities/research institutes and enterprise sector	Continuing low level of applied industrial research and weak diffusion of new technologies in economy	Creation of Competence Centres bringing together research units and enterprises in a medium-term co-operative research programme.	Increased co-operation and expenditure on applied research / Improved commercialisation of research results / Increase in sales from new-to-market products or services.
Absence of technology orientated business infrastructure.	Inability to attract high-tech manufacturing or service foreign direct investment.	Further development of technology park type structures up to the standards.	Increase in employment of in high-tech manufacturing and services / Increase in value-added, high-tech exports and income levels.
Lack of adequate facilities and services for technology based start-ups.	Slower development of high-tech start-ups and spin-offs.	Creation and extension of high-technology (pre-) incubation facilities.	Increased number of new-technology based firms / Increase in value-added and income levels.
Absence of early-stage (seed and start-up) capital for new technology based firms.	Low rate of commercialisation of research results through spin-offs.	Government support to stimulate private capital investment in seed-capital funds.	Increased number of new-technology based firms / Increase in value-added and income levels.

Strength *What is the situation?*	***Opportunities*** *How can it be exploited?*	***Strategic Response*** *How will the measure address it?*	***Objective*** *Contribution to measure / SPD objectives*
Limited number of innovation intermediaries providing technical support, management and training services.	Insufficient increase in number of innovative enterprises and diffusion of new technologies and management techniques.	Awareness raising and competence building actions in enterprise sector with view to increasing number of requests for ESTAG funding schemes.	Increased in number of enterprises undertaking innovation and technology projects and take-up of public funding / Increase in productivity, value added and incomes.
Low number of scientists and engineers in workforce.	Inability of enterprises to adopt new technologies and undertake R&D and manage innovation projects	Funding for mobility scheme between research organisations and enterprises aimed at both increasing number of industrial orientated PhDs and placement of specialists in enterprises.	Increase in number of enterprises undertaking innovation and technology projects and flow of knowledge between research community and enterprise sector.



It is our belief that the existing and proposed funding mechanisms will enable absorption of the planned funding within the lifetime of the programme and an expansion of the number of enterprises actively investing in RTDI activities. This outcome is conditional on the maintenance, and possibly extension of human resource capacities within the Ministry of Economic Affairs and ESTAG.

4.2.2 Target group of the RTDI measure

It is difficult to arrive at a precise figure for the number of companies currently or potentially liable to be interested in the funding schemes, managed by ESTAG, included in the measure. Recent reports[19] have been unable to put numbers on even the number of research performers although statistics on research expenditure from the Estonian Statistical Office, the CIS survey and the client base of ESTAG allow a somewhat more exact approach to calculating the potential "clientele" for the SPD RTDI measure. The table below summarises data available on firms undertaking research, development and innovation activities. Further investigation will be required in subsequent phases of the project. An important indicator for future measures to be funded under the SPD will be the number of new "clients" for ESTAG schemes (i.e. firms which have never previously secured funding for R&D or were non-R&D performers). The rate of repeat contracts by SMEs is also a good indication of the change in absorptive capacity within these firms (typically, smaller firms take longer, due to financial and human constraints, to absorb new technologies).

Estimations of potential "client base" for R&D and innovation measures

Indicator	*Number*	*Comment / source:*
R&D performing firms	974 (1999)	Sub-set of sample of statistical office on basis of firms declaring R&D expenditure (total sample 9894 in 1999)
Client base of innovation relay centre (ESTIRC)	270	ESTAG annual report 2001
Firms identified in database of Enterprise Estonian as potentially interested in ESTAG schemes	+/- 200	Interview ESTAG – criteria: existence and size of company R&D potential
Firms concluding financing agreement with ESTAG	26 (2001–2002)	Data from ESTAG projects
% of Innovative firms (98–00)	35.7%	Community Innovation Survey

From the above table, the number of firms actively engaged in R&D or innovation varies in percentage terms between 10% (R&D questionnaire based on enterprises reporting R&D costs) and more than one-third of all firms (Community Innovation Survey methodology). In numeric terms, the lowest estimation would be about 200 firms interested in ESTAG schemes up to almost a 1000 R&D performing firms. On this basis, **it would seem that the number of funding agreements of ESTAG in 2001/2002 leaves considerable room for expansion in the scope of activities towards new firms.**

Recommendation:
A principle objective of the RTDI measure should be to increase the number of enterprises benefiting from direct support (grants, loans or equity financing) or indirect support (advisory and consulting services, etc.) provided through ESTAG schemes. A broader sectoral coverage with an increasing penetration of leading enterprises in each of the main industrial sectors should be encouraged. At the present time, the applied R&D/product development focus and the "technology sector" focus of ESTAG makes it difficult to develop actions aimed at technology transfer in specific industrial sectors (notably the 'traditional sectors').

[19] *The 2000 report of Hernesniemi proposed a classification of Estonian firms according to technology needs and sources (based on interviews with only 10 firms); while the High-Tech Venturing report (2001) and Competence Centre Feasibility Study (2002) of Technopolis adopt the "competence stairway" model20. However, the "empirical findings" (sic) on the Estonian competence stairway (based on interviews with 26 firms) offer no quantitative insight into the potential client base for existing or expanded programmes of ESTAG.*

Other organisations listed in the target group of the RTDI measure have been defined in in a relatively broad manner (universities, innovation support organisations, etc.). At the same time, it is clear from the analysis carried out in this project that there is currently a very limited constituency of intermediaries liable to submit projects to the schemes (investment or soft measures). The lack of such intermediaries is in turn a main explanatory factor for the small number of firms currently making use of ESTAG grants and loan schemes.

Recommendations
The current planning of the Innovation Awareness scheme should take into account the need to improve the capacity of sectoral business associations, vocational colleges and other 'non-core' stakeholders to begin to play a more active role in stimulating enterprises to undertake innovation projects.

4.2.3 Financial planning and project selection

The financial projection included in the SPD is based on the assumption that the RTDI measure will absorb 55% annually of the planned funding allocated to the Competitiveness priority. This implies that a choice needed to be made between the inclusion of certain schemes or projects and the phasing of the expenditure (it may be more realistic to assume a more stepped progression in absorption capacity over the three years). While the increase in funding made available for RTDI in Estonia will be considerable (doubling at least the current funding provided through all ESTAG schemes), the view of the expert team is that the current financial plan is credible.

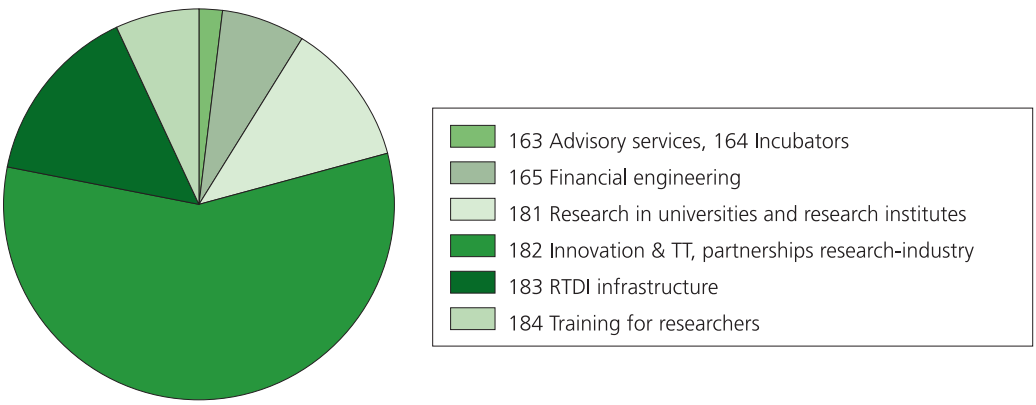
The tables below summarise the planned funding by action line and source of funding and per year.

TOTAL 2004–2006 *Action line of measure*	*Total cost MEEK*	*ERDF*	*National public*	*Private*	*Other (EIB)*
Strengthening knowledge base	140	105	35	0	0
Financing RTDI	140	75	25	40	Possible
Strengthening innovation system	697.5	376.9	125.6	195	Possible
Developing knowledge & skills	80	30	10	40	0

The annual breakdown by source of financing is provided in the second table. There is a gradual increase in annual amounts spent reflecting the likely higher investment in RTDI infrastructure expected towards the end of the programming period.

Annual breakdown 2004–2006 *Year*	*Total cost MEEK*	*ERDF*	*National public*	*Private*	*Other (EIB)*
2004	333.1	171.1	57	105	
2005	369	198	66	105	Possible EIF
2006	355.4	217.8	72.6	65	Possible EIF
Total	1057.5	586.9	195.6	275	

The diagram below illustrates the share of total cost by Structural Fund category for the period 2004–2006 as planned in the draft SPD.



The financial plan is based on the assumption that a large part of the funds will be absorbed by the Competence Centre programme and by a number of major RTDI infrastructure projects. This concentration of resources can be considered rational in as much as it seeks to create critical mass in a limited number of projects and an appropriate balance between 'soft' (competence centres) and hard (infrastructure) investment should facilitate absorption of funds. However, this implies that:

- the 2003 first round of funding (25 MEEK) for the Competence Centre programmes, using Estonian funds only will stimulate enterprises and research organisations to submit funding requests equivalent to three times this amount on an annual basis for the period 2003–2006. There is some risk that this hypothesis will not be met. However, the planned national technology programmes and existing ESTAG schemes could be used to absorb any 'slack' particularly if the ESTAG funding schemes give greater emphasis to technology transfer and process innovations as recommended by this report.
- At the present time, as noted above, the number of 'mature' major RTDI infrastructure projects is limited. The current level of preparation of the two or three main projects in Tallinn and Tartu (technology parks, biotechnology incubation centre) is adequate but further feasibility work is required notably with a view to ensuring that the projects are financially sustainable (generating at least sufficient income to replace or renovate infrastructure and equipment over time). With a view to expanding the scale and scope (notably geographically to other regions of Estonian than Tallinn or Tartu), the expert team recommends that a study be carried out to identify additional investment projects related to RTDI and that on the basis of the recommendations of this study funding for feasibility studies should be made available to project promoters via ESTAG.

All investment projects should be encourage to apply the guidance of the DG REGIO '*Guide to Cost-benefit Analysis of Investment Projects*' and provide a feasibility study including as a minimum:

- Definition of objectives of the project (and their contribution to the objectives of the measure, priority and SPD);
- Identification of the project (object of the CBA, promoter, partners, related (previous) projects and experience of promoter);
- Socio-economic context (particularly of region in which project is located) and overall institutional context (at Estonian level and decision-making authorities for the project);
- Strategy: potential demand for infrastructure created (notably from enterprises), assurance of avoidance of overlap with existing facilities, proposed strategy (including pricing of services, promotion and marketing, etc.); estimate of potential use of infrastructure (e.g. utilization rate on annual basis of equipment purchased, occupation rates for technology centers or incubators, etc.).
- Human resources (including training needs);
- Location: choice of location versus alternatives, description of pre-chosen site (including amenities), cost of land/site preparation, availability (local authority policies, etc.), environmental impact assessment.
- Implementation plan (detailed timescale for project implementation cycle)
- Financial analysis: costs, investment, sources of financing, net cash flow and net present value and internal rate of return calculations;
- Socio-economic cost-benefit analysis
- Risk analysis (underling assumptions, financial and economic variable, etc.).

4.2.4 Monitoring and evaluation

Recommendation
There is a need to establish more realistic and precise targets for monitoring policy outcomes than those included in the Knowledge Based Estonia Strategy. These should take the form of a number of baseline indicators for the RTDI measure linked clearly to the overall objectives of the competitiveness priority and the SPD.

The following indicators provide baselines for monitoring the "innovation performance" of the Estonian economy during the period of implementation of the SPD. These are both overall SPD targets and priority level indicators, which will help to estimate both direct and indirect impacts of the RTDI measure on the business competitiveness and economic growth. The indicators are intentionally mirrored on those of the European Innovation Scoreboard in order to facilitate monitoring.

No.	Indicator	Estonia	EU15 (CC13)	Gap compared to EU (CC13)	Target 2006
1	Business expenditure on R&D (BERD) /GDP	0.2%	1.2%	1 point	GERD/GDP 1.5%
2	Gross value added per head in EEK and %	21.2%	23.8% (26.5%)	2.6 points (5.3 pts)	
3	Employment in high-tech manufacturing (%)	3.9%	7.6% (2000)	3.7 points	
4	Employment in high-tech services (%)	2.6%	3.2%	0.6%	
5	Manufacturing productivity (as % of EU15)	26%	100% (41%)	74 points (15 points)	

A limited number of these indicators need to be selected for the programme complement and a tentative quantification of targets established.

Recommendation:
The Ministry of Economic Affairs and Communication should as a matter of priority establish a clear framework for the evaluation of the RTDI measure and other existing schemes. Appropriate budgeting for external evaluation as well as internal resources for monitoring of schemes and investments will be required from 2003 onwards.

Core measure indicators for RTDI (ERDF) measure – Estonian SPD 2003–2006

Indicators	Baseline level	Target level
	OUTPUTS	
▪ **Strengthening the knowledge base**		
Centres of excellence created/supported	Volume of funding, number of centres, MoEd 2001–2003	Target to set
Research related floor space created/renovated	M² of floor space, MoEd 2001–2003	M² of floor space 2008
Newly installed scientific equipment in centres of excellence	Average cost of new equipment installed, MoEd 2001–2003	Cost of installed equipment 2006–8
▪ **Financing RTDI projects**		
Firms receiving financial support for RTDI projects	Volume of funding, number of projects, ESTAG average 2001–2003	ESTAG average: 2004–06
Joint R&D projects between firms and research institutions supported.	Volume of funding, number of projects, ESTAG average 2001–2003	ESTAG average: 2004–06
Seed or venture capital raised in supported funds	Volume of capital raised; New scheme – no baseline	Target to set.
▪ **Strengthening the innovation system**		
Technology related business space created	Total M² of floor space in tech parks/incubators, ESTAG 2001–2003	M² of floor space 2008
Competence Centres supported	Volume of funding, number of centres, ESTAG 2003	Target to set
Newly installed technological equipment in Competence Centres	Average cost of new equipment installed, ESTAG 2003	Cost of installed equipment 2006–8
Number of grants to new-technology based start-ups in incubators	Volume of funding, number of grants; New scheme – no baseline	Target to set
▪ **Developing knowledge and skills about innovation**		
Research-industry mobility grants	Volume of funding, number of grants; New scheme – no baseline	Target to set

Indicators	*Baseline level*	*Target level*
Existing businesses receiving innovation related advice	Volume of funding, number of firms; New scheme – no baseline	Target to set
Start-ups/spin-offs receiving innovation related advice	Volume of funding, number of firms; New scheme – no baseline	Target to set
Technology watch or diffusion projects	Volume of funding, number of projects; New scheme – no baseline	Target to set
RESULTS		
▪ **Strengthening the knowledge base**		
Funding of centres of excellence from EU RTD Framework Programme	Volume of funding, number of projects; Baseline 2001–2002 figures	% annual increase
New R&D jobs created by centres of excellence	Number of FTE jobs; Baseline 2001–2002 figures	% annual increase
Projects successfully completed by centres of excellence	Number of PhDs, publications, patents; Baseline 2001–2002 figures	% annual increase
▪ **Financing RTDI projects**		
Investment in RTDI induced in businesses supported under schemes	Volume; ESTAG average 2001–2002	% annual increase
Investment made by seed or venture capital funds	Volume; New scheme – no baseline	As % of raised funds
Patents applied for by assisted projects	Number; ESTAG average: 2001–2002	
New processes introduced by assisted businesses	Number; ESTAG average: 2001–2002	ESTAG average: 2004–06
New products introduced by assisted businesses	Number; ESTAG average: 2001–2002	ESTAG average: 2004–06
▪ **Strengthening the innovation system**		
New spin-offs from higher education and research institutions	Number; Average 2000–2002	% annual increase
New research-intensive FDI investments	Number; Invest in Estonia data 2000–2002	% increase in investments
Technology-related business space occupied after 18 months	Total M² of floor space occupied; New scheme – no baseline	% of total space
Investment in Competence Centres induced from private sector	Volume; New scheme – no baseline	Ratio public/private funds
▪ **Developing knowledge and skills about innovation**		
Mobility grant recipients hired after end of grant period	Number; New scheme – no baseline	Number and % of total
New 'client' businesses for ESTAG schemes	Number; ESTAG clients 2001–2002	% new / old clients
Businesses satisfied with advice/competence raising services	%; New scheme – no baseline	Number and % of total
IMPACT		
Increase in turnover in assisted businesses	ESTAG average: 2001–02	Number and % of total jobs
Increase in export related turnover in assisted businesses	ESTAG average: 2001–02	Number and % of total jobs
Total net additional jobs in assisted businesses or research institutions	ESTAG average: 2001–02	Number and % of total jobs

Indicators	*Baseline level*	*Target level*
Total net new jobs in technology related business space	New scheme – no baseline	Number and % of total jobs
Total net new jobs in assisted R&D organisations (Centres of Excellence)	Baseline 2000–2002 figures	Number and % of total jobs
Revenue generated by research institutes from new IPR	Baseline 2000–2002 figures	% annual increase
Number of new technology based start-ups surviving after 2 years	New scheme – no baseline	Number & % survival rate

4.2.5 Institutional strengthening

The current human resources (four people) of the Ministry of Economic Affairs and Communication's Innovation and Technology Unit are stretched by the quantity of work involved in preparing the various schemes. Additional tasks related to the supervision (respect of EU Structural Fund and State Aid regulations), monitoring and evaluation will also begin to add to the workload of the unit. While the quality and knowledge of innovation policy of the staff is good (as noted above, the members of the unit are actively participating to EU policy benchmarking exercises and other training initiatives), the need to set aside time for further 'policy learning' activities within the unit also pleads in favour of the maintenance of adequate staffing levels.

The Estonian Technology Agency has a staff of 10 people to manage an annual budget of approximately 130 million EEK at the present time. The expert team did not have the remit nor the resources to produce more in-depth recommendations on the management and organisation. However, the evaluation of the ESTAG grant/loan schemes underlined that efficiency of procedures could be improved by for instance reducing the number of stages and committees involved in project selection. 'Out-sourcing' of programme promotion to enterprises to other intermediaries or regional offices of Enterprise Estonia would also allow the HQ staff to concentrate more on programme (as opposed to project) management. However, an increasing workload related to the implementation of the various additional RTDI schemes currently under design can be expected. Therefore, in order to ensure effective disbursement of Structural Fund support the current team should be reinforced and their capacities enhanced.

Interviews carried out as part of this study underlined that awareness of innovation policy issues, practice and tools at European level amongst the main stakeholders (both public and private) in the Estonian innovation system is patchy and the implications of project preparation with a view to meeting Structural Fund criteria is low (notably with respect to infrastructure investment projects. In consultation with the Ministry of Economic Affairs and Communication, and as requested by the Terms of Reference, a proposal for a **study tour** has been drafted.

List of Main References

Estonian Export Agency / Ariko Marketing, Eksportööride Uuring (Exporters survey) 2001;
Estonian Institute of Future Studies. Innovation Policy in Six Candidate Countries study for European Commission. Innovation Policy Profile for Estonia. September 2001;
Estonian National Development Plan – Single Programming Document (2003–2006) Strategic Document. Draft as of 5/3/02;
Estonian Technology Agency. SPINNO Programme. Tallinn 2001;
Estonian Technology Agency, Annual Report 2001 (draft, confidential);
Enterprise Estonia: Innovation in Estonian Enterprises 1998–2000. Results of the Innovation Survey (CIS3 method) conducted by the Estonian Statistical Office;
Estonian Statistical Office. Research and Development 2000. (In Estonian, tables and summary in English). Tallinn 2001;
European Commission. European Trend Chart on Innovation. Country Reports for Estonia and measure sheets. Various dates (2001–2002). Available at: http://www.cordis.lu/trendchart/);
Hernesniemi Hannu, Eltalieto Ltd, Evaluation of Estonian Innovation System. March 2000 (Funded by PHARE ES9620.01.01);
Kolk Alar Estonian Technology Agency, Powerpoint Presentation;
Pärna Ott, Fostering Innovation Policy Making Process: the case of Estonian. Powerpoint presentation, delivered at Trend Chart workshop on candidate countries, 24–25 June, Luxembourg;
Pralla Ilmar, Estonian Technology Agency, Powerpoint Presentation delivered at Trend Chart workshop on candidate countries, 24–25 June, Luxembourg;
Research and Development Council, Research and Development in Estonia, 1996–1999. Structure and Trends, Tallinn 2001;
Research and Development and Innovation Policy Measures 2003 (Excel file) – financial projections;
Riigikogu (Estonian Parliament) Knowledge-Based Estonia: Estonian Research and Development Strategy 2002–2006. December 2001;
Tallinn Technology Park, Powerpoint Presentation;
Tallinn Technology Park, Business Plan, Short Version, 2002
Tarmo Kalvet et al, Archimedes Foundation, Analysis of the Estonian ICT Sector Innovation System. Executive Summary, Tartu 2002;
Technopolis BV Competence Centre Programme Estonia, Feasibility Study;
Technopolis BV, High-Tech Venturing in Estonia: background report for ESTPIN programme, September 2001

Annex 1 | Innovation Scoreboard 2002 – Selected Candidate Countries[1]

No	Indicator	Year[2]	EU	CZ	EE	HU	LT	LV	PL	SI	SK
1	**Human resources**										
1.1	New S&E graduates	2000	10.26	4.00	**6.83**	4.49	9.35	5.52	5.90	13.10	–
1.2	Population with tertiary education	2001	21.22	11.59	**29.42**	13.96	45.03	18.15	11.73	14.12	10.66
1.3	Participation in life-long learning	2001	8.5	–	**5.3**	3.0	3.7	16.3	5.2	3.7	–
1.4	Employment in medium-high and high-tech manufacturing (% of total workforce)	2001	7.57	9.16	**4.79**	8.80	3.18	1.72	7.54	8.74	6.75
1.5	Employment in high-tech services (% of total workforce)	2001	3.61	3.22	**3.38**	3.24	2.01	2.19	–	2.71	3.03
2	**Knowledge creation**										
2.1	Public R&D expenditures (% of GDP)	2000	0.67	0.54	**0.53**	0.45	0.53	0.29	0.45	0.68	0.24
2.2	Business expenditures on R&D (% of GDP)	2000	1.28	0.81	**0.15**	0.36	0.07	0.20	0.25	0.83	0.45
2.3.1A	EPO patent applications (per million population)	2000	152.7	12.1	**6.9**	16.1	1.1	2.5	2.3	20.6	5.9
3	**Transmission and application of knowledge**										
3.1	SMEs innovating in-house (% of manufacturing SMEs)		44.0	–	**33.2**	–	49.0	–	4.1	16.9	–
3.2	SMEs involved in innovation co-operation (% of manufacturing SMEs)		11.2	–	**13.0**	–	12.0	–	–	–	–
3.3	Innovation expenditures (% of all turnover in manufacturing)		3.7	–	**2.4**	–	–	–	4.1	3.9	–
4	**Innovation finance, output and markets**										
4.1	High-tech venture capital investment (% of GDP)	2001	0.242	0.021	–	0.035	0.900	0.624	0.045	0.150	–
4.3	Sales of "new to market" products (% of all turnover in manufacturing)	2000	6.5	–	**6.0**	–	–	–	–	–	–
4.4A	Home internet access (% of all households)	2001	31.4	13.6	**30.1**	14.8	6.8	7.2	9.8	30.0	16.7
4.5	ICT expenditures (% of GDP)	2000	6.93[3]	9.3	**9.8**	8.7	4.7	–	5.9	5.2	7.5
4.6A	Inward FDI stock (% of GDP)	2000	30.3	42.6	**53.2**	43.4	20.6	29.1	21.3	15.5	24.2

Source: 2002 European Innovation Scoreboard, European Commission

1 *Main data source is EUROSTAT excl. 3.1–3.3, 4.3, 4.6 (National Statistical Offices), 4.1 (EVCA), 4.5 (WITSA/IDC (Digital Planet), 4.6A (UNCTAD (World Investment Report).*
2 *Year of reference has taken as majority of all countries excl. 3.1–3.3 (EE 2000, LT 1998, PL, SI 1999).*
3 *The EU mean is calculated using WITSA/IDC data and is thus not comparable with the mean for the MS Scoreboard.*

Annex 2 | List of People Consulted

Name	*Position*	*Organisation*
Enn Metsar	Executive Officer, Technology and Innovation Division	Ministry of Economic Affairs
Maria Hinrikus	Head of Department, Economic Development Department	Ministry of Economic Affairs
Renaldo Mändmets	Deputy Secretary- General International Relations	Ministry of Finance
Rein Vaikmäe	Research Policy Adviser	Ministry of Education
Ott Pärna	Executive Officer, Technology and Innovation Division	Ministry of Economic Affairs
Jaanus Tärnov	Director	Estonian Local Government Support Foundation
Katrin Männik	Executive Officer, Technology and Innovation Division	Ministry of Economic Affairs
Raivo Tamkivi	Director	Tallinn Technical University Innovation Centre
Ilmar Pralla	Support Programme Manager	ESTAG
Alar Kangur	Business Analyst	ESTAG
Marek Tiits	Manager	Research and Development Council Secretariat
Alar Kolk	Member of Board	Enterprise Estonia
Kitty Kubo	Head of Department, Technology and Innovation Division	Ministry of Economic Affairs
Hele Everaus	Vice Rector for Institutional Development	Tartu University
Mart Ustav	Professor CEO	Tartu University; Quattromed (Biotechnology start-up)
Ülle Must	Director	Archimedes Foundation
Peep Sürje	Vice-Rector	Tallinn Technical University
Jaanus Purga	Member Executive Board	Viru Keemia Grupp
Erik Terk,	Director (& member financing committee of ESTAG)	Estonian Institute of Future Studies
Ülo Jaaksoo	CEO	Cybernetica
Raul Malmstein	Deputy-Secretary-General	Ministry of Economic Affairs
Mart Repnau	Business Development Unit,	City of Tallinn
Ardo Reinsalu	CEO	Docobo Ltd.
Laur Lubja	CEO	AS JALAX
Mehis Pilv	Member of Supervisory Board	AS Silmet
Anti Kuiv	Director	Estonian Technology Agency
Margus Hanson	Deputy Mayor	Tartu City Government
Taavi Lepmets	Investment manager	LHV Ventures
Kristjan Kalda	Partner	Baltcap
Olev Schults	Partner	Cresco
Maive Rute	CEO	KREDEX
Toomas Noorem	General Director	TARKON
Meelik Kattago	CEO	SAK (Centre for Strategic Studies)
Rene Tõnnisson	Executive Board Member	Tartu Science Park Foundation