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

Finland

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ERAWATCH COUNTRY REPORT 2009: Finland

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ERAWATCH Network – Advansis Oy

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Executive Summary

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

In 2008, Finland's GERD as a percentage of GDP was 3.39% that was significantly higher than the EU 27 average of 1.83%. Among European and OECD countries, Finland's GERD percentage was only surpassed by Sweden in 2007 (Eurostat 2009). The growth rate of GERD in Finland between 2000 and 2008 has been average in the EU and R&D expenditures have grown quite modestly in proportion to GDP at an average annual growth rate of 4.8% (Statistic Finland 2009). Business sector R&D intensity (BERD as % of GDP) was 2.45% (2007) and well above the 1.17% average of EU-27, representing a trend of the annual business R&D expenditure growth rates of 5.1% between 2000 and 2008 (Statistics Finland, 2009). All major R&D financing sectors, especially government, business and abroad, have contributed to this growth, though at different paces.

The field of education, research and innovation policies are experiencing a rapid change in Finland. On one hand, the external change factors such as globalisation, ageing population, technological development and concern over sustainable development have been recognised as societal challenges in the national policy making. At the same time concern has been expressed of the ability of the research and innovation system to address these issues. As a result the ability of various actors as well as the system and policy has been under evaluation and this has led to several changes. There are numerous reforms and changes underway in the field of education, research and innovation policies, such as the university reform, the structural development of the higher education system, national innovation strategy, reform of the sectoral research, the development of the national infrastructure policy and the development of four-stage research career system[1]. Moreover, internationalisation has also received increasing attention as well as the consolidation of research funding (STPC, 2008).

[1] Four-stage research career model prepared by the Ministry of Education in universities aims to increase the transparency and predictability of a research career. The first stage consists of young researchers working on their doctoral dissertation, the second stage is the career phase of researchers who have recently completed their doctorate, the third stage consists of independent research and education professionals capable of academic leadership, and the fourth stage is that of professorship.

National Reform Programme (NRP) sets out progress against both EU-level Lisbon Strategy related priorities and against the Finnish government programme, presenting the measures taken in the areas covered by Finland's country-specific recommendations and points to watch. In the field of research policy, the main targets are to increase the number of companies involved in R&D work, increase funding for government research institutes (PROs), structural reforms in R&D system to promote knowledge-based growth, harmonizing the research and innovation policy strategies of various actors, to encourage new forms and areas of demand-based and user-oriented innovation, strengthening internationalization, the development of the operating environment of growth companies and improving framework conditions such as better entrepreneurial atmosphere, more serial entrepreneurship, more private venture capital and stronger competence basis for growth entrepreneurship. Finally the targets are to bring together scattered R&D resources to form strong national knowledge clusters. More attention is given to the utilisation of research to respond to the challenges in the society, environment and business. Additional public funding is targeted to support top performers, remove bottlenecks in the system and to promote demand- and user driven innovation activities.

Promoting R&D funding is a high priority on the Finnish political agenda. It is commonly seen in Finland that investing in R&D is necessary for increasing capacity for innovation that fuels competitiveness and productivity growth. Therefore there is a strong public commitment to increase R&D funding also in the future. However, it seems that much of the proposed new funding will be to a great extent connected with various reforms in the research system.

Barriers to R&D investment	**Opportunities and Risks generated by the policy mix**
Economic crisis affecting private sector R&D	New measures, processes and support for user and customer oriented innovations may increase private sector R&D
Economic crisis may affect negatively the plans for private sector investments in university research	New Universities act may provide incentives to universities to find new ways to attract R&D funding
	Pooling and prioritising in the national strategies may increase R&D investment in strategic areas

The international dimension and especially the European Research Area (ERA) are seen increasingly important especially for enhancing the quality of research. However, from the national policy perspective ERA dimension is also important as there is a need to join forces with international partners as well as to complement the rather limited national resources in a small country with large-scale cooperative instruments and infrastructures.

	Short assessment of its importance in the ERA policy mix	**Key characteristics of policies**
Labour market for researchers	• Minor	
Governance of research infrastructures	• Important - national policy development has received support from European activities	• Centralised specific policy for research infrastructures still shaping
Autonomy of research institutions	• Important, although ERA dimension is mostly not specified	• The autonomy is expanded through changes in the management and financing system
Opening up of national research programmes	• Minor - the process of opening up is not much ERA related	• Mostly national based

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1 Introduction

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

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

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

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

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

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

2.1 Structure of the national research system and its governance

Finland is a sparsely inhabited Nordic country with only one percent of the total EU population. In 2007, Finland's GDP per capita was 16.7 % above the EU 27 average. In January 2009, Finland's unemployment rate was 6.6% which was slightly lower than EU 27 average of 7.6% (Eurostat, 2009). In 2008, Finland's GERD as a percentage of GDP was 3.39% that was significantly higher than the EU 27 average of 1.83%. Among European and OECD countries, Finland's GERD percentage was only surpassed by Sweden in 2007 (Eurostat, 2009). During the period between 2002 and 2008, there were only minor changes in Finland's GERD percentage (Eurostat 2009).

The growth rate of GERD in Finland between 2000 and 2008 has been average in the EU and R&D expenditures have grown quite modestly in proportion to GDP at an average annual growth rate of 4.8% (Statistics Finland 2009). Business sector R&D intensity (BERD as % of GDP) was 2.45% (2007) and well above the 1.17% average of EU-27, representing a trend of the annual business R&D expenditure growth rates of 5.1% between 2000 and 2008 (Statistics Finland). All major R&D financing sectors, especially government, business and abroad, have contributed to this growth though at different paces.

Main actors and institutions in research governance

The highest-level governance takes place at the Parliament and at the national government. Especially, the national government – regardless of its political composition – has actively taken part in science, research and innovation policy issues for more than a decade. The government is supported in by a high level advisory body, the Research and Innovation Council (formerly Science and Technology Policy Council of Finland), which is led by the Prime Minister. The council is responsible for the strategic development and coordination of Finnish research and innovation policies.

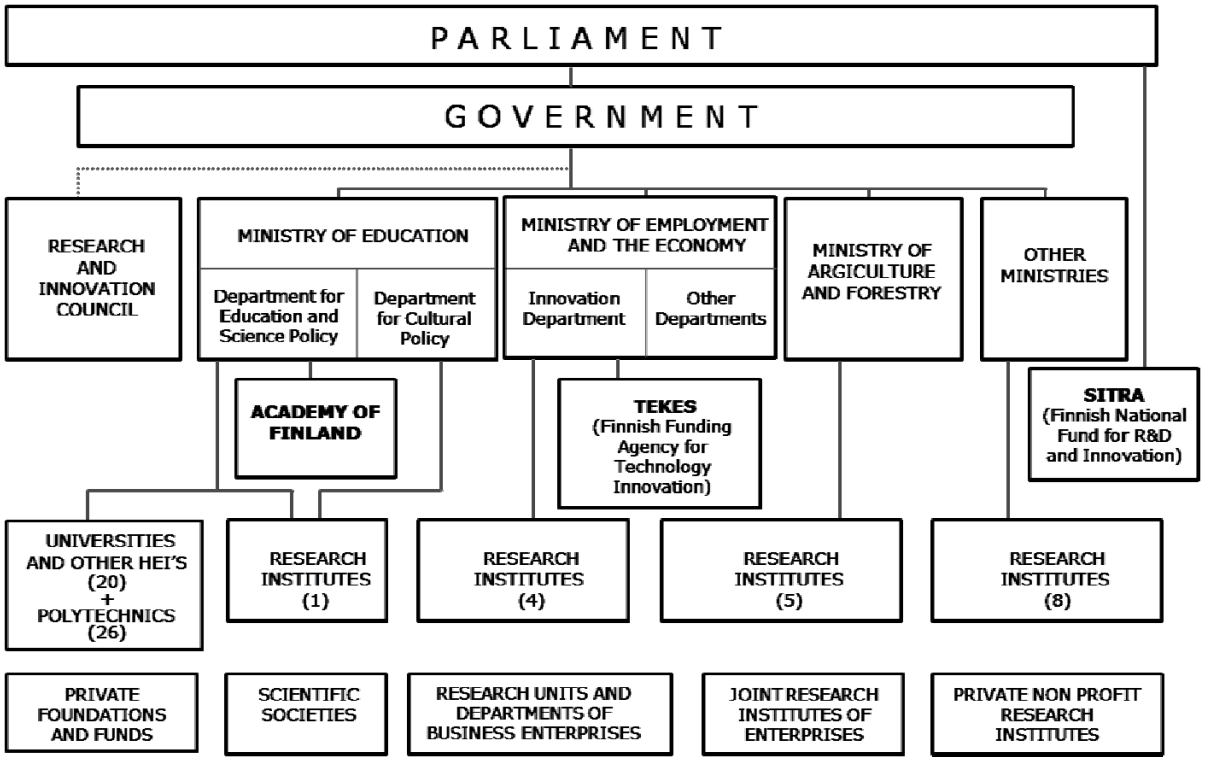
The second level consists of the ministries. The key ministries concerned with research policy are the Ministry of Education (MoE) and the Ministry of Employment and the Economy (MEE). While there is a historically developed sectoral division of labour between the two ministries concerning science and technology policy, cross-sectoral cooperation has increased in issues related to science and innovation during the past few years. This is partially due to their shared interests to promote research funding in the government budget, for which close participation in Science and Technology Policy Council has provided a good platform. As a general trend, there is a move from narrowly defined science and technology policy towards a broad-based innovation policy incorporating issues of research policy, technology policy, and elements from various other policies.

The third level consists of the R&D funding agencies, the Academy of Finland and Tekes, the Finnish Funding Agency for Technology and Innovation. The Academy of Finland funds basic research and other research related activities through competitive grants. While the majority of Tekes funds are allocated to R&D projects

carried out by companies, Tekes is also a large financier of research at the universities and public research institutes. In 2009, 46% of the total government research funding (including direct funding of universities) is channelled through these two organisations (Statistics Finland, 2009).

At the fourth level there are the organisations conducting research: universities, public research institutes, private research organisations and business enterprises. There are 20 universities and 26 polytechnics in Finland. They are owned by the state and get their basic funding from the state budget. There are also 18 public research institutes funded by the state.

Figure 1: Overview of the governance structure of the research system in Finland



Source: ERAWATCH Research Inventory 2009, Structure of the Research System, updated

The institutional role of the regions in research governance

Finland comprises 20 Regions all categorised at the NUTS 2 level. The institutional role of the regions in the research governance is small since the research policy is mainly decided at the national level. Regional concerns have an effect on the national policy in many respects, however. For instance, the Ministry of Education reconciled the objectives of the national research policy and the regional policy in a strategy document titled Regional strategy for accomplishing education and research policies until 2013 (Ministry of Education, 2002). The municipalities in Finland are strong actors (with own financial resources) compared with many other countries and particularly the bigger cities and towns have had a very active role in local economic development and research policy, often related to support in building infrastructure and support services for R&D activities.

Regional Councils are appointed by the municipalities and are therefore politically presenting the local governments. Furthermore, they also have some of their own resources. The main instruments for funding their policies so far have been the

Regional Operational Programmes co-funded by Structural Funds (SF), the national government and the local governments. With the increasing focus of SF towards RTDI, the role of regions has become more important.

Main research performer groups

R&D is mainly performed by business enterprises in Finland. In 2008, enterprises had 72.3% share of total R&D expenditures (Eurostat, 2009). A distinctive characteristic is that one company, Nokia, accounts for nearly 50% of total business sector R&D in Finland (Pajarinen & Ylä-Anttila, 2008). The higher education sector, mainly the 20 universities of Finland, had 18.9% share of total R&D expenditures while the share of government departmental research (including non-profit research performers) was 8.6% in 2008 (Eurostat 2009). In terms of money, the total domestic expenditure on R&D was €6,446m in 2008 (Eurostat, 2009).

2.2 Summary of strengths and weaknesses of the research system

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

Finland was one of the first countries to adopt the national innovation system (NIS) approach in the development of research policy structures and activities since the early 1990s. The approach was successful and was continued with refinements until the early 2000s, when it was seen to lose some of its momentum without structural changes. As a result, during the recent years, a comprehensive development work with several still ongoing reforms has been initiated in Finland. These include the university reform, the structural and other development of sectoral research, the creation of national infrastructure policy and a research career system, the internationalisation of research, and the development of R&D funding.

Table 1: Summary assessment of strengths and weaknesses of the national research system

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	• High public and private R&D expenditure
	Securing long term investment in research	• A further increase in R&D investments is a widely accepted policy objective as well as an innovation oriented approach to national policy
	Dealing with barriers to private R&D investment	• The strength of the Finnish system is that BERD is already at a very high level. • BERD concentrated on one sector (ICT and especially on Nokia)
	Providing qualified human resources	• Strengths exist at the overall high level of basic education and large existing HRST • Weak ability to attract talented domestic and foreign students and an unattractive research career system
Knowledge demand	Identifying the drivers of knowledge demand	• National key areas are identified in the co-operation between public and private sectors • R&D funding system may have difficulties to identify the knowledge demand of new players and SMEs
	Co-ordination and channelling knowledge demands	• Several co-ordination mechanisms for knowledge demand • At the same time these various mechanisms are not well coordinated in practice by themselves.
	Monitoring of demand fulfilment	• Evaluation is systematically carried out in many different levels
Knowledge production	Ensuring quality and excellence of knowledge production	• High publication output and international visibility • Mechanisms open to new scientific opportunities • Research activity fragmented with many research performers
	Ensuring exploitability of knowledge	• Many mechanisms to match scientific knowledge production to economic and societal needs • Many instruments to support the exploitability of knowledge • Question about the adequacy of the well-functioning funding mechanism to satisfy the research needs of the society
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	• A number of effective instruments exists to support knowledge circulation
	Profiting from international knowledge	• A good participation of Finnish partners in international collaborative research • Relatively low level of foreign R&D investment • Mediocre attractiveness for international students and talented knowledge workers and low mobility of Finnish researchers
	Enhancing absorptive capacity of knowledge users	• High level of S&E graduates and workers in S&T • Low level of PhDs working in the private sector • The absorptive capacity of knowledge users concentrated on large corporations

2.3 Analysis of recent policy changes since 2008

The contribution of research and research policies to Lisbon goals (as well as to other societal objectives) goes beyond the fostering of R&D investment. It is therefore important to also analyse how other remaining shortcomings or weaknesses of the research system are addressed by the research policy mix. The

focus of the section is on the analysis of main recent policy changes which may have a relevant impact on the four policy-related domains.

2.3.1 Resource mobilisation

In October 2008, Finland published its second National Reform Programme (NRP) that reflects on what has been done to meet the demands of the Lisbon strategy and outlines the general outlook of the most recent challenges in the Finnish economy, as well as the Government's agenda of economic reforms in response to these challenges. It sets out progress against both EU-level priorities and against the Finnish government programme, presenting the measures taken in the areas covered by Finland's country-specific recommendations and points to watch.

Although it has been noted that Finland cannot reach the set target to raise the GERD as a proportion of GDP to 4% in 2011, the government is nevertheless committed to increase public R&D investments. There is also a set target that public funding should remain 30% of all GERD (Science and Technology Policy Council, 2008). For 2009 the total government funding for research and development goes up to €1.9b, which means nearly 6 per cent growth in nominal terms and 2 per cent growth in real terms (Statistics Finland, 2009)

An effort has also been made in Finland in recent years to broaden innovation policy beyond traditional R&D funding. This change in policy emphasis was highlighted in the National Innovation Strategy, published in October 2008. According to the new strategy priorities of innovation policy will be "moved in the direction of markets that promote innovations, non-technological development, user-orientation and public services".

In addition the following more specific objectives have been outlined, based on the government National Innovation Strategy (as presented in the Finnish NRP 2008-2010):

- more companies involved in R&D work
- government research institutes receiving more external funding for research
- to strengthen the role of VTT Finland in the implementation of innovation policy
- knowledge-based innovation policy will be promoted and structural reforms in R&D will be made to further foster it
- innovation policy strategies and measures of those executing them will be harmonized to the basic range of options in the national innovation strategy.
- to encourage new forms and areas of demand-based and user-oriented innovation activities (incl. public and private services) within the innovation policy, such as expanding innovation policy to the service sector, incl. fostering innovations in social welfare and health care services.
- strengthening of the link between internationalization and innovations
- overall development of the operating environment of growth companies within the scope of a broad-based innovation policy (better entrepreneurial atmosphere, more serial entrepreneurship, more private venture capital and stronger competence basis for growth entrepreneurship)

- bring together regionally dispersed R&D&I activities into networks of innovation communities and create strong regional innovation clusters on the basis of national content selection and the strategic strengths of each region

Changes in National Reform Programme regarding the role of research in the broader economic growth strategy

According to the Finnish NRP, "The guidelines of the Lisbon strategy match quite well with the national policies of Finland of balanced social and economic reform". In the area or research policy the programme suggests that public R&D funding will be increased annually by 5 per cent between 2008 and 2011 with the target of increasing the GDP share of research to 4 per cent. The impact of public R&D funding is also planned to be improved. Other measures emphasized in the NRP are:

- Investments in expertise will be made by reforming the research and higher education system
- Increasing the basic funding of universities and founding an internationally top-rank university
- The availability of domestic and international venture funding facilitating the growth of companies will be improved,
- The development of the private capital investment sector in Finland will be comprehensively promoted
- The economy's innovation capacity will be strengthened through strategic enhance the activity of innovation organisations by tightening cooperation and increasing interaction between actors investments in selected areas,
- Regional innovation clusters will be created with world-class operating environments based on national content choices and the strategic strengths of the regions

During late 2008 two key policy documents were published that specifically addressed the need for providing resources for research as a means to increase competitiveness and welfare. In the National Innovation Strategy (Government white paper on Innovation) it has been stated that "Implementation of the strategy requires intense long-term investments in the competence basis and renewing innovation activity by the public and private sectors" and that "high quality teaching, research and development activities have formed the basis for Finland's success." In the Science and Technology Policy Council (nowadays Research and Innovation Council) strategy document "Review 2008" states that adequate funding is necessary to develop and maintain the contents and structure of the innovation policy.

Both strategy documents follow the earlier guidelines and targets set in the government programme to secure long term investments in research. They state that public R&D funding must be increased in the long term although it "must be allocated together with already existing resources in a productive manner." The review 2008 goes even more specific by stating that public R&D funding should be increased significantly (40%) by 2011. The main targets would be the universities as well as Tekes and several other organisations also. The funding targets are closely linked to new instruments and reforms in the research and innovation system as well as the targets set in the Finnish NRP.

In February 2009, a new roadmap for national research infrastructures was published. The project identified 24 national-level research infrastructures and proposes 20 initiatives to be included in a list of new infrastructures or major upgrades of existing infrastructures. Of these initiatives 13 are related to European level ESFRI[3] roadmap. The roadmap also makes recommendations for securing the financing of these infrastructures.

Dealing with uncertain returns and other barriers there are clear aims in the government strategies to target new funding towards the most important targets and in a way that it promotes the application of results of research. The ongoing policy priority has been to promote business R&D investments and to develop more market incentives for firms and other organisations to innovate. In practice, this means changes in legislation and government measures to support the creation and commercialisation of innovative products and services. One example of new measures is the pilot project that provides innovation vouchers to SMEs in the energy sector, which is part of the EU KIS-PIMS initiative that aims at designing and implementing new funding schemes for innovative Service companies.

For providing qualified human resources there have been both new developments in funding as well as structures in Finland. The developments during the past few years have been especially related to universities. The university sector has been considered too fragmented and the governance system of the universities is facing challenges to respond to both regional and global needs (Rouvinen & Ylä-Anttila, 2009). As one response to these challenges, government decided on 28 February 2009 on the content of the new Universities Act. The aim of the revised legislation is to enhance the autonomy of universities and to render them autonomous legal entities in order to ensure that the universities will be better placed to make the best use of their income from capital and to better supplement their basic financing with donations and business activities. This means that in addition to new investments made by the government (see above), the size of new investments depends on the amount of donations to the universities by enterprises and other bodies.

The new Act will come into force on August 1 2009. A new Aalto University is also formed from the merger of three existing universities. Additional specific government financing is directed especially to the new Aalto University (created by the merger of the Helsinki University of Technology, the Helsinki School of Economics and the University of Art and Design Helsinki), but also to other universities. This merger also aims partly at improving the quality of human resources.

[3] European Strategy Forum on Research Infrastructures, a strategic instrument to develop the scientific integration of Europe and to strengthen its international outreach

Table 2: Main policy changes in the resource mobilisation domain

Challenges	Main Policy Changes
Justifying resource provision for research activities	• Addressing the importance of research and innovation in the National Innovation Strategy 2008 • Addressing the importance of research and innovation in the Science and Technology Policy Council Review 2008
Securing long term investments in research	• TIN policy recommendation to increase R&D funding significantly and emphasising the importance of this policy during recession (STPC, 2008) • Strengthening the basic capital of universities under public law in 2010. • A roadmap for national policy in order to develop research infrastructures in a more strategic way
Dealing with uncertain returns and other barriers	• Focusing R&D funding to areas that are important for securing the national knowledge base • Developing of innovation support tools (e.g. vouchers) for companies to facilitate R&D • Recommendations to increase funding that is targeted to increase the number of enterprises engaged in R&D • Recommendations to support for horizontal programmes in sectoral research
Providing qualified human resources	• Enhancement of university core funding • Development of researcher career system • Establishment of Aalto university and re-organising several other universities

2.3.2 Knowledge demand

Perhaps one of the most general tools identifying the framework conditions for knowledge demand are the research and innovation policy reviews prepared by the Research and Innovation Council (formerly Science and Technology Policy Council). The reviews analyse past developments, draw conclusions and make proposals for the future. The latest study was published in December 2008.

In a more practical level the knowledge demand is facilitated through interactive joint preparation of various R&D programmes and other measures. Recently the most important of these have been the new research calls in the recently (2007-2009) established Strategic Centres of Science, Technology and Innovation (CSTI), which have been jointly prepared by the stakeholders from the private sector, public sector and the higher education sector. Other important instruments are the planning processes of the R&D programmes by Tekes, the Academy of Finland and various ministries. E.g. in Tekes has started one new programme “Built Environment 2009–2014” in 2009 and two others are in preparation (renewable energy, lean resource solutions). New programmes are prepared jointly by various stakeholders.

For the coordination of knowledge needs some policy developments have taken place. The Ministry of Employment and the Economy (MEE) has started a process for forming an action plan for measures to support demand-led and user-driven innovation policy. The development of public procurement in research and innovation policies is also in the agenda of MEE in 2009 (MEE definition of Innovation policy 2009). Another process is the development of sectoral research to better meet the needs of the society. In autumn 2008 a committee report was completed with several proposals. One of the key proposals was that a clear national sectoral research policy be drawn up for Finland.

The Academy of Finland has also published a new strategy for research programmes. One specific change in the strategy is the increased emphasis of

international co-operation as a way to increase the quality of research. According to the strategy research programmes are an important forum for interaction between disciplines, knowledge providers, users and financiers. According to the strategy the programmes should also create long term societal impact.

The establishment of CSTIs is complemented by co-ordinating other measures with them. A good example is the Academy of Finland's decision to finance 110 graduate schools with 901 graduate school positions and graduate school coordinators for 2010–2013. What was ne in the decision was that consideration was also given to the need for PhDs in the disciplines represented by CSTIs in addition to normal discipline assessments.

In the operational level a new CSTI in energy and environment industries (CLEEN Oy) was established in autumn 2008 and another one in the field of health and welfare is in planned to be established in 2009. The CSTI will co-ordinate research in selected strategic areas.

For monitoring the knowledge demand there has been several developments. Perhaps the most comprehensive is the extensive evaluation of the national innovation system launched by the Ministry of Employment and the Economy, which is expected to last until autumn 2009. The basic aim is to investigate which are the major drivers of change in the system and how well they are addressed in the innovation policy. The evaluation does not address knowledge demand directly but indirectly by assessing the capability of the system to identify and address the knowledge demand. One specific focus area in the evaluation is "demand & user orientation", which is emphasised in the National Innovation Strategy. Other important dimension is "Education, research and the economy", which addresses the capabilities of education and research to meet the needs of the economy.

Another recent development is the Impact Framework and Indicators for Science, Technology and Innovation (VINDI) project by the Academy of Finland and Tekes, which aims to create an overall view– an impact framework– of effectiveness of science, technology and innovation. The impact framework has been developed in 2008. Based on the framework and indicators there is a plan to identify the changes in knowledge and expertise in Finland and to track the impacts of these changes in the near future.

Table 3: Main policy changes in the knowledge demand domain

Challenges	Main Policy Changes
Identifying the drivers of knowledge demand	• National Innovation Strategy process • First CSTI research calls • New R&D programmes • Evaluation of the science and research (SIGHT 2009)
Co-ordinating and channelling knowledge demands	• Process for forming an action plan for measures to support demand-led and user-driven innovation policy initiated • New Academy of Finland Research Programme Strategy • The establishment of new CSTI to co-ordinate and channel the knowledge demands • The development of sectoral research to better meet needs of the society
Monitoring demand fulfilment	• Systemic evaluation of the innovation system underway • VINDI project for impact assessment for science technology and innovation

2.3.3 Knowledge production

One part of the University reform and especially the new universities act is to improve the quality of knowledge production by re-organising research activities. Organisational changes take place in department level but also between universities through coalitions and mergers. One of the aims of the new Aalto University is to improve high-level cross disciplinary research by combining technical, business and industrial arts competence.

The new National Innovation Strategy (October 2008) contains several challenges and proposals related to knowledge circulation. One proposed key measure is to increase government support for demand oriented and user-centred innovation. This approach requires broad based interaction between knowledge users and knowledge producers but also between the producers and users of various products and services. Another key mechanism is to develop the utilization IPR. One part of this development is to enhance the capabilities of SMEs to protect intellectual property but also to make better use of it. Another dimension is to develop the IPR mechanisms to support better knowledge circulation. There is process underway to create a dedicated IP strategy for the national intellectual property rights system. In November 2007, a committee representing both business world and public bodies was formed to plan and prepare the IP strategy. The first report with guidelines was completed in late 2008 and further planning will proceed.

One of the new policy initiatives to improving quality and excellence of knowledge production has been to widen the scope of the "Finland Distinguished Professor Programme" (FiDiPro) that funds the recruitment of internationally renowned researchers into Finnish universities and research institutes. In addition to professors a new instrument, "FiDiPro Fellow" has started to offer mobility grants for offering new opportunities for young researchers. The first FiDiPro Fellow call for proposals opened funding in February 2009.

The promotion of excellence is not only limited to national policy but also includes a Nordic dimension. In 2008 the Nordic Ministers of Research approved a large-scale common Nordic initiative to promote cutting-edge research within climate, energy and the environment. The project, known as the Nordic Research Excellence Initiative, was launched in early 2009 with a budget of about DKK350m (about €50m) over the next five years.

Many of the other ongoing structural reforms in the field of research policy continue, such as the development of sectoral research system to develop research in various research institutes and the development of research career system for attracting and retaining talented young researchers as well as the internationalisation of research. All of these reforms aim also to increase the excellence in knowledge production in different ways. The main recent development in these activities is the new strategy for the internationalisation of Finnish higher education institutions that was completed in January 2009. The strategy lays down the guidelines for the internationalisation of Finnish higher education institutions for 2009–2015. The Strategy sets five main objectives for the internationalisation of higher education institutions, which are

- a genuinely international higher education community
- enhanced quality and attractiveness of higher education institutions
- promotion of knowledge exportation
- support to multicultural society, and
- heightened global responsibility.

Another more strategic tool is the SIGHT 2009, an extensive evaluation project to be conducted jointly by the Academy of Finland and experts from a wide array of disciplines to evaluate the state and quality of Finnish science. The process consists of four sub-projects: one of the sub-projects will build an overall view of the prerequisites for research, the strengths and the performance of Finnish universities. Another sub-project surveys the internationalisation of scientific research. The third sub-project is to prepare an impact framework for research, technology and innovation. The fourth project aims to develop the bibliometric data and will be carried out as a joint venture between the Nordic countries.

Table 4: Main policy changes in the knowledge production domain

Challenges	Main Policy Changes
Improving quality and excellence of knowledge production	• University reform process • The creation of Aalto university to improve cross-disciplinary excellence • Opening up FiDiPro • strategy for the internationalisation of Finnish higher education institutions • Evaluation of the science and research (SIGHT 2009)
Ensuring exploitability of knowledge production	• Improving the management of university inventions • The development of university innovation services

2.3.4 Knowledge circulation

The university reform (and especially the new Universities Act) aims at developing the university management and financing system to support interaction between university, firms and the society. In addition to a broader funding base the new more autonomous position enable universities to collaborate with other parties in new ways.

The new strategy for the internationalisation of Finnish higher education institutions does not only aim to the quality of knowledge production but also to facilitate access to international knowledge.

Improving access to knowledge has also been facilitated by increasing international collaboration in research programmes. Recent examples include the international BONUS programme which was launched at the beginning of 2009 and funded by the countries around the Baltic Sea (Academy of Finland is the Finnish partner) as well as by the EU Commission. Another example include the Academy of Finland SALVE research programme (national health), which is carried out in collaboration with Canada, the UK and Norway.

Nordic collaboration continues to facilitate access to international knowledge. Recent developments in the research cooperation in the Nordic countries include the graduate schools and Centre of Excellence Programmes, such as the Climate, Energy, Environment Programme (2009–2013).

Table 5: Main policy changes in the knowledge circulation domain

Challenges	Main Policy Changes
Facilitating knowledge circulation between university, PRO and business sectors	• The National Innovation Strategy • The development of university management and financing system to support interaction between university, firms and the society The revision of the IPR administration and the creation of the new National IPR Strategy
Profiting from access to international knowledge	• Policy for increasing collaborative research programmes and Nordic collaboration
Absorptive capacity of knowledge users	• No changes

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

Following the analysis in the previous section, this section assesses whether the recent policy changes respond to identified system weaknesses and take into account identified strengths.

Table 6: Summary of main policy related opportunities and risks

Domain	Main policy related opportunities	Main policy-related risks
Resource mobilisation	• Strong drive to increase R&D funding to support ongoing structural changes • CSTI and University reform mobilising private sector research funding	• The economic situation may impact research and innovation budgets
Knowledge demand	• Strong political pressure to increase the societal impact of R&D investments • Focus on demand and user orientation • Sectoral research reform	• The economic situation may affect the innovation activity of the private and government sector • Large number of non-innovative firms • Increasing demand orientation may hinder knowledge production if not implemented properly
Knowledge production	• Development of researcher education • Development of a researcher career system • Development of R&D infrastructures	• The new funding policy caused by the university reform may also lead to problems in the university funding • creating well-resourced top-level actors may affect negatively to wider knowledge base
Knowledge circulation	• Increasing mobility	• CSTIs may limit knowledge circulation to those who are not shareholders and partners

3 National policy mixes towards R&D investment goals

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

knowledge into growth. Corresponding investment policies are mainly pursued at national level and determined with a national focus.

The chapter is structured around five questions:

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

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

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

The economic situation is the biggest threat for Finland in achieving the established R&D investment objectives. The objective of 4% GERD/GDP by 2011 was an ambitious one even with optimal economic conditions and now it has been acknowledged (e.g. Science and Technology Policy Council, 2008) that it cannot be reached.

The objectives to increase public R&D investments are closely connected to selected reforms and new measures such the university reform, the reform of sectoral research, new research infrastructure policy (connected with ESFRI) as well as the establishment of CSTIs. It seems that the biggest barrier for achieving the objectives may be political ones as the economic situation may affect the decision making processes.

There has not been any specific target for BERD set by the government as the level of BERD has been over 2% of GDP for some time (2.45% in 2008). Instead the more general challenge (or barrier) is the low number of innovating companies in the economy as R&D activity is much concentrated on small number of firms and industries. If the number of innovating companies does not grow significantly, it is impossible to achieve the targets for private sector research especially when the dominant ICT sector may cut R&D investments. The low number of innovating companies also affects the public R&D investments in a way that all resources cannot be effectively distributed to high level R&D.

The the share of foreign R&D-investment as a share of private R&D in Finland was 6.5% in 2007, which is low in international comparison. Although high level of education and infrastructure are seen as strengths, the geographical location and has been a weakness in attracting FDI. However, in the R&D intensive sectors the attractiveness of Finland has remained relatively high compared to FDI as a whole. The share of foreign affiliates in total R&D expenditures by enterprises has also

increased substantially during the past few years. The foreign investments for private R&D are mainly concentrated on R&D intensive enterprises and especially the software sector.

As a whole Finland has challenges to attract FDI especially as Finland is a small market (especially compared with the big Asian markets) and this may also affect the location of foreign R&D investments in the future.

3.2 Policy objectives addressing R&D investment and barriers

The funding model of the Strategic Centres of Science, Technology and Innovation, as well as the new funding model of universities both aim to increase private sector funding for research. Moreover, the ongoing reform of the enterprise and innovation service system in the administrative sector of the Ministry of Employment and the Economy, "the EnterpriseFinland service renovation", aims to ensure an equal supply of public enterprise services on uniform grounds for enterprises and founders of enterprises throughout the country, as effortlessly as possible and based on the same operating model.

The aim of promoting R&D funding has been given a high priority on the Finnish political agenda. The current government programme – an action plan agreed by the parties represented in the government – states that investing in R&D is necessary for increasing capacity for innovation that fuels competitiveness and productivity growth in Finland (Prime minister's office, 2007). In 2008, this argument was reinforced in the new proposal for the National Innovation Strategy document prepared by the current government. According to this White paper document, public resources targeted at broad-based innovation activity and R&D must be increased at a pace exceeding that of general economic growth in Finland (Ministry of Employment and the Economy, 2008).

The question of R&D investments is addressed specifically in the Science and Technology Policy Council strategy document Review 2008. The Review states that "funding must be increased and it must be allocated together with already existing resources in a productive manner". There are several objectives or guidelines addressing R&D investments:

- the need for a long-term stream of funding
- the share of public funding does not decrease
- there should be a balance between public basic and competitive funding (currently 54:46)
- core funding of each university is increased in a way that decreases the fragmentation of research
- (new and current) resources are directed at the most important targets: CSTIs, other selected fields, research infrastructures, the implementation of a researcher career system, internationalisation, creation of partnerships
- funding promotes the application of the results of research and innovation activities, and promotes their transfer into practice and commercialisation
- funding increases the number of enterprises carrying out R&D
- funding mechanisms of sectoral research have to be improved so that the research needs of society can be flexibly satisfied

- public research organisations' external research funding is excluded from the Government Productivity Programme (that aims to cut public expenditure).

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

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

3.3.1 Overall funding mechanisms

Public sector funding

The main providers of public R&D funding are the Ministry of Education (MoE) and the Ministry of Employment and the Economy (MEE). For the funding year 2009, the Ministry of Education received by far the greatest amount of government R&D funds among the ministries; altogether €837.3m. This represents 44% of the total government R&D funds (with a real annual increase of 0.3%). In the administrative field of the Ministry of Education are all the universities, polytechnics and the Academy of Finland. Universities received €490m of institutional support (core R&D funding), which corresponds to 58.5% of direct public research and development funding allocated by the MoE. The Academy of Finland received almost €309m from the Ministry of Education to be granted to competitive research funding and other research policy measures. Most of the funding by the Academy of Finland is project funding but there are also other forms such as centres of excellence funding, Academy research posts and mobility funding (Statistics Finland, 2009).

In terms of research funding, the Ministry of Employment and the Economy is the second most important ministry in Finland. The funding of the Ministry of Employment and the Economy (MEE) was €673m in 2008, which was 37.5% of the total government R&D expenditure. At the end of 1990s its share was still almost on par with that of Ministry of Education while recent increases in university and basic research funding have decreased MEE's relative importance. Under the administrative field of MEE are Tekes (€574.9m) and several public research institutions under MEE (with €102.2m of budget R&D funding). Especially Tekes budget has been on the rise during the past five years.

Tekes and Academy of Finland are the main providers of competitive R&D funding. The budgets of these two organisations have been increasing faster than the government R&D funding in general.

Private sector funding

In Finland, the role of private sector both in performing and funding R&D is decisive. In 2005, 66.9% of GERD was financed by business sector and 70.8% of GERD was also performed by business enterprises (OECD, 2008). In comparison, the estimated EU-27 averages were, correspondingly, 54.1% and 62.6%. Because of the great effort of industry, the Finnish higher education and government sectors have relatively small part in performing R&D. In 2005, 19% of GERD was performed by the higher education sector and 9.6% by the government sector (the corresponding

estimated EU-27 averages being 22.5% and 13.9%). In same year, domestic industry financed most of BERD (90.9%) while BERD investments from abroad (5.3%) and from government (3.8%) were about half of the estimated EU-27 averages. Industry's investments in HERD (6.5%) and GOVERD (12.4%) were equal to or above the estimated EU-27 averages.

Three industries – the electrical and optical equipment industry (€27.5b), the machinery and equipment industry (€19.2b), and the forest industry (€22.4b) – accounted for one half of the gross value of industrial production in 2007 (Statistics Finland, 2009b). In 2006, the BERD of electronics and electrotechnical industry was €2,320m that was more than half of the total BERD (€4,108m) of Finland. The relative importance of the electronics and electrotechnical industry for the Finnish R&D activity is huge. This is underlined by the fact that among business sectors the next-highest number of BERD was only €253m (that of machine and metal product industry). A Finnish peculiarity is that the BERD of the electronics and electrotechnical industry almost equates with the BERD of Nokia that accounts for nearly half of total business sector R&D expenditure, as noted earlier. From this it follows that Nokia's knowledge needs are essential drivers of business knowledge demand in Finland.

3.3.2 Policy Mix Routes

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

1. promoting the establishment of new indigenous R&D performing firms;
2. stimulating greater R&D investment in R&D performing firms;
3. stimulating firms that do not perform R&D yet;
4. attracting R&D-performing firms from abroad;
5. increasing extramural R&D carried out in cooperation with the public sector or other firms;
6. increasing R&D in the public sector.

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

The Finnish policy mix covers all routes to stimulate R&D investment. However, the relative importance of various routes varies. It is also typical for the Finnish approach that many significant policy instruments not only focus on one specific group or funding mode, but tackle several different routes simultaneously. Many Finnish policy instruments also typically have a flexibility to switch or change emphasis between different modes depending on the situation (Boekholt, 2007). The flexibility in the design of policy instruments has meant that key shifts in policy focus can be tackled with existing instruments and only a few major additions to the portfolio of measures have been added recently.

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

There have been instruments for supporting new R&D performing firms in Finland for some time. In the past decade there have been several general projects and programmes issued by the successive governments and co-ordinated by the Ministry of Trade and Industry (nowadays Ministry of Employment and the Economy), such as the Entrepreneurship project 2000-2003, entrepreneurship policy programme 2003-2007. In the 2007, the government set up a new "Policy programme for employment, entrepreneurship and worklife", which is designed to ensure commitment to jointly established strategic goals on the part of the various parties related to these issues. MEE has also set up a Growth Enterprises group within the Innovation Department, which bears responsibility for structuring, developing and implementing the growth enterprise policy, part of the broad-based innovation and industrial policy.

The Finnish instruments have been until recently mostly focused on improving the framework conditions such as promoting entrepreneurship, providing venture capital as well as creating incubator activities. Dedicated R&D instruments have been less common although a few of these have also emerged recently.

Tekes and the Growth Company Service of EnterpriseFinland provide funding instruments to support SMEs. Finnvera and its subsidiary VeraVenture, Finnish Industry Investment and regional TE-Centres all have instruments that support for innovative start-ups. Most of these instruments are related to general funding support for companies but in many cases these also target (innovative) start-ups.

Public sector financing support has also focused much on seed-financing and loans Public financing on equity terms is available from Finnvera plc, Sitra and Tekes. Seed financing is provided, amongst others by Seed Fund Vera Ltd and the Finnish Industry Investment is the Financing Programme for Early Stage Companies.

There are also various incubators activities in Finland. These incubators have been mainly maintained by various local and regional Science parks and Technology Centres. As opposed to some other countries the incubators gathered their financing from various sources on project basis and there has not been a centralised funding model for the incubators.

Some new developments have also been created recently. In February 2008 Tekes introduced a new funding instrument for young innovative companies. Innovation is one of the key criteria for funding as the firms operations have to be based on an innovative business idea based on specific expertise or new technology. The new instrument aims to grant funding in three separate phase (feasibility, conditions for growth, rapid growth) for the selected companies. The development of companies will be monitored continuously and in order to be eligible for the next phase, the company has to have achieved the targets set for development in the previous phase. To its full extent, about €1m the funding can reach only in the second phase.

Tekes has also launched another instrument targeting innovative SMEs, which includes start-ups. Funding for the purchase of innovation service is a new instrument launched by Tekes to promote business development of innovative SMEs. The funding enables SMEs to combine external expertise into their R&D projects. The aim is to encourage SMEs to develop their business activities in a comprehensive way and to exploit external services for company's innovation activities (Tekes, 2008; Inno Policy Trendchart, 2008).

In March 2006 MEE announced that together with Tekes it will introduce a new business accelerator programme VIGO for fast growing young companies. The program aims to increase significantly the quality of projects and to make young start-ups more fit for venture capital investments. The goal is to strengthen the Finnish venture capital markets and make their country as well as to attract international accelerator experts and venture capitalists. The goal is that the accelerator companies collect at least €100m of private capital in three years. However, as VIGO is still a quite recent initiative (starting in 2009), there is not any information available from the impact of the programme yet.

As numerous new instruments have been introduced especially during the past decade by variety of public actors, the system as a whole has become complex to access and to administer (Rouvinen & Ylä-Anttila, 2009). There seems to be a need to improve the co-ordination Route 1 type of policy instruments at various levels.

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

The Route 2 type of investment has been a very strong element of the policy mix in Finland during the last decade. Especially the role of Tekes through both general R&D grants and loans as well as through thematic programmes has been considerable.

Tekes provides R&D companies with grants and loans within the following parameters: R&D grants run from 25 to 65 percent of the eligible costs and R&D loans run from 25 to 70 percent of the eligible costs. High-quality, advanced technology and effective networking are essential criteria in Tekes' R&D funding decisions. Additionally, the project's long-term effects, such as employment and potential turnover and exports are considered at the evaluation process.

Tekes programmes are a more targeted form of R&D funding for companies based on a specific theme. Companies can participate through their own projects or become part of joint research projects. Many programmes place special emphasis on participation by SMEs and promote cooperation with major companies and research institutes. The programmes typically last from 4 to 7 years. During recent years Tekes has invested around half of its funding through technology programmes.

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

The flexibility of policy instruments in Finland is seen in Tekes programmes. During recent years more and more programmes have been initiated in the fields where R&D is not performed in large scale (such as construction) and in the areas, where non-technological innovation is more prominent, such as services.

There are quite few instruments that are specific to companies that do not perform R&D yet. There is Business development support provided by the regional economic development centres (TE-centres), and loans and guarantees by Finnvera. However, these instruments do not differentiate between R&D performing companies and those who do not perform.

Generally it has been noticed in Finland that despite slight growth in recent years the number of enterprises engaged in R&D is still small and strongly focused on few sectors (Science and Technology Policy Council, 2008). Another weak spot has been the relatively low level of R&D activity in the non-manufacturing sectors. This has been partly the reason for the Finnish policy to look for new opportunities to promote innovation in the services sector (both private and public sector) and start developing

new instruments that promote customer and market driven innovation activities. Although these developments are still in the early stages it is quite probable that more resources will be directed to these activities in the future.

Route 4: Attracting R&D-performing firms from abroad

Attracting R&D performing firms has not been a top priority in the Finnish policy mix. These type of instruments are relatively new to Finland consist mainly activities of Invest in Finland, an organisation that assists foreign companies in finding business opportunities in Finland. However, the resources of Investment in Finland are modest compared to many other countries. At the same time the individual cities are also active in their activities to attract R&D performers from abroad. A good example of this kind of activity is the Greater Helsinki Promotion (GHP), an international business promotion agency for the Greater Helsinki area.

Some instruments involve elements for attracting R&D activity implicitly. A good example is the Centre of Expertise programme, a fixed term government programme aimed at focusing regional resources and activities on development areas of key national importance. In addition to developing strong regional knowledge hubs it also aims at "increase the capacity of regional innovation environments to attract internationally active businesses, investment and top professionals".

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

The links between public and private R&D have been a strong focus of the policy mix in Finland for a long time. As a result, cooperation is one of the strengths of the research policy in Finland. There are not many dedicated instruments for supporting co-operative R&D, but co-operation is one key dimension in other forms of activities. The abovementioned Tekes programmes have a strong collaborative element as they commonly promote joint projects. The same aspect is also included in the Centre of Expertise programme where the increase in joint projects is one of the key objectives of the programme.

The most important recent initiative is the Strategic Centres of Science Technology and Innovation (CSTI), introduced in 2006 by the Science and Technology Policy Council for creating networked centres of high research expertise that offer a "new way of coordinating dispersed research resources to meet targets that are important for Finnish business and society". The organisation of the various CSTI has been carried out together by the industry, universities and research institutes. On specific task of the CSTI is namely to increase co-ordination of research activities between partners to meet the knowledge demand. According to the framework set by the Science and Technology Policy Council in June 2006, in CSTI "companies, universities and research institutes will agree on a joint research plan". The research plan will aim to meet the research needs related to expected applications by companies within a 5 to 10 year period. The research agenda will be implemented through research programmes, consortium projects and company projects.

The government will allocate additional funding to these centres but the aim is to mobilize the private sector to take part more actively in research funding. This is achieved by giving companies (as well as universities and research institutes) the main responsibility in establishing the centres and a key role in directing the research activities carried out in these centres. In the decision to set up CSTI it has been explicitly stated that "in addition to shareholders, public funding organisations will

commit themselves to providing funding for the centres for a long time period". So far there are five operational CSTI: Forestcluster Ltd (forest and paper), TIVIT Oy (information and communication industry and services) and FIMECC Oy (Finnish Metals and Engineering Competence Cluster), the energy and environment cluster CLEEN Oy and RYM-SHOK Oy for the cluster around built environment. Yet another CSTI for the health and wellbeing cluster is currently under construction.

Route 6: Increasing R&D in the public sector

Funding of public research has been a major component of the Finnish policy mix for R&D funding. A significant part of the government budget appropriations or outlays on R&D (GBAORD) goes to finance of budget funding. The public R&D funding is directed mainly to universities, to government research institutes as well as to the Academy of Finland and Tekes.

The funding provided for universities and public research institutes represent the largest share of the public sector R&D. However, the share (41.5%) is still quite low in international comparison and although institutional funding for universities consists a significant part public sector R&D funding it has been seen recently that the core funding for universities is too low in order to develop attractive research careers and for developing research infrastructures. The reason behind this situation is that during the past decade the share of external (competitive) funding has been high.

The amount of competitive funding instruments is significant in Finland and has also increased rapidly. For example the Academy of Finland various research funding decisions increased from €73m in 1995 to €157m in 2000 and to €264m in 2007. With this funding the Academy supports public R&D in various ways though grants to research, researcher training as well as internationalisation and mobility. This is carried through grants, research programmes and centre of excellence programmes (funding academic research units). In addition to support for private sector R&D, a significant part of Tekes funding is also directed to R&D in the public sector. Around 40% of all Tekes R&D funding goes to universities and public research institutes. Also the Tekes funding for universities and public research institutes has increased steadily from €86m in 1995 to €140m in 2000 and to €185m in 2007.

According to the ex-post evaluation of the Structural Funds a total of €208.1m was allocated to RTDI activities during the programming period 2000-2006, which was 13.7% of all SF funding for Finland. For the 2007-2013 period, the specific objective "Promotion of innovation and networking and strengthening of knowledge structures" will cover approximately 35% of the ERDF funding and when looking at the R&D activities under other priorities Finland will invest over 54 % of all funding in activities related to RD&I. The R&D funding trough SF is obviously more emphasised in the 2007-2013 period, although most of the funding will directed to framework conditions such as research infrastructure and development of R&D support services.

There are plans to further increase government funding especially for universities (Science and Technology Policy Council, 2008). The additional funding is planned to take place both in the form of institutional funding as well as raising the basic capital of the universities. These plans are tightly connected with the objectives of the ongoing university reform. The new Universities Act aims to expand the funding opportunities of the Universities. According to the new Act, the government would guarantee core funding for all universities. As independent legal persons, the universities would receive funding from university business operations, donations and any capital income they may have, in addition to the government funding.

The importance of education and innovation policies

Education and innovation policies in Finland are closely tied to those affecting research and these different policies are increasingly considered as a whole in the strategic level of policy making. This is clearly evident in the 2008 review by the STPC where a distinct acronym "ERI" is widely used to describe the context of Education, Research and Innovation policies forming a broad based entity, also called as a "systemic approach". In the same strategy report it is also specifically stated that "The education policy is an increasingly important part of this whole whilst research forms a major element of the overall innovation policy".

The importance of education policy is also visible in the way how university reform and the structural development of higher education system and implementation of four-tier researcher career system are systemically discussed from the wider perspective of ERI policies. Especially researcher training and research careers are amongst the priorities of education policy in 2009. Other discussion points have been mainly focused on the quality of education, the selection and support for top performing units, internationalization of education as well as links between education and working life. According to STPC the new expanded innovation policy approach has meant that also the polytechnics, upper secondary level education institutions and their public and private organisations producing new knowledge and know-how have more tasks in relation to enhancing the knowledge base. Finland has also been active in the Bologna process. The idea has been that new harmonised academic degree standards and other cooperation facilitate the mobility of researchers, which provides better access to human resources.

Assessment of the importance of policy mix routes and their balance

Table 7: Importance of routes in the national policy and recent changes

Route	Short assessment of the importance of the route in the national policy	Main policy changes since 2008
1	Relatively major. Entrepreneurship receives a lot of policy attention and there is support for early stage finance. Much of the efforts has been through creating framework conditions rather than dedicated funding	Business accelerator programme VIGO for fast growing young companies
2	Major focus – direct measures especially trough Tekes grants and loans and programmes	None
3	Minor focus – not directly addressed other than through general encouragement and potential incentive of R&D tax credits.	None
4	Relatively minor. Individual organisations and measures at the national and local city level but the investments modest compared to other routes	None
5	Increasing specific policy focus – encouragement of science base-industry interaction has been a long standing priority but the measures have been mainly integrated in the mainstream instruments	More Strategic Centres of Science Technology and Innovation have been established
6	Public sector research is a major route for investment. New investments linked to various reforms in the research system as well development instruments to better support the needs of the economy and society	New Universities act aims to broaden the funding base of universities

3.4 Progress towards national R&D investment targets

Several strategy documents (Government programme, NRP 2008-2010 and STPC Review 2008) define the target for GERD to represent 4% of GDP by 2011. According to current GDP and R&D funding estimates this objective will not be attained. The share of public spending is aimed to contribute around 30% of total investment (or 1.2% of the GDP). The government R&D funding is planned to be increased by 5.7% in 2009 to €1899.7m, which is in line with the target of 5% annual increase.

Table 8: Main R&D investment indicators for Finland

	2005	2006	2007	2008	EU-27 (latest year)	
					Average	Year
GERD (euro million)	5474	5761	6243	*6446*	*226120*	**2007**
R&D intensity (GERD as % of GDP)	3,48	3,45	3,47	*3,39*	*1,83*	**2007**
GERD financed by government as % of total GERD	25,7	25,1	24,1	**na**	*34,2*	**2005**
GERD financed by business enterprise as % of total GERD	66,9	66,6	68,2	**na**	*54,5*	**2005**
GERD financed by abroad as % of total GERD	6,3	7,1	6,5	**na**	*9,0*	**2005**
GBAORD (euro million)	1614	1694	*1730*	*1798*	*87639*	**2007**
GBAORD as % of general government expenditure	2,03	2,08	*2,04*	**na**	*1,55*	**2007**
BERD (euro million)	3877	4108	4513	*4661*	*144089*	**2007**
Business sector R&D intensity (BERD as % of GDP)	2,46	2,46	2,51	*2,45*	*1,17*	**2007**
BERD financed by government as % of total BERD	3,8	3,7	3,5	**na**	*7,2*	**2005**

Source: Eurostat[4]

Table 9: The development of R&D expenditure in Finland 2001-2008

	BERD		GOVERD		HERD		GERD	
	million €	%	million €	%	million €	%	million €	%
2001	3,284.0	71.1	500.9	10.8	834.1	18.1	4,619.0	3.3
2002	3,375.1	69.9	529.7	11	925.6	19.2	4,830.3	3.35
2003	3,527.9	70.5	515.4	10.3	961.7	19.2	5,005.0	3.43
2004	3,683.5	70.1	530.1	10.1	1,039.8	19.8	5,253.4	3.45
2005	3,876.9	70.8	554.7	10.1	1,042.1	19	5,473.8	3.48
2006	4,107.8	71.3	574.2	10	1,079.2	18.7	5,761.2	3.45
2007	4,513.4	72.3	564.7	9	1,164.6	18.7	6,242.7	3.47
2008*	4,661.3	72.3	559.5	8.7	1,225.2	19	6,446.0	3.37

Source: Statistics Finland[5]

The figures in Table 8 demonstrate that BERD has increased faster than GERD. Also the share of HERD has been increasing in the past two years. In general the increase in GERD has been on average 4.9% between 2001 and 2008. The latest estimates show that that the growth of especially business R&D has slowed down but at the same time government R&D spending and financing for the HEI sector will continue to increase.

[4] *Note:* Values in italics are estimated or provisional. **na** = not available
[5] *Note:* Values in italics are estimated or provisional

Table 10: Main barriers to R&D investments and respective policy opportunities and risks

Barriers to R&D investment	Opportunities and Risks generated by the policy mix
Economic crisis affecting private sector R&D	New activating processes and support for user and customer oriented innovations may increase private sector R&D
Economic crisis may affect negatively to plans for private sector investments in university research	New Universities act may provide universities new ways to attract R&D funding
	Pooling and prioritising in the national strategies may increase R&D investment in strategic areas

4 Contributions of national policies to the European Research Area

ERAWATCH country reports 2008 provide a succinct and concise analysis of the ERA dimension in the national R&D system of the country. This Chapter further develops this analysis and provides a more thorough discussion of the national contributions to the realisation of the European Research Area (ERA). An important background policy document for the definition of ERA policies is the Green paper on ERA[6] which comprises six policy dimensions, the so-called six pillars of ERA. Based on the Green Paper and complementing other ongoing studies and activities, this chapter investigates the main national policy activities contributing to the following four dimensions/pillars of ERA:

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

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

4.1 Towards a European labour market for researchers

In 2007, there were 39,000 researchers (FTE) in Finland (OECD, 2008). The number of researchers as % of labour force was 2.01 in 2006 (Source: Eurostat). This figure was more than twice as much as the estimated EU-27 average of 0.82[7]. In 2000-2006, the number of researchers increased slightly by 11.9%. In 2000-2007, the total

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

[7] There are not comparable Eurostat statistics from other countries outside the EU but according to OECD the number of researchers as % labour force was 1.50 in 2005 when it was 0.93 in the US.

amount of doctoral degrees increased by 32% (KOTA database, 2009). With regard to science and engineering, the increase of doctoral degrees was also 64%. Simultaneously, the number of other higher education degrees in science and engineering increased by 34%%.

The large number of researchers and doctoral degrees is partly explained by the Finnish graduate school system. In 2007, the system comprised 119 graduate schools. The schools had about 1450 graduate students who were paid for working full-time on their doctoral dissertations. The goal is that the students complete their doctoral dissertations in four years. All of Finland's 20 universities house one or more graduate schools, often in collaboration with other universities or research institutes.

Since the number of Finnish citizens reaching the graduation age will becoming smaller it is obvious that having a sufficient pool of qualified human resources is one of the key challenges in Finland. There is an increasing need to attract foreign researchers and other experts to the country in order to maintain the high level of R&D and innovation activity.

In international comparison the inwards mobility and immigration of foreign professionals has been relatively low in Finland. In 2006, there were 5,434 foreign graduate or postgraduate students in Finland with an annual increase of 10% (MoE 2007). The number of foreign doctoral students was 1,641. For the sake of comparison, the share of foreign doctoral students was more than doubled in other Nordic Countries in 2004 (OECD, 2007) In comparison to the total number of graduate or postgraduate students, 160,400, the share of foreign students was also low in Finland, only 3.9%.

In the same way as with researchers, the students' interest to undertake studies abroad (outflow) has declined. The visits of university teachers and researchers abroad have been in decline (except the technical fields) since the beginning of 2000s. The inflow of foreign researchers and teachers to Finnish universities was 1733 people (2012 in 2000) in 2007. At the same time the outflow of domestic teachers and researchers was 1223 (1467 in 2000) (Source: KOTA-database, 2009).

Several weaknesses in the Finnish research system for attracting researchers from abroad have been identified (Noki & Kovanen, 2008). The career opportunities for researchers have been limited with few permanent positions and therefore a dependence on short term funding. The remuneration level has been lower than in many other European countries. In some studies it has been also noted that often the families and especially spouses have had difficulties in getting a job.

The administration has also proved to be a challenge. Basically there are rules and practices to help foreign researchers to work in Finland but the information is fragmented and there has not been a dedicated programme to facilitate the immigration of foreign experts. The private sector has also not been very keen to recruit foreign researchers except for the few international companies. The administrative limitations at the universities have also made it more difficult to compete internationally (e.g. salaries).

4.1.1 Policies for opening up the national labour market for researchers

Finland does not have a specific programme for attracting experts from abroad but some changes have been made to indirectly render the Finnish labour market more open for foreign researchers and other experts. The Aliens Act has a specific route for experts with a fixed period tax relief programme for foreign experts. The

universities have also been given more opportunities to operate in the international educational markets. However, there are still many obstacles and issues that need further development as the Review of STPC in 2008 states:

"International competitiveness of income taxation must be ensured when it comes to non-Finnish key individuals and experts. We must introduce a proactive employment- and competence-oriented immigration policy and legislation to support it. Comprehensive implementation of the integration policy requires considerably increased resources. Preparation of a policy promoting multiculturalism must be commenced."

With respect to mobility of researchers also a specific Mobility portal has been established. In opening up universities Finland has been very active in the Bologna process and the changes in legislation have been carried out to facilitate the process of internationalisation.

It has been acknowledged also that since Finland cannot compete very well directly for researchers it is important to attract foreign potential future researchers already at the stage when they are still studying. As a result the Ministry of Education and universities have agreed that more Master's degree programmes in English shall be established. There are also some joint study programmes with foreign universities (e.g. Lappeenranta University of Technology and Russian universities from St. Petersburg). The accession by Russia to the Bologna Process has made it easier for Finnish universities to jointly plan educational programmes with Russian partners.

It has been also discussed that the most promising stage for attracting researchers is typically the post-doc phase when young researchers are more mobile than during a more established phase in the career. The development four-tier researcher education and increasing funding opportunities for the post-doc phase is under development. Although the development of the researcher career opportunities is targeted to all researchers it will also open up new possibilities for foreigners.

The major dedicated instrument has been the FiDiPro-programme started in 2006. FiDiPro aims specifically to world-class researchers with well-established scientific expertise. The incentives for international mobility of senior researchers are attractive research environments and infrastructure as well as competitive salaries. Experts to be hired will have to be of high international level both in regard to scientific competence and experience in providing researcher training. Starting from 2009 a new FiDiPro Fellow -programme has also started. It will target young promising researchers in addition to professors that were the target of the original programme.

According to first informal feedback based on applications and user comments the FiDiPro programme has been well received and has had active participation. However there has been concern about the administrative burden as well as the ability of the programme to attract truly first class researchers. However, the initiative has not yet been evaluated so whether it has been successful is not yet known.

4.1.2 Policies enhancing the attractiveness of research careers in Europe

The decreasing outwards mobility of Finnish researchers has been a concern in the Finnish research and education policy for some time. It has been stated in several time that Finnish researchers should be encouraged to internationalise. However, given the long term prospect of shortage of skilled workforce there are not nay

policies for promoting research careers in Europe but about fixed term mobility of Finnish researchers who are hoped make most of the research careers in Finland.

Finland is active in participating in the EU mobility schemes. Finnish organisations have been very successful in recent Marie Curie actions although the Finnish participation is still below average. Finnish researchers are also encouraged to participate in joint European research initiatives such as the Framework programmes, COST. Especially Academy of Finland and Tekes are also involved in various ERA-NET activities. In addition, these organisations promote international co-operation and mobility in their R&D funding schemes.

Uptake of the Charter of Researchers

There are two organisations in Finland that have signed the Charter of Researchers: the Academy of Finland and the Finnish Council of University Rectors. Through the latter, all universities are also represented. This covers the majority of research organisations in Finland although the state research institutes (from the main research performers) and Tekes (from main R&D funding organisation) have not signed the Charter. The impact of the charter to national policy making is still unclear as the initiative is still rather new.

Remuneration policies

Until recently the universities did not have much freedom in determining the salaries of the academic staff. However, during the 2000s, a new salary system for universities (VPJ) has been introduced. It consists of two assessment systems: an assessment system applicable to teaching and research personnel, and an assessment system applicable to other personnel. In this new salary system a personal performance salary component (maximum 46% of the basic salary) has been introduced, which will give some additional freedom of action. In specific cases a contractual salary can also be paid e.g. to highly distinguished foreign professors. However, the salary is still in most cases determined by the joint salary system and not by individual universities. In the state research institutes a similar salary system with basic salary and personal performance component is also widely used.

The new Universities Act will give universities more freedom with regards to salaries. E.g. the new Aalto University (with a foundation as a legal form) aims to be more competitive internationally and higher salaries are expected be introduced to some academic staff. However it seems improbable that this increase in the level of remuneration could spread very wide as the funding for the university is not expected to grow significantly.

Moreover, the Academy of Finland FiDiPro provides additional funding opportunities for the universities and research institutes to hire a recruitment of internationally renowned researchers for a fixed period.

Promotion of women

In 2006 the share of female researchers (headcount) was 32% in Finland. This was slightly higher compared to 30% in EU27. In the business enterprise sector the share was 18%, which was the same as in the EU27. In the government sector (43%) and higher education sector (45%) the share of women is relatively high. However, compared with the share of women of university students (54%) women are still underrepresented in the research labour force. The situation is even more biased, when looking at the share of women holding professorships (23.5%), although the

share of women holding professorships is amongst the highest in Europe. The share of women as researchers has also increased throughout the 2000s (except for the business enterprise sector).

There has been a notable amount of research on the situation with women in the research profession but not many specific measures have been introduced. The legal position of women in having career breaks for family reasons is fairly good with the restoration back to the same work guaranteed by the law (this also applies to men) and contract extension for fixed-term contracts is also possible. According to some practices the role of women is mainly compromised by the increased demands from the work itself with increasing amount of work to be done, which causes problems to all researchers with families but particularly women. In this way it could be argued that the real world working life imposes more challenges on the position of women than the formal structures.

Most of the universities as well as the Academy of Finland have also introduced specific equality plans (that also cover women). At the University of Helsinki, for example, an Equality Plan has been adopted, as stipulated by the Act on Equality between Women and Men (Act No 609/1986), to advance gender equality and prevent discrimination. There are also specific equality committees that oversee the development of equality issues. The impact of these policies remains unclear as there has not been any systematic monitoring of these activities.

There are also some initiatives to promoting the employability of women in engineering and technology fields. Compared with many other European countries the share of women in engineering research is quite low. The same applies to the share of female researchers in the private sector. One recent example of initiatives was WomenIT – Women in Industry and Technology, an ESF development, training and research project 2001-2006, which promoted the employment of women in the sectors of technology and industry.

4.2 Governing research infrastructures

Finland has also a long tradition of utilizing the infrastructures and experimental arrangements of other countries, since Finland has not had the funds for major investments in research infrastructures (National-level Research infrastructures, 2009). In the early days this was mainly carried by individual Finnish researchers or research teams, who used international infrastructures through offering their expertise in exchange or with payment of small user fees. The formal participation in international research infrastructures began in the 1980s. As a result Finland has been very active in participating in international research infrastructures especially in the European level as well as with other Nordic Countries.

The establishment of European Strategy Forum on Research Infrastructures (ESFRI) in 2002 has been perhaps one area where ERA has had a significant influence is the process of establishing a national research infrastructure policy. As of today Finland has not had any centralised research infrastructure policy but the establishment and development of research infrastructures has been decentralised to various organisations such as ministries, universities and research institutes. However, this situation is changing.

Following the recommendation given in the Science and Technology Policy Council's report of 2006, the Ministry of Education and the Ministry of Trade and Industry appointed a Committee to prepare a proposal that identifies important research

infrastructure, a system of funding for research infrastructures and procedures for identifying and evaluating the need for establishing new infrastructures. In February 2009 a national roadmap for important national research infrastructures was published with proposals for organising a national research infrastructure policy in the future. The steering committee identified 24 projects and accepted 20 proposals for significant national research infrastructures. The European dimension is integrated in the roadmap as thirteen of the selected projects are associated with ESFRI roadmap projects.

Finland has also been active in ESFRI and has participated in the preparatory phase of 314 projects on the ESFRI roadmap (with national and FP7 funding). Through international memberships Finland is also involved with 3 other ESFRI roadmap projects. Finland has also had successful cooperation with other Nordic countries in participation in some European research infrastructures. Examples include the joint Nordic Nordsync consortium within the European Synchrotron Radiation Facility (ESRF) infrastructure and the Facility for Antiproton and Ion Research (FAIR) project.

Finland has also had co-operation with other Nordic countries in regards to research infrastructures for some time. An example of joint Nordic investment in astronomy is the Nordic Optical Telescope (NOT), the Nordunet data network and the distributed Nordic DataGrid Facility (NDGF) for high performance computing.

With the expressed need for a more centralised research infrastructure policy a need for additional funding for the development of research infrastructures has also been addressed. According to estimates Finland spends approximately €130m annually of public funding for the upkeep of the national research infrastructures and around €30m for the membership fees in international research infrastructures. In addition the participation in and utilization of international infrastructures requires investment and coordination of activity at the national level. According to the roadmap another €30m would be needed annually for the development projects between 2008 and 2020 as well as a centralised funding system for securing the funding for the renewal of the existing research infrastructures. There have not been any formal decisions yet about these proposals but it can be assumed that more attention (and resources) will be given to the development of research infrastructures in the future.

It has been also noticed in Finland that research infrastructure policy has to be an integral part of national research and innovation policy and in this way the development of research infrastructures will probably be a more central part of the policy mix. Based on the recent developments, Finland will also seek active collaboration within ERA in the development and use of European research infrastructures and aims to coordinate the related national activities. The planning of the development of the national research infrastructures is aimed to accommodate to the European developments. In addition to research per se there is an aim to better utilise the European research infrastructures for the mobility of researchers, researcher training and the planning of the work of researcher training schemes.

4.3 Research organisations

The university system in Finland has been going through a modernisation process during recent years. In 2007, measures for preparing a university reform were started with the aim to renew the structure of the university system as well as to give universities more autonomy. The reform process is underway and is about to be formally completed when the new Universities Act will become effective in August

2009. From a resource point of view, the objective of the reform is to concentrate resources for better performance and to give universities more autonomy to manage their own resources and to widen the resource base. The increased resources included specific government financing to the new Aalto University (created by the merger of the Helsinki University of Technology, the Helsinki School of Economics and the University of Art and Design Helsinki), as well as additional financing to other universities. In the decision of June 17th 2008 the government ministerial committee for economic affairs made the decision of investing €150m to improve the solidity and capitalization of the universities (excluding Aalto University that has separate funding reserved).

The internationalisation of universities has taken place to great extent through internationalisation of education. The 2005 degree reform gave the universities greater potential for international co-operation. Universities have launched numerous international Master's programmes and several Erasmus and Erasmus Mundus programmes, while they have also designed provision at Master's and doctoral level in particular to be more suitable for international students (Universities, 2006).

The Finnish universities are quite open especially in terms of student and researcher exchange and research collaboration. For example the University of Helsinki has more than 350 exchange partners in Europe and another 80 bilateral agreements with universities in other parts of the world. The biggest technical university, TKK, has around 100 Erasmus partners and around 50 bilateral agreements around the world.

The increased role of the European context is also visible in external funding of universities. The share of external R&D funding of international origin for universities has grown with some fluctuation from 11.6% in 2000 to 15.5% in 2007 of all external university R&D funding. Of the entire R&D funding 11.7% was EU R&D funding, 1.8% foreign private sector funding and 2.0% other international funding (KOTA database, 2008). The share of the EU R&D funding of all funding at the Finnish universities has increased from 3.9% to 6.5% from 2000 to 2007.

However, specific need for further internationalisation of universities has been identified and that the internationalisation of the higher education system should be accelerated. This need was addressed in the process for creating a new internationalisation strategy for universities in 2008. The strategy was published in 2009.

The aim of the internationalisation strategy is to bring together the issues related to the international dimension of the government activities to reform the university system. The strategy also aims to launch other measures related to the selected development areas.

There is also an ongoing initiative to renew the sectoral research system. Based on the specific report for developing sectoral research (Sektoritutkimusryhmän mietintö, 18 December 2006), the government made a decision on 28 June 2007 to develop the sectoral research to better meet the changing needs of the society (sectoral research is defined to mean all research that supports public policy and public services). In the resolution sectoral research was divided into four main areas: regional and community structures and infrastructure, knowledge, work and well-being, and sustainable development and safety, with each area constituting a sufficiently wide, synergic entity. There have been further consultative reports published in 2008 but the reform process is yet quite uncompleted.

4.4 Opening up national research programmes

The official approach to ERA by the Ministry of Education is that one key mechanism for Finland to participate to the development of the European Research Area is by actively networking national research programmes with national research programmes of other countries (Education and Science in Finland, 2008). During recent years both Tekes and the Academy of Finland have actively developed the international dimension of their programmes. Many of the programmes are open to foreign participants (although not always funding) and international co-operation within research projects is actively encouraged. In practice this has meant that e.g. new research programmes by the Academy of Finland have been designed with an international dimension in mind and some of them are truly collaborative, involving partner research organisations from other countries.

Of the ongoing Academy of Finland Research Programmes 6 out of 10 are open to foreign participation and hereafter all programmes that do not exclusively target on national issues will have some kind of international dimension. Tekes also supports international co-operation but only finances the Finnish counterparts. However, to promote co-operation, Tekes has established cooperation agreements with international funding agencies all over the world to exchange information and launch joint calls for proposals or joint R&D programmes. However, the international co-operation has not had any specific ERA dimension; instead collaboration is typically sought with countries and foreign organisations, which are seen as suitable partners.

The international dimension typically covers bilateral agreements with foreign research funding organisations or co-ordination with ERA-NETs and the main rule is that those programmes that have a visible European dimension or value added will be carried out trough ERA-NET activity. Also co-ordination of national programmes with Framework programmes and other European instruments is typical. Currently the Academy of Finland co-ordinates two ERA-NETs (BONUS and NORFACE) and participates in 14 other ERA-NETs. Tekes coordinates 3 ERA-NETs (WoodWisdom-Net, ERA-Build and Matera) and is participating in 11 other ERA-NETs.

Besides active focus on operating within ERA, the Finnish research policy has also a specific Nordic dimension. The Nordic countries collaborate in many different operations and arenas, e.g. in various Nordic research programmes and Centre of Excellence Programmes.

4.5 National ERA-related policies - a summary

In general it can be concluded that in Finland many developments in line with the ERA objectives have been taking place during the past few years. There is an ongoing university reform as well as the reform of the (sectoral) public research institute system. The internationalisation of labour market of researchers has also developed although so far Finland has not been very successful in this. The opening up of national programmes has also developed gradually although this process has not thus far extended to funding. On the other hand, the planning of Finnish national programmes is commonly co-ordinated with the activities at the European level with the aim to find a suitable division of labour between national and European instruments. The development of research infrastructures has been given more attention recently and there is a clear focus on developing a more centralised national policy for developing research infrastructures. This process is deeply integrated with the European developments of ESFRI.

However it can be argued that most of these changes have not been directly influenced by ERA but more based on national policy discussion and identification of needs to renew various dimensions of the research and innovation system. As many of the development paths have been in line with the objectives of ERA there has been little need to make significant changes in the national policy developments. This has not by any means meant that Finland would not have participated in the development of ERA. Participation in European activities is strongly encouraged and national activities are co-ordinated with the European activities.

As a result it can be argued that ERA dimension has not had a significant influence on the design of national policies for research. Perhaps the policy area, where ERA has had the biggest impact on Finnish national R&D policies is the research infrastructures; this part has been relatively underdeveloped in Finland compared to other research policy dimensions.

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

	Short assessment of its importance in the ERA policy mix	**Key characteristics of policies**
Labour market for researchers	• minor	• Towards a more competence based immigration policy • Developing a more attractive research career system • Participation in European initiatives
Governance of research infrastructures	• Important - national policy development has received support and inspiration from European activities	• Centralised specific policy for research infrastructures still in the making
Autonomy of research institutions	• Important, although ERA dimension is mostly not specified	• The autonomy is expanded through changes in the management and financing system
Opening up of national research programmes	• Minor - the process of opening up is not much ERA related	• Mostly national based

5 Conclusions and open questions

5.1 Policy mix towards national R&D investment goals

The main barriers to private sector R&D investments in Finland are the worsening economic situation, the low number of R&D performing companies as well as low R&D intensity in non-manufacturing sectors. Also the ability to attract FDI has been rather low.

When looking at the policy mix for stimulating R&D investments it can be concluded that the support for public sector research is a major route for investment as in many other countries. In addition to strong commitment to continue major support for public R&D the new investments are in many cases linked to various reforms in the research system as well as to development of policy instruments to better support the needs of the economy and society.

Stimulating R&D investment in R&D performing firms has also been a widely used rout in Finland. Especially Tekes funding trough grants and loans has been a major instrument. Recently these instruments have also increasingly catered for non-technological areas as well such as services. Other forms of more specific instruments have also been introduced recently

Promoting the establishment of new indigenous R&D performing firms has also been a priority. Entrepreneurship receives a lot of policy attention and there is support for early stage finance. However, much of the efforts has been trough creating framework conditions rather than dedicated funding

Support for firms that do not perform R&D yet is not a major focus although the relative importance is on the rise. Yet there are quite few specific instruments in use. Entrepreneurship receives a lot of policy attention and there is support for early stage finance. Much of the efforts has been trough creating framework conditions rather than dedicated funding

There has also been an increasing specific policy focus in encouragement science-industry interactions. This route has been a long standing priority but mostly the measures have been integrated in more mainstream instruments such as Tekes programmes. The recently established Strategic Centres for Science, Technology and Innovation have been a new major instrument in this area and the new centres are expected to receive significant funding in the future.

Attracting R&D-performing firms from abroad has not been a major focus in Finland. Individual organisations such as Invest in Finland and measures at the national and local city level but the investments in these activities are not very significant.

5.2 ERA-related policies

The ERA and ERA-related policies do not assume major significance in the overall national research policies and strategies in Finland. This does not mean that European and international context is not important for Finland. Although there is a strong national priority of research and innovation policies, international linkages are necessary not only for scientific reasons (quality of research, international knowledge networks) but also to economic reasons to complement the rather limited national resources in a small country. As a result, the participation in European initiatives by public and private sector researchers alike is strongly encouraged by the government. However, there is relatively little evidence of any developments that focus on greater cooperation with the ERA (in comparison with more general internationalisation strategies).

Finland is approaching ERA in many dimensions. However, although ERA is specifically addressed in the internationalisation activities of various research policy actors, ERA is not specifically addressed very clearly but is only one dimension in the more broader internationalisation plans, although an important one.

The main components of national strategies to the ERA appear to be the general high level of integration of the Finnish research base in European activities. The overall openness of Finland to foreign research collaboration is also increasing although national programmes do not yet offer funding for non-Finnish individuals or companies. In terms of its attractiveness to external researchers Finland has not done very well although the situation has improved during recent years and much effort has been done to improve the situation. One specific area where ERA has

been increasingly visible in the national policymaking is the research infrastructures policy.

It is not possible to identify any main challenges for the national R&D system in relation to ERA development. It is commonly argued in Finland that the focus for internationalisation of research activities have been a focus area at least since 1990s and that EU policy has mainly strengthened this development by providing concrete tools for collaboration that would have been difficult to set up nationally. Finland is therefore in a good position to integrate activities related to ERA development into national research policy activities.

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List of Abbreviations

BERD	Business Enterprise Expenditure on R&D
CoE	Centres of Excellence
COST	European Cooperation in the field of Scientific and Technical Research
CSTI	Strategic Centres for Science, Technology and Innovation (also the Finnish abbreviation SHOK is often used in the reports)
ERA	European Research Area
EU	European Union
ERDF	European Regional Development Fund
ERI	Education, Research and Innovation policies
ESFRI	European Strategy Forum on Research Infrastructures
FDI	Foreign direct investments
FP6	Sixth Research Framework Programme (European Commission)
FP7	Seventh Research Framework Programme (European Commission)
FTE	Full-time employee
GBAORD	Government Budget Appropriations or Outlays on R&D
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
ICT	Information and Communication Technology
IPR	Intellectual property rights
MoE	Ministry of Education

PRO	Public Research Organisations
R&D	Research and development
SIGHT 2009	The evaluation of science and research in Finland
Sitra	Finnish National Fund for Research and Development
SF	Structural Funds
SME	Small and medium sized enterprises
STPC	Science and Technology Policy Council (now Research and Innovation Council)
Tekes	Finnish Funding Agency for Technology and Innovation

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Abstract

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

This report encompasses an analysis of the research system and policies in Finland.

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