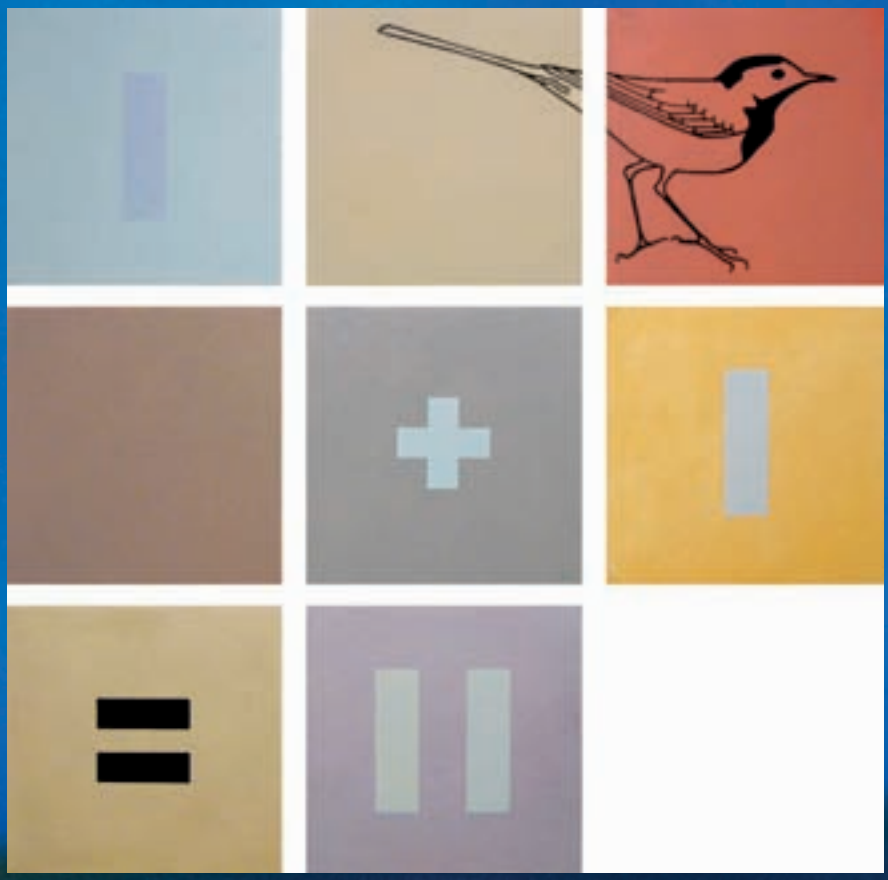
The State and Quality of Scientific Research in Finland 2009

Summary



Academy of Finland
Research funding and expertise

The State and Quality of Scientific Research in Finland 2009

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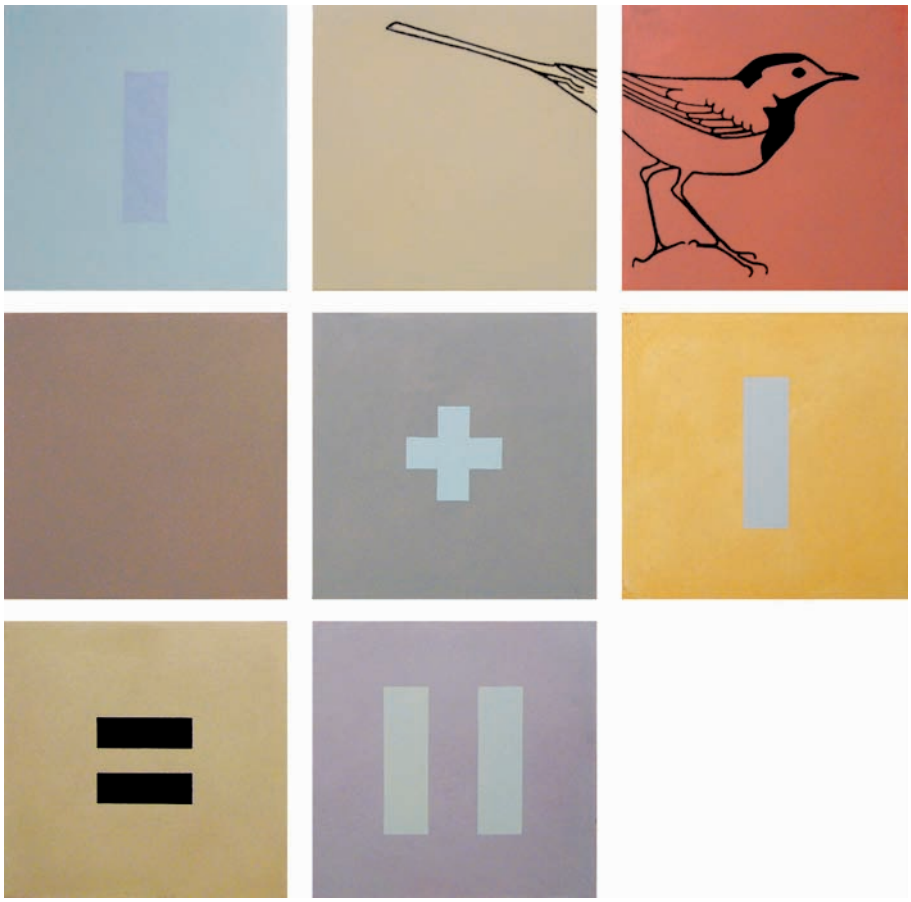

Edited by Paavo Löppönen, Annamaija Lehvo, Kaisa Vaahtera & Anu Nuutinen

Academy of Finland

Academy of Finland in Brief

The Academy's mission is to finance high-quality scientific research, act as a science and science policy expert and strengthen the position of science and research. The Academy's activities cover all scientific disciplines.

The main focus of the Academy's development activities is on improving opportunities for professional careers in research, providing resources and facilities for high-profile research environments and making the best possible use of international opportunities in all fields of research, research funding, and science policy.

The Academy has a number of funding instruments for various purposes. In its research funding, the Academy of Finland promotes gender equality and encourages in particular women researchers to apply for research posts and research grants from the Academy.

The Academy's annual research funding amounts to more than 287 million euros, which represents some 15 per cent of the government's total R&D spending.

Each year Academy-funded projects account for some 3,000 researcher-years at universities and research institutes.

The wide range of high-level basic research funded by the Academy generates new knowledge and new experts. The Academy of Finland operates within the administrative sector of the Ministry of Education and receives its funding through the state budget.

For more information on the Academy of Finland, go to www.aka.fi/eng.

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Vammalan Kirjapaino Oy, 2009

The State and Quality of Scientific Research in Finland 2009

Introduction

This document provides a summary of the Academy of Finland's latest comprehensive review of the current state of science and research in Finland. The review was approved by the Academy Board in August 2009 (Academy of Finland publications 10/2009).

The review

- provides an analysis of scientific research in Finland and the national research system in a European and global context;
- offers an assessment of the current state of research and the research system based on various indicators and comparisons; and
- outlines future directions for the development of scientific research and the national research system.

This document focuses primarily on the review's treatment of the national research system and on the main proposals for future development.

The national research system: recent trends of development

The case of Finland offers a good illustration of how a concerted and sustained development effort in the field of science and technology policy can move a country to the international forefront.

Following the creation of the country's basic science and research infrastructure in the 1960s and 1970s, including the establishment a network of universities and mechanisms for competitive funding, the next step in the 1980s was to proceed to the stage of technological development. The main goal was to diversify the national production structure and to bolster economic competitiveness. A dedicated funding agency (Tekes) was created to channel the necessary funding. Funding volumes increased very rapidly, and national technology programmes in particular provided a solid foundation for the expansion of information and communications technologies and for the diversification of industrial production. The technology programmes quickly led to increasing

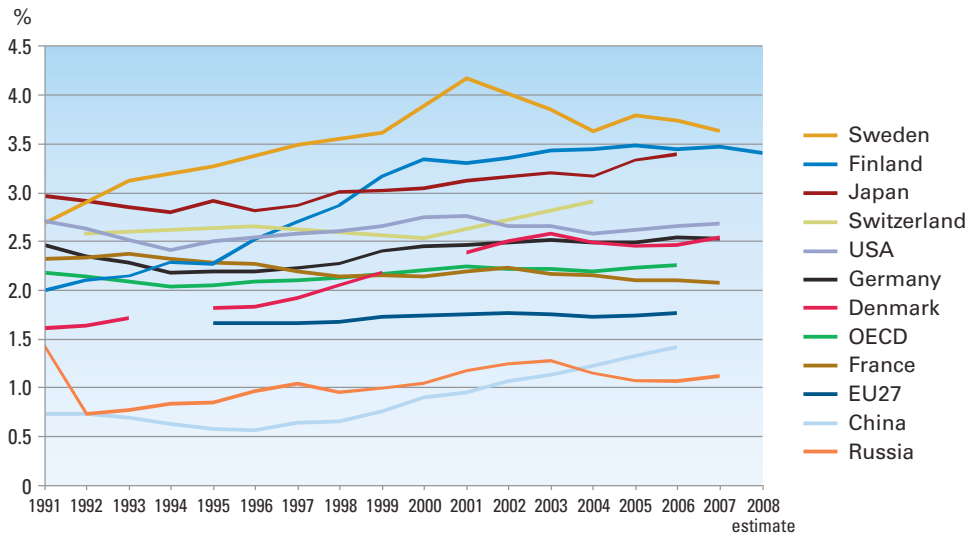

Figure 1. R&D investment as a proportion of GDP in selected OECD countries and in China and Russia.
Source: OECD 2008a.

cooperation between universities and businesses, which remains one of the main strengths of the Finnish research system to the present day.

Finland was the first OECD country to adopt the concept of national innovation system as a tool of science and technology policy development in the late 1980s and early 1990s: all actions and measures aimed at improving knowledge, skills and competencies were thus brought under the same umbrella. This same approach was also applied when in 1996 the Government decided to invest a substantial proportion of the proceeds from the sale of state enterprise shares into research and product development. This injection of extra funding into research and its multiplier effects meant that the country's investment in R&D, as a proportion of GDP, increased from 2.3% in 1995 to 3.4% in 2000, one of the highest figures in the world (Figure 1). During this period, both the Academy of Finland and Tekes saw their budgets more than double. This paved the way to significant new funding instruments in science and research and to the creation of the graduate school system, the post-doctoral researcher system, the national Centre of Excellence strategy and Centre of Excellence programmes.

In the run-up to EU membership and following accession in 1995, opportunities for international science and research cooperation expanded exponentially. EU cooperation has ever since provided an important springboard for the internationalisation of Finnish science and research.

The early 2000s marked a period of establishment in national science and technology policy. Finland ranked consistently among the top performers in international comparisons that focused on such aspects as knowledge-based development, sustainable development and international competiveness. Finland's main strengths were identified as lying in investment

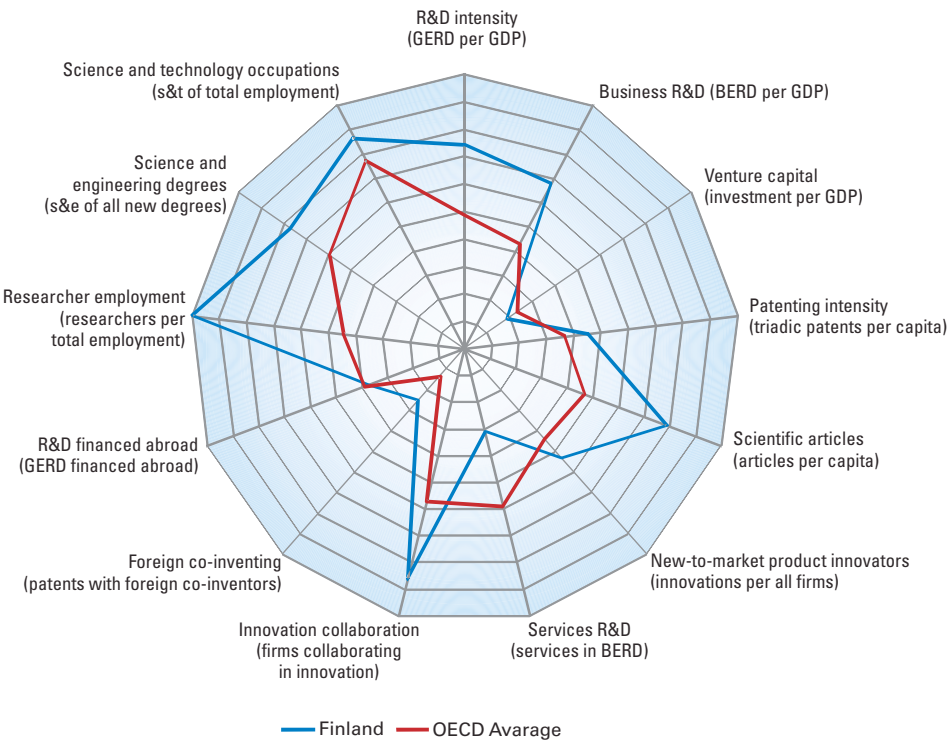

Figure 2. Profile of the Finnish research and innovation system.
Source: OECD 2008c.

in science and technology, education, researchers and the availability of researchers, and technological development. Relative indicators of scientific productivity and the quality of research also put Finland among the very best OECD performers.

Development efforts today are mainly driven by the 2005 Government resolution on the structural development of the public research system. A major focus is on the efficiency and impact of that system. The new Universities Act (2009) will afford universities greater economic autonomy, but also require them to prioritise operations, to profile units and organisations and to strengthen structures of cooperation.

The new network of Strategic Centres for Science, Technology and Innovation bring together scientific research, technological development and innovation in areas that are most crucial to the growth of Finnish business and industry. Strategic Centres are jointly run by public research funding agencies, private business companies and universities.

Figure 2 illustrates the main characteristics of the Finnish research and innovation system as compared to OECD averages. In a comparison with the world's leading science nations, five distinctive characteristics stand out in the Finnish system. R&D investment as a proportion of GDP and private business investment in R&D have remained at the same high level that was achieved in the early 2000s. In Finland, business companies work much more closely with research institutes and universities than is the case in the OECD on average. Finland stands apart from other OECD countries most clearly in terms of the number of scientists and researchers per one thousand employed people. Foreign funding for R&D is at a relatively low level. Finally, the number of scientific publications per capita is at the same level as in the traditionally strong science nations.

Structural development of the research system

For the past 15 years, the Finnish research system and Finnish research have ranked among the very best OECD performers as measured on many indicators. International comparisons have highlighted Finland's relatively strong and increasing investment in R&D, the sound and effective institutional framework for R&D, the high level of education and the country's success in the information technology field. Finland has shown a long-term commitment to developing consistent education, research and innovation policies.

In recent years, however, Finland's international competitiveness and position as an information society have been weakened. The growth targets set for R&D funding have not been reached. Needs for change have been identified both in the structures and in the operation of public education and research organisations. International comparisons of research output and quality show that Finland has fallen behind all the other Nordic countries. The information technology, forest and mechanical engineering sectors, all of which are of great importance to Finland, are also losing ground internationally. It is possible that current knowledge-based and technological strategies are too restrictive to effectively address the new emerging challenges.

In 2008, Finland's overall R&D investment came to 6.4 billion euros. The private business sector[1] accounted for 72% of this. The remaining 28% came from public sources: 19% from the higher education sector and 8.7% from other public sector sources. Other funding came primarily from abroad, chiefly from the EU framework programme for research.

Finnish R&D expenditure increased from 1998 to 2003 by 38.9% in real terms and from 2003 to

1 1) Business sector: manufacturing and other industries; 2) Public sector: government administrative branches (including government research institutes), other public institutions, private non-profit sector; 3) Higher education sector: universities, university hospitals, and polytechnics (from 1999).

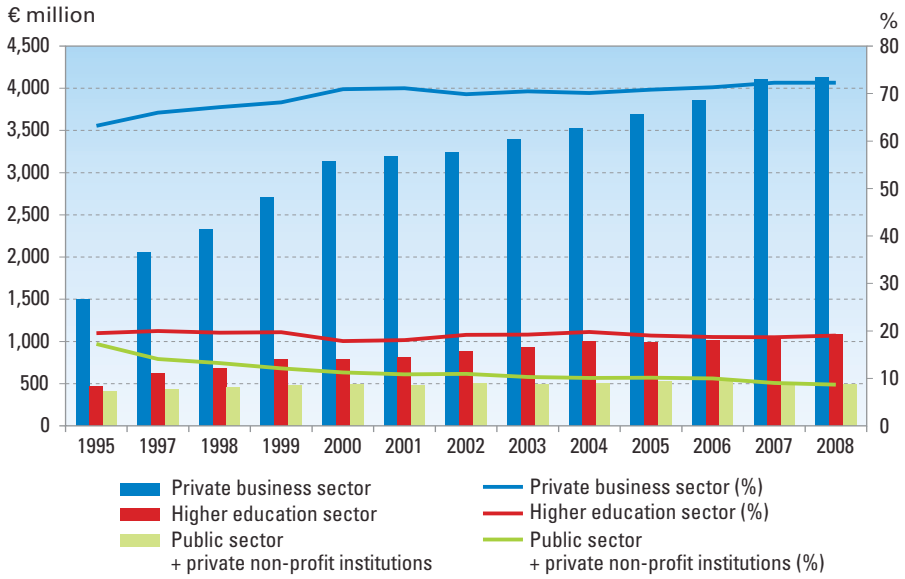

Figure 3. R&D expenditure in Finland* and breakdowns by sector in 1995–2008.
Source: Statistics Finland 2009.

* Deflated by GDP market price index (2000=100). Undeflated figures for 2008: total R&D expenditure 6.45 billion euros, with the private business sector accounting for 4.66 billion, the higher education sector for 1.23 billion and the other public sector for 0.56 billion.

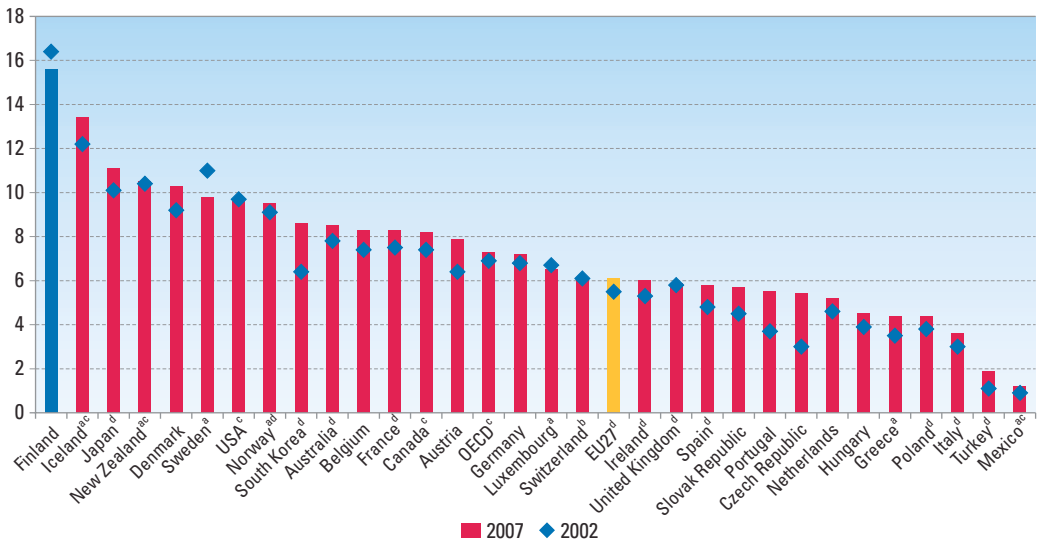

Figure 4. Number of research person-years per one thousand employed persons in OECD countries in 2002 and 2007. *Source: OECD 2008b, Main Science and Technology Indicators.*

a Data for 2003.
b Data for 2004.
c Data for 2005.
d Data for 2006.

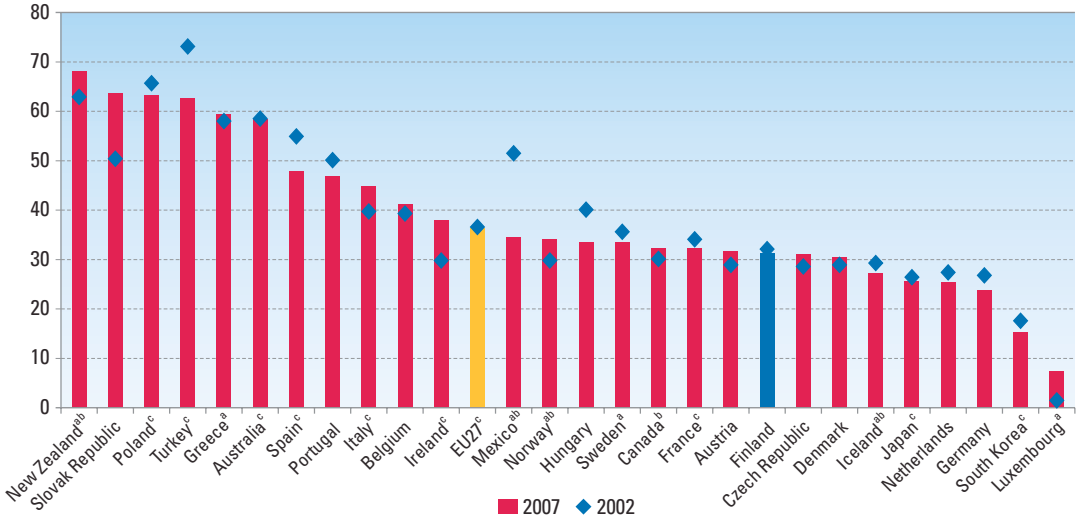

Figure 5. Higher education sector research personnel as a proportion of total R&D personnel in OECD countries* in 2002 and 2007. *Source: OECD 2008a, Main Science and Technology Indicators.*

* Data for the United States and the UK missing.
a Data for 2003.
b Data for 2005.
c Data for 2006.

2008 by 18.6%. The figures for the public sector were 8.1% and 0%, for the higher education sector 36.1% and 17.3% and for the private business sector 46.0% and 21.7% (Figure 3).

R&D currently provides employment for 2.3% of the active labour force, which is more than in any other OECD country. This is explained among other reasons by the rapid growth of research in the Finnish information industry, the high rate of tertiary education in the population and increased R&D funding. Staff numbers and person-years in R&D have increased in both the higher education and business sectors.

An analysis of the number of research person-years[2] shows that this figure began to drop 2004. In 2002 the number of research person-years per one thousand employed persons in Finland was 16.4%, in 2007 the figure was down to 15.6% (Figure 4). Finland and Sweden are the only OECD countries recording a drop in the number of research person-years from 2002 to 2007.

In the higher education sector, the number of research personnel in 2008 totalled around 28,500. Universities and university hospitals accounted for some 24,000 persons and polytechnics for around 4,500. Researchers working in the university sector accounted for 31% of total R&D personnel, which is lower than the EU27 average of 37%. The figure has dropped slightly from 2002 to 2007 (Figure 5).

In universities, overall research expenditure increased in real terms by 36% from 1997 to 2002. This trend slowed in the early 2000s. From 2002 to 2007, real expenditure growth was down to 9%, with total research investment in universities standing at one billion euros. The main source of outside funding was the Academy of Finland, which accounted for 31% of all funding from outside sources in 2007 (Figure 6). Tekes accounted for 18% of outside funding and private businesses for 15%. The main source of foreign funding was the European Union, which accounted for 11% of outside university funding.

2 Includes categories ISCO-2: Research Professionals and ISCO-1237: R&D Department Managers (OECD 2002, Frascati Manual… 2002).

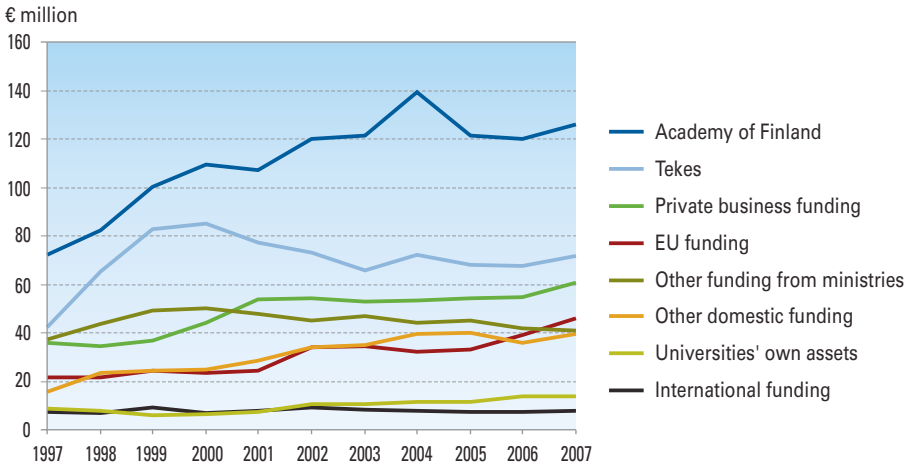

Figure 6. Research expenditure in universities* by sources of non-core budget funding in 1997–2007.
Source: Statistics Finland 2009.

* Deflated by Statistics Finland public expenditures price index item (2000=100) describing changes in university costs. Undeflated figures for 2007: Academy of Finland 151 million euros, Tekes 86 million euros, funding from business companies 72 million euros, EU funding 55 million euros, other funding from ministries 49 million euros, other domestic funding 47 million euros, universities' own assets 16 million euros, international funding 9 million euros.

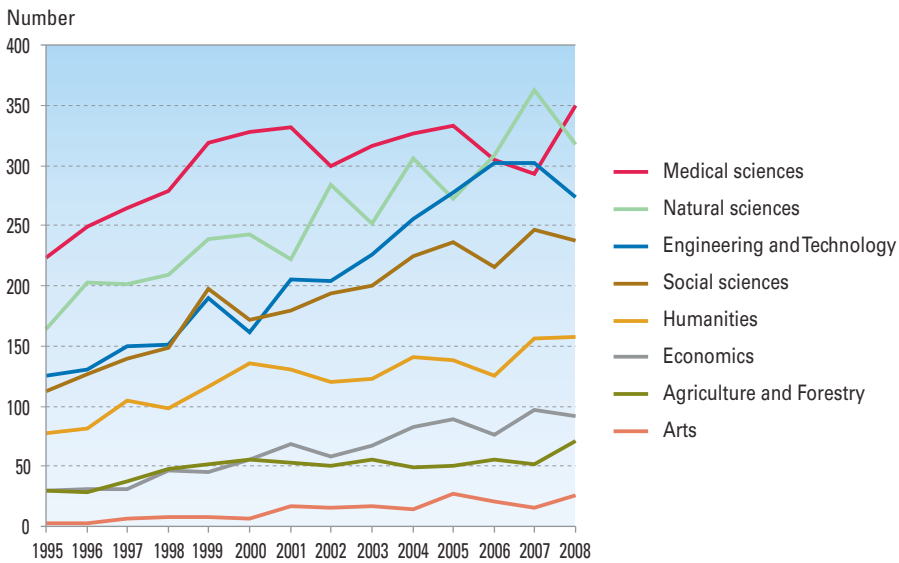

Figure 7. Number of PhD graduates by field of research in 1995–2008.
Source: Kota database, Ministry of Education.

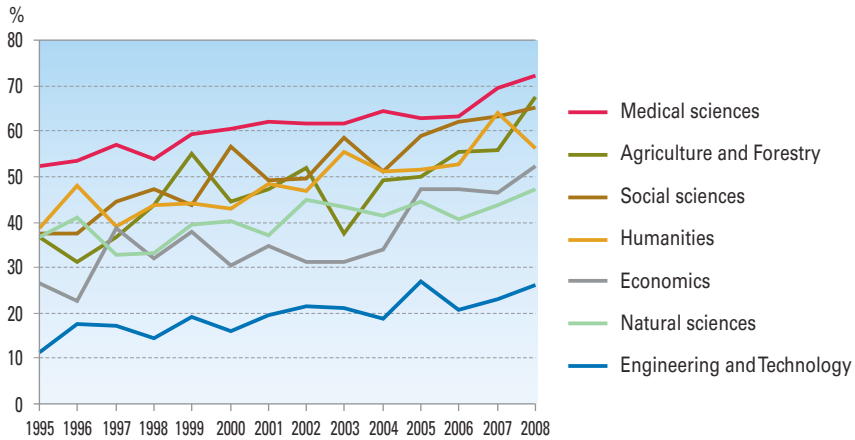

Figure 8. Proportion of women among PhD graduates by field of research in 1995–2008.
Source: Kota database, Ministry of Education.

The growth of funding for universities has slowed in the 2000s. In many disciplines outside sources now account for more than 50% of total university funding, thus exceeding the maximum level recommended by the Research and Innovation Council.

The number of PhDs completed at Finnish universities today stands at around 1,500 a year. Over the period from 1998 to 2008, this figure increased by 54%, and in the past five years (2003–2008) by 21%. By field of research, the slowest growth in the number of graduating PhDs in 2003–2008 is recorded for medicine and health sciences and the fastest for arts (Figure 7). The proportion of women among PhD graduates has increased significantly in all fields of research (Figure 8). In 2008, women accounted for over half of all PhD graduates in all other fields except the natural sciences and engineering.

High-quality research environments shall provide adequate opportunity for cooperation and career advancement in research, adequate research funding and a high level of research infrastructure. However, most of the existing funding for creative and competitive research teams and research environments in Finland is fragmented and relatively short term. One persistent difficulty in Finnish research teams is that, by international comparison, they do not have enough senior researchers relative to the number of PhD thesis writers. Many teams also lack in cultural diversity, which is a direct consequence of inadequate recruitment of foreign researchers.

Support for research infrastructures

Research infrastructures are an integral part of the national education, research and innovation policy strategy. In 2008, an international review and assessment of research infrastructures in Finland found that public investment in the maintenance of nationally significant infrastructures comes to around 130 million euros a year. Furthermore, some 30 million euros is spent on membership fees to international infrastructures. The conclusion from the assessment was that some nationally significant research infrastructures are fragmented and becoming outdated, and that there is not enough cooperation to make the best possible use of them. There is no centralised and coordinated funding system for upgrading and renewing infrastructures, or for the financing of new national projects. Participation in major international infrastructure projects requires investment and coordination domestically, too.

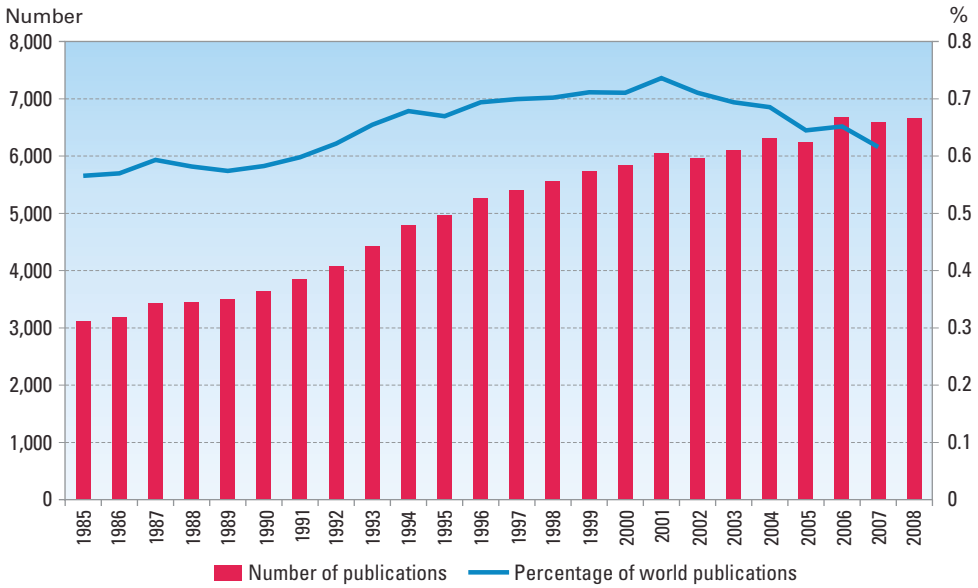

Figure 9. Number of publications from Finland and proportion of world publications in 1985–2008.
Source: Thomson Reuters databases, Swedish Research Council 2009.

Research output and scientific impact[3]

Measured by the number of international scientific publications, the output of research in Finland increased quite strongly from the mid-1980s through to the 2000s, but this trend came to a halt in the late 2000s (Figure 9). Over a period of 20 years, the number of publications from Finland almost doubled. During the ten-year period from 1988 to 1998, publication numbers increased by 60%, and from 1998 to 2008 by 19%. Over the past three years, the number of publications has declined by 0.2%. Finnish publications account for just over 0.6% of world publications.

Universities account for almost 70% of all scientific publications in Finland, government research institutes for around 17% and private business companies for around 6%. These shares have changed very little since the mid-1990s.

The relative citation impact[4] provides a rough measure of the visibility and scientific impact of research. The number of citations received by Finnish publications increased sharply and reached the world average (relative citation impact = 1) in the early 1990s (Figure 10). Finland's relative citation impact peaked at 1.05 during 2000–2002, when the number of citations received by Finnish publications was 5% higher than the average for world publications. During the 2000s, the number of citations received by Finnish publications has been around 3% higher than the world average. In a Nordic comparison, Finland's and Sweden's relative citation impacts have shown weaker trends in the 2000s than Norway's and Denmark's. In 1995–1997, Finland ranked eighth among OECD countries, in 2005–2007 it was down to 13th place (Figure 11).

3 The data are sourced from Thomson Reuters (Philadelphia, Pennsylvania, USA© Copyright Thomson Reuters® 2009. All rights reserved). The Swedish Research Council has processed these data by type of publication and field of research, modified discipline classifications, fragmented publications and citations and removed self-citations.

4 Finland's relative citation impact = *(number of citations received by Finnish publications/number of Finnish publications)/(number of citations received by world publications /number of world publications)*. The average for all countries of the world = 1. If Finland's relative citation impact is 1.05, for instance, this means that Finnish publications have received 5% more citations than world publications on average.

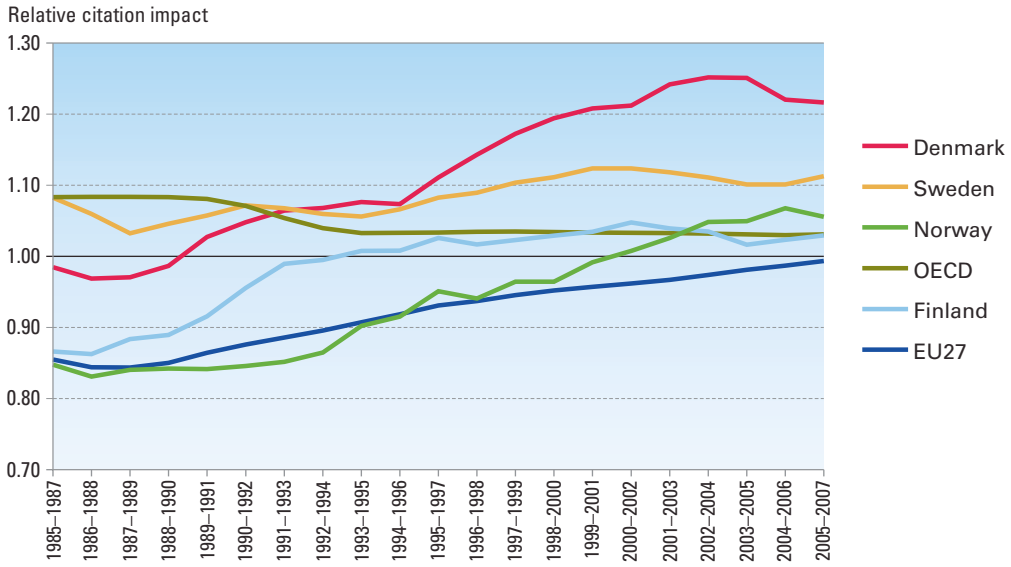

Figure 10. Relative citation impact for Finland and selected Nordic countries, OECD and EU27 countries in 1985–2007. *Source: Thomson Reuters databases, Swedish Research Council 2009.*

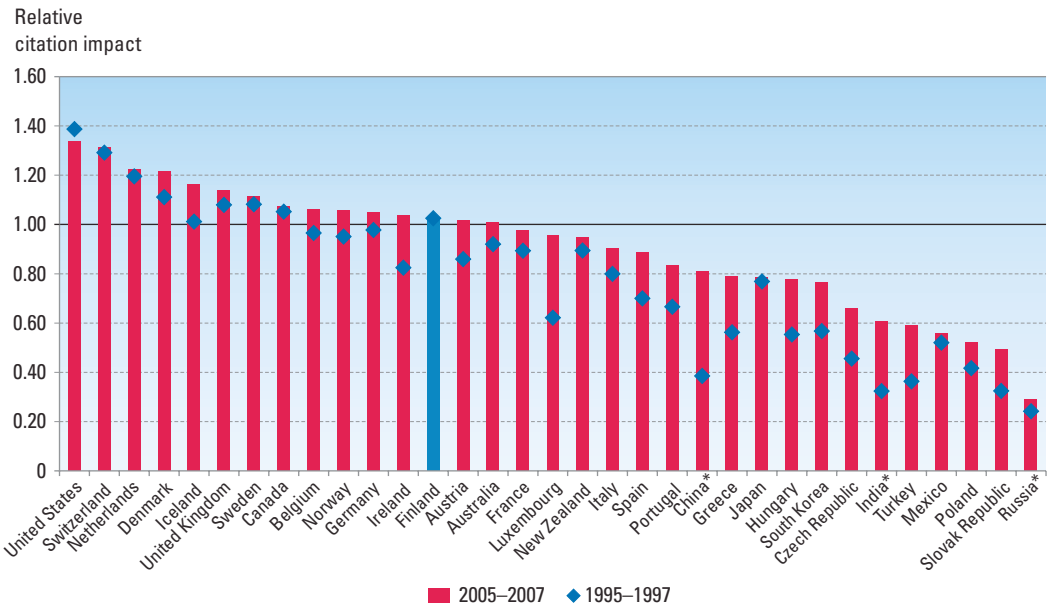

Figure 11. Relative citation impact for OECD countries and India, China and Russia in 1995–1997 and 2005–2007. *Source: Thomson Reuters databases, Swedish Research Council 2009.*

* Non-OECD countries.

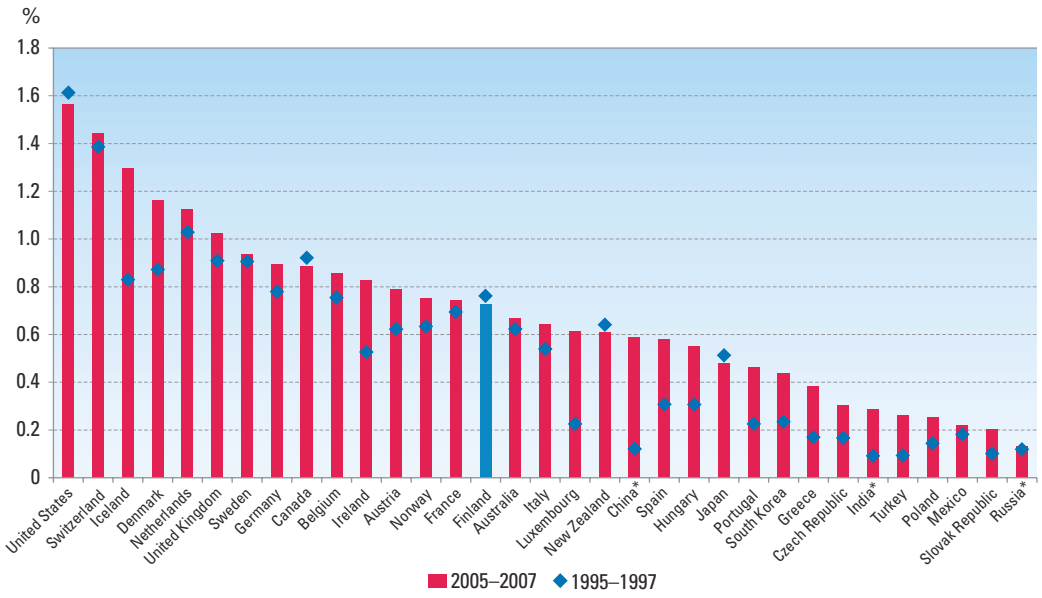

Figure 12. Proportion of publications in OECD countries and in India, China and Russia that rank among the top one per cent of the most cited world publications in 1995–1997 and 2005–2007.
Source: Thomson Reuters databases, Swedish Research Council 2009.

* Non-OECD countries.

As a proportion of all Finnish publications, 0.7% ranked among the 1% of world publications that have received the most citations in 2005–2007 (Figure 12). Finland's ranking among OECD countries has dropped from 10th to 15th. All the other Nordic countries are now ahead of Finland.

International comparisons suggest that the visibility and impact of scientific publishing in Finland is on the decline. Finland's rankings in OECD comparisons have dropped from the 1990s to the present day. Finnish publications have not been cited as often as publications from the other Nordic countries, for instance. The gap to Denmark in particular has widened rapidly for more than 10 years now, and Norway overtook Finland in the early 2000s. In Sweden, citation trends have been similar to those seen in Finland, although they remain at a higher level. On this criterion, then, the quality of scientific research in Finland is exactly comparable to the average for OECD countries. Given that around 70% of all Finnish scientific publications are produced at universities, it is clear that any serious attempt to address the situation must start out by improving the facilities and framework conditions for research at universities.

Finland and the changing geography of science

Because of the small size of the national research system and an earlier tendency for research in Finland to turn in on itself, Finnish science policy has for decades emphasised the importance of increased international engagement in science and research. International evaluations have drawn attention to what is described as the Finnish paradox: whereas business and industry in Finland is highly internationalised, business sector R&D, funding for R&D and the whole national research system are distinctly national in nature and orientation. Compared to its resources and general development, the Finnish research system remains exceptionally immature in terms of its internationalisation.

R&D investment in the United States and Europe has been declining as a proportion of total world investment, whereas figures for Asian countries and

China in particular have been on the increase. The number of PhDs completed in China is about to overtake the number of new PhDs in the United States. In the current global labour market, competition for the best expertise is continuing to grow and patterns of researcher mobility are changing profoundly. Increasing effort is devoted to making national research systems more appealing and attractive.

The United States remains in a class of its own in certain measurements of scientific impact; the only country that comes even close is Switzerland. However over the past 20 years many other countries, particularly Australia and Canada as well as the Netherlands, Denmark, Sweden and Finland, have been closing the gap to the United States.

In response to the challenges of internationalisation, steps have been taken to further develop excellence, to increase the appeal of the national research structure (e.g. infrastructures), to strengthen international research cooperation and to increase mobility.

Mobility is particularly important to small countries like Finland. In 2006, no more than 3% of the country's research personnel were foreign-born, compared to the 10% average for EU27 and more than 10% in countries that in many other respects are closely similar to Finland: Ireland, Sweden, Austria and the Netherlands (Figure 13).

International teacher and researcher exchange between universities increased throughout the 1990s, but since the turn of the decade have continued to decrease in all other except engineering fields, where the number of visits has steadily grown (Figure 14).

The number of foreign-born postgraduate students has increased in all disciplines in 1995–2007. In the humanities, natural sciences and social sciences, the numbers have more than quadrupled, in engineering more than tripled.

European cooperation has been and remains an important part of the internationalisation of Finnish science and research. The European Union is by far the most important source of outside funding: in engineering it accounts for more than 90%, in the natural sciences and social sciences for 85–90%. The contribution of foreign business companies is significant only in the field of medicine, where it accounts for just over 30% of total funding.

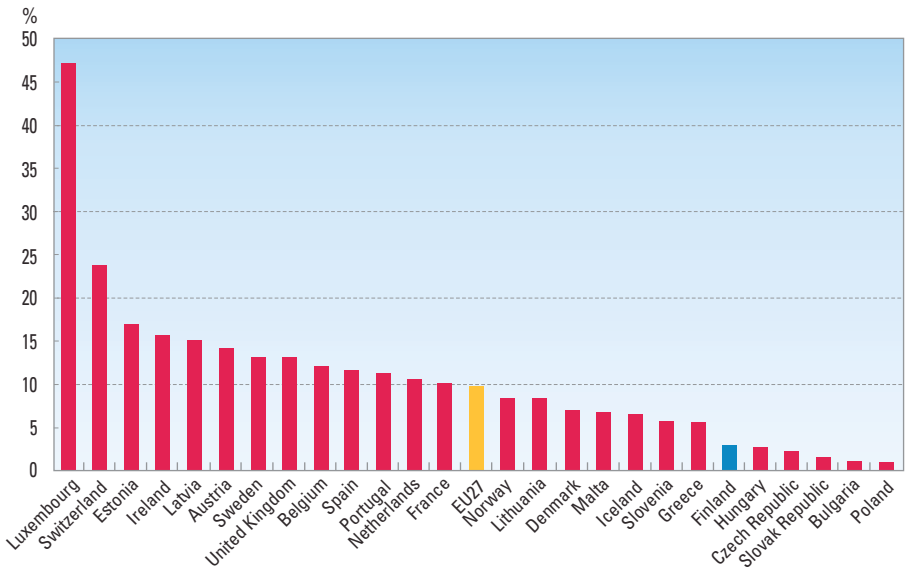

Figure 13. Foreign-born nationals as a proportion of R&D personnel aged 25–64 in EU27 and selected countries in 2006. *Source: OECD 2008d.*

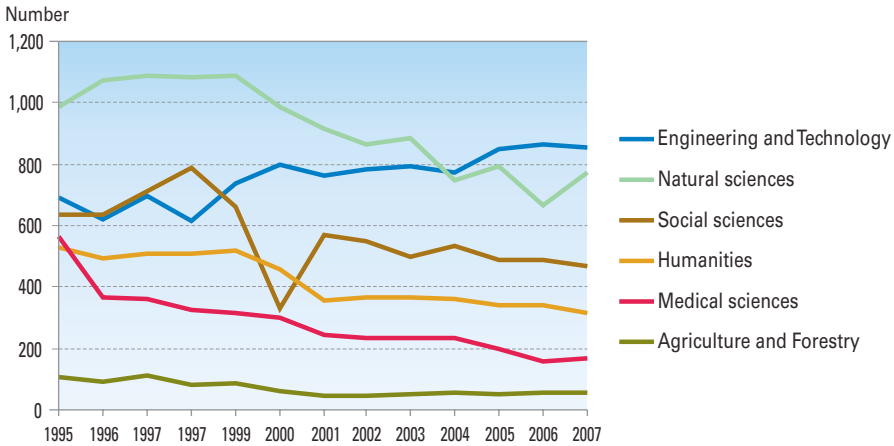

Figure 14. International university teacher and researcher visits in 1995–2007.
Source: Kota database, Ministry of Education.

The significance of EU cooperation is clearly reflected in Finnish researchers' co-publications. Joint publishing has increased in line with the general international trend. Co-publications with EU25 researchers account for 55% of all co-publications, compared to just 14% for co-publications with colleagues from the United States.

These figures indicate that in the humanities and social sciences, European co-publishing has been of great importance to Finnish research. Together with Spain, Sweden and Norway, Finland ranks among countries that have greatly strengthened their position in European publishing cooperation. European networking among Finnish researchers has become much more diversified over the past 15 years.

Science in society

People in Finland traditionally have strong belief and confidence in the importance of knowledge and learning to individual citizens and to the nation as a whole. Knowledge has had a very prominent role in the Finnish concept of education, both among elites and popular movements.

Together with the other Nordic countries and the Netherlands, Finland is in a group of countries whose citizens are well-informed about the basics of natural science. People in Finland have a very positive general perception of the research profession and of how research can contribute to the development of technology and industry. Finnish people take a much keener interest than Europeans on average in science news. American studies have shown that overall, people in Finland are better informed about science and they show a much more positive attitude to science and technology and the opportunities they offer than Europeans and Americans on average.

European studies indicate that young people in Finland are more convinced than young people in EU27 countries that the benefits of science outweigh its risks or harms. They also have much stronger belief than others that science and technology can help to eradicate world poverty and hunger and to resolve some of the major problems facing humankind.

People in Finland have extraordinarily high confidence in scientific institutions (Figure 15). Confidence in all science and research institutions (universities, science and the scientific community, Academy of Finland, VTT Finland and Tekes) has continued to increase since the beginning of the 2000s.

Science and technology policies in advanced countries have placed increasing focus in recent years on the requirements of efficiency and impact. For purposes of providing a coherent assessment

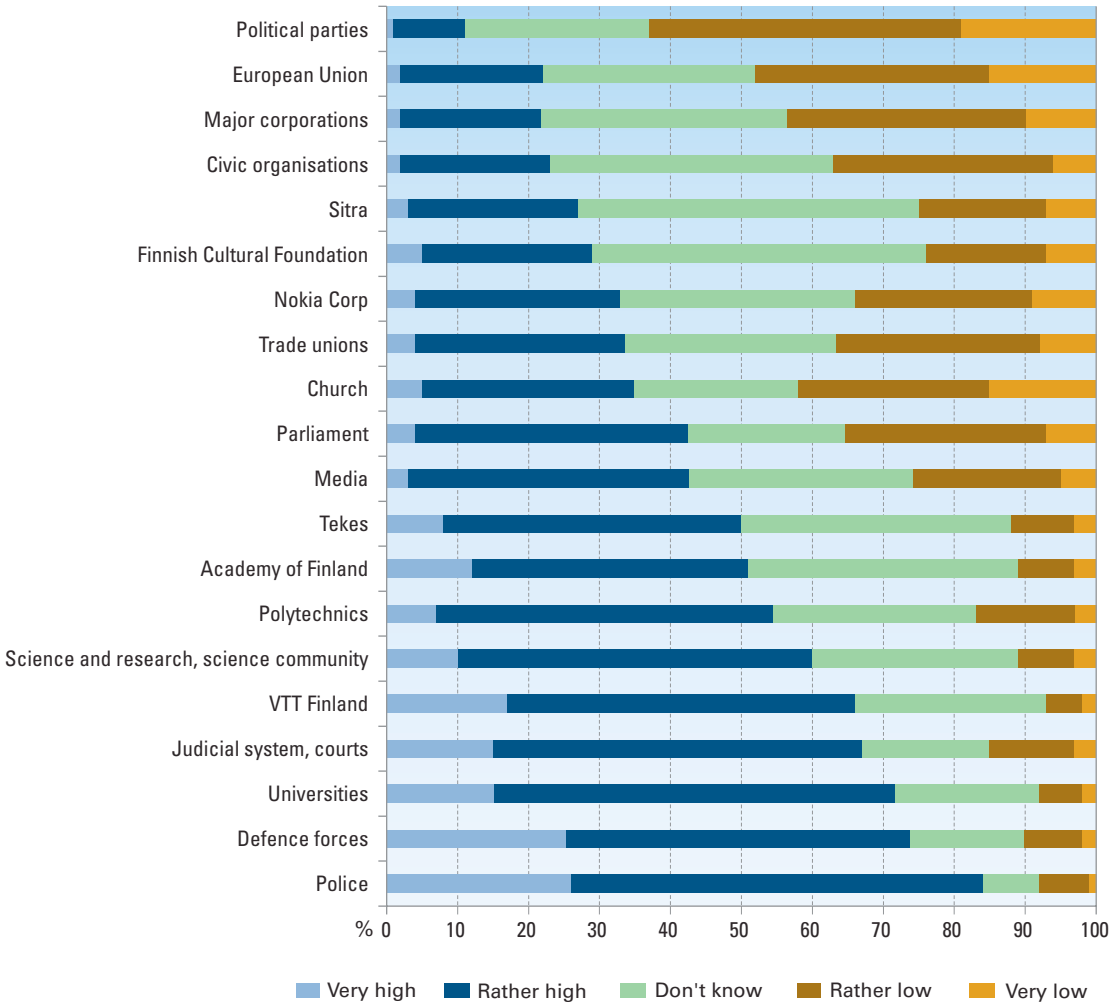

Figure 15. Degrees of trust felt for given institutions within society (%). Questionnaire survey among Finnish people in 2007. *Source: Finnish Science Barometer 2007.*

and analysis of the impact of science, technology and innovation, the Academy of Finland and Tekes have developed a tool known as the *impact framework* (Figure 16). Within this framework the focus of assessment and analysis is on core areas of society, providing valuable information with which to monitor the achievement of social policy objectives.

Impact framework analysis proceeds from impacts to inputs, addressing the question of what kinds of impacts science, technology and innovations are expected to produce. As such it provides a platform for analysing impacts as part of the strategic development of science, technology and innovation policy.

The impacts of science, technology and innovation are studied within core of areas of society that are called *impact areas*. Within each of these areas, the analysis focuses on impact framework data. Development efforts start out from four impact areas:

- Economy and renewal: Economic impacts, such as economic growth, productivity, international competitiveness, reform of the production structure, consumption and purchasing power, and employment.

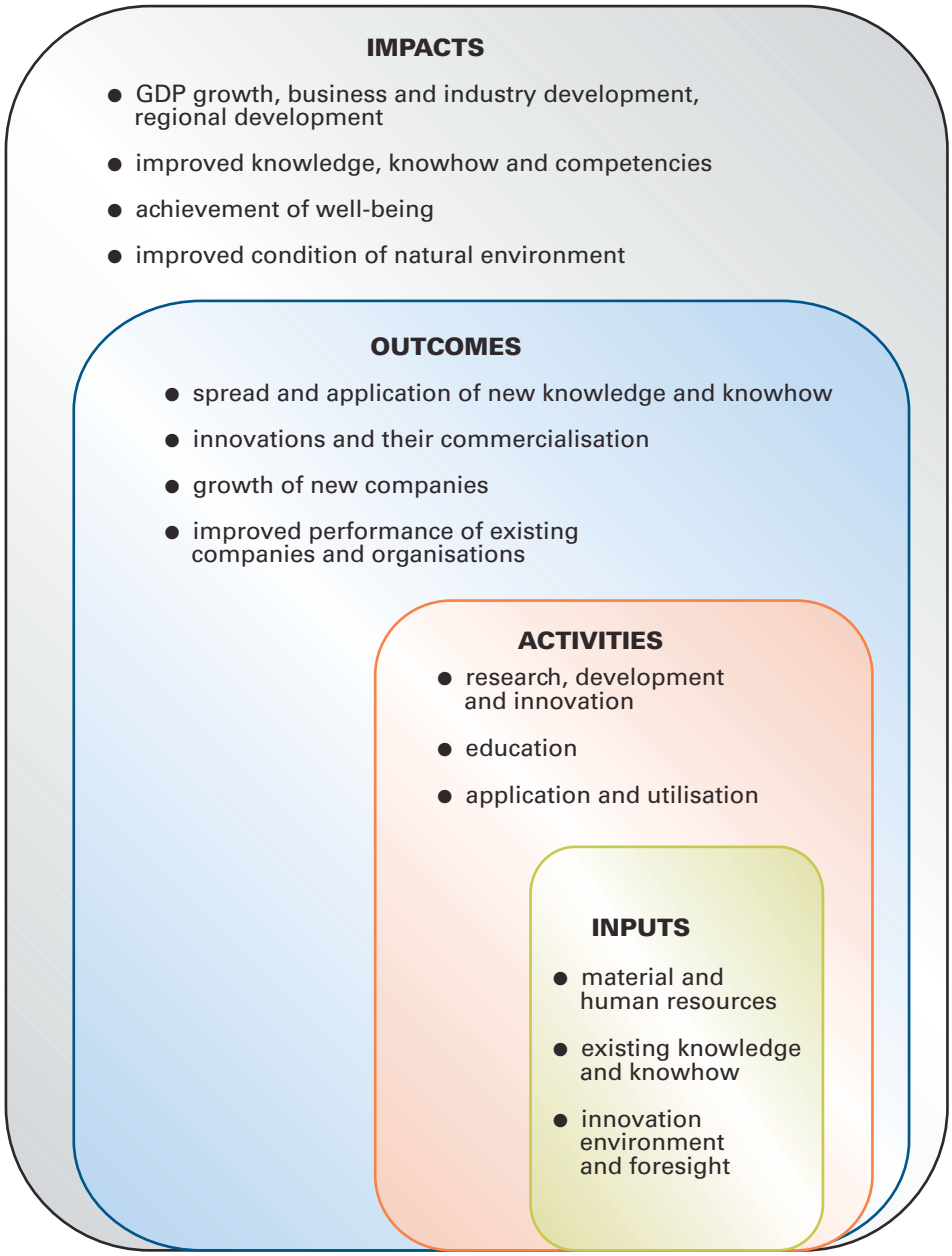

Figure 16. The impact framework. *Source: Lemola et al. 2008.*

- Learning, education and skills: Key issues with regard to impact are the quality of the education and research system and its success in creating the skills and knowledge foundation necessary for the growth and development of Finnish society.
- Finnish welfare and well-being: The combined effect of objective well-being, such as health, living conditions and income, and subjective well-being, such as social relations, self-realisation and happiness.
- Environment: Indicators describing the state and function of natural systems, the state and development of scientific research, technology and innovation concerning the environment.

The next indicator report on Finnish science, technology and innovation, which is updated annually, will be published in 2010.

Overall assessment of the state and future of Finnish science

The evolution of the Finnish research system from the 1960s to the present day is a good example of how long-term and consistent development efforts can yield internationally significant results.

In 1993 Finland's R&D expenditure as a proportion of GDP reached the OECD average level of 2.2%, climbing further to 3.4% in 2000 on the back of the additional research funding pledged by the Government in 1996. Since then, R&D investment has remained at this high level. The number of researchers has increased particularly in universities, but quite substantially in the private business sector, too. In the early 2000s, Finland's research intensity was by far the highest in the world, and has continued to remain so despite a slight downturn in recent years.

In 2008 the number of new PhD graduates in Finland was twice as high as in 1993, and during this period there has been a marked increase in the overall number of PhDs in the country.
This has been achieved through the adoption of performance-based management practices at universities, which has given a major boost to PhD training programmes. In 2005, Finland had by far the highest proportion of PhD graduates per thousand population aged 25–34 years, 3.1; Germany in second place lagged some way behind at 2.6. The training of large numbers of PhDs has obviously brought various benefits to Finnish society and the Finnish economy, but it has done little to improve the conditions for research at universities: most of the investments have gone towards education rather than research.

In the early 2000s, the number of international scientific publications produced in Finland relative to population and relative to GDP, was fourth highest among OECD countries. Over the past couple of years, the number of scientific publications has been falling. One particularly noteworthy change is that indicators of scientific significance and quality (impact factors) have been on the decline since around 2000–2002. Measured by impact factor, the quality of scientific research in Finland is now at exactly the same level as in the OECD countries on average, and lower than in all the other Nordic countries.

One factor contributing to these trends could well be that research funding in Finland as well as the current science and technology policy debate tend to lean quite heavily in an applied direction. A disproportionate amount of research at universities today focuses on application and product development at the expense of basic research. Key policy documents over the past few years have placed scientific research primarily in a technological and economic context. Other relevant factors probably include the large proportion of doctoral students within the research community, the standard of the science infrastructure, the research system's low level of internationalisation as well as defects in the principles of research funding and scientific management.

The Academy proposes that

- *A national science strategy* be developed to help improve the output and quality of scientific research in Finland. The strategy shall set out 10-year development objectives and identify the means of achieving those objectives.

Based on the comparisons and analyses carried out, the Academy proposes that the following be identified as priority areas of development:

Internationalisation of the Finnish research system

- The research system must be made more attractive and appealing both from a mobility and an international cooperation point of view. Key steps in this regard are to improve research infrastructures and to offer incentives that favour internationalisation.
- Steps are needed to advance the internationalisation of graduate schools so that students who are training to become researchers start the process of international networking while they are still studying.
- For reasons of networking it is crucially important that Finnish researchers and organisations are more actively involved in EU-coordinated programmes.

PhD training and research careers

- Age at PhD graduation must be significantly lowered.
- Incentives and funding criteria must be developed so that senior researchers take on a more prominent role in Finnish research teams instead of doctoral students.

Creative research environments and cooperation

- New funding instruments shall be developed to facilitate longer-term and more flexible funding for creative teams that have achieved a high scientific level.
- Greater mobility between organisations and disciplines is important for the development of creative research environments.
- Strategic Centres for Science, Technology and Innovation shall reinforce the position of scientific research as an element in restructuring of their fields.

Research infrastructures

- It is imperative that the investments set out in the Finnish national-level research infrastructure roadmap are completed by 2016.
- Finland needs to have a coordinated funding system for scientific infrastructures. The most convenient arrangement would be for the proposed research infrastructure council to be based at the Academy of Finland.

Science in society

- The education and research system must be considered as a single entity in order to strengthen the recruitment base for research.
- The principles and practices of evidence-based policy must be adopted in order to strengthen the position of scientific expertise in social policy development.
- Long-term scientific research remains the key to technological development and innovation.
- Networking and the involvement of individual citizens and organisations shall be further developed as the most important avenue channelling the social impact of research.

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