

OECD SCIENCE, TECHNOLOGY AND INDUSTRY OUTLOOK 2004 COUNTRY RESPONSE TO POLICY QUESTIONNAIRE

FINLAND

1. General framework and trends in science, technology, and innovation policy

Main features of recent scientific, technology, and innovation policy developments and the rationale behind them, including new innovation strategies.

The triennial review of the Science and Technology Policy Council (STPC), entitled '*Knowledge, Innovation and Internationalisation*', was issued in December 2002. According to this policy document, one of the main lessons to be learned from the 1990s was that *success in creating innovations* is a key factor for the success of both business enterprises and societies. One precondition for this is high-level technological and business know-how. Apart from technological innovations, this requires systematic input into producing social innovations geared to prevent societal and social development from diverging from economic and technological development. The set of actions thus determined will constitute the core of the *national strategy* in the coming years.

Another issue in focus is the *internationalisation of Finnish science and technology*. Behind the internationalisation of science, scholarship, research and innovation lie similar factors as behind globalisation and relevant network-building more generally. A systematic aspiration to create innovations cannot be limited to the national setting and traditional international cooperation. Internationalisation must proceed at the level of the innovation system as a whole, and Finland must be able to internationalise its own operations and its national science and technology institutions. This is why the STPC has launched preparations of *Finland's international STI strategy*, due to be endorsed by mid-2004.

Major changes in the legislative, administrative, organisational, institutional, or budgetary framework for the formulation and implementation of science, technology, and innovation policies.

During the year under review Parliamentary elections were held and a new Government was nominated. In the Government's action plan the emphasis is on strengthening expertise and entrepreneurship, together with other growth factors. According to the Government, the keys maintaining Finland's competitiveness are promoting research and development, raising the educational level of the population, and pursuing a co-operative approach to incomes policy and boosting the productivity of the public sector. Faster application of new information technology is also singled out.

Special attention is paid to regional development in the Government programme. R&D and innovation activities are seen as important tools for promoting regional development. This theme has been in the vanguard of policy debate and also runs through the Government programme. The new Government has undertaken, among other things, to promote closer co-operation between the various organisations

supporting innovation that have a presence in the regions.. In late summer 2003, in line with the Government programme, the Ministry of Trade and industry has nominated a rapporteur to evaluate the regional exploitation of technology funding

Changes will be anticipated due to the ongoing review of the structural challenges of the public R&D system, including a structural assessment of various intermediaries between public R&D and the economy and the society at large. The STPC launched the review together with the relevant ministries in summer 2003, and it will be ready at the end of 2004.

At the political level, the strategic portfolio of the government has been redesigned. The portfolio of the present government consists of a few big intersectoral programmes of two kind: a) four intersectoral policy programmes (employment, entrepreneurship, information society, and civil participation), and b) eight other intersectoral policy areas deserving special attention, one of these being Research, technology, and innovation.

Another project is being implemented by an expert group on *science and (civil) society*, aiming at concrete measures to improve science and technology education, STI communication, and interaction between research and decision-making. One consequence already is the launching of the second *Science Barometer* in Finland.

Major shifts or changes in the balance of the use of different types of policy instruments, and/or attention or support given to particular science, technology, and innovation policy areas.

Activation of regionally-driven development of technology is on the agenda of the present government. Long-term development of technology policy and funding are seen as part of building an operational environment that is regionally balanced and emphasizes entrepreneurship. Universities and polytechnics have a strong role in regional development, and the formation of centres of expertise in all parts of the country will be supported. Strengthening the synergy between knowledge clusters, industrial clusters and social capital in regions is needed.

Future project or policy issues identified by technology foresight, forecasting or technology road mapping.

Foresight as such is one area to be developed in Finland. Otherwise, in addition to the integrated development of social and technological innovation, the international STI strategy preparations and the review of the structures of the public R&D system referred to already, the challenges include development of incentive researcher careers, further increases in (public) STI funding, matching of education and labour market, and development of (new) national competencies.

2. Public sector research and public research organizations

R&D funding for public research organisations

In the 1990's public sector R&D funding increased considerably but its share of the total funding decreased because private sector funding grew even more rapidly.

In the year 2000 the level of public sector funding was 1,3 bn euros; three years later it was 1,5 bn euros. Its share of the total funding rose 1 %. The reason is the slackening pace of private-sector R&D funding. The universities' and polytechnics' share of public sector research funding has been growing and was still increasing in 2000 - 2003 (table 1). The new Government promises to provide a considerable increase in the amount of public financing available for research and development.

In the 1990's the focus of public sector R&D funding was on energy, and the promotion of industry and science. In 2000-2003 interest in energy, the promotion of industry, earth sciences, water and the atmosphere diminished while that of defence and general research funds grew (table 2).

In the 1990's the emphasis of funding was in the fields of natural sciences, medicine, nursing and social sciences. The role of technology was decreasing. In 2000-2002 the same trends were continued except in the area of natural sciences (table 3).

Over the long term the proportion of research funded by the universities themselves and by the public sector as a whole has decreased and the share funded from other sources increased.. This trend has continued in the first years of the 2000's in the university sector but at a slower pace than before. The trend in the public sector reversed and the share of own funding grew. The main reason is the economic recession, which has reduced the available private sector R&D resources (table 4).

Major initiatives to reform public sector research

The Government has promised to continue to enhance the capacity of the regions to benefit from public R&D funding. There will be closer co-operation between the various organisations that support innovation and have a regional presence. The regional availability of their services will also be improved.

The importance of innovation activity in universities and polytechnics has grown rapidly. One of the main policy measures was to include the duty to promote the utilisation of new knowledge in the Universities Act as the university's third mission. Policy measures to promote more efficient commercial exploitation of research results continue along the lines laid down by the previous Government.

An important issue in the education system has been to increase the overall flexibility of the system to better respond both to opportunities for individual choice and to the needs of research and the labour market. In the year 2003 a Committee set up by the Ministry of Education made a concrete proposal for a two-tier university degree structure also in view of the international developments. The Committee proposes that the new structure would be adopted in 2005.

Another issue in the university sector is the regional development of higher education. A working group set up by the Ministry of Education emphasised connecting the development of higher education to the economic and industrial structure and its phase in the region. In order to meet the needs of the regions, higher education institutions must pay special attention to developing their regional responsiveness through intensified co-operation with local business and industries and by facilitating the transfer of expertise to working life.

3. Government support for private-sector R&D and innovation

Major policy changes in the instruments and mix of instruments.

On the level of practical policy and implementation, neither the instruments nor the mix of instruments have faced major changes. However, the issues put in the focus of the STPC review and the new government programme, are already present eg. in the Tekes technology programme portfolio. The share of programmes giving more weight to the systemic nature and the non-technological elements of innovation is increasing. For example, there are more programmes concerning service innovations and innovation related business problems.

Technology programmes still cover almost half of Tekes over all support to R&D, although the share of direct financing to firms' innovation projects has slightly increased.

Changes in emphasis of specific technological/industrial sectors

Somewhat more concern towards services and 'non-technological innovations' but otherwise no important changes in emphasis of specific technological/industrial sectors.

Programmes to support R&D and innovation in SMEs and new technology-based firms

In its programme, the present Government pays special attention to regional development and SMEs. The new strategic guidelines for innovation policy prepared by the Ministry of Trade and Industry emphasize the importance of developing innovation policy as a whole. As a consequence, more concern will be paid to all dimensions of the innovation environment and horizontal cooperation with other policy sectors. This implies more comprehensive possibilities to coordinate the support for innovation in SMEs

SMEs and new technology based firms have already for a lengthy time been under a special concern in the Finnish innovation policy. The efforts are also bearing fruit: in 2003 almost a quarter of Tekes' client firms were new start up companies. The same year, SMEs received 58 percent of Tekes R&D finance. This results from many Tekes activities to develop e.g. business, marketing and internationalisation competencies of SMEs. These are usually embodied as standard features into conventional Tekes financing instruments.

A specific Tekes program (TULI) has also been launched to seek out research based business ideas within research community. TULI combines consultation with financing and supports the early stages of research idea commercialization. The intermediate evaluation found the program successful and promising.

4. Enhancing collaboration and networking among innovating organisations

Collaboration and networking among innovating organisations is the cornerstone of the Finnish innovation system, and has been an integral part of most innovation policy measures. No important new special measures have been introduced, but incremental developments to deepen and develop the quality of cooperation has of course been continuously initiated.

Rules governing ownership and licensing of publicly funded research

New legislation on universities' IPR questions is under preparation to be introduced to Parliament in the near future. The new legislation will clarify the situation and economic benefits coming to the partners concerned (universities, researchers, private firms).

5. Human resources for S&T

The development of S&T degrees

Growth in the number of master and PhD degrees in science and engineering was rapid and constant in the 1990's. The pace of this growth has slowed down at the beginning of this decade. This could be explained as quite a normal phenomenon in Finland reflecting the change of economic conjuncture (table 5).

Reducing the gender gap

The Academy of Finland has worked consistently to support women's research careers. In 2000 the Academy adopted an Equality Plan to promote gender equality in the science community by means of a clearly defined set of measures. According to the Plan the minority gender should occupy at least 40 % of all research posts, expert positions and working group appointments. Where applicants are equally

competent and qualified for the post, preference shall be given to the minority gender. Data are collected and analysed and the implementation of the Plan is continuously monitored.

Efforts to attract R&D investment by foreign owned companies

Attracting foreign R&D investment has been under serious concern. What makes a country attractive for both foreign R&D investment and foreign top class scientists is more a question of the innovation system as a whole than an issue of concrete, single policy measures. This is one dimension in preparation of *Finland's international STI strategy* mentioned above.

Improving public understanding of science

A concrete measure aimed at raising the awareness of R&D and innovation among the public is the organisation of various competitions and prizes for successful, new and fast-growing firms, inventors or innovators. One of the best known measures is INNOSUOMI. Its basic mission is to promote an innovative culture, to encourage innovation and the creation of new companies, and to improve co-operation between entrepreneurs, funding organisations and the public sector. The prize is awarded annually in recognition of exceptional innovation and entrepreneurship. In 2003 a new prize, - the Millennium Technology Prize, worth EUR 1 million - was established. The Finnish Technology Award Foundation has established the prize to recognise outstanding technological achievements specifically directed at the advancement of society and its ability to sustain people's quality of life.

New web-based information services have also been established to increase awareness of science and technology in Finland. In order to facilitate the use of public innovation services *Research.fi* contains material and data about different factors in the Finnish innovation system. This information service is designed to cater for the needs of the decision-making, monitoring and evaluation of Finnish science and technology. Links to the most important documents, publications, statistics, etc. are given in all areas. The overall aim of *Research.fi* is to build up the knowledge base on Finnish science and technology and relevant indicators, especially impact indicators.

The High Technology Finland 2003 service includes a book and website offering a cross-section of Finnish high-tech companies and organisations. The material is published in co-operation with the Finnish Academies of Technology, Tekes, Sitra and Finpro.

6. Policies to boost innovation in the service sector

The new strategic guidelines for innovation policy prepared by the Ministry of Trade and Industry emphasize the importance to support a balanced development of innovation in all sectors. In this, the role of services in the innovation system has continuously increased. In the Finnish innovation policy, services are looked at from a broad perspective. Services have a twofold role in the innovation system and thus a twofold approach in the policy:

First, services as a part of other clusters. In other, 'non-service' industries the role of KIBS firms and KISA functions within non-service firms is increasing. In innovation policy KISAs are seen as an integral part technological and business development of all clusters. Research work on the changing role of KISAs in the Finnish innovation system has resulted in more concern on KISA functions within policy instruments. Within Tekes, there are also on-going technology programmes, such as UTT 'Business concepts for industries', INFRA 'Construction and services' CUBE 'The building services technology programme' that pay particular interest in the KIBS/KISA role in innovation.

Second, services within service dominated clusters producing actual service innovations. Telecommunication and software services have of course been in the core of innovation policy. In addition,

innovation policy concern in services that are not in the first hand 'technological' is steadily growing. Tekes has, for example, launched extensive programmes for supporting innovation in health care. The recently finished iWell, 'Technology programme for welfare and health' is followed by Finnwell, 'Tekes Technology programme for health care' that will be one of the largest Tekes programmes ever, with a budget of 150 m€ of public money and a corresponding sum of the private sector.

Other service related Tekes programmes include DESIGN 2005 'Industrial design – technology's counterpart in competitiveness' and a programme on Leisure and free time innovation to be launched later this spring.

7. Policy evaluation

In the winter of 2002, the Ministry of Trade and Industry in collaboration with Tekes launched the *ProAct programme*, to increase understanding and knowledge of the effects of technology, research and technology policy on society and the economy, and the effects of society on technological development. The second stage of the programme started in January 2004, with 33 projects.

The programme is an important instrument in developing innovation policy intelligence within the ministry and Tekes. Various seminars, workshops, discussion forums and other activities to increase discussion and interaction between policy decision making and innovation policy research will be arranged during the programme time. .

The results of the programme will be exploited in the development of technology policy-making. Increasing discussion and cooperation The programme will also promote researcher training in the field. The research will focus on significant socio-economic changes and phenomena, such as the development needs of technology policy, the renewal of innovation processes, the development needs of the research system in the internationalising research field, and the challenges of technological competitiveness in the new economy.

Recent changes in policies regarding the evaluation of innovation policy programmes or institutions.

Legislative or regulatory changes requiring evaluation.

No such changes.

Requirements for evaluation of different elements of innovation policy.

Cf. the ongoing structural review of the public R&D system described in section 1.

Methodologies employed in evaluations at different levels.

Both qualitative and quantitative methods are used. Development of impact analysis methodologies is considered necessary and, in this respect, concrete joint steps are being taken by two key expert organisations, the Academy of Finland and the National Technology Agency (Tekes), in international collaboration.

Institutional mechanism.

No major changes.

Efforts to ensure that results of evaluations feedback into policy development.

Evaluation reports are always public, and they are succeeded by follow-up activities, where findings and recommendations are analysed by responsible bodies. One topical example is the international evaluation of the three governmental expert and funding organisations, the Academy of Finland, Tekes, and the Sitra fund. The three evaluation reports are an important input into another evaluation process, namely that of the public R&D system discussed above.

Information, if available, about the outcomes of recent major evaluations of R&D or innovation policies.

In December 2002, an international evaluation on the impact of public research funding of biotechnology in Finland was issued. There have been special efforts in this area in Finland since mid-1980s. In the evaluation, strategies for the future were also studied. Due to the report, a new funding scheme of the so-called biocentres in Finland was prepared. Other recommendations, e.g. on the internal structures of and curricula in universities are under further analysis.

The Academy of Finland published in November 2003 the third review of the quality and impact of scientific research in Finland. These reviews are prepared on a triennial basis, and they give a general picture on the development of the quality and international visibility of Finnish science. The social impacts of basic research were tackled for the first time, and reference is made to the point 7 c).

Table 1. R&D expenditure by sector 1991, 1999-2003, mill. euros

Sector	1991	1999	2000	2001	2002	2003
Total	1711	3879	4423	4619	4826	4862
Enterprises	975	2644	3136	3284	3371	3380
Public sector	358	470	497	501	530	518
Higher education	378	765	789	834	926	964

Table 2. Government's R&D expenditures by socio-economic objectives 1991, 1999-2003, mill. euros

Socio-economic objective	Milj. euroa					
	1991	1999	2000	2001	2002	2003
Total	800	1275	1300	1350	1392	1417
Agriculture, forestry and fishery	71	73	70	75	78	87
Manufacturing industry	195	357	360	370	386	377
Energy	29	79	85	77	61	62
Defence	11	18	17	21	22	42
Earth, water and atmosphere	15	21	20	17	14	14
Health and environment	144	213	216	220	237	229
General research funds	310	482	506	540	566	579
Space programs	24	33	27	29	28	27

Table 3. Public sector and higher education R&D expenditures by field of science 1991, 1999-2002, mill. euros

Field of science	1991	1999	2000	2001	2002
Total	663	1213	1265	1310	1426
Natural science	137	287	293	299	307
Engineering	207	335	367	361	391
Medical and nursing sciences	94	239	249	269	303
Agricultural sciences	84	92	92	100	107
Social sciences	92	187	189	203	234
Humanities	49	73	74	78	84

Table 4. Public sector and higher education R&D expenditures by source of financing 1991, 1999-2002, mill. euros

Source of finance	1,991	1,999	2,000	2001	2002
Higher education					
Total	360	765	789	834	926
Self-funding	239	354	351	364	402
Other funding	120	411	438	470	523
Public sector					
Total	358	470	497	501	530
Self-funding	236	258	273	277	295
Other funding	121	212	224	224	234

Table 5. Master and PhD degrees in science and engineering, 1991, 1999-2002

Degree	1991	1999	2000	2001	2002
Master of science	2296	4004	3534	3586	3723
PhD	197	429	404	427	488

Sources: Statistics Finland, Ministry of Education.