



Science and Technology Policy 2006-2009



The Prime Minister's Office
The Science and Technology Policy Council
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*Adopted at the meeting of the Science and Technology Policy
Council, June 1, 2006*

1. Guided by vision for the future

In its vision of the future the Science and Technology Policy Council (STPC) views Iceland as a society at the forefront among nations, based on rich human resources and a culture with international flavour. Icelandic society will be characterised by high living standards, quality of life and health, strong moral awareness and a vibrant, multifaceted economy. The environment for conducting scientific research and technological development are favourable and knowledge is applied to underpin a wide range of innovations in industry as well as in public services. Public investments in education, scientific research, technical development and innovation reap ample returns from scientific, social and economic advances.

The competitive edge and social well-being of nations in the age of globalization are largely determined by their ability to look to the future, recognize opportunities and systematically exploit their knowledge and competence. Globalization is accompanied by increasing competition but at the same time it opens new opportunities for wealth creation based on novel ideas and specialized know-how. The key to success is a vision of the future and tenacious, well educated people capable of evaluating and exploiting opportunities associated with the rapidly changing social and market conditions. A coordinated effort by the government sector and the private sector is needed to elevate Iceland internationally to a forefront position

in scientific and technological performance thus underpinning a competitive, rich and highly performing economy.

2. The Strategic Priorities 2006-2009

The STPC places highest priority on the following:

- to establish an internationally outstanding educational and scientific institutional system, closely connected to a dynamic economy, capable of providing leadership in responding to rapid changes;
- to strengthen public competitive funding schemes and merge these in related areas;
- to encourage private firms and the public sector institutions to join efforts in strengthening research and development in order to boost successful and profitable innovation and thus international competitiveness based on knowledge;
- to redefine the role of the public sector in financially supporting scientific monitoring and research in support of public interest, environmental protection and sustainable economic growth.

3. Coordinated efforts

3.1 Financing of science and technology development

The STPC considers important that the overall expenditure on R&D, as a share of GDP, continue to increase beyond the 3% mark which was reached in recent years. The share of the private sector economy should increase relatively faster than the public sector share and reach 60% of the total by 2009¹. This division of percentage share between the public and the business sector in financing RTD would be approaching the ratio in the countries against which Iceland would like benchmark. The goal would be 10% annual increase

¹ In 2003 the total expenditure on r&d was 2.97 % of GDP. The share of the public sector was 48% and 52% by the private sector. The average inncrease in total expenditure on r&d was about 13% per annum at fixed prices in the decade 1993-2003.

in RTD spending on the average until 2009. For this to be realized new methods and coordinated efforts by the public sector and the business sector is needed. This will be further elaborated in the following sections.

The STPC recommends that:

- further increases in the direct public appropriations to research be primarily directed towards competitive funds and programs that offer grants on the basis of applications and quality assessment;
- funds which are designated to finance research at public institutions be integrated into larger competitive funds to allow the enlargement of grants, increasing the volume and ambition level of projects and ensure that comparable procedures be used in evaluating the quality of applications for all public funding;
- basic institutional financing of research institutions and universities be reviewed in the light of performance evaluations;
- programmed financing be increasingly used in line with the STPC policy. The financing of the Program on Health Related Genomics and Nanotechnology be secured for the period 2007-2009.

3.2 Transparency and continuity in competitive funding

Competitive funding is among the most effective tools for promoting result oriented conduct of research and development. It is vital to ensure continuity in funding from basic research to innovation in the market and strong cooperative interaction between universities, research institutions and industry. This promotes timely and efficient exploitation of research results towards social and economic benefit. Enterprises need to become more active participants in research and innovation and market prospects need to be taken into consideration when awarding grants for financing risky RTD projects.

The STPC recommends that;

- the grant policies and procedures of the competitive funds be reviewed regularly in order to better coordinate and simplify the administrative process, increase continuity in financing and improve the evaluation procedures in view of scientific gains as well as socio-economic benefit.

- the objectives of the Technology Development Fund be broadened with the view of strengthening cooperation with risk financing organisations in financing projects with new start-up and spin-off companies.
- enterprises be encouraged to participate in and apply for project grants for research, development and innovation from competitive funds against their own contribution;
- projects meeting the quality criteria and implemented through active, professional and financial collaboration between companies, universities and research institutions, other aspects being equal, be given priority in the awarding of grants;
- special attention be given to the procedures for evaluating applications involving two or more scientific disciplines as well as applications that span the interface of humanities, social sciences, technology and the creative arts;
- special emphasis be given to the international contacts in development and innovation related projects and incentives developed for that purpose.

3.3 Policy making and evaluation of policy effectiveness

The STPC underlines the importance of an effective interaction between the public and the private sector in formulating and implementing science- and technology policy with the view of clarifying the overall goals and finding the most appropriate means of implementation. Strategic assessment of the impact of science and technology policy plays an important role in the efforts to learn from the implementation and design more efficient tools to attain the goals of the STPC.

The STPC recommends that:

- the effectiveness of research be raised and efforts be made to shorten the time of development phase of business related project ideas as far as possible. Measures to this end be introduced into the STPC policy agenda;
- the impact of STPC policy on research, development and innovation be regularly evaluated by appropriate means. The first such evaluation shall be started in the fall of 2006 covering the outcome of the first three operational years of STPC.

- the collection and analysis of statistical data pertinent to research, development and innovation be strengthened.

3.4 Strengthening international cooperation

Active international cooperation in science, technology and innovation opens a number of opportunities in education, training and cooperation through collaboration with many of the World's best universities, research institutions and research companies. Participation in international cooperation programmes, both Nordic and European, has been very successful which gives some measure of the strength of Icelandic science and technology community in international competition. Procedures to prepare decision about participation in such programmes must be established. Iceland offers ideal conditions for research cooperation in many fields of science and technology and a positive environment to develop and test technical solutions before launching these in larger markets.

The STPC recommends that:

- participation in international science and technology cooperation be further strengthened as a part of the globalising strategy of the Icelandic science and business community;
- the outcome and benefits gained so far from the participation in international cooperation be evaluated and the strategic priorities made accordingly;
- support be given to enhanced efforts in Nordic science and technology cooperation and in the EU 7th Framework Programme for Research and Technological Development;
- cooperation with the Arctic Council member states, The United States of America and Asian Countries be strengthened;
- financial resources be ensured for allocations to common, programmed funds in those areas where Icelandic participation appears particularly appropriate and where international peer review panels evaluate the applications in competition;
- the leadership by Icelandic scientists be encouraged in international co-operation projects where Icelandic competence is at the forefront and support be given to such participation in international cooperation.

3.5 Knowledge Park (Vatnsmýrin)

The STPC has in its resolutions encouraged the various interested parties involved to coordinate their efforts to establish a “knowledge park” in the area of Vatnsmyri in Reykjavik. The planning and construction design for this area is still at an initial stage and offers a unique opportunity to concentrate “knowledge activities” into that area in order to improve the conditions for innovation and stimulate the exploitation of the outcomes of research and development work. The establishment of a dynamic knowledge park in Vatnsmyri would benefit the country as a whole and provide a powerful backbone for regional knowledge centres.

3.6 Review of the organisation and roles of universities and public research institutions

The STPC is of the opinion that the roles and the organisational framework of the universities and research institutions need further review. Where mergers may not be possible the STPC emphasises the urgent need for cooperation and coordination at the same time as competition for funding at the project level is encouraged. The organisational framework and the administrative structure of the universities and research institutions must be developed to promote their efficient operation.

The STPC encourages the institutions concerned to:

- merge or co-locate operational units that work towards similar goals in order to improve their effectiveness improve their relations and provide stronger platforms for cooperation and contact with industry.

4. Education at the frontier

The STPC underlines that policy for education, in important respects, is also a policy for employment and economic affairs. The Icelandic society is transforming from an economy based on natural resources towards a knowledge-based and service-based economy that is goal-oriented and fully participating in international competition.

4.1 A better primary and secondary school

A coherent and continuous education from kindergarten to graduation from a university is essential for the development of a knowledge-based society. The focus of the curricula of the whole educational system must be sensitive and responsive to the needs of society at all times. Competition among students and schools is healthy to the extent it promotes creative thinking and cultivates entrepreneurship in order to harness knowledge and promotes innovation.

The STPC underlines the following in the efforts to strengthen primary and secondary education:

- that the recommendations put forward in a recent evaluation of educational research in Iceland be elaborated in order to underpin and reinforce policymaking in the field.
- that educational practices be refocused on encouraging students to build up a positive self-image, introduce them to independent, disciplined and diversified working methods and constructive, critical thinking.
- that ethical consciousness, based on humanitarian and egalitarian values should guide the social development of students living in a multi-cultural society.
- professional leadership in the schoolwork and in teachers education has to be reinforced in order to make available at all times sufficient number of ambitious and interested staff ready to develop teaching methods that respond to changes in society and underpin improvements in schoolwork at all levels.
- there is a need for more coherence between the choice of topics in educational research and the needs of policymaking and development of the educational system.
- there is a need for improving teaching methods in sciences and technological subjects at the compulsory schools and to encourage young people to enrol in such fields. This includes also changes in the curricula for teacher education.

4.2 Stronger universities – demands for quality in education and research

The number of students at universities has increased by 75% since

1997. Today universities prepare a greater number of students, than ever before, to take on tasks that require scientific approach, knowledge and skills.

It is the STPC's opinion that university education at all times has to pay due attention to the needs of society at large: It has simultaneously to be academically stringent and oriented towards societal needs for practical skills. Research is an important element in support of undergraduate education, a necessary aspect of education towards a secondary university degree, and a fundamental instrument in scientific training towards a doctoral degree. The co-operation between companies and universities is steadily increasing and is focused on solving particular problems, scientific training and exploiting the results of research. Universities are a part of the international community of education and science and their operations need to be strengthened further.

The STPC encourages those concerned to:

- clarify further the demands made to students and academic staff and to improve regular quality control of teaching and research through evaluation of performance and working practices;
- develop further indicators, reflecting the objectives and intended societal impact of the funds spent on higher education;
- link budget appropriations to the universities to evaluation of the their performance;
- make an assessment of how the education offered by universities corresponds to the needs of society;
- introduce more flexible and a wider scope of academic and practical university education that meets both academic quality standards and the diversified needs of society.
- increase flexibility in fulfilling the obligations of university staff between research, teaching and administrative tasks.

4.3 Freedom of research

The production and the use of knowledge is not a linear process from basic through applied research and development towards innovation. When addressing issues in innovation it is often necessary to raise fundamental question, the answer to which has an applicability that

ranges far beyond single technical solutions. It is the opinion of the STPC that applied research needs support at the same time as we need to strengthen the universities as institutions of education and research. Free research has intrinsic independent cultural, social and economic values, and may sometimes challenge accepted truths and knowledge. This type of blue-sky research can contribute to a more fundamental understanding of nature and society and sometimes produce results that were neither planned nor could be anticipated.

The STPC considers that:

- Freedom of inquiry at universities must be ensured when their ties with companies become closer and cooperation intensifies.

4.4 International universities – selected Ph.D. programmes

There has been a rapid increase in the number of students enrolled in research based tertiary education and at present roughly 300 Icelandic students take part in such studies. One main explanation is the rapid increase in the number of students heading for a Masters degree, presently around 2000 students, of which approximately 50% are enrolled in a Masters programme involving considerable research training. The Icelandic Graduate Fund plays an important role in strengthening research based education and training in the country.

The STPC shares the opinion that:

- research based university education and Ph.D. programmes need to be internationally recognized, offering first class guidance and good facilities for conducting research.
- while improving options for obtaining second or third level degrees offered by the universities at home are increased, it is very important to retain the source of scientific strength obtained through Icelandic students attending the best universities in the world.
- internationally recognized doctoral programmes in selected fields of scientific strength can attract Ph.D. students and teachers from abroad.
- the Graduate Student Fund needs to be strengthened and enabled

to support Icelandic and foreign students based on outstanding merits.

- Icelandic students involved in Ph.D. programmes abroad must also be eligible for support from the Fund.
- it should be feasible to grant support to companies that want to strengthen their scientific and technological capacity by means of the Graduate Fund's contributing up to 50% of the cost of Ph.D. training for company employees.

4.5 The links of universities and public research institutions to society, the business sector and innovation

The universities need to make an effort to spread knowledge about the results from scholarly work, scientific research, and technological development and opportunities arising from these, to the society as a whole.

The Council is of the opinion that:

- scientists must be made more aware of the value of patenting and intellectual property rights, and the importance of exploiting their intellectual assets for the benefit of society, without discouraging the efforts to publish in peer reviewed journals;
- more effort should be put into to acquiring patents based on research and to encourage companies to use them, as well as to increase awareness of the importance and ways to secure patents.
- it is important to draw the attention of companies to the technological and innovative potential of scientific results;
- there is a need to promote the development of a market for intellectual assets and to encourage the exploitation of research results particularly in sectors that often are considered to be outside the scope of innovation, such as trade and services.
- the emphasis placed on international publishing in the evaluation criteria used by the universities should not discourage the will to publish in the Icelandic language;
- there is a need to create a forum for cooperation between universities, spin-offs and research-intensive SME's, innovative and high-tech companies, and public research institutions.

4.6 Life-long learning

Innovations across all sectors of the economy and rapid technological changes demand renewal of the knowledge and skills of the workforce. This calls for increased and more focused efforts in life-long learning. It must respond to the needs of the individual for increased knowledge as well as the needs of the labour market for increased and more focussed knowledge and job related skills.

It is the STPC's opinion that:

- life-long learning, student- and professional counselling needs to be reinforced in particular for those who need to strengthen their position in the labour market.

5. Effective innovation – more competitive companies

5.1 The ICT community – heading for the frontline

In recent years the Government has through a concerted effort promoted more extensive use of ICT technologies. The STPC favours continued efforts to make the best use of ICT in order to keep Iceland among the leading nations in the use of ICT.

The Council encourages that:

- the collaboration between governmental organisations and private companies on ICT applications be strengthened, in particular by the participation through calls for tender of private companies in the development of new software solutions;
- secure, high-speed communication at acceptable rates should be available for transfer of data for scientific, service and business purposes between Iceland and other countries.

5.2 Business climate – opportunities for more research and innovation

It is the role of government to facilitate economic stability and to create favourable business environment for companies in order to foster innovation and growth. Active innovation in companies is the

prerequisite for the growth of well-paid jobs that create added value from knowledge. It is important that the business sector increase its research and innovation efforts. It is therefore important that the working committees of the STPC and the Ministries concerned develop effective tools to encourage increased business investment in RTD. The Council is of the opinion that it is important to increase the number of companies performing their own research and that the business environment be made more favourable to highly innovative and research intensive companies in the country.

The STPC recommends that:

- the public support system for research, development, innovation and economic growth be simplified and made more transparent and comprehensive taking also into account the different needs of new companies for public support.
- more efforts should be made to encourage companies to build up their knowledge base and that grants be provided to support RTD projects carried out by their employees who are enrolled in research based tertiary education.
- innovative efforts in the service sector be strengthened, particularly in culture-based service activities, humanities and social science sectors.

5.3 Public tenders in support of RTD and innovation

In a number of countries public tenders and procurement are used to encourage research, development and innovation. This implies the involvement of public organisations as informed buyers participating in setting the specifications and carrying out the development of particular technological solutions needed in the public sector.

The STPC encourages the public sector organisations involved to:

- consider how co-operative tenders may be used to promote development and innovation in the business sector.
- enter into collaboration with research intensive and high-tech companies on development projects where appropriate.
- issue calls for tenders and buy research services from private companies, where appropriate, instead of building up in-house capacities.

6. Research in the public interest

An important feature of the Icelandic cultural identity is respect for the environment, nature and society. Knowledge about its culture, social fabric and its development, national history and language, is the key to being an independent nation. Understanding and monitoring of the natural assets, their diversity, properties and conditions at any time is basic to a rational and sustainable use of important natural resources. Quality of life relies to a large extent on a healthy population. Healthy food and lifestyle are important factors. Research on the interaction of these factors will be decisive for the development of our society in the future. It is important to disseminate and bring the results of such research to the attention of the public and the authorities.

6.1 Society and ethical values

Research in humanities and social sciences provides the basis for insight and understanding of the organisation and development of our culture, education and society. More than half of all academic researchers in the country conduct their work within these fields. Their research relates to Icelandic realities and the results become immediately applicable e.g. in the development of the administrative and legal framework, social provisions and in the educational system. Consequently, humanists and scientists have put emphasis on making their results known and accessible to the general public in addition to publishing their findings in international peer-reviewed journals.

Controversial ethical issues have figured prominently on the agenda in the public debate recently, including issues relating to the environment, business practices and in science and technology. It is important to ensure the freedom of scientific enquiry and at the same time to comply with accepted ethical standards and conventions. It is essential that there exists a mutual trust and good practice among scientists themselves and between the science community and the general public. The present legal framework for science ethics is primarily limited to biomedical research and the protection of the individual integrity when handling sensitive information.

The STPC emphasises that:

- there is a need for a comprehensive evaluation of opportunities and appropriate strategies to encourage innovations based on research in the humanities and social sciences.
- more use should be made of results from humanities and social scientific research in support to policymaking and for stimulating innovations in public service, education and for cultural ends.
- there is a need to stimulate active debate on ethical values in education, research and exploitation of knowledge.
- the legal framework for scientific ethics, including bioethics and the protection of individual rights should be reviewed.

6.2 Monitoring the environment and a sustainable use of natural resources

Knowledge about the fundamental processes of the land and its natural environment is basic to policy making for utilization of natural resources, protection of the environment and preparing responses to natural hazards. There is a need to better define the role of government in the gathering basic data on nature, mapping, conducting basic research on nature and in monitoring the land and marine environment. Monitoring efforts are less suited for engaging in competition for research funds on the basis of scientific novelty and need a different source of funding. This issue calls for co-ordination of the operations of many public institutions, reporting to different ministries.

Well co-ordinated system for monitoring the environment is an important tool that contributes to the implementation of government policies and gives weight to Icelandic standpoints in international negotiations, e.g. on environmental and fisheries policies. Databases established through monitoring of environmental processes are also an important source of information for future research on natural phenomena, environmental changes and the development of human societies in Iceland and the Arctic region.

The STPC encourages continued efforts in research on sustainable use of natural resources both on land and in the sea, that contribute to environmental improvements, the creation of new jobs and increasing exports of knowledge-based products and services.

The STPC recommends that:

- a comprehensive overview should be made of existing databases on the land and marine environment and the nature of Iceland, including the sea-bed of the oceans surrounding the country, and a multi-annual plan should be drawn up to improve and co-ordinate these databases;
- these databases need to be built up continuously in a digital form to be preserved and made accessible for research and public use;
- a plan for environmental monitoring should be drawn up in support of policy making for sustainable management of natural resources, environmental protection and in preparation for natural hazards;
- efforts should be made to increase international co-operation in these fields.

6.3 Health and nutrition

Health services are based on biomedical research. Co-operation in the fields of biomedical and clinical research has an impact upon the provision of health services and opens up new opportunities for innovative development by companies engaged in production and service, including pharmaceutical development, diagnostics and the production of bioactive agents. Icelandic researchers have a documented strength in a number of research fields that have been given priority by international organisations.

Research on nutrition and public health are gaining more attention. Research on the quality, security and nutritional value of food products are becoming essential for food production, using land- or marine-based resources.

The STPC places emphasis on:

- increasing innovation in the health sector based on biomedical research.
- the feasibility to use bio-banks and patient records for research, as well as to improve service to patients.
- that it is important to initiate a public debate on policy for keeping and maintaining health-related databanks and bio-banks for future research, health service and innovation.

- the need to introduce measures to facilitate co-operation of bio-medical and clinical researchers with domestic and foreign companies in this field.
- increasing food security for the benefit of consumers as well as for producers.
- increased research effort on factors that are decisive for healthy food and lifestyles.

