

SCIENCE AND
TECHNOLOGY POLICY
ICELAND



Prime Minister's Office
The Science and Technology
Policy Council
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Science and Technology Policy

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Introduction

When evaluating the competitive advantage of nations, the role of education and achievements in the field of scientific research and business innovation weighs heavily. Recent resolutions of the OECD Ministerial Council underline how education, research, innovation and entrepreneurship are the driving power for economic growth in societies that develop by acquiring and utilising new knowledge. Member states are encouraged to increase their support for science and research, creating favourable conditions for innovation based on new knowledge.

During the past decade, there has been a remarkable increase in expenditure on research and development work. Icelanders spent 3% of their gross domestic product on research and development undertakings in 2001, compared to 1.1% in 1990, thereby reaching the goal which the European Union has set itself to achieve by 2010.

The benefits of this investment may be measured for instance by the favourable outcome of Icelandic scientists in international co-operation and through added innovation, which has led to growth in employment and in the exports of goods and services based mainly on knowledge.

The increased emphasis by the business sector on research and innovation may in part be traced to Government policies in economic affairs, education, business environment and taxation. Here it is worth mentioning reform in the educational system, economic stability, growing freedom in the financial market, the privatisation of state-owned companies, and the tax environment for businesses, which is now among the best to be found in Europe. By responding to the opportunities created by these factors, Icelandic business has managed to restructure itself, invest in research and development, and better utilise human resources. A significant prerequisite for these changes is a higher number of people with a specialised education. All of this has helped result in Iceland's economic growth surpassing the average in other OECD nations.

Science and Technology Policy

The role of the Science and Technology Policy Council is to promote scientific research and research training in the sciences and encourage technological progress in Iceland, for the purpose of strengthening the foundations of the country's culture and boosting the competitive capacity of its economy. Operating under the direction of the Prime Minister and consisting of ministers, scientists and business representatives, the Council formulates public policy on scientific research and technological development.

The principal function of scientific and technological policy is to express the priorities set by the Government and inform of the improvements to be made in the support structure for research and development. It also serves to guide those who participate in implementing the policy in selecting appropriate strategies towards established goals. It is important to provide appropriate framework for cooperation among the public actors in science, technology and innovation and to strengthen their links to business life and society at large, which benefit from their activities. These actors can either be in a state of competition, co-operation, or both at the same time.

The main strength of Icelandic research endeavours lies in competent people who have a solid, international education and connections and possess the ambition and initiative to use their knowledge and achieve success on an international scale. The main weakness, in contrast, is the country's small population and limited resources, not least because these are spread over many small research units. This is balanced by using the advantages of smallness and short routes of communication among individuals, institutions and business life - between those who gather and those who apply new knowledge.

This situation can considerably enhance the effectiveness of research and development. In this respect the conditions for research and development work are favourable in Iceland when tasks call for dissimilar stakeholders and interests having to work together. These conditions need to be better exploited, since this can to a great extent determine the success of Icelanders in international co-operation and competition. At the same time, the weakness stemming from the limited size of research units and groups must be remedied.

Priorities in science and technology

The long-term goal of the science and technology strategy is to enhance the cultural and economic strength of Iceland in a competitive international environment, to ensure that Iceland's economy and quality of life continue to rank at the forefront of nations. This will bring the nation new knowledge and competence useful i. a. for the following purposes:

- increasing sustainable utilisation of resources, creation of wealth, and generation of attractive job-opportunities in a knowledge society;
- improved health and social security and encouraging maturation of a civil society where freedom of enterprise and social equity reign;
- reinforcing the economic and cultural independence and thus the foundations for living in Iceland;
- enhancing the influence of Iceland in the international arena and facilitating the adaptation of Icelandic society to variable external conditions.

So as to provide still more favourable grounds for such development the Icelandic Government intends in co-operation with stakeholders in this arena to take the following actions during its term of office:

1. **Increase the public resources intended for allocation from competitive funds** and co-ordinate their operation to insure their optimum use for scientific and technical research and support to innovation in the Icelandic economy.
2. **Strengthen the role of universities as research institutions** by building up and encouraging diversity in research at Icelandic universities through competition between individuals and research teams for research grants from competitive funds.
3. **Review the organisation and work-methods of public research institutes**, with the objective of uniting their strengths and co-ordinating their activities more closely with the universities and business sector.

Furthermore, the Government will introduce a variety of supporting measures aimed at strengthening the infrastructure for science and technology in the country and the status of Iceland as a leading knowledge based society. More specifically the objective is to:

- establish strong research teams for working in an international environment by giving priority to the most competent individuals, institutions and firms;
- increase the co-operation between research institutes, universities and business enterprises in forming knowledge clusters capable of attaining a strong position in international competition;
- make research and development attractive to business enterprises, supporting the emergence of high-technology firms which to a large rely on research for their growth.;
- give increased weight to research training of young scientists in an internationally competitive research environment;

- assure open public access to the results of publicly financed research, databases and other scientific and scholarly information, promoting the utilisation of these for added value to society;
- pass laws encouraging scientists to protect their intellectual property rights through patents, and institutions and firms to introduce measures to properly manage the intellectual property of their employees;
- regularly assess the quality of research conducted by universities and research institutes, by subject areas or fields of employment or knowledge clusters, and take the results of these into account when deciding on appropriations and priorities

Enlarging the competitive funds

Governments support research in various ways. Direct budget appropriations for universities and research institutes create the general framework enabling them to obtain additional funding for their research by competing for grants from domestic and foreign funds and by contracts with those who use the results of their research. The policy adopted by the Science and Technology Policy Council is that public support of research, technological development and innovation should increasingly rely on competition for grants from public funds, based on originality, well-defined projects and competent applicants, who might be individuals, firms or institutions.

For this reason, the Icelandic Government has decided to give increased importance to competitive funds in financing research. Appropriations to public funds for science and technology sponsored by the Ministry of Education, Science and Culture, the Ministry of Fisheries, and the Ministry of Industry, as well as appropriations for their administration, amounted to around ISK 800 million of the national budget for 2003. This includes about ISK 700 million to funds within the Ministry of Education, Science and Culture. The Government of Iceland has made efforts to raise appropriations for these funds and their administration in the 2004 budget by about ISK 400 million, of which approximately ISK 200 million would be for funds within the Ministry of Industry and ISK 100 million to a programme, under the auspices of the Ministry of Fisheries, for increasing the value added the fishing industry.

The Government intends appropriations to public funds for the sciences and technology sponsored by the above-mentioned ministries to rise by around ISK 250 million in 2005, about ISK 200 million in 2006 and approximately ISK 100 million in 2007. Thus appropriations for competitive funds and their administration will be about ISK 1,750 million at the end of this Government's term of office, i.e., around ISK 950 million higher than at the beginning of the term thus more than doubling the appropriations.

Research Fund

The Research Fund is the most powerful tool of the public sector for reinforcing the research community infrastructure through project grants based on applications from scientists, business firms and institutions. The Science and Technology Policy Council emphasises that the Research Fund give increasing priority to larger projects, encouraging the formation of knowledge clusters and larger research teams. In addition, the Science and Technology Policy Council encourages the Fund to give young scientists an opportunity to establish their work in Iceland and contribute to the further accumulation of scientific and technical knowledge.

The Research Fund offers grants in accordance with the priorities set by the Science and Technology Policy Council and the grants strategy defined by the Science Board based on a peer review evaluation of research project quality, the competence of the individuals involved and the facilities available for completing the project. The target is to raise the available resources of the Fund from ISK 420 million in 2003 to ISK 600 million at the end of the current Government term of office.

Technical Development Fund

The Technical Development Fund is intended to support technological development and research to support innovation in the economy of Iceland. The Fund will in general operate as a competitive fund through which firms, research institutes and universities will have the possibility of financing projects that support technological development and innovation. The Fund is intended to give support to spin-off ventures and innovative firms to secure that economic benefits accrue to society from the scientific and technical knowledge and the innovation arising from these new ventures. The Science and Technology Policy Council attaches high importance to close co-ordination between the Research Fund and the Technical Development Fund, as well as co-operation with other public funds and venture investors as regards support for these firms. This will be an extremely significant factor in the scientific and technological strategy of coming years.

The Technical Development Fund can take the initiative to establish programmes and specific actions prepared in consultation with the business community, research institutes and universities, in areas which are likely to give economic returns and have a decisive impact on developments in a given economic sector or group of companies. Finally, the Technical Development Fund is permitted to enter into partnerships with venture capital investors for seed and early risk financing toward establishing firms which base their operations on technological development and research and which involves a nov-

elty to the economy. The available resources of this Fund are to be ISK 200 million in 2004, rising to ISK 500 million towards the end of present Government term.

Fund for Equipment

The role of the Fund for Equipment is providing grants to universities and other public research institutions for the purchase of expensive and specialised equipment for research. The Science and Technology Policy Council emphasises that the grants strategy of the Research Fund be observed when making grants from the Fund for Equipment. Other things being equal, those applications involving co-operation among research bodies on financing and the use of equipment purchases shall have priority. In this manner the Fund for Equipment can deeply influence the economic returns and impact of investments; - on the one hand by a faster improvement of facilities and, on the other hand, by a reduction of unnecessary duplication in the purchase of scientific apparatus.

Fund for Graduate Research Training

The Fund for Graduate Research Training has the purpose of disbursing grants to research-linked graduate education. Above all, this Fund has supported university graduates engaged in research studies in Iceland toward the master's degree and fulfilled a significant function in the recent rapid expansion of research based graduate education. Nonetheless, doctoral students have become much more numerous in the past years. Since they play especially important role in research, whether in the public or private sector, the Science and Technology Policy Council emphasises their being offered educational opportunities in Iceland comparable to those offered elsewhere. The role of the Fund for Graduate Research Training should be reviewed in this context.

Already next year the resources of the Fund will be increased by 25%, then amounting to ISK 50 million.

Programming of research

A major tool for coordinating the building capacity in the field of science, technology and innovation is defining the objectives for specific areas of research to receive priority in funding over a limited period on the basis of well-formulated research plans. Such temporary plans are called "research programmes". On the initiative of the Ministry of Education, Science and Culture, the Government of Iceland made a special financial appropriation for a research programme in the field of information technology and environmental research. This plan was initiated in 1999 and will be completed in 2004, with a total financial provision of ISK 580 million.

Sponsored by the Ministry of Fisheries, another research programme is being launched under the label of “Added Value from Fisheries”. The first stage of this will last for five years. It was prepared in co-operation with professionals and stakeholders both in fisheries and fish processing industry.

In the future the Science and Technology Policy Council will lead the formulation of research programmes, Thus research plans that public bodies wish to implement shall be sent to the Science and Technology Policy Council for evaluation. The intention is that when recent programmes have come to an end the funds released will flow to new programmes in the area of research and innovation.

Research at universities

Universities play a leading role in producing and transferring scientific knowledge and have attained an ever greater role in the utilisation of research results for innovation. Strengthening the universities as institutions of research and increasing the competition for public funding for research are among the three main policy objectives of the Science and Technology Policy Council. Thus the mechanisms for funding university research in a modern competitive environment is therefore extremely important for implementing the policies of the Council.

Decisions on state budget appropriations to university research have been based on tradition or special contracts, or have taken specific projects at individual schools into consideration rather than general rules or an external assessment of success. The appropriations vary widely among universities. There are in some cases no budget allocations for university research, while in other cases they amount to up to one-third of the total allocations for the school concerned.

The Ministry of Education, Science and Culture is working on the modification of regulations affecting the direct appropriations for university-level research. One of the alternatives being examined is assuring universities a specified basic appropriation for research and toward internal development, whereas they would otherwise compete for research money. In this way increased appropriations to competitive funds would create the fresh opportunities for progress at universities, while competition would create the necessary quality control. These changes are necessary in the eyes of the appropriating authorities in order to guarantee that funds are used optimally and are subject to systematic prioritisation within the universities themselves as well as by the funds supporting research. However, it is important not to disrupt the foundation of the ongoing scientific and research activities that merits public support. At the same time, investment must be continued in facilities, apparatus and other infrastructure which is needed for the realisation of quality research work.

The Science and Technology Policy Council feels that appropriations for research at universities should be based first and foremost on the quality and results of the research conducted and that it is not possible to assume any fixed relationship between expenditure on teaching and research. It is therefore important for appropriations to build on general rules and clear criteria , which however need to be defined. Moreover, the Science and Technology Policy Council emphasises regular external evaluation being applied to research activities in universities.

Not only does the Science and Technology Policy Council place importance on universities formulating a clear policy for themselves on research, in accordance with the overall policy of the Council, but the Council also encourages increased co-operation among universities, research institutes and firms on research and research training. The participation of research institutes in master's and doctoral studies by providing research facilities and guidance is well suited to enhancing co-operation among these institutions and meeting the needs of the economy and society in general.

Role of public research institutions

The Science and Technology Policy Council believes the division of tasks between public research institutions themselves and their relationship to the universities ought to be reviewed. The goal should be to increase co-operation, enlarge research groups, and share funds, knowledge and facilities better so as to achieve more impact on the international competitive market for technology development and innovation. Research institutes and universities have to work closely together, for instance on the training of young scientists and engineers. Another priority of the Council is co-operation on interdisciplinary projects that seem promising for innovation but firms would normally not undertake otherwise. In addition, the Science and Technology Policy Council urges institutions as well as universities to work with centres of knowledge outside the capital city area in cases where this is appropriate and where professionally attractive grounds can be found and local initiative brought into play.

The target is for proposals on further implementation of these ideas to be available at the spring 2004 meeting of the Council.

Improving infrastructure of the scientific and technological framework

Besides the three principal objectives outlined above in the strategy of the Science and Technology Policy Council, several important aspects are discussed below which concern the furthering of scientific and technological activities in Iceland. The Science and Technology Policy Council submits to

the scientific and technological community, i.e. to universities, institutes and firms as well as other stakeholders, the consideration of these aspects during ongoing policy-making.

International co-operation

International participation by Iceland in work on science, technological development and innovation is one of the cornerstones in scientific and technological strategy and a prerequisite for growing Icelandic activity in this field. Iceland's participation in the EU Framework Programme on Research and Technological Development has led to considerable success. Furthermore, interest is growing in Nordic regional co-operation within the framework of the European Research Area, as described in the Sixth Framework Programme of the EU. Sponsored by the Nordic Council of Ministers, work is proceeding toward composing a White Paper on the so-called Nordic Research and Innovation Area (NORIA), which in the coming years may be expected to shape Nordic co-operation in this field. In recent years, co-operation in the area of science and technology has also grown between Iceland and the USA. Through memoranda and declarations of co-operation this has been brought into a more formal structure that link it to agencies that finance scientific research in the US.

Iceland's active participation in international co-operation on research provides backing to overseas marketing initiatives by the Icelandic companies and introduces the latest knowledge for them to use in international competition. Supporting technological development in firms is a significant factor in Nordic and European co-operative programmes, building in many instances on co-operation among research institutes, universities and business firms.

The Science and Technology Policy Council is of the opinion that Icelanders should take an active part in the discussion now occurring in Europe and within the Nordic countries on the possibility of reciprocally opening the support system of these countries to people in education and science in other countries. It is probable that the professional and financial advantages will outweigh the cost of participation for Icelanders, because they have qualified individuals in science and technology who have proved their abilities in an internationally competitive environment.

Centre for Technological Innovation - Co-operation on support for innovation

Offering support to innovation and technological development is the duty of the Centre for Technological Innovation, in accordance with the policies of the Science and Technology Policy Council at any given time. The Centre fills a major function by establishing co-operation among public bodies which com-

prise the support network for innovation in the economy and which shape and operate support projects tailored to small and medium-sized enterprises and individuals, particularly in regard to the realisation of new business ventures. The Science and Technology Policy Council calls attention to the operation of support centres for entrepreneurs as an important means of connecting knowledge in universities and research institutes to the running of businesses. Thus the Centre for Technological Innovation must maintain extensive co-operation with universities and institutes and provide service in this area.

The Science and Technology Policy Council believes that experience demonstrates the effectiveness of promoting public-private co-operation through so-called “innovation clusters”. Such clusters involve public bodies and groups of firms in related fields working informally together so that potential users of new knowledge meet those who hold knowledge needed by the users. Some experience exists in Iceland of carrying out projects which build on this concept; instances that might be mentioned are the Fisheries Technology Forum and the Health Technology Forum.

The Science and Technology Policy Council would like to encourage the Technical Development Fund, the Centre for Technological Innovation, and the appropriate governmental authorities, as well as associations in the employment sector, to engage in further co-operation on organising innovation clusters in Iceland. Not only will this approach allow for co-ordinating the energies of numerous bodies with the purpose of achieving added success for innovation and for entrance into foreign markets, but these means will also facilitate product development, innovation and the initial marketing of new types of goods and services.

Co-operation on building up research facilities - links to regional policy

The Science and Technology Policy Council wishes to encourage universities, institutes and firms to work together on creating research facilities within areas defined for common purpose. These bodies might apply together, as appropriate, to the Research Fund, Technical Development Fund, Fund for Equipment, or Fund for Graduate Research Training in order to finance specific items, among which expensive instruments, data-bases, and facilities used by a number of parties might be named as examples.

Regional development will probably be determined to a large extent by success with innovation in the economy and knowledge based job-creation in the rural communities of Iceland. Research units manned by competent personnel with strong initiative can have a decisive, and positive impact on regional development, especially in certain areas where it is possible to harness local uniqueness. The Science and Technology Policy Council emphasises that

universities and research institutes in regions outside the capital city area should continue to be enabled to carry on research and technological development in fields especially well-suited to reinforcing innovation in the local economy and business life of the respective region.

In the opinion of the Science and Technology Policy Council, these endeavours should be promoted above all through the organised co-operation or linking of such rural centres to research institutes and/or universities which possess a greater breadth of knowledge and provide access to needed equipment and facilities. Regional support programmes can in this context play a significant role and lead to co-operation.

Incubation centres / technology parks / science parks

In many countries around the world, technology parks have been constructed in the vicinity of universities and research institutes so as to create a favourable environment for spin-off firms, meaning businesses ideas founded on knowledge gained through research. Moreover, it is common for mature companies to carry out part of their development work inside such knowledge centres. Part of the services that spin-off firms receive in such environments can be financial and administrative support. Experience shows it to be common for spin-off firms and new start-ups to take five to ten years before achieving notable success.

Domestically, the University of Iceland is an affiliate of the Tæknigarður Innovation Centre, while a Biotechnology Centre is operated at Keldnaholt by the applied research institutes. Several technology based firms have started operations at these locations. Recently the University of Iceland and other bodies have introduced the idea of building up technology parks founded on such assumptions.

The Science and Technology Policy Council considers proposals for technology parks and knowledge villages could fall well in line with the Council's policy and areas of priority.

Patents and protecting intellectual property rights

The increasing volume of scientific and research activity in Iceland raises the importance of protecting intellectual property and knowledge assets. While this was for a long period not high on Iceland's agenda, that has changed in recent years. Patents issued to Icelanders by the US Patent Office have risen from 4-5 per year until 1997 to 20-25 since 2001. A similar increase is detected in patents issued by the European Patent Office. It is important that the patenting process be efficient and the legal status of employees and employer clear. There must also be appropriate incentives for registering patents and using them to economic advantage.

In Iceland, there are as of yet too few patents taken by the personnel of public research institutes and universities. The task of obtaining and defending patents remains extremely specialised and costly. Universities have not perceived benefits for themselves in attending to this matter to any degree, in particular because, according to laws currently in force, the right of use lies entirely with each and every employee.

During Iceland's current Parliament session, the Government intends to present a bill to amend laws regarding the inventions of employees, expecting the coming legislation to induce the further use of knowledge to economic advantage and also to encourage universities and research institutes to register patents more frequently. These institutions need to acquire the capacity to assess the patentability of research findings and to market the patents obtained along with the knowledge lying behind them.

The Science and Technology Policy Council also believes it would contribute to greater technological development and a more efficacious business environment for Iceland to become party to the European Patent Convention.

Access to public research data and documentation

The public sector fulfils an important role by funding studies of Icelandic nature and the monitoring of the environment, of resource exploitation, of health and of care for public welfare. The expenses for these investigations are mainly paid by direct budget appropriations. Over the long term the data gathered during such research can become a valuable resource to be exploited by institutions as well as private parties, or through their co-operation. As a resource usable for scientific research and co-operation among universities, research institutes and firms or among countries, such databases must be managed in accordance with international standards and their utilisation provide just returns to society.

The Prime Minister has appointed a working group to prepare legislation to facilitate the freest possible access by the public and by users to research documentation and results from work funded by government appropriations. The goal is to ensure that the public has as much freedom as possible in accessing this information, against fair service charges. The work in this area now proceeding under the auspices of the OECD and the EU will be taken into account in determining Government policy in this area.

Women in the sciences - encouragement for the future

A significant factor in cultivating a vigorous scientific community is ensuring the active participation of women in research work. Lending ever more weight to demonstrated research experience and to competition in financing research creates the risk of women ending up in a more problematic position when

they take a break from scientific work for childbirth. As a result they are at risk of not returning to research jobs. Valuable human resources might thereby vanish from the scientific community. Thus it is necessary to consider measures that will ease, for both parents, the unification of family responsibilities and work on research.

Support for self-employed scientists and scholars

Many scientists and scholars work on a freelance basis, providing their own work facilities. While independently-employed scholars and scientists have access to the Research Fund and in some cases to the Salary Fund for Authors of Scholarly Works, they normally have no possibility of providing their own co-funding in the manner of institutions or companies, and they usually pay the overhead costs out of their own pocket. Rules on the amount and conditions for research fund grants have to give consideration to the special situation of such scientists.

Taxation issues-fiscal measures

It is generally recognised as the role of the public sector to devote part of the national expenses to research and development in order to boost productivity for economic growth and increased welfare and the achievement of various other national goals. Recently, a survey sponsored by the OECD demonstrated that the situation in each nation determines the way in which governments help to encourage firms to use a portion of their expenditure for research and development undertakings. The main tools of governmental authorities are grants, tax rules, patent protection and the operation of public research institutions, all of which approaches have advantages and disadvantages.

Icelandic authorities have in past years worked toward simplifying tax rules and lowering tax percentages, so that firms retain a higher ratio of their income, thereby receiving indirect encouragement to engage in research and develop products bringing them future profits. The plan is to continue on the same path, taking care when modifying tax rules that no imbalance appears between different forms of business organisations. In this regard consideration will be given to suggestions that inequalities exist among firms, public institutions and non-profit foundations in connection with the levying of value-added tax.

Research culture

A fundamental aspect of shaping a creative research environment is that mutual trust pervade the scientific community and the public have trust and confidence in the scientists. Encouraging discussion on codes of ethics in science is an important effort to sharpen consciousness of ethical conduct in science and to be prepared if there are deviations.

The Science and Technology Policy Council emphasises the importance that those who work at research and technological development adhere to rigorous scientific and scholarly procedures and advance their professional development. The Council would like to draw attention to the importance that the outcomes of research be publicised and that researchers do not hide results, methods, ideas or technique except temporarily and when commonly recognised reasons demand it, such as the need for protecting intellectual property rights and obtaining patents.

The next steps

This resolution on policy in scientific and technological matters is the first step in the task of the Science and Technology Policy Council. The plan is to use this winter to develop the strategy further and to aim at presenting an action programme for 2004-2007 at the spring meeting of the Council in April 2004.

