Science and Technology Policy Council 2003 – 2006

External Evaluation Report

Commissioned by the Ministry for Education, Science and Culture, Reykjavik, Iceland

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Executive Summary

Background
The Science and Technology Policy Council was established in 2003 and set policy objectives for the period 2003 to 2006. The specific policy objectives were to (1) increase the public resources intended for allocation from competitive funds and co-ordinate their operation; (2) strengthen the role of universities as research institutions; and (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.

Purpose of the evaluation
In 2006 the Science and Technology Policy Council decided to evaluate the policy objectives. The purpose of the evaluation is to assess whether the objectives have been reached and to analyse the activities of the science and technology policy, and to suggest how science and technology can be strengthened. The evaluation should recommend how the performance of future policies can be evaluated.

Evaluation methods
The overall evaluation exercise consists of two parts; an internal evaluation based on surveys and interviews, and an external evaluation. The internal evaluation is a separate document from this, but is quoted and used as an input here. This report is based on meetings in Iceland and a review of documents and literature. The internal evaluation took place in December 2006 and January 2007. The external evaluation was completed in April 2007.

Progress in respect of objectives
During the period there was considerable progress on the specific objectives spelled out in 2003. Some of the objectives take longer to reach than three to four years. The targets to increase funding has been reached. Cooperation between universities, institutes and firms has been successfully encouraged though funding instruments that lead to stronger research teams. Research training of young scientists has received a significant boost through increased number of graduate students and additional funding. A new law on inventions of employees has been passed that will encourage public institutes to take more active role in protecting and commercializing results. A national database on publicly funded research is maintained but more needs to be done to promote the utilization of research results. Quality assessments are slowly being implemented for public institutions but very few thematic assessments have been carried out. In sum, there was progress towards general goals as well as specific accomplishments in respect of targets.

Policy content
During the first years 2003 – 2006 the Council's policy focused on few, well-defined objectives. In the long run, there are number of challenges where there is a need for policy guidance to the Icelandic research and development community. These areas are in respect of focus in research, where there is a dilemma to both set priorities and allow for the unexpected research results to emerge. It is also important to encourage interdisciplinary research and to develop clusters. Many observers suggest that such clusters could be formed in the sectors of marine resources, geothermal energy, and health sciences. International cooperation is essential and must be seen as a two way process – the challenge is to make Iceland attractive to foreign researchers and high-tech companies. There is a continuing need to assess quality through a focus on impact and social benefits from science and technology.

Policy implementation
The science and technology policy is implemented through a combination of rules and regulations, monetary incentives, and information (sticks, carrots and sermons). The mix of policy instruments need to make more use of information, flagship targets etc. to motivate researchers and firms. The Council has facilitated Inter-ministerial coordination in respect of policy, but there is a need for stronger coordination in respect of policy implementation. The walls between ministries are still high. Public funding is set on a good track, but private funding remains low, and there is need for innovative approaches to mobilise venture capital and other forms of research funding. The institutional scene is evolving and there is a need for closer coordination and continued merger of institutes and funds.

Policy evaluation
There are four areas that need systematic approaches to evaluation: (1) research proposals, (2) research results, (3) the Council's activities and impact, and (4) the social and economic impact of science and technology. These require different approaches, sometimes indicators play an important part of the inquiry. The focus should be on understanding how impact is created. The evaluation suggests indicators in the first, third and fourth area.

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Chapter 1. Introduction

Background

In 2003 significant changes were made in the organization of science and technology. That year three laws were passed: *Law on The Icelandic Science and Technology Policy Council,* which established the Council. The *Law on Public Support for Scientific Research* and *the Law on Public Support for Technological Development and Innovation in Industry* meant that the organisation of public funds for science, technology and innovation was revised. The purpose of the Science and Technology Policy Council (SPTC) was to bring political attention and support to scientific progress and technological development. The Council is headed by the Prime Minister of Iceland and it meets twice yearly. The meetings are prepared and supported by Science and Technology Committees as well as an informal Interministerial Coordinating Committee. The Council has taken a number of initiatives over the past three years, 2004 to 2006.

At its meeting in June 2006 The Science and Technology Policy Council decided that an evaluation of the new structure should be undertaken. The reason was that in the past three years the Icelandic research community had gained some experience from this new system and that these experiences would merit a closer scrutiny. It would be of interest to assess the new initiatives systematically and independently and hence this evaluation of the performance and impact of the Science and Technology Policy Council was initiated.

Purpose

The evaluation as a whole, starting in November 2006 and ending in April 2007, consists of two parts; an internal evaluation, an external evaluation. The terms of reference for the evaluation are attached as annex 1. The objectives of the evaluation as a whole are:

1. To bring forth the performance and impact of the establishment of the Science and Technology Policy Council and new laws on public support for scientific research, technological development and innovation that took effect in 2003.

2. Evaluate the progress of specific objectives set by the Science and Technology Policy Council.

3. Develop suggestions on how to improve the execution of science and technology policy.

4. Evaluate and develop suggestions on how to improve organisation and effectiveness of the interaction between ministries, public institutions and private companies on science and technology issues.

5. To define performance indicators for Science and Technology Policy Council's policy and to lay the foundation for a regular evaluation of its progress.

There is a division of labour between the internal and external evaluations. The internal evaluation focuses on the first two tasks, while the external evaluation focuses on the three latter tasks. The internal evaluation is more concerned with the past, with the results that were achieved during the past three years. The external evaluation is more oriented towards the future and towards changes in the system. The terms of reference for the evaluation are enclosed in annex 1.

Methods

The empirical data for the external evaluation comes from interviews with stakeholders in the scientific and technological community on Iceland. The two of us in the evaluation team have met with representatives of the Science and Technology Policy Council, with the different administrative bodies that implement policies, with universities, research institutes, companies, and other organisations. The list of meetings and schedule of visits is enclosed in annex 2. We have also taken part of policy documents, various analyses of scientific progress, higher education and economic development. These are listed in annex 3, and in the text as they are being used. Both of the authors of this report took part in meetings in Iceland and the conclusions presented here were developed jointly. Kim Forss held the pen when writing this report and a first draft has been discussed by the two of us.

Much as we have met many stakeholders, we have also worked under considerable time constraint. Our discussions have had a general and strategic orientation, but there is much we don't know concerning the research processes and the links between administration, research and social/economic use of research findings. <u>Our observations and findings should be regarded as hypotheses and as general remarks in the light of comparative international experiences and benchmarking.</u>

Guide to the reader

This report could be read on its own but as the text above makes clear, it is part of a larger evaluation process. In the next chapter we summarise the internal evaluation report and comment on its findings. It is part of our role as external evaluators to provide a quality assurance of the internal evaluation process. Chapter 3 deals with some critical policy issues that did not figure prominently in the 2003 – 2006 period, but that merit attention in the present policy period (2006 – 2009). Chapter 4 discusses organisation and effectiveness, and in chapter 5 we turn to the development of impact assessment and the methods to assess performance of the Council's future work. Chapter 6 sums up the analysis and the discussion in eight concluding remarks. We have marked what we think are some of the highlights of the discussion by underlining them to facilitate the reading and to see the main points in sometimes rather abstract arguments.

Chapter 2. Summary of the internal evaluation

Introduction

In this chapter we look at the major conclusions of the evaluation as a whole, that is, what the internal and external evaluations conclude in respect of the terms of reference. The evaluation was expected to examines the following factors:

1. To what extent have the general objectives, put forth in the laws from 2003, been realised?
    a. Strengthening of scientific research, scientific education and technological development.
    b. Cooperation between different actors involved in scientific research.
    c. Improved competitiveness of Icelandic industry through technological development, research and innovation.

2. How has the organisation of governance, decision making and policy implementation worked?
    a. The effects of the establishment of the Science and Technology Policy Council.
    b. The effects of Science and Technology Policy Council on the operations and interactions between ministries.
    c. The opinion of the science community on the operation of the Council, its decisions and their follow-up.

3. To what extent have the main objectives of the Science and Technology Policy Council been realised?
    a. The effects of increased financing of public research funds and their integration.
    b. The strengthening of universities as research institutions.
    c. The restructuring of the organisation and operation of public research institutions.
    d. Increased cooperation in research

The main evidence needed to answer these questions come from the internal evaluation report, which, in turn builds on a survey to a major part of the Icelandic research community as well as a substantive number of interviews with key decision-makers. On top of that, the external evaluation held meetings as described above. It is useful to gather data through parallel processes of evaluation, not least since there may be a tendency to bias in a small community where most people know each other well, and where many have several and overlapping roles in the system. Nevertheless, the data from the internal and external evaluation do point in the same direction.

Assessment of general objectives

Though there is no specific such thing as general objective mentioned in the policy, the first paragraphs of the policy statement do express a general intent. The policy statement was adopted by the Council on its meeting in December 2003, that is, at the very end of the first year. The Council cannot thus have guided science and technology much during 2003, and it is in 2004, 2005 and 2006 that it has had the opportunity to shape events. Box 1 presents the general objectives of the policy. The long-term goal is indeed long-term, and it is not the focus of the evaluation. However it is important to bear the long-term goals in mind when the policy issues of relevance and importance are discussed in the next chapter. As a very general remark, a number of different reviews seem to confirm that even over a short period of time, the Icelandic society is moving towards achieving these long-term objectives. The growth rates have been impressive, the knowledge-base of commerce and industry is increasing, and society has handled many of the external shocks that have affected the other Nordic and European countries well.

Box 1. The general objectives of the Council.

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 bringing the nation new knowledge and competence useful 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.

Source: Science and Technology Policy 2003 – 2006. Adopted at a meeting of the Science and Technology Policy Council on December 18th, 2003. (translation provided by the Ministry of Education, Science and Culture, December 2006).

The OECD Working Party on Innovation and Technology Policy[1] concluded that the per capita income is approximately 20% higher than the OECD average in 2003, up from around 10% higher in 1995. Spending on research and development has increased significantly from 1.6 to 3% of GDP during the same period, and even more after that. Government funding of research and development exceeds all other OECD countries. But there are also question marks, as for example regarding how society will cope with increasing immigration and with sustainable use of energy in the light of new plans for large scale raw material processing (see for example OECD

[1] Policy Mix for Innovation in Iceland. Working Party on Innovation and Technology Policy. OECD, Directorate for Science, Technology and Industry. April 2006.

Economic Survey, Iceland, 2006[2]). When the volume of research funding is discussed, it is important to remember both the increase and the percentages above, but also the overall volumes – and the latter remain very small and that has consequences for a number of policy decisions as well as for the results that can be achieved.

As for the last three bullet points in box 1, it would seem as if they have been reached. Quoting the internal evaluation report[3], it is evident that public resources for competitive funds have increased in real terms since 2003. This applies both to national and European funds. Competitive funding as a source of income for both public and private bodies in Iceland is significant and has increased in absolute and in relative terms since 2003. There is a very sharp distinction between the two main funds where universities lead on average 80% of projects funded by the Research Fund and companies on average 65% of projects funded by the Technological Development Fund. When the Research Fund is compared to its predecessors, there is a very clear and a significant shift of responsibilities and probably funding from companies and particularly public research institutes to universities. The implicit objective to have fewer and larger projects with more cooperation between different actors has been achieved and projects are now on average bigger than under the previous system. It is important this development continues and even becomes reinforced.

The role of universities as research institutions has been strengthened by growth in graduate programmes and through increased research funding directly to the universities and from the Research Fund. New comprehensive legislation for Higher Education that came into force in 2006, creates conditions for improved quality control and further development of Icelandic Universities. The University of Iceland – by far the largest university – has presented a very ambitious objective to become ranked among the world's leading universities and a five year action plan that will significantly boost its research capacities. Following this action plan a new agreement with the government was signed that will significantly increase its basic research funding.

The internal evaluation also concludes that there is general agreement that review and reorganisation of public research institutes has moved forward since 2003. Two public institutes no longer exist as such; one was moved under the Agricultural University and one was transformed into a government owned limited company. At the same time there is agreement that progress has been slow, particularly regarding the Technology and Building Research institutes. These two institutes have now become merged through a law that was passed in Parliament during the last week of its session. A proposal to combine these with the regional Development Agency was dropped. The Science and Technology Policy Council has only partly functioned as a policy coordinating body in this restructuring process. Despite some difficulties, there are a number of public research institutions around which there is little controversy and where there is a feeling that review or reorganisation is not urgent.

[2] Iceland. OECD Economic Surveys. 2006.
[3] Here and in other parts of this text, we quote from the draft internal evaluation report by Agust H. Ingtorsson, dated 19 February 2007.

The external evaluation has not found any evidence to the contrary for the time being, though this institutional development must be considered in the long term. The meetings we had lent broad support to the above conclusions, and there is no doubt that the general objectives referred to are being met. There is an overwhelming support by all main stakeholders that the restructuring of the system in 2003 was a good thing. In particular there is strong support for a dialogue between science, industry and the highest political level. Many of our interviews pointed to the importance of setting one coherent policy for three year periods which can guide individual ministries, institutions and companies in their own policy making. This main conclusion has already been feed into the new policy statement for 2006-2009 and into proposals for changes to the Science and Technology Council which would see its renaming to Science and Innovation Policy Council, which is also an appropriate signal of strategic focus.

Assessment of organisation

Probably the most important effect of the Council is that it has led to an increased visibility around the importance of science and technology in the society, and that in turn has led to an increased funding. The fact that the Council has met regularly and that its meetings have led to policy statements and to many recommendations on how to strengthen research and technology has in itself had a major impact. <u>It is not only the Council itself, but also the other new organisational entities that have had an impact;</u> the regular and frequent meetings of the Science Committee and Technology Committees that prepare the agenda for the Council, as well as the Inter-ministerial Committee on Science and Technology meant that the interaction between stakeholders has increased and there is a dense network of communication between the actors.

<u>This network has meant that coordination between different ministries on policy issues related to research and technological development has significantly increased. Policy development has been very well coordinated. But the operational coordination has not been equally well developed</u>, and the attention during these first years appears to have been on the policy issues, which is a correct priority. Yet there is a perceived need for more coordination and the Council has not always been involved in deliberations by individual ministries. There is, for example, a lack of clear guidelines or working procedures for decision on participation in international activities.

There is a broad support for the organisational changes in the research community. An overwhelming majority support the changes, and to the extent that some are critical, it is that the desired changes are not happening fast enough. The direction of change is supported, some still would like to see the speed of change increase and then it is, in particular, increased operational coordination between ministries that is wanted.

Assessment of the realisation of the Council’s objectives

Considerable progress has been made on most of the specific objectives spelled out in 2003. Table 1 sums up the progress in respect of the specific objectives mentioned by the Council. It must be pointed out that some of the objectives do take longer to reach than three to four years, and in addition, even if the objectives can be reached in four years, the statistical data to assess them is not available until later.

In sum, we can agree with the internal evaluation that cooperation has been successfully encouraged through funding instruments that will also lead to stronger research teams. Success in international competitive funds indicates the existence of a number of strong research teams. Research training of young scientists has received a significant boost through increased number of graduate students and additional funding from the Research Fund. New law on inventions of employees has been passed that will hopefully encourage public institutes to take more active role in protecting and commercializing it research results. A national database on publicly funded research is maintained but more needs to be done to promote the utilization of research results. Finally quality assessments are slowly being implemented for public institutions but very few thematic assessments have been carried out.

Table 1. Assessment of the Council's specific objectives

Objective	External evaluation team's comments
Establish strong research teams for working in an international environment by giving priority to the most competent individuals, institutions and firms;	There has been considerable change in the desired direction as projects build on collaboration and the selection process has made use of quality criteria.
Increase the co-operation between research institutes, universities and business enterprises in forming knowledge clusters capable of attaining a strong position in international competition;	Cooperation has increased and led to larger projects. It is questionable if one can speak of clusters, the scale and intensity has not yet come that far, and it takes longer than three years to establish strong clusters.
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;	There are high technology firms, and also changes in lower technology firms, but most appear to have been in existence since before 2003. Few private enterprises contribute much to research funding.
Give increased weight to research training of young scientists in an internationally competitive research environment	The numbers of graduate and Ph.d students have increased and they play a significant role in research projects.
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;	Work is under way to open publicly funded databases for access by the scientific community. More work needs to be done on quality and access according to principles developed by the OECD. The results of most research projects are reported to financiers and in various academic publications, or in some cases the results lead to patents.
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;	A new law on invention has been passed so there is some progress on this subject, but it is a large and complex and much remains to be done. However, the level of commercialization remains low.
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	Quality is assessed regularly based on numbers of publications and quotations. These are some indicators of quality, but they need to be developed, in particular to assess impact and utility.

Conclusions on internal evaluation

The internal evaluation is the most important source of data in respect of the first two evaluation questions, and it provides important data in respect of the next three evaluation objectives too. But as we are an external evaluation team that is expected to take the work onwards, with the help of the internal evaluation, we need to assess the quality of that work. It is generally said that the quality of an evaluation can be discussed in terms of its; (1) utility, (2) feasibility, (3) propriety, and (4) accuracy[4].

The internal evaluation is short and concise. It is written in a clear and direct language, with a frank assessment of progress and shortcomings. The major conclusions are clearly presented. Even though there are no recommendations as such directed to specific actors, which is usually taken as a prerequisite for usefulness, it is quite clear from the analysis what kind of actions that need to be taken as well as whom would be the lead actor. There is hardly any doubt about that from those who are familiar with the system, even though the report does not spell that out (and it was not expected to do so). The report is useful and it seems likely that it will be put to good use.

The quality of feasibility refers to an evaluations timing and connection to decisions as well as to its cost efficiency. The internal evaluation is timely; it was made prior to our visit to Iceland and could thus be utilised in our meetings and it meant that we could take the discussions further into the problems than would otherwise have been possible. The timing is suitable to the policy cycle as the old policy period came to an end in 2006. However, the question is if the new policy for 2006 to 2009 should have been formulated after the evaluation rather than before, so that any lessons from the evaluation could have been reflected in the overarching policy statement? The internal evaluation was completed in less than two months time and built on extensive interviews plus a survey. Both were necessary and it is hard to imagine that either could have been done with less resources than were actually spent on the exercise. It was definitely cost-efficient.

The propriety standard reflects a concern for the ethical dimension of evaluation, that is, whether the data collection process has been proper, has respected informants' rights to anonymity and protection, or whether the integrity of any stakeholders might have been compromised. The internal evaluation was a transparent process; the report has been shared, and there has been a large amount of interaction. Propriety also concerns whether all legitimate stakeholders have been consulted. The survey meant that almost everybody in the Icelandic research community could put forward their opinions on the policy, and it is thus uniquely participatory. But it remains for the evaluation to use much of this data, as the report that is so far on the table does not use all of the data from the survey. This will be presented directly in the community.

As for *the accuracy standard*, that is, whether the findings are valid and reliable, there is no reason to doubt them. There is solid empirical evidence in the form of statistics, organisational analysis, or reviews of legal processes, to support the conclusions. We have not found any contrary evidence. Nevertheless, there are two issues to address.

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[4] The Program Evaluation Standards; Joint Committee on Standards. Sage Publications, 1994.

The response rate to the questionnaire was low. It is not clear why and whether adequate efforts to increase the response rate were undertaken. There were no interviews with what could be constituted as a control groups, that is, companies or others who did not receive funds, who were not interested or had their proposals rejected, nor with ministries who are not identified as main partners in the system. Perhaps data from such groups could have changed the overall impression. It is understandable that no major effort to reach these were taken in such a short time as the internal evaluation had at its disposal, but the fact remains and does imply that the conclusions must be understood viewed with this in mind. Still, the internal evaluation is both valid and reliable, and lives up to high standards of accuracy.

In conclusion, there is no doubt that <u>the internal evaluation scores high in terms of internationally accepted criteria of what constitutes good evaluation practice as specified in the standards of utility, feasibility, propriety and accuracy.</u>

Chapter 3. Policy content

Policies and reality

It is interesting to note that the name of the Council is not the same in Icelandic as in English. The difference lies in the word policy, which is not there in the Icelandic name. We do not want to embark on a lengthy academic exercise about what constitutes a policy, but we would like to call attention to that this is not an obvious concept. Is policy expressed only in the document mentioned above, taken by the Council on the 18th December of 2003? Or is policy also expressed in the deliberations of the Council, in the resolutions that have been published after the seven meetings between 2003 and 2007? Or could it be said that policy is also expressed in the legislation, in the decisions taken by the different boards of the funds, and in the committees?

In our view, policy is something that needs to be interpreted broadly. Even though the focus is and should be on the document entitled "policy" , this is not the only source of strategic guidance – and it is strategic guidance that is the core of policy. One of the main challenges of policy is to provide strategic guidance in a rapidly changing world, and to provide relevant guidelines for people and organisations to respond to global challenges. When there is an evaluation of policy, a key question must be if the policy does provide such guidance.

In international comparison, we would say that both the first policy statement and the subsequent resolutions from the council are uniquely focused. As the internal evaluations shows, and as we discussed in chapter 2, the policy objectives are very concrete, practical and down-to-earth. The policy set specific objectives that, for the most case, can be assessed at the end of the period. That is a very strong advantage, and it is also relatively unusual in the world of policy-making.

The drawback that may possibly come from such a focus is that there are strategic issues, challenges, and conditions that are not sufficiently addressed, and where the actors in the system do not get sufficient guidance from the policy? In this chapter we point to five such themes; substantive focus, interdisciplinary research, internationalisation, quality and impact. These subjects have to some extent been discussed in the Councils meetings, and there are references to them – particularly in the resolutions. But they do not feature strongly in the policy document.

When the policy was formulated, there was a discussion on the extent and range of content and deliberation on whether broader issues should be reflected in the policy. It was decided to keep it focused on concrete and practical issues, and maybe the difference in languages (between Icelandic and English) helped achieve the focus it has. One of the main arguments in favour of keeping it to immediate activities was that the Council itself is an experiment and an unusual feature in Icelandic politics and administration. As such, it would get a better start if the objectives were carefully set and whether it could be clearly assessed whether they have been reached at the end of the period. This was a prudent decision and the evidence of performance and the scope for learning at present suggests it was right. However, future policy deliberations may want to make sure that attention is also paid to broader challenges, even if they are not always translated into policy objectives.

Focus in research and development

It is common that policies for science and technology specify in which substantive fields the emphasis that public and private funding will have. They often articulate where policy-makers think the best opportunities are, for example in pharmaceutical research, in environmental research, legal studies, management, astronomy, or whatever it happens to be. Iceland has faced and continues to face a dilemma in this respect. The policy documents do not have many references to specific substantive areas. There is no indication that, for example, fisheries research on sustainable management of marine resources would be a priority, nor of any other substantive field.

On the other hand there are priorities in practice and these are spelled out in that there are some funds that are tailor-made for specific sectors and for specific applications. So the question is why the overarching policy does not set down national priorities? The answer to that question has to take into account the small size of the Icelandic research community. With a population of around 300.000 persons, with eight universities, and with an academic community of some few thousand researchers, with around 20 doctoral theses in a year times, and some 344 new applications to the funds every year, the choice is far more difficult to make unless the priorities were backed by additional dedicated funding.

When larger countries such as the other Nordic countries - even if they too are small by comparison – set priorities in substantive fields, that does not exclude a number of other subjects. In Sweden, Finland, etc, there can be a thematic focus at national policy level that does not exclude that a number of other research projects are initiated and can thrive. But given the size of the Icelandic research community, it is likely that setting priorities – even against the background of the growth of funds – would be far more excluding in practice.

There is no doubt a need to maintain academic freedom and to allow researchers to define subject areas of inquiry. Often the most worthwhile and potentially useful products come out of research that nobody could foresee. There are indeed very good reasons to doubt that policy makers could foresee in which fields the most promising research advances that will lead onwards to innovation and technical development will take place.

On the other hand, there is also a trend that research with an impact needs a considerable amount of financing. Scale is more important today than ever in the past. Collaborative arrangements in the research process also drive costs while at the same time it is necessary to create an impact. The smaller the resources, the more essential is it to focus and make sure that the money is well spent and likely to have an impact.

This is a dilemma and it is typical of dilemmas that they cannot be resolved. Problems are solved, not dilemmas, they must be lived with and coped with. The dilemma between a free and broad research agenda, with unpredictable benefits on the one hand, and on the other hand a legitimate worry from taxpayers and investors that money is well spent and put to use to create a competitive economy, must be handled.

This is a policy dilemma, nothing else, and hence it is essential that the policy is vocal on the subject; that it explains how the dilemma is handled and how the balance between breadth and focus is decided and maintained.

Interdisciplinary projects and clusters

As the policy does not mention substantive areas of research it may follow logically that it does not say much about interdisciplinary research either. We have commented on the reason for this on page 13 above, and we endorse the choice of focus during the first policy period.

Successful research tend to occur within specific disciplines, but for many years there has been a growing trend towards interdisciplinary research. This is difficult to accomplish; it tends to be larger in scale and requires more of management skills than traditional, smaller research and development projects do. Here again is an issue of balance, it is necessary to obtain the depth and specialist knowledge of within-discipline research, but it is also necessary to have the broader scope and interrelationships of interdisciplinary research. Neither social nor technical problems appear within neat scientific disciplines, and hence it takes interdisciplinary approaches to work out solutions.

Interdisciplinary research is difficult and in fact there are many incentive systems that work against it. For the single researcher, it is often more attractive to build a career within a discipline. There are clear and accepted systems for quality control. It is comparatively easy to publish in scientific journals that follow traditional disciplines. There are interdisciplinary journals, but their merit is often not as well recognized and many of them are not even included in the citation index databases. The promotion to new levels, posts at foreign universities, tutoring research students, etc. are all tasks and career moves that are more effectively pursued within disciplines.

As the forces that encourage a researcher to stay within a single disciplines are so strong, and as it entails a risk to engage in interdisciplinary research, it is often necessary to undertake special measures to support such moves. It is particularly desirable to support such moves as society as a whole probably stand to gain from more interdisciplinary research. The question of how to encourage interdisciplinary research, to what extent to encourage it, how to maintain the balance between disciplinary rigour and interdisciplinary creativity, is a policy issue.

Foreign observers of the Icelandic research and development community have unanimously pointed to the need to establish strong clusters of research, technical development and innovation. Such clusters tend to be interdisciplinary, they focus on a theme, such as for example geo-thermal energy. But in the practical work it is necessary to combine different technical skills, earth sciences, social insights, to form commercially viable systems. So far, the policy statements have not singled out any specific clusters. Perhaps the time has come to do so.

It is beyond our competence to suggest any clusters, but there are a number of questions to confront; how many clusters, at which level of funding, around which problems or solutions or branches, which interdisciplinary combination – and not to mention the more operational issues of how they would be designed, how to make them flexible, how to involve corporations, and how to connect to international networks. These are a mix of policy questions and more operational and managerial questions. Our observation is that these are current issues at the top of the minds of many researchers as well as among managers and politicians - and there is a need for clear strategic guidance and for national priorities. A number of studies, domestic and international, have pointed to competitive advantages in marine resources, health sciences, and geothermal energy.

International cooperation and globalisation

It is obvious that international cooperation in science and technology is important and the policy statement of 2003 is also clear on that subject. The resolutions from the Council between 2004 and 2006 devote much attention to international cooperation. The quote[5] below is illustrative:

> "The participation of Icelandic scientists in international cooperation increases by each year. This participation provides science and technology with new opportunities and is simultaneously a measure on the position of Icelandic science in a multinational comparison.
>
> Europe
> The proposal of the Commission of the European Union (EU) on the 7th Framework Programme on Research and Technological Development (FP7) envisages a doubling of disbursable funds each year from 2007-2013. ……. It is envisaged that in the new Framework Programme there will be ample opportunities for Icelandic participants and universities, research institutions and companies have to be encouraged to make use of these opportunities. Proposals on specific topics will be published in the coming autumn….
>
> The Nordic Countries
> The Nordic Science and Technology cooperation has been radically transformed recently with the establishment of NordForsk and NICe. ……The STPC requests that Ministers concerned contribute to strengthen the position of Iceland in international cooperation through active participation in Nordic cooperation.
>
> The Arctic
> During its chairmanship in the Arctic Council in 2004 Iceland's initiative on issues pertaining to the Arctic got positive responses…... The renewed interest in strengthening the scientific cooperation between the member states of the Arctic Council will be followed up by the Nordic Council of Ministers. …..STPC asks the Minister of Education, Science and Culture, in cooperation with the Minister of Foreign Affairs and others ministers concerned, to suggest ways to enhance the Icelandic participation in the research cooperation in the Arctic region and to propose these measures to the Council during the next year of its operation."

The point is that this and other policy statement discuss international cooperation in terms of researchers and firms going abroad to take part in initiatives elsewhere. There is undoubtedly a strong tradition of going abroad for higher studies, and it is also clear that Icelandic companies are successful on foreign markets. However, in an expanding research environment international collaboration must also imply that foreign researchers and foreign firms come to Iceland and take part in activities that originate here and that have been defined here.

[5] The Science and Technology Policy Council. Resolution of June 2, 2005.

Is the Icelandic research environment attractive for foreign firms and researchers? Do they seek opportunities in Iceland? Do the clusters in Iceland form particularly attractive centres for inspiration and ideas, where the future is formed and where there is much to fetch? The Council could deliberate on these policy issues and they merit attention in the future. Interviews with researchers and firms indicate that there are a number of obstacles when foreign firms and individuals come to Iceland. Many of these affect other ministries, and hence an interministerial body would be a perfect place to identify such obstacles, to work out solutions and follow-up that the necessary actions take place. These actions may affect such things as work permits for researchers, immigration papers, assistance with schools and employment for family members, etc. The point is that policy deliberations on internationalisation must take into account that cooperation works in both directions; it is not only Icelandic firms and researchers going abroad. There is much to gain from bringing foreign researchers and companies to Iceland.

Quality of research and development

There are several indicators that point to the quality of Icelandic research and development. The OECD working party[6] presents statistics on patents, funding, entrepreneurship, the technological basis of firms, etc. The European Innovation Scoreboard 2006[7] also point to some indications of quality, but concludes that "*the innovation performance of Iceland in 2005 is in line with the European average*".

More specifically, indicators such as numbers of scientific publications in relation to population and citation impacts place Iceland among the top of the OECD countries. Iceland ranks[8] as number 2 of 30 countries in Agricultural Sciences, as number 3 in natural sciences and medical sciences, as number 4 in humanities, number 16 in social sciences and number 23 in engineering and technology. Though the latter two figures are not impressive, the first four definitely are.

There are stringent systems for quality control at the universities and the applications for funding, are controlled for quality. In respect of the Research Fund, the quality control focuses exclusively on numbers of publications and quotation impact. These are good indicators of quality, but they must not be confused with the concept itself – that which they indicate. Scientific quality and quality in respect of technical development and innovation is far more complex. The traditional peer review of scientific output is a necessary parallel investigation. Doctoral disputations would normally be subjected to a thorough quality discussion that captures the depth of research, the novelty, the reliability and validity of methods, the relevance of findings and how they connect to previous findings, etc. The assessments of applications for the Technology fund, on the other hand, focus on the marketability and chances of application in the economy.

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[6] Policy Mix for Innovation in Iceland. Working Party on Innovation and Technology Policy. OECD, Directorate for Science, Technology and Industry. April 2006.

[7] European Innovation Scoreboard 2006: Strengths and Weaknesses Report. Joint Research Centre of the European Commission. January 2007.

[8] Finnish Science in International Comparison. A Biometric Analysis. Academy of Finland, 2006.

The quality discussions that we have found are focused and that is fine. But research merits should not only be assessed on past publications and quotations. It is necessary to undertake a thorough peer review of the expected scientific contribution and of the other aspects of research quality that can be assess in a proposal. Having said this, it must be acknowledged that the research projects are often small and it is costly to call in scientific panels. But there is a trend to larger projects and cluster formations and then it becomes possible to invest more in the assessment of proposals. Besides, it is urgent to shift the policy focus from some few quantitative indicators of quality to a broader assessment of quality, particularly if one wants to promote innovative research that lead onwards to technological development. The quality assessments need to be developed at the proposal stage, when the projects are finished, and it seems that the personnel policies at universities also might benefit from a more qualitative approach. Some of the researchers we met during interviews mentioned that the most important criteria for promotion and career development were numbers of publications and quotations, and as we have mentioned above, these are only two aspects of what constitutes academic merit.

Impact and utilization of results

Quality and impact are related subjects but it is useful to keep them apart for analytical purposes. The studies quoted above present different indicators of impact of research, but as with quality, the indicator must not be confused with the subject it is meant to be an indicator for. The indicators only capture fragments of what impact might be, they could point in the wrong direction, and they usually come late. One frequently mentioned indicator is the share of knowledge intensive products in manufacturing as a whole and in exports. Iceland does well, as demonstrated by the Ministry of Education, Science and Culture[9].

Just to mention one problem with indicators; fish products are not classified as knowledge intensive exports, still research and development may lead to a technology intensive production chain. On the other hand, development of knowledge intensive services, such as banking, may well put research and development to use, but perhaps not based on technological development occurring at Icelandic universities. The point is that indicators must be treated with care.

It is not impossible to know about the impact of specific research on society. Most researchers know quite well what happens with the knowledge they produce. But the foundation of such knowledge is close, practical and down-to-earth assessment of what happens, where and how. Once such knowledge exists it is possible to apply measures and to aggregate information. But the starting point must be knowledge about actual situations.

The internal evaluation concludes that there is not much knowledge of impact. This is a major challenge. Funds for research have been growing and that is probably the outstanding success of the Council. It is expected that funds for research will continue to grow, and the policy objectives for 2006 – 2009 assume continued growth of public and private funding of research. If research does not prove its impact, it is not likely

[9] From Fisheries-based to Knowledge-based Growth in Iceland. Powerpoint presentation. May 17, 2005.

that growth can be sustained. It is therefore essential that impact becomes a key policy issue and that entails:

- To assess research and technological development projects on the basis of their expected impact and utility
- To assess the impact of research when it comes to an end and afterwards
- To use information on impact and expected impact as criteria for the allocation of funds

Furthermore, impact does not just happen as a consequence of research, it is created through careful design. The research process can be organised to maximise the chances of impact, for example through communication, integration of users in the process etc. The knowledge of how the process should be organised to maximise the chances of impact needs to be strengthened and such knowledge can also be used in the screening of proposals. But the main challenge is to make impact and utility a continuous part of the policy debate.

Chapter 4. Policy implementation

Policy instruments

As a first step in the comments on policy implementation, we would like to consider different policy instruments. What instruments does the Council use to put policies into practice? Table 3 below summarized the notion of policy instruments. It is convenient to distinguish three classes of policy instruments[10]:

(a) **Regulations -** measures in the form of rules and directives, which mandate staff and stakeholders to act in accordance with what is ordered in these rules and directives. Such measures are popularly called "sticks".

(b) **Resources -** involve either the handing out or taking away of human and financial resources for specific purposes. The government can make additional resources available, earmark general funds and/or redirect existing resources. These measures can be called "carrots".

(c) **Information** – advocacy, motivation, exhortation, covers all attempts at influencing/convincing stakeholders (the administration, scientists, public authorities and private firms) through the transfer of knowledge, the communication of reasoned arguments (negotiation) and persuasion. The information may concern the nature of the problem at hand and reasons why people should respond. These measure are called "sermons".

In brief, when a new policy is designed, the decision-makers can in principle instruct (use directives), pay (use subsidies, provide resources) or persuade (use information) vis-à-vis their stakeholders, to make them comply with policy. In the following, we will talk about these policy instruments in the broad categories of sticks, carrots and sermons. In the period 2003 – 2006 the implementation of the policy relied primarily on "sticks" and "carrots". This was quite appropriate, considering that the focus of the policy was limited and that the targets were quantitative and that some required development of new laws. There was appropriate mix of policy instruments to achieve the general objectives of the policy.

The new policy has another set of objectives and there are also other issues that need attention. The mix of policy instrument needs to be revised, and in particular it is likely that the policy instruments that are somewhat jokingly referred to as "sermons" need to be developed considerably. A complex system such as the actors in science and innovation can be influenced through knowledge and communication, through visions and ideas, and not only through rules, regulations and monetary incentives. If the Council decides to devote attention to questions of impact and quality, it is likely that "sermons" rather than "sticks" or "carrots" will be important instruments.

The policy mix for science, innovation and entrepreneurship needs attention. Much of the policy effort is focused on the generation of new scientific and technological knowledge. There is no doubt that this is important and can stimulate growth, particularly in traditional and high-technology industries. But diffusion of knowledge and non-technological aspects of innovation also need attention, and these may require yet another policy mix.

[10] Bemelmans-Videc, M-L., Rist, R. and Vedung, E. (1998) Carrots, Sticks and Sermons. Policy Instruments and Their Evaluation. Transaction Publishers, New Brunswick.

Box 2. Model of the policy instruments

POLICY INSTRUMENTS	**1. Regulation** **STICKS**	Legislation
		Council Directives
		Programme Guidelines
		Strategy notes
	2. Resources **CARROTS**	Additional resources
		Earmarking of existing resources
		Redirection of resources
		Additional staff
		Redeployment of staff
		Organisational structures
	3. Information **SERMONS**	Statements from the Council
		Meetings and workshops
		Training/motivation
		Web page messages
		Publications
		Flagship targets
		Recommendations from evaluations
		Informal communication

Inter-ministerial coordination

One of the achievements of the Council is that inter-ministerial policy coordination has been significantly strengthened, particularly at the level of policy coordination. The respondents to our interviews indicate that there are still some barriers to communication within ministries in respect of science and technology, in particular;

1. not all ministries are represented on the Council and it is difficult to engage those ministries that are not represented on the Council in the policy implementation.
2. once policies have been coordinated through the Council, there are a number of implementing decisions that need to be taken, and these too require coordination between ministries. But coordination at this level is more difficult and does not follow automatically out of the policy coordination.

There are probably not any specific coordination instruments to apply to these situations. The examples of issues that were provided to us, examples where there was a need for increased inter-ministerial coordination to make progress, were different in kind. Sometimes, it was a question of agreeing how to share costs, prepare a budget, and allocate funds. At other times it was a question of decisionmaking based on information from several sources, and of mediating conflicting interests to reach a compromise.

Iceland has rather strong and independent ministries and the ministers take decisions within their mandates. In other Nordic countries government ministries are less independent, and the processes for collaboration between ministries are highly developed, to the point where inter-ministerial decision-making is the norm rather than the exception. But in such cases, the ministers themselves are less independent and the norm can be that government takes decisions collectively. This is the case in Sweden. It is much beyond our task to suggest changes in these respects. The point is rather that the cases of lacking coordination between ministries appear to be systemic and can thus not be addressed only in respect of science and technology. However, the practical organisational solutions have to start somewhere. It seems possible to address these problems in the field of science and technology as it is relatively “easy” to generate consensus on means and ends. Some of the organisational solutions may thus be developed and tested here and then introduced in respect of other policy fields. The division of labour between ministries is strong and even more so further down in the administration. Inter-ministerial coordination does not solve all problems that relate to several sectors, but needs to be followed up on.

Funding of research, technology development and innovation

As we have seen above, the funding of research and development has increased considerably. The growth in funding has come mainly from the public sector, and one company stands for most of the private sector investment in research. But in absolute terms the amounts are still low. The vast majority of Icelandic companies do not invest significantly in research and development and are not significant partners in the policy development described here.

It is thus a challenge for the Council to broaden the innovation base by encouraging innovation in all kinds of firms, including the smallest, and to support entrepreneurship. This entails not only funding for developing new knowledge but also policies to stimulate diffusion of knowledge and good practice among a broad set of firms, not only in manufacturing but also in service industries. As noted in the OECD peer review, Iceland continues to rely on direct government funding to finance business research and development. It does not use tax incentives. Among smaller OECD economies, this is consistent with current practices in Finland and New Zealand, but differs from Ireland, Norway, the Netherlands, Australia and Canada.

It is also beyond our mandate to suggest any changes in financing of business research and development. But we have seen that the private part of research funding needs to increase in order for the whole system to have the desired impact. We are not aware of any study of the potential costs and benefits of an Icelandic tax incentive and perhaps a first step would be to undertake an assessment of the situation and consider the alternatives. During our interviews we met several persons who thought the time was ripe to channel private funds into some form of innovation fund, with risk taking in the commercialisation of research and technical development and based on the principles of investments and incentives in the private equity sector. It would be important to try to involve the strong Icelandic financial institutions in such actions. The time could be ripe for new approaches in this field, and the Council could play a role in initiating studies and by creating a platform for the actors in this field.

The role of the private sector

The Council and the policy statement have been very clear on the need to foster collaboration with private industry. Representatives of industry are included in the Council (business and labour have 4 seats). Many research institutes cooperate with industry and universities in research programmes. Nevertheless there seem to be few formal programmes, such as targeted funding and the Technology Development Fund, to stimulate closer cooperation between industry and the public science system, and much cooperation appears to occur on an ad hoc basis, drawing on personal relationships[11]. Icetech and Impra were involved in these programs. This has probably served Iceland well, and has led to cost-effective networks with low transaction costs. As the Icelandic economy continues to shift towards knowledge-based development these features may change. International cooperation will lead to (and requires) other networks and may not make use of traditional modes of cooperation.

Rannis' mandate and role

As the internal evaluation notes, Rannis is an authority under the Ministry of Education, Science and Culture. Rannis has a central and crucial role to play in the development and implementation of the policy for science and technology. As such, it is an organisation that will evolve continuously as the policy changes and shifts and as new problems emerge. In such a dynamic context, organisational design and structural solutions are likely to be of limited duration. During our brief visit to Iceland we met with representatives of Rannis as well as with other organisations such as Impra, Icetech and the New Business Venture Fund. There are structural issues to be resolved concerning Rannis place in the science and technology system and the organisational design needs to be developed. The solutions to these problems are detailed and technical, and we have not had the possibility to get a complete overview of problems nor of possible organisational solutions. Nevertheless, we would like to raise some issues that may need to be reviewed or studied further:

The four main funds that are used to finance science and technology appear to be overlapping and the question is if the quality of assessment, follow-up and evaluation could be facilitated if they were all merged. Rannis provides operational service to them all. Funds for graduate training and doctoral studies form part of two of the funds and while we have no reason to doubt that there is some informal coordination when it comes to take decisions, the processes as such would be more easy to coordinate and more transparent if the finances come from the same fund. The same applies to equipment, and one wonders if it is ever necessary to finance equipment without considering the overall research purpose that the equipment is part of. Some interview responses suggest that the policy instruments function well while being separate, and the internal evaluation suggest that there is a gap between the funds rather than an overlap. Nevertheless, we have never seen such a division of labour between research funds and would suggest that it merits further attention to analyse whether they van be managed more cost-efficiently under one umbrella.

In this context we should also mention funds for science and technology that are administered by the Ministry of Fisheries. We have not analysed the Fisheries Fund, but it would seem that the main advantage that comes from operating it as a separate fund is that the money is not used for anything but fisheries related research. It would seem that there could be synergy effects by merging this with the other funds, and it should be possible to earmark funds for fisheries, particularly if that is clearly spelled out as one of the important clusters for future science, technology and innovation. In

[11] Policy Mix for Innovation in Iceland. Working Party on Innovation and Technology Policy. OECD, Directorate for Science, Technology and Industry. April 2006.

fact, it is hard to see how interdisciplinary ideals of cluster formation can be realised if it is maintained as separate funding. Similarly, the organisational boundaries between Rannis, Impra and Icetech would need to be reassessed. There is a logic to have them set up separately, but there is also a logic to merge them and create larger units. The Icelandic scene is small and there is a risk that institutional overhead grows too large in relation to the number of firms and research projects that get support.

There are a number of organisational entities above Rannis, as well as parallel to it in innovation as well as in other ministerial department. Rannis cannot be involved everywhere, nor would that be appropriate, but it is important that there are consultative processes where the expertise at Rannis is used for decision support. Rannis needs to be equally involved in all reviews and preparation of decision-making that has a bearing on science and technology policy. It is important to remember that Rannis is not only an instrument to manage funds and provide the secretarial services for managing the scrutiny of proposals. It has other roles too;

- coordinating and promoting Icelandic participation in international cooperation;
- monitoring and evaluating R&D performance
- promote public awareness of research and innovation.

It is thus a broad mandate that relates to all the policy instruments mentioned above (sticks, carrots and sermons) and it needs to be appropriately funded for each. It is also clear that these roles do not apply to any one field of science only, and Rannis mandate is to serve Icelandic scientific community across all fields of science and humanities (without exception).

Chapter 5. Developing the approach to evaluation and measurement

The external evaluation has also been asked to define performance indicators for the Science and Technology Policy Council's policy and to lay the foundation for a regular evaluation of its progress. Evaluation is a broad subject, and it seems that the Council has adequate instruments to assess various aspects of organisational performance and there are also defined approaches to evaluate research quality. As we have mentioned above, we found too little attention to impact in the above approaches. This section will thus focus on the evaluation of impact, as we think that is the most important aspect of any evaluative argument around research quality.

Is it possible to measure impact?

Many would claim that it is difficult or even impossible to measure impact of research. Can it be done? The answer to that question is; "Yes, of course". Impact can be measured but one must remember that measurement presupposes a scale. The question is rather, what kind of a scale and what does it mean to assign values on a scale. In research, several scales are used, from simple ordinal scales to ratio scales. A ratio scale is more sophisticated and requires very precise data. An ordinal scale can use qualitative data and consists of categories that rank activities, such as:

Highly satisfactory
Satisfactory
Unsatisfactory
Highly unsatisfactory

Many agencies use such ranking scales when they assess impact. During this study we have met a number of researchers and asked about what has happened to their findings after the research was over. We could possibly have rated impact on a scale such as this (from very high to very low). The question is whether that information would be of much interest and relevance? The value judgement that such measures are based on is subjective. The problem is, whose judgement would be used to measure and what kind of empirical data would support the measurement? There are different kinds of impact, with a variety of potential consequences, and it is difficult to say, for example, that using research to develop the problem solving skills among teachers (pedagogy), or developing a patent for commercial ventures (engineering), or as inputs to a legislative process (political science) is worth more than any other impact. There is no objective way to judge one to be better than the other, nor even to pronounce them equally good, which is implied on a scale such as the one illustrated above.

Assessment and the use of case studies

Instead of measuring impact, it can be described. Information and knowledge is effectively contained and disseminated in narrative form. By providing concrete and evocative examples of how research is put to use, we can proceed to discuss whether that impact is good or not, whether it has been achieved at a reasonable cost, what the obstacles were, and how it can be sustained or increased. That is a more interesting discussion than to present measurements on a scale. Researchers usually know what happens with the knowledge they produce. A political scientist working on election processes may, for example, be called into a Parliamentary committee to present findings. These may be used in deliberations and could be visible in a final proposal from the committee, but perhaps it would be less visible as other considerations than specific research findings would be used as decision support. In one example, we heard that researchers in pedagogy were asked to assist develop material around conflict handling in high schools, and after the research process there were several seminars with school leaders, teachers, and people in communities. These and many other processes could be described with a higher level of detail and critical examination.

As this example shows, impact is observed as a “case” that can be revealing and instructive. It happens when a person, a commercial firm, or an organisation does something as a result of research findings. It is best described as a short story. The number of instances of impact from any one project would be difficult to know, but it could be many instances of varying degrees and types. Furthermore, it is useful to know how impact occurs in particular cases. Stories have always been effective and efficient means of communication, and stories can be vehicles to convey information on how impact is created and supported.

Table 3. Elements in evaluation of research

Evaluation question	Methodological choice	Sources of information	Timing
Expected utility and quality of the research proposal	Assessment of the proposal and verification of interest among user groups	Study of the proposal and interviews, peer review and externally commissioned utility evaluation, also based on indicators	Before funding decision
Quality of research	Inquiry into the research findings, their relevance and utility	Peer review of the research project at the end of the project.	At the end of the research project
Immediate impact of the research	Interviews with stakeholders and potential users, critical examination of obstacles to use, evidence of action taken	Specifically commissioned evaluators, preferable with practical experience from the sector/area of use concerned	Ex post, but how long depends on when it may be meaningful to assess impact.
Impact of the Council’s activities	Assessment of the working process and the outcomes of the Council’s work	Assessment of progress based on detailed work plan, milestones in producing outputs and outcomes, and indicators of progress	Assessments on an annual basis and for some indicators with longer time intervals
Social and economic impact of research	Long-term competitive development of the economy and also of social and cultural targets of research	Social and economic indicators from international databases	Such indicators are collected systematically by OECD, Eurostatistics, and other bodies.

Systematic approaches

A comprehensive assessment of the impact of research requires many types of information. Much work is done internationally, and when that is the case it is perhaps not necessary to use resources on Iceland for the same purpose. Table 3 shows the different levels of information that is necessary and where the information can be gathered. Indicators can be used; (1) to assess the expected utility of a research proposal, (2) to assess the Councils output and outcomes, and (3) the social and economic impact of research. In respect of the latter, it is important to note that indicators themselves will not provide the answers, but in a study of the impact of research, it is necessary to use statistical information. In the text above we have quoted information from the OECD, studies of research in Finland, and other surveys. These are examples of how indicators may be used within an inquiry, but the indicators have to be made part of an interpretive narrative, they do not by themselves provide the information that decision-makers seek. In the text below we provide examples of indicators that can be used in respect of these three areas.

Table 4. Indicators of whether a research proposal is well designed to create an impact.

Indicator	Major shortcomings	Some shortcomings	Useful design	Very useful design	Comments and/or motivation
Is there a communication policy and/or plan?					
Is there a budget for communication?					
Is someone appointed to be in charge of communication?					
Are the human and financial resources sufficient for communication?					
Is there a definition of target groups and messages for communication?					
Were user groups involved in the proposal?					
Is there some form of reference group with users to follow progress?					
Are there clear mandates for the involvement of user groups					
Are management and leadership of the research process well taken care off?					
Are there contracts in place that specify ownership and benefits of the research?					

Indicators to assess expected impact of research proposals

Table 4 presents a set of indicators that can be used to assess the expected impact of a research proposal. Note that these are not in themselves examples of use, they are indicators based on research design; that is, whether the research process is organised so that it is likely to have a large impact. The assessment of likelihood is based on how the research process is organised and how the communication process is elaborated – as without organisation and communication it is not likely that there will be much impact to study later. Once the indicators have been identified one needs to decide how they will be assessed, whether through a qualitative analytical text or whether they should be rated on a scale – and if so, what kind of a scale. In the example brought forward here it would be possible to use a simple ordinal scale such as in the table, but with an option for the evaluator to motivate the rating.

Indicators to assess the Council's work

The purpose of these indicators, within the overall system of evaluation, would be to follow the progress of the Council's work. The text above has described how the Council works, how its meetings are prepared, and some of the policy directives that the Council has produced. There is now a new policy for the period 2006 to 2009, and the Council has specified objectives for this period. The Ministry of Education, Science and Culture has developed a set of indicators for this purpose in the text "Indicators for the Science and Technology Policy Council policy for 2006 – 2009". These indicators lay a useful framework to assess the work of the Council, and they should make it possible to regularly assess performance against targets. The set of indicators is not yet fully developed, and against this background we would advice:

1. that the number of indicators is kept relatively low. There are four policy objectives and within each of these around 5 to 8 sub-objectives. If there were five indicators for each sub-objective, there would thus have to be around 100 indicators and that is too much. It is perhaps feasible to use around 50 indicators in total, but that is probably a maximum. Each indicator has to be understood, assessed, discussed and put to use, and for most users of evaluations and progress reports there is a limit to how much information it is possible to digest.

2. that the overall number of indicators reflects the different nature of information. Some of the indicators build on readily available statistics, or on statistics that can be produced by schools, universities or companies (number of students in adult education, investment in R&D companies, etc.) But other indicators require more work, for example number of spin-offs from research). It is important to decide who will gather the information and when it will be delivered at the same time as one identifies the indicator.

3. the indicators to be used should have the same requirements in respect of timing, that is, it should be possible to assess them at the same time. None of them should require two or three years to pass before relevant information can be gathered.

4. It is common that indicators point in different directions, and hence the analysis that the indicators should contribute to must be extensive. Indicators do not speak for themselves, but must be placed in an analytical context to be really useful. Time and resources should be set aside for this.

5. Often it is not the value of the indicator as such that is really interesting, but rather the rate of change – and possibly potential benchmarking with similar indicators in other countries. Therefore it is generally better to have few indicators that can be gathered at relatively low cost, but that can be used to chart trends and patterns in a comparative perspective.

6. Most of the suggested indicators focus on effects in society. There could also be indicators that reflect whether certain "milestones" in the Council's work have been reached, for example, whether preparatory studies have been produced, whether decision proposals have been elaborated, whether systems for consultation and coordination are in place and so on.

Indicators in respect of social and economic impact.

It is common to use indicators in an assessment of the impact of science and technology. The publications that we have quoted above all make use of indicators in the descriptive and analytical work. The table summarizes what we consider to be the most relevant indicators to assess the impact of science and technological development, and they are all contained in the European Innovation Scoreboard. These indicators are grouped into 5 areas that signify innovation, science and technological development. The five areas are; innovation drivers, knowledge creation, innovation and entrepreneurship, applications, and intellectual property.

Table 5. Examples of indicators of social and economic impact.

Innovation Drivers	1. Graduates in science and engineering 2. Tertiary education 3. Broadband penetration rate 4. Life-long learning 5. Youth education 6.
Knowledge Creation	1. Public R&D expenditures 2. Business R&D expenditures 3. Share of medium high/high-tech R&D 4. Share of firms receiving public funding 5.
Innovation and Entrepreneurship	1. SMEs innovating in-house 2. Innovative SMEs cooperating with others 3. Innovation expenditures 4. Early-stage venture capital 5. ICT expenditures 6. SMEs using organisational innovation 7.
Applications	1. Employment in high-tech services 2. High-tech exports 3. Sales share of new-to-market products 4. Sales share of new-to-firm products 5. Employment in medium-high/high-tech manufacturing 6.
Intellectual property	1. EPO patents 2. USPTO patents 3. Triad patents 4. Community trademarks 5. Community designs 6.

Source. European Innovation Scoreboard 2006. Available at http://www.proinno-europe.eu/inno-metrics.html

The advantage with using these indicators is that there is a readily available methodology for how to gather data. It is otherwise often hard work to define exactly what kind of data and measures that should go into each indicator. Instructions on how to gather data is available from the source mentioned above. Yet another advantage is that comparative data that can be used for valid and reliable comparison is available from a number of other countries. The indicators can be supplemented and aggregated to form larger clusters of indicators, and there are formats for comparing data and analyse strengths and weaknesses that can make the analytical work cost effective.

Resources and methods

Any practical approach to evaluation presupposes a decision on budget. The questions that can be answered, the relative accuracy of an answer, and the methodological choice all depend on the money. At times it is possible to have a relatively good answer to an evaluation question with some easy methods while a very precise answer may require quite a lot more – and that cost would perhaps not be justified to take a decision or to understand the issue with that much higher certainty.

The first two evaluation questions have to be answered in respect of all research proposals and completed processes. But they are not the most expensive evaluation processes and they can be completed each with a limited amount of resources. The narrative case studies of impact require more resources, possibly three to five weeks to assess the impact of one research project. Hence it is necessary to select a sample, and perhaps it would be possible to make a random selection of some 20% of the projects, while at the same time making sure that the projects with the largest budgets are always evaluated. The methodological choice in such impact evaluations has to vary depending on the project to be assessed and the evaluator. Sometimes document analysis, at other times questionnaires and surveys, and yet other times carefully selected interviews, would be appropriate.

The assessment of the Council's work would require more resources. While some of the indicators can be assessed at little or no additional cost, others would require a format for reporting from other organisations, or specific research and evaluation team. Any decision on indicators would have to depend on the budget available. The indicators quoted in respect of social and economic impact also require resources to be gathered and analysed. A rough estimate is that most of the information is available, or is regularly gathered through statistical services or via Rannis. Hence it is only the time needed for aggregation and analysis that needs to be budgeted.

Chapter 6. Conclusions

This external evaluation has covered a large field and many complex issues. At times we have discussed a topic or a dilemma where there is no exact answer at present, and where the Council has to balance opposite claims in respect of science and technology – for example the need for diversity on the one hand and the need for priorities on the other hand. As concluding remarks, we would like to highlight the following nine aspects of our study:

High quality and increasing quantity of R&D is necessary for Iceland. The role of the Council is crucial to secure that development.

Several of the policy objectives of the Council were reached and there was considerable progress in respect of others. The Council has definitely had an impact and it is necessary to continue to give policy guidance to society and to the research community and to foster innovation based on science and technology.

Transparent, participatory and consensus building system to establish visions and provide strategic guidance for R&D.

There are close contacts between different actors in the research and development community and the transaction costs are often low, and that is a very strong competitive advantage. The Council and other actors have initiated processes of policy consultation in the research community and that is commendable. The creation of joint visions of the future is an example of this, and that is a necessary process of deliberation to generate inputs to decisions on, for example, clusters and priorities.

Comprehensive policy process, relevant in respect of strategic choice and global challenges/opportunities.

The first policy document focused on budget increases and legislative institutional development for research. The first years were characterised by restructuring organisations and other organisational development initiatives. In the future, a number of other policy issues need to be addressed and in the long run, the Council would need to identify issues and make sure that its policies are comprehensive in respect of all strategic issues concerning science, technology and innovation.

Necessary to identify and define a limited number of interdisciplinary clusters of R&D and ensure stable and long-term financing of these.

Geothermal energy, health sciences, and marine resources have been mentioned as clusters where Icelandic research and Icelandic companies have competitive advantages. Whether in these or other interdisciplinary fields, it is necessary to define the questions to be addressed and form the clusters, both institutionally, in terms on networks, international collaboration, commercial opportunities and actors, and in terms of funding.

The share of private funding needs to increase and the role of the private sector in research, technology and innovation should be developed.

This remains a weakness in the system and a closer scrutiny shows that even though overall funding of research is high in terms of GNP, the role of private finance is very limited. On top of that, it is concentrated to very few firms, meaning that most are not affected and are not part of these developments. New initiatives to engage private funds in venture capital formation is necessary and innovative approaches here are necessary and urgent.

Competitive funding should account for a growing share of R&D expenditures. Competitive funding strengthen quality, provide a better base for monitoring and evaluation, and are effective tools to ensure that policies are implemented.

There has been an increase in competitive funding, but there are still many actors in both science and technology who work with budget allocations. The effects of competitive funding have been positive, and it is necessary to continue to increase the overall share of competitive funding.

Coordination between sectors at all levels in the administrative system need continuous attention.

There is no doubt that the increasing coordination between ministries for policy purposes has been very useful to achieve results and change the science and technology system. But coordination has focused on the policy level and there are many operational issues that need to be coordinated continuously.

Increasing focus on impact and utilization at all levels of the R&D system. Practical and qualitative approach to assessing impact and utility.

There is hardly any information at all on impact of the research funding and it should be a priority both to assess proposals for their expected impact and utility, to incorporate impact in evaluations of research quality, and to evaluate impact when funding has come to an end. This is a complex whole of evaluative information that depends on many different methods. Sometimes indicators are useful instruments, at other times narrative case analysis is more useful. In the short run, the focus should be on narrative cases of impact so as to increase the knowledge of how and when research is put to use.

International collaboration is necessary and vital both to gain an impact and to produce research of high quality.

Icelandic researchers have a tradition of going abroad and the domestic research community has gained much from that. But it is also necessary to develop mutually reinforcing links and to make Iceland an attractive place for researchers and innovators from other countries. Internationalisation works in both directions, to and from Iceland.

Annex 1. Terms of Reference

Project initiation document (PID)

Title: Evaluation of Performance and Impact of the Icelandic Science and Technology Policy Council 2003-2006

PRINCE 2

Release: 2.1
Date: 23.11.06

Author: Arnór Guðmundsson

Owner: Ministry of Education, Science and Culture

Client: Prime Minister's Office
Document number: 2.1

Abbreviations and explanations

The Science and Technology Policy Council (SPTC) is headed by the Prime Minister of Iceland. Three other ministers have a permanent seat on the Council: The Minister of Education and Science, the Minister of Industry and Commerce and the Minister of Finance. At the discretion of the Prime Minister, two other ministers with research in their portfolio may join the Council. Currently these are the Minister of Fisheries and the Minister of Agriculture. Fourteen other members are appointed to the Council upon nominations by the Ministers with research portfolio (6 nominations), parties to the Employers Association and Employees Union (4 nominations) and by the coordinating committee of higher education institutions (4 nominations).

The Minister of Education and Science appoints nine of the non-ministerial members to the **Science Committee** and the Minister of Industry appoints an equal number to the **Technology Committee**. The mutual overlapping membership on the committees contributes to coordination between science, technology and innovation in the policy making process.

Interministerial committee on research: A consultative committee with representatives from the Ministries of Fisheries, Health, Agriculture, Environment, Finance. The chairs of the science and technology committees and the director of Rannís (see below) also sit on the committee. The committee is chaired by the Halldór Árnason, director in the Prime Minister's Office (PMO)

The Icelandic Center for Research (RANNÍS), reporting to the Ministry of Education, Science and Culture, provides operational support to the committees and funding bodies, to manage the international connections, monitor the effects and impacts of policies and to provide intelligence and informed advice to the STPC and its boards and sub-committees, as requested.

See also: http://www.rannis.is/files/Overviewdes05_876885556.pdf

Purpose of Document

Define the project of evaluating the performance and impact of the Icelandic Science and Technology Policy Council. The document sets the basis for the management of the project, control of its progress and the assessment of overall success. It serves a basis for approval by the Interministerial Committe on Science and Technology and as a guide to the people involved in the internal and external evaluation.

Background

At its meeting last June 1st. The Science and Technology Policy Council decided that an evaluation should be performed of its work from it's initiation in April 2003 to the year 2006. In the evaluation one has looked at the Finnish example of regular evaluation of the government's Science and Technology Policy.

In the year 2003 significant changes were made in the organization of science and technology area in Iceland. That year three laws were passed: *Law on The Icelandic Science and Technology Policy Council*, *Law on Public Support for Scientific Research* and *Law on Public Support for Technological Development and Innovation in Industry.* These changes involved transferring the governance in the science and technology area to the level of the government, The Science and Technology Policy Council that is chaired by the Prime Minister. At the same time the organisation of public funds for science, technology and innovation was revised.

At present one has gained some experience from this new system, although the longer term effects may not be realised. It has therefore been decided to initiate an evaluation of the performance and impact of the Science and Technology Policy Council.

Project Definition

Project objectives

- To bring forth the performance and impact of the establishment of the Science and Technology Policy Council and new laws on public support for scientific research, technological develoment and innovation that took effect in 2003.
- To define performance indicators for Science and Technology Policy Council's policy and to lay the foundation for a regular evaluation of its progress.
- Develop suggestions on how to improve the execution of science and technology policy.
- Evaluate and develop suggestions on how to improve organisation and effectiveness of the interaction between ministries, public institutions and private companies on science and technology issues.
- Evaluate the progress of specific objectives set by the Science and Technology Policy Council.

Stakeholders

Science and Technology Policy Council
Ministry of Education, Science and Culture
Prime Minister's Office
Ministry for Trade and Industry
Interministerial committee on research
Rannís – The Icelandic Center for Research
Impra – Technological Institute of Iceland
Alþingi - Parlament
Public Research Institutions
Universities
SA – Confederation of Icelandic Employers
SI – The Federation of Icelandic Industries
ASÍ – Icelandic Confederation of Labour

Defined Method of Approach

Internal evaluation will be conducted and a report written with background information and representation of the opinions of different stakeholders. The internal evaluation is further to present a critical analysis of strengths and weaknesses of the science and technology system and suggestions on how it can be improved. The report will examine in a critical way the execution of Science and Technology Policy, its societal impact, organisational aspects and the outcome from specific actions and objectives. A part of the internal evaluation will involve defining performance indicators for the Science and Technology Policy

The internal evaluation will be lead by a team leader, who is responisble for the internal evaluation report. He will be supported by two experts from the Ministry of Edcuation, Science and Culture. The internal evaluation will involve all major stakeholders, f.ex. representatives from industry, public research institutions and ministries.

The Office of Evaluation and Analysis in the Ministry of Education, Science and Culture defines the framework for the internal evaluation in cooperation with external reviewers.

Two external experts will undertake a review and write a report based on the internal evaluation and a site visit in Iceland.

Project scope

The evaluation focuses on the time period 2003-2006. For the development of performance indicators and assessment of societal impact the view is more longer term, towards 2009.

In this project one examines the following factors:

I. *To what extent have the general obectives, put forth in the laws from 2003, been realised?*
   a. Strengthenin of Scientific research, scientific education and technological development.
   b. Cooperation between different actors involved in scientific research.
   c. Improved competitiveness of Icelandic industry through technological development, research and innovation.

II. *How has the organisation of governance, decision making and policy implementation worked?*
   a. The effects of the establishment of the Science and Technology Policy Council.
   b. The effects of Science and Technology Policy Council on the operations and interactions between ministries.
   c. The opinion of the science community on the operation of the Council, its decisions and their folllow-up.

III. *To what extent have the main objectives of the Science and Technology Policy Council been realised?*
   a. The effects of increased financing of public research funds and their integration.
   b. The strengthening of universities as research institutions.
   c. The restructuring of the organisation and operation of public research institutions.
   d. Increased cooperation in research

Performance indicators for Science and Technology Policy will also be developed.

Exclusions

Icelandic participation in international research will be excluded in the evaluation exept when it has direct relevance for overall development in the country.

In the evaluation one will not look at specific research projects or research institutions except when it has direct relevance for the overall development in the country.

Project deliverables
The project deliverables are:
1) An internal evaluation report with a critical analysis of the performance and impact of the work of the Science and Technology Policy Council and suggestions for improvement. The report will include a description of the current position and a study of the performance during the last three years based on statistics, interviews and a survey among stakeholders,
2) Proposals for performance indicators for Science and technology policy
3) A report on an external evaluation by foreign experts of the performance and impact of the Science and Technology Policy Council.
4) The results of the evaluation will be made public possibly at a conference.

Constraints
The budget approved by the government for the evaluation is limited and might need to be supplemented.
The time limit for the evaluation is very tight, but the results are to be ready by March 2007.

Interfaces
The evaluation may interface with a policy for innovation and regional development that is being developed by the Ministry for Trade and Industry.

Assumptions
The results of the evaluation will be of use for policy making in the area of science and technology, improvements and changes in the organisation, for decision making on future funding of science and technology.

Initial Business Case

In the Science and Technology Policy Council decisions are made that have a wide impact on society. It is important that the Council's decisions are based on sound evidence and that all stakeholders are informed about the general impact of decisions and results of specific actions. During the last three years financial support for science and technology has increased significantly and it is important that the financial support is directed towards areas and projects where strong benefits are reaped. It is also important to study how effectively the Council's decisions are implemented and how the various actors who are involved in the implementation interact.

Project organisation structure

Group	Members	Areas of Responsibility
Interministerial Committee on Research	Representives from Ministries involved in research, chairs of the Science and Technology Committees, Director of The Icelandic Center for Research	Steering of project. Approval and monitoring of project plan. Reports to Ministries. Participates in internal review.
Internal evaluation team	Ágúst H. Ingthorsson, team leader. Arnór Gudmundsson, Office for Evaluation and	Conducting internal evaluation and writing of a report. Data gathering and consultation with

	Analysis Edda Lilja Sveinsdóttir, Department of Science	stakeholders. Cooperation with external reviewers.
Office of Evaluation and Analysis	Arnór Gudmundsson, project manager	Management of overall project. Responsibility for contracts and financing. Coordination of internal and external evaluation
Department of Science	Vilhjálmur Lúdvíksson, Director	Consultation
Focus groups	Representatives of stakeholders.	Input into internal evaluation. Interviews with external evaluators.

Communication plan

The interministerial committee on research will be briefed on the project during its monthly meetings.
The internal evaluation team meets regularly according to needs, convened by team leader or project manager.
A letter of introduction will be sent to stakeholders and the evaluation presented at their meetings.
The results of the evaluation will be presented publicly.

Project quality plan

In order to insure the quality of the internal evaluation its framework will be developed with an external expert. The internal evaluation team will work with experts and stakeholders in Iceland to insure that the internal evaluation report provides good input for the external review. The same process will be followed for the development of performance indicators.
Emphasis will be placed on consultation and coordination with the external evaluators in order to ensure the effectiveness and quality of their work.
As the timeframe for the project is very tight an emphasis will be placed on controlling the factors that can affect the progress of the project and to put in extra resources if needed.
In order to keep the budget use will be made of resources within the Ministry of Education, Science and Culture and The Icelandic Center for Research.

Initial project plan

See plan in appendix that will be updated regularly.

Initial risk log

The following main risks are defined initially:

- Project is not finished within initial time-frame.
- Cost overruns.
- External reviewers not able to come for site visits at the scheduled time.
- The objectivity of the internal review team questioned.
- Disagreement within the interministerial committee as to the scope and content of the internal evaluation.
- Different understanding between internal and external reviewers as to the content and scope of the evaluation.

The results of the evaluation not taken seriously by stakeholders.

Contingency plan

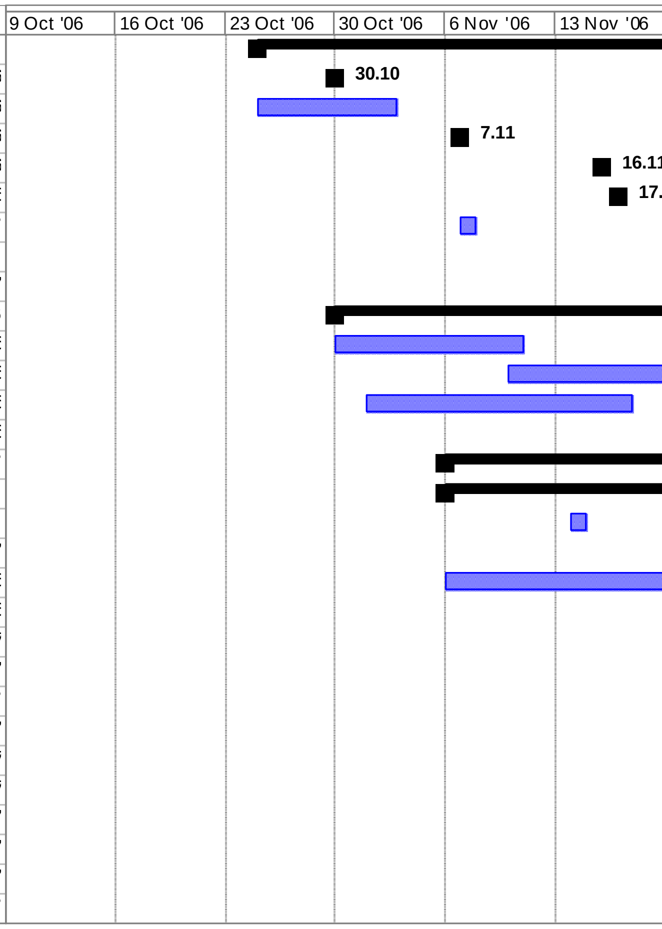
As this evaluation is conducted within a very tight timeplan there is not much flexibility for contingencies. Some flexibility will be included in the project plan. In order to facilitate reaction to contingencies the chairman of the interministerial committee will be able to approve changes in the workplan and organisation of the project.

Project filing structure

Forms from Prince2 project management system will be used for documentation and status reports filed regularly. Documents will be made accessable in a closed website that will be accessable to internal and external reviewers and filed in Ministry of Education file management system.

Appendix – Original project plan

ID		Task Name	Duration	Start	Finish
1		**Administration**	**122 days?**	**Wed 25.10.06**	**Thu 12.4.07**
2		Government approval	0 days	Mon 30.10.06	Mon 30.10.06
3		Writingn of project plan	7 days?	Wed 25.10.06	Thu 2.11.06
4		Project plan approved	0 days	Tue 7.11.06	Tue 7.11.06
5		Internal review team appointed	0 days	Thu 16.11.06	Thu 16.11.06
6		Project initiation	0 days	Fri 17.11.06	Fri 17.11.06
7		**Steering group meetings**	**67 days**	**Tue 7.11.06**	**Wed 7.2.07**
12		**Status reports**	**65 days**	**Wed 6.12.06**	**Tue 6.3.07**
17		Project auditing	10 days?	Fri 30.3.07	Thu 12.4.07
18		**Preparation**	**23 days?**	**Mon 30.10.06**	**Wed 29.11.06**
19		Selection of external reviewers	10 days?	Mon 30.10.06	Fri 10.11.06
20		Contracts with external reviewers	11 days?	Fri 10.11.06	Fri 24.11.06
21		Preparation for data gathering	13 days?	Wed 1.11.06	Fri 17.11.06
22		Setting up website	3 days?	Mon 27.11.06	Wed 29.11.06
23		**implementation**	**108 days?**	**Mon 6.11.06**	**Wed 4.4.07**
24		**Internal evaluation**	**65 days?**	**Mon 6.11.06**	**Mon 5.2.07**
25		**Meetings of internal reivew t**	**56 days**	**Tue 14.11.06**	**Tue 30.1.07**
38		Interviews and survey among	41 days?	Mon 20.11.06	Mon 15.1.07
39		Gathering of data	30 days?	Mon 6.11.06	Fri 15.12.06
40		Definition of performance indic	17 days?	Thu 7.12.06	Fri 29.12.06
41		Writing of internal evaluation re	24 days?	Tue 2.1.07	Fri 2.2.07
42		Internal evaluation report sent	0 days	Mon 5.2.07	Mon 5.2.07
43		**External review**	**43 days?**	**Mon 5.2.07**	**Wed 4.4.07**
44		Reading of internal review repo	14 days?	Mon 5.2.07	Thu 22.2.07
45		Site visit	3 days?	Mon 26.2.07	Wed 28.2.07
46		Debriefing by external reviewe	0 days	Wed 28.2.07	Wed 28.2.07
47		Preliminary report	0 days	Thu 15.3.07	Thu 15.3.07
48		Writing of final report	21 days?	Thu 1.3.07	Thu 29.3.07
49		Conference?	0 days	Thu 29.3.07	Thu 29.3.07
50		**Follow-up/auditing**	**5 days?**	**Thu 29.3.07**	**Wed 4.4.07**



Annex 2. List of Meetings

Evaluation of Performance and Impact of the Icelandic Science and Technology Policy Council 2003-2006

Schedule for Visit by External Reviewers
February 26-28, 2007

Venue: Þjóðmenningarhús/National Centre for Cultural Heritage

Monday February 26

9:00-10:30

Meeting with the Self-evaluation group – questions about the self-evaluation report.
Arnór Guðmundsson, Director, Office of Evaluation and Analysis, Ministry of Education
Ágúst H. Ingþórsson, Director, Research office, University of Iceland.
Edda Lilja Sveinsdóttir, Advisor, Office of Higher Education and Science, Ministry of Education.

10:30-12.00

Interministerial Committee on Science and Technology
Halldór Árnason, Director of Prime Minister´s Office,
Hans Guðmundsson, Director, Rannis
Hanna Dóra Másdóttir, Advisor, Ministry of Industry
Hallgrímur Jónasson, Director, Technological Institute, Chairman, Technology Committee,
Vilhjálmur Lúðvíksson, Director, Office of Science, Ministry of Education,
Guðrún Nordal, Professor, University of Iceland, Chairman of Science Committee,
Edda Lilja Sveinsdóttir, Advisor, Office Science, Ministry of Education,
Eiríkur Baldursson, Secretary of the Science and Technology Council,

12:00-13:00
Lunch
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13:00-14:30

Rannis- Icelandic Research Centre
Hans Guðmundsson, Director,
Kristján Kristjánsson, Head of Research and Innovation,
Þorvaldur Finnbjörnsson, Head of Analysis, Evaluation and Indicators,
Hjördís Hendriksdóttir, Head of International Affairs,
Páll Vilhjálmsson, Head of Communication.

15:00-16:00

Representatives of Universities
Skúli Skúlason, Rector Hólar University College,
Hjálmar H. Ragnars, Iceland Academy of the Arts,
Jón Atli Benediktsson, professor University of Iceland,
Áslaug Helgadóttir, Agricultural University,
Viðar Hreinsson Reykjavik Academy of Independant Scolars,
Jón Ingi Benediktsson, RHA - University of Akureyri Research Insitute
Rebekka Rán Samper, Bifröst University.

Tuesday February 27

9:00-10:30

Representatives of Research Institutions
Jóhann Sigurjónsson, Director of The Marine Research Institute,
Ólafur Ástþórsson, The Marine Research Institute,
Magnús Pétursson, Director, National Hospital
Guðmundur Þorgeirsson, National Hospital
Torfi Magnússon, National Hospital
Ólafur Baldursson, National Hospital
Rósa Björk Barkardóttir, Cancer Research Institute/National Hospital
Ragnheiður Inga Þórarinsdóttir, National Energy Authority

10:30-11:30

Representatives of Companies
Freygarður Þorsteinsson Össur LTD,
Hilmar V. Pétursson CCP Gaming Industry Innovators
Kári Stefánsson DeCode Genetics,
Friðrik Skúlason, Frisk Inc. Software Company

11:35-12:00

Meeting with Prime Minister Geir H. Haarde and Jón Sigurðsson Minister of Industry and Commerce.

12:00-13:30

Lunch with representatives from Ministry of Education, Science and Culture and Ministry of Finance at Hótel Borg.

13:30-15:00

Representatives of Industrial Associations and Trade Unions
Vilhjálmur Egilsson, Director, Confereration of Icelandic Employers,
Jón Steindór Valdimarsson, assistant director, Industry Association,
Sigurður Jónsson, Director, Federation of Trade and Services.
Kristján Þórarinsson Resource Biologist The Federation of Icelandic Fishing Vessel Owners
Rúnar Bachman, Icelandic Labour Federation,
Halldóra Friðjónsdóttir, Federation of University Educated Employees.

15:00 – 16:30

Other competitive research funds
Bjarni Guðmundsson Framleiðnisjóði landbúnaðarins, Agricultural Fund
Jón Steindór Valdimarsson, Innovation Fund

17:00-

Bjarni Ármannsson, CEO, Glitnir Bank

Wednesday February 28

13:00- 14:00

Debriefing
Inter-ministerial committee and General Secretaries Ministry of Education, Science and Culture, Minstry of Industry and Trade, Prime Minister's Office,

14:00-15:30

Science and Technology Committees

Friday March 2
Kim Forss visit to the University of Reykjavík, University of Education and University of Iceland

Annex 3. List of documents used in the evaluation.

Basic characterization of the research system. Overview. ERAWATCH Research Inventory.

European Innovation Scoreboard 2006. Strengths and Weaknesses Report.

Gudmundsson, H.K. (2007) Rannis, the Icelandic Centre for Research. Powerpoint presentation.

Icelandic Centre for Research and Ministry of Education, Science and Culture (2005)
An evaluation of educational research and development in Iceland.

Lehvo, A. and Nuutinen, A. (2006) Finnish Science in International Comparison. Academy of Finland.

Ludviksson, V. (2005) From Fisheries-based to Knowledge-based growth in Iceland. Powerpoint presentation

Macdonald, A., Kaldalons, I., and Jonasson, J.T. (2005) Tension and slippage: the status and impact of educational research in Iceland.

OECD (2006) Thematic review of Tertiary Education. Iceland.

OECD Economic Surveys (2006) Iceland

OECD (2006) Policy mix for innovation in Iceland. Working Part on Innovation and Technology Policy.

Porter, M. (2006) Building a Competitive Economy: Implications for Iceland. Powerpoint presentation, Reykjavik, October 2006.

Sigfussdottir, I.D., Asgeirsdottir, B.B., and Macdonald, A. (2005) An evaluation of scholarly work at the University of Iceland. A study carried out for the Ministry of Education, Science and Culture.

STCP (2006) Science, Technology, Innovation.