Education, Research and Innovation policy

A new direction for Iceland

Expert panel

Christoffer Taxell (Chairman)	Chancellor Åbo Akademi University, Finland
Richard Yelland	Head of the Education Management and Infrastructure Division of the Education Directorate of OECD, France
Iain Gillespie	Head of Science and Technology Policy Division, Directorate for Science, Technology and Industry, OECD, France
Markku Linna	Former Permanent Secretary, Finnish Ministry of Education, Finland
Arnold Verbeek (Rapporteur)	Senior Expert STI policy and Manager of the Competitiveness and Innovation division at IDEA Consult, Brussels, Belgium

This report was prepared on behalf of the Icelandic Government, the Minister of Education, Science and Culture

May 2009

TABLE OF CONTENTS

p.

1 INTRODUCTION

In October 2008, the Icelandic banking and financial sectors - with activities totalling more than ten times national GDP - collapsed. The worldwide crisis has affected Iceland's economy, and its citizens, severely and swiftly. The ensuing recession obliges the Icelandic Government to review many aspects of its policies, and to find alternative pathways to growth and development, one of these being creating better links between education and innovation in a modern knowledge based economy.

The fall-out from the economic crisis has significantly affected the image of Iceland in the world, just as it has affected the day-to-day life of its population. The Icelandic Krona has lost half of its value, inflation and external debt both have increased substantially, and sharp increases in unemployment have had adverse effects on peoples' lives.

Iceland will face extraordinary budget cuts during the coming years, estimated at 10 % in the next two years. At the same time a GDP contraction of almost 10% is expected marking a dramatic change from the trend of recent years.

It is clear that Iceland needs to enter a new era in which, more than ever, education, science and technology and innovation policy will be important as engines of economic growth. Iceland needs to focus, further invest in the knowledge based economy and sectors that create real value. Happily, it will be building on a solid core of achievement and reform in these sectors in recent years.

At the beginning of 2009, the Minister of Science, Education and Culture ordered the establishment of a national task force to think about the future of Iceland's education, research and innovation policy within the above mentioned context. This group is further complemented by the work of a panel of international experts, whose role is to take an 'outside – inside' perspective, and to help Iceland to move forward.

The international panel is composed of the following members:

Christoffer Taxell (Chairman)	Chancellor Åbo Akademi University, Finland
Richard Yelland	Head of the Education Management and Infrastructure Division of the Education Directorate of OECD, France
Iain Gillespie	Head of Science and Technology Policy Division, Directorate for Science, Technology and Industry, OECD, France
Markku Linna	Former Permanent Secretary, Finnish Ministry of Education, Finland
Arnold Verbeek (Rapporteur)	Senior Expert STI policy and Manager of the Competitiveness and Innovation division at IDEA Consult, Brussels, Belgium

The mandate of the international expert panel is to provide policy guidance and suggest actions on mainly the following issues:

- In the face of a serious crisis in public financing and falling income from university capital funds how should the human resources and management of the national university system be mobilized to provide the best response to national needs?

- How should the national funds for research and innovation be strategically oriented to mobilize closer cooperation between the public sector research organizations and private sector industry to stimulate industrial innovation in the short term as well as underpin long term knowledge based growth and the competitiveness of the economy in the future, based on human and natural resources?
- How could the institutional environment for education, research, technological development and innovation be improved either through organizational adjustments or better coordination? In particular, how could the role and working methods of the Science and Technology Policy Council and its two subcommittees for science and for technology be strengthened in order to pursue an effective policy throughout the institutional structure for education, research and support to innovation?

The panel had the benefit of a number of existing reports and reviews on the Icelandic STI (science, technology and innovation) environment and performance (these are referred to in a parallel background report).

The panel undertook two missions to Iceland. In February (2009) it met and spoke with a wide range of people from academia, industry and the policy making system (the programme is presented in Annex 1). A second mission to Iceland was undertaken at the beginning of April (2009). During this mission, preliminary panel conclusions were discussed with key actors in the system (the programme is presented in Annex 2). The panel met between the two missions to Iceland on the 19th of March in Helsinki (Finland) where it discussed the status, preliminary findings and the next steps. The panel presented its final report to the Minister of Science, Education and Culture on 25 May 2009.

In chapter 2 we present and discuss some of the key elements of the Icelandic education, research and innovation system and governance. Subsequently, in chapter 3 we discuss the main issues and challenges that have been identified and that need further attention in the near future. In chapter 4, we present our recommendations for action.

2 EDUCATION, RESEARCH, INNOVATION SYSTEM AND GOVERNANCE

This section presents the main features of the higher education, science, technology and innovation landscape, and how they are governed and organised. A number of key indicators are provided to support the discussion and conclusions that follow. For more complete background information and facts, we refer to our parallel stand alone background report. The discussion below, which is not exhaustive, is structured around four dimensions: education and training, innovation system and governance, science and research, R&D and innovation.

Education and training

Higher education in Iceland has grown and diversified more quickly and more recently than almost any other OECD country, and circumstances dictate that Iceland must now adapt its system more quickly than others as well. In general, education at all levels is essential in order to provide and nourish the seeds of future growth, especially in times of economic crisis. Iceland has clearly recognised this importance over the past decade and has to keep doing so. It is important to maintain investment levels in all forms of education as much as possible.

The high levels of investment in education are admirable. Between 2000 and 2005, total public spending on educational institutions in OECD countries rose on average by 19%. In Iceland the growth was twice as much, about 38%, mainly the result of the low population density and the small average size of schools in Iceland. Iceland is the OECD country which invests the most in primary, secondary and post-secondary non-tertiary education as a proportion of GDP (about 5.3%). Investment in tertiary education is below the OECD average however, despite the enormous growth in the number of university graduates over the past 11 years (63%, compared to the OECD average of 15%).

Of the seven higher education institutions[1] in Iceland that fall under the auspices of the Ministry of Education, Science and Culture and the Higher Education Institution Act no. 63/2006, three are regarded as private institutions (although they receive state funding for teaching), the other four are public. Whereas private universities are allowed to use tuition fees to generate additional income, public universities are not. And depending on the status of the university (public or private), the employees of the university do, or do not, have civil servant status.

Since 1999, the relation with the universities is managed through a system of contracts. The first of these contracts was with the University of Iceland. The contracts are customized according to the characteristics of the individual universities, and stipulate the performance and indicate the volume of the activities of the university, at least in teaching. Quality assurance in universities is governed by 2006 legislation.

[1] The University of Iceland is the largest and the oldest public university in Iceland. The University of Reykjavik (in the past merged with the Technical University of Iceland) is a younger private university. Others are: Bifröst University, University of Akureyri, the Icelandic teacher college, Icelandic Academy of Arts, Institute for Experimental Pathology, Keldur, and the Science Institute, part of the University of Iceland.

Approximately 19% of total expenses (2006) of Icelandic universities relate to administrative costs and ancillary services. On average, the universities obtain about 21% of their "private" funding through some form of competition. To a varying degree, these higher education institutions also carry out research, although this is a relatively recent development. Several of these institutes may provide graduate training (towards PhDs), often in collaboration with foreign partners. To a certain extent, similar courses (e.g. law) are provided in more than one institution.

At the upper secondary level, the number of graduates in science, mathematics and computing has increased in the last few years. The level of drop-outs from upper secondary education lies around 19.3% for all programmes; for vocational training this is 21.5%. Drop-out rate from tertiary education lies at 14.7% (all degrees). The PISA[2] results are modest. Finland, the best performer, has on average around 10% better test scores, despite spending about 20% less per student on compulsory schooling. The results (in 2006) for mathematics scale were better than the OECD average, however for reading and science the scores were respectively below and in line with the OECD average.

Vocational education is offered in comprehensive schools, industrial-vocational schools and specialised vocational schools. Many forms of vocational training award the students a legal certification for certain types of employment.. However the training opportunities available are varied. Although Iceland scores very well in lifelong learning, workplace learning in Iceland is rather low compared to other countries. This is because most Icelandic companies are very small and do not have the resources to train. Vocational training is important, as it can help to steer the development of skills towards the future needs of industry. In this respect, so far no systematic efforts/studies have been carried out (see also section on human resources) to analyse future labour force needs and their skills.

With a small population and until recently dependent on other countries for graduate education, international co-operation[3] in the field of education is extremely important. Under the responsibility of the Ministry of Education, Science and Culture the Office of International Education handles student exchange programmes which form a part of the Nordic co-operation and co-operation with the European Union, within which Iceland participates being a party to the Agreement on the European Economic Area. The Icelandic Government Student Loan Fund supports Icelandic students going abroad for studies, in particular for studies towards a second and a third degree. There are no specific national programmes or initiatives for facilitating international co-operation of universities. The opportunities are opened up by multilateral or bilateral agreements and the institutions receive budget appropriations in order to make use of the opportunities opened up by the existing agreements. The legal framework for the universities and colleges provides for their own initiatives in entering into international co-operation.

[2] OECD Programme for International Student Assessment

[3] The total number of foreign students at universities in Iceland is around 5% of all students enrolled. The largest number of foreign students is coming from European countries. While humanities is the most popular faculty, receiving 50% of the incoming foreign students, other subjects are also attractive to foreign students, including natural sciences, social sciences and business and economy.

System and governance

The management of Iceland's innovation system is fragmented and involves several ministries (including Fisheries and Agriculture; Industry; Commerce and Trade; and Education, Science and Culture). Coherence and coordination among these numerous actors appears to present a real challenge. The diversity of the university system which was described above further complicates the picture.

Among the public research institutes, the Icelandic Innovation Centre (a merger between the Technological Institute of Iceland, IceTec, and the Building Research Institute) fulfils the primary function of transferring technology and expertise to business and industry and assists companies to innovate successfully. Impra, the Service Centre for Entrepreneurship and SMEs is a semi-independent unit within the Innovation Centre. The Centre reports to the Ministry of Industry.

The Icelandic Centre for Research (Rannís) provides professional assistance in the preparation and implementation of science and technology policy in Iceland. It manages and administers the support system for research and technological development, provides services and information to the Council and its sub-committees, and the broader scientific community. A task of Rannís is also to monitor and evaluate the results of programmes and projects, a task that is yet fully to be fulfilled. Furthermore, the centre coordinates international collaborative activities in science and technology of Icelandic organisations. Rannís reports to the Ministry of Education, Science and Culture.

Concerning venture/investment capital, the most prominent actor is the New Business Venture Fund, an independent company owned by the government, which financially supports innovative projects often in co-operation with private and other institutional investors. A new Fund, Frumtak, was established in 2008, addressing innovative new technology based firms with high growth potential. Recently, several more spontaneous initiatives have also been undertaken; a noteworthy example is the fund established by the singer Björk in collaboration with Audur Capital. However, despite these examples, the supply of venture capital in Iceland remains relatively unstructured.

The key governmental body in charge of the design and coordination of research and development policy in Iceland is the Science and Technology Policy Council of Iceland (the Council). The role of this body is to define the strategic orientation for research and technology development policy in Iceland; although in reality it does not succeed in fulfilling this role mainly due to a lack of expertise and capacity. The Council has two subcommittees, one for science and one for technology.

Evaluation, and more specifically research and development programme evaluation, as a fully fledged part of the policy cycle, has so far not received sufficient attention in Iceland (see, for example, the various annual PRO-INNO TrendChart reports). Ad-hoc evaluations have certainly been carried out, almost always by 'externals'. The results of these evaluations are not widely diffused and are insufficiently taken into account in the design of new measures. Systematic *ex ante* and *ex post* evaluations need to be introduced.

A performance agreement was signed at the beginning of 2007 between the Ministry of Education, Science and Culture and the University of Iceland, on the introduction of performance based funding (in the context of its 5 year strategy). However, for the other smaller universities and the public research organisations, such contracts have not yet been developed and adopted. Contracts of this sort should be more widely diffused to other public (education and research) organisations.

Science and research

Science and research in Iceland mainly takes place in the universities and the public research organizations (private sector science and research will be touched upon in the next chapter). The research organisations mainly function under the responsibility of specific ministries and are funded through such ministerial channels. Some collabo-

ration with the universities does occur, but could and should be greatly increased and formalised.

About 64% of all public research is funded by the Ministry of Education, Science and Culture and this has remained relatively constant over the last 7 years. The remaining 36% of public research is performed by the research institutes under their various ministries. In absolute terms, 10.064 Mio ISK (or 63 Mio EUR) will be invested in 2009 by the Ministry of Education, Science and Culture. Of that, 14% will be competitive funding (compared to 13% in 2006 and only 7% in 2003). Iceland aims to double annual appropriations to competitive funds between 2008 and 2010. This is a necessary and welcome goal.

Icelandic research generally appears to be of high quality. Publication output in a number of specific areas is high (measured per 100.000 inhabitants) and widely acknowledged by peers (with a high citation impact). Particularly strong are the areas of Molecular Biology and Genetics, Clinical Medicine, Immunology and Biology and Biochemistry. A large part of this excellence can be attributed to the consistently high international scientific excellence of deCODE genetics.

Few indicators are available concerning the mobility of researchers and students, although the general understanding is that over 2000 higher education students are studying abroad at any one time. Mobility between the private and public sectors is hampered by the different working conditions in the two sectors as in all countries, but the abolition of lifelong tenure in public institutions is one positive aspect that is expected to facilitate sectoral mobility.

The Research Fund and the Graduate Education Fund are two of the main policy instruments available to government. The Research Fund is mainly targeted to the research community in various institutional settings with a focus on encouraging the formation of knowledge clusters and larger research teams. The latest budget adopted foresees an increase in the main competitive funds: Research Fund (9% increase), targeted programmes (97% increase), Graduate Education Fund (11% increase).

As in other countries with limited resources, there is an ongoing debate in Iceland about the extent to which research funding should be subject to prioritisation - often seen as a choice between diversity and focus. Iceland has made some concrete choices, although not always obviously in line with the received wisdom on her comparative advantage in fields such as the life sciences, geothermal energy and the creative industries. Nevertheless, a foresight exercise carried out under the auspices of the Science and Technology Policy Council (STPC) in 2007, was an important step towards prioritisation. The areas selected through this foresight exercise were: 1) natural resources, environment, and sustainable development, 2) health and wellbeing, 3) strengths of a small nation, and 4) industries, trade and funding of knowledge production and innovation. Based on the results of this exercise, the STPC called for project proposals in relation to "Centres of Excellence" and "Research Clusters", to be funded for up to 7 years with an annual maximum budget of 80 million ISK. In February 2009, three projects were selected: The Icelandic Institute for Intelligent Machines – IIIM, The Geothermal Research Group, and The Centre of Excellence in Gender, Equality and Diversity Research.

Systematic evaluation is not in place today, although performance contracts have been concluded with most of the universities. These performance contracts between the universities and the Ministry are monitored annually, although they are not yet systematically translated into variations in funding. Moreover, the system only applies to supplementary funding and not to the main block grants.

Research, development and innovation

By 2001, Iceland had already met the European Union target of spending 3% of its GDP on research and development. Compared to other OECD countries (using 2005 data), the lion's share of Icelandic research and development is funded by and performed in the public sector, whereas Iceland underperforms in respect of the amount of research carried out by business and enterprise. The large majority of companies in Iceland do not perform research and development. The Icelandic Innovation Centre (more specifically Impra) has a clear role in helping companies to become innovative. Where possible, the current turmoil needs to be regarded as an opportunity to ramp up innovation levels. The new scheme that has been developed as a response to the financial crisis, whereby unemployment benefits can partly be used for paying staff hired by companies for innovative projects, is an interesting development, potentially addressing both skill deficits in surviving companies and providing the highly skilled released from the financial sector with a continuing career anchor in Iceland.

The European Innovation Scoreboard[4], classifies Iceland among the countries of 'moderate innovators', together with Cyprus, Estonia, Slovenia, Czech Republic, Greece, Italy, Norway, Portugal and Spain. This is a slide backwards compared to 2007 (a changed statistical processing method may have contributed to this). Relative strengths, compared to the country's average performance, are to be found in *Linkages & entrepreneurship* and relative weaknesses in *Throughputs*, *Innovators* and *Economic effects*, the latter including factors such as the valorisation of research and the generation of real economic value.

Performance in *Firm investments*, *Linkages & entrepreneurship* and *Economic effects* has worsened, in particular due to a decrease in employment in medium-high & high-tech manufacturing (-7.8%) and knowledge-intensive services exports (-6.0%). Some commentators have observed that this apparent decline can be attributed to high levels of employment and competition from the rapidly expanding financial sector for highly educated manpower as well as the high exchange rate for the ISK together leveraging reduced competitiveness of local industry in the years preceding the financial crisis. Among high-income countries, Iceland (12.5%), Hong Kong (10.0%) and the United States (9.6%) show the highest levels of early-stage entrepreneurial activity[5]. Of all sectors, research and development expenditure was highest (37%) in the health sector.

However, the most *innovative* sectors for Iceland are machinery and equipment, and electrical and optical engineering. In terms of manufacturing specialisation, Iceland is specialised in medium-high-tech and medium-low-tech sectors. In the food and beverages sector about 52% of all firms innovate in-house. The share of research and development personnel within the European Research Area is the highest in Iceland, Finland, Sweden, Luxembourg, Denmark and Norway (between 2.44% and 3.22%). Iceland's patenting performance of has grown strongly in the last few years, especially in health related technologies.

Iceland has excellent framework conditions for innovation according to the OECD innovation monitor. Iceland, Denmark, and Finland are ranked in the top five when it comes to framework conditions for innovation. ICT – and ICT use – is an important prerequisite for innovation. Among all Nordic countries, Iceland has the second-best framework conditions for ICT[6]. Iceland does not have a tax incentive scheme for research and development in place today (like the Norwegian SkatteFUNN). The main argument for not introducing one so far has been the low corporate tax rate (now down to 12%) and also the associated costs. Historically, the Icelandic government

[4] European Commission (2008), "European Innovation Scoreboard 2008 - Comparative Analysis of Innovation Performance", Commission staff working paper

[5] Global Entrepreneurship Monitor (2007), Executive Report, Babson College and London Business School

[6] Nordic Council of Ministers (2009), "Nordic Innovation Monitor"

has provided little direct funding for business-performed research and development[7]. While there are no tax incentives for business research and development, direct funding for research and development has begun to climb modestly, in response to the establishment of several new competitively awarded funding schemes. Although the Icelandic policy mix for innovation has had a strong leaning toward support for the science base, recent developments have begun to build up some complementary support for business research, development and innovation.

The main instrument in relation to research, development and innovation policy in Iceland is the Technology Development Fund, which supports technological development and innovation projects with economical benefits. Awards can be made to researchers in the business, and public sector. An additional 20% of a project's costs can be financed by the fund if international there is international collaboration. Last winter 10% of the Fund was earmarked for new technology based companies in areas of sustainable fuels and sustainable buildings at the request of the Ministry of Industry. However, the performance of this fund requires *ex post* evaluation.

The Centres of Excellence programme also aims to stimulate private investment in research and development and collaboration between industry and academia. Formalised programmes to stimulate industry-science linkages remain relatively underdeveloped in Iceland, although strong informal linkages are present. Such informal linkage of course may have negative as well as positive implications for risk taking. Funds and programmes such as the Technology Development Fund, Nanosciences and –technology and Post-genomic biomedicine, and Added Value in Fisheries aim to stimulate collaboration between the public and private sectors, although such collaboration is not required. No evaluation of the impact of these measures is available and indeed it may yet be too early to perform credible evaluation.

On the funding side of start-ups and new ventures, in 1998 Iceland's New Business Venture Fund (NBVF) began its operations. The NBVF was provided an initial allocation of USD 53 million (ISK 5 billion) in 1998, but its investments fared poorly, due in no small part to the global decline in stock markets. The Fund received an additional USD 11 million (ISK 1 billion) in 2004, and was expected to receive an additional USD 27 million (about ISK 2.5 billion) in the 2007 to 2009 timeframe, with the requirement that the fund attracts an equivalent amount of private sector funding, including from pension funds. Subsequently, Frumtak was set up as a cooperative undertaking of the 3 largest banks, the pension funds and the NBVF. Due to the economic crisis, the existing funds are facing various difficulties. New initiatives are being and have been undertaken but as things stand there appear few real possibilities for investors to 'exit' with their investment or, indeed for sustainable innovative firms to exit and stand alone with a viable market position. On the 'entry' side, there are insufficient measures to trigger investors (e.g. absence of tax-incentives) both on an institutional and a private investor level to invest in young, emerging companies and limited or no exit from existing funds mean that entry barriers are raised further.

Cluster policy has been around in Iceland for some years. The first (public) initiative is the so-called "regional growth agreements" – they are an initiative under the responsibility of the Ministry of Industry and managed by Impra. The regions together with Impra set the stage for the development of these agreements. The initial objective was to strengthen the value chain in existing industries. The Regional Development Agency has the responsibility of overseeing implementation of the growth agreements. Impra has the role of supporting the clusters/companies and facilitating their progress.

[7] Instead, efforts have been focused on reducing the corporate income tax, which has been lowered in recent years from 53% to 12% – the lowest level in Europe and among the lowest in the OECD – and a flat tax of 10% is applied to capital gains. The current taxation levels have met with generally favourable approval from the business community, with the result that companies have decided to expand their international operations from an Icelandic home-base rather than move abroad.

3 COMMENTARY BY THE PANEL

3.1 Introduction

The positive and resilient attitude of the Icelanders that we met impressed the panel. Both prior to and during the economic crisis much work has already been carried out, and many good ideas and possible solutions to the difficult challenges lying ahead have been considered. Some of these have been canvassed in earlier reports. This attitude and these reflections made the work of the panel easier than it might otherwise have been. Nevertheless, it is clear that difficult and perhaps unpopular decisions need to be made and implemented.

It should be a shared political responsibility to take the necessary measures in education, science, technology and innovation and to prepare Iceland to deal with the challenges but also the opportunities that lie ahead. Ministries other than Education, Science and Culture – and notably the Ministry of Industry – need to be fully committed to and involved in the consideration and implementation of the urgent recommendations made in this report.

We cannot sufficiently emphasize the importance of excellent education and training, on all levels, for sustained economic growth. Although our remit does not cover primary and secondary education we believe that cuts in these sectors should be avoided as far as possible although this should not prevent efforts to improve efficiency. Equally important is to think about generating value from knowledge, i.e. the value for society. Innovation plays a crucial role herein, bringing knowledge to the market and making sure that there are adequate 'returns'. Opportunities for Iceland remain in this respect largely underutilized.

Our reasoning in what follows below is therefore twofold: firstly, in the short run to increase the efficiency in the system, which will help Iceland to partly deal with the considerable financial strains, and secondly, in the longer run, to prepare Iceland to make better use of its strengths and opportunities offered.

In what follows we present a discussion of the main issues considered by the panel. On the basis of this discussion we subsequently present our recommendations.

3.2 Education and training

Institutional structure

Iceland's higher education system has grown and diversified quickly. Like many other countries it now faces a need for rationalization and streamlining. The crisis is not responsible for this, but it makes it more urgent. There seemed to be a general agreement in our discussions that Iceland has a complex and fragmented tertiary education and research system. This leads to among others to inefficiency and missed opportunities to collaborate and combine strengths. Iceland has been aware of this and has responded in the past: several institutional mergers have already taken place. However, it is our view that these moves towards the creation of an effective and coherent system of higher education and research have not been sufficient.

Overlap in programs and research activities cannot be avoided in any system and with seven universities and a broad range of public research institutes in Iceland, some degree of competition in popular areas such as law and business is healthy. But duplication comes at a cost and there seemed to be common ground between the panel and the Icelandic representatives we spoke to that further functional integration is needed, based on a shared vision on how Iceland's education and research system can best be equipped to use future opportunities. Such a vision is essential, as rationalization should not be an objective in itself.

Among the elements of this vision should be the full utilization of potential synergies and cross-fertilization (e.g. between the creative arts and business), a balance between fragmentation and necessary diversity, a balance between collaboration and competition, flexibility and ability to quickly respond to global developments. In such a vision, intelligent integration fulfils an important role. Integration of the universities, but also increasing the closeness of the research carried out in the public research institutes and the universities, are needed. At the same time, one should not ignore the potential cost savings (in view of the economic crisis) of further integration. Administrative support could be further streamlined (today about 19% of total costs can be linked to administrative support and ancillary services) thereby saving money that can be used for other purposes, for example to increase levels of competitive funding in the universities.

Iceland is a large country with a small population, in which rural/regional development objectives play an important role. Without doubt, the rural presence of universities has made a great positive difference to the development of local economies and local employment. It is important that regional presence is maintained in the future, even in a new institutional setup.

In recent years Icelandic universities have started to independently develop graduate training programs. For example, the University of Iceland has developed a strong collaboration with Matís concerning doctorate training and the exchange of faculty members. The University of Reykjavik on the other hand has not yet reached the level to start this type collaboration. Instead of allowing each university to individually develop graduate training programs, possibilities to establish a single Icelandic Graduate School (Academy) should be seriously considered. Setting up a graduate school however will require a greater degree of cooperation and combination of skills and expertise than has hitherto been the case.

Funding structure

Some universities are private with significant levels of public funding, other are public but need private funding. The large majority of university funding today is so-called block funding, based on the number of students. Competitive funding is only limited, implying that competition as such, which is believed to benefit the quality of education and research, is limited. Where tuition fees are permitted, today only for the private universities, they are determined on the basis of discussions with relevant stakeholders, mainly student organisations.

In the light of the severe budget cuts that are expected in the coming years, the differing employment status between public and private university staff poses a problem. 60-70% of total institutional costs are related to salaries and reallocation of resources is not easy. Even though the use of part-time faculty may alleviate the problem, it seems inevitable that for the public universities the levels of salaries would probably have to be lowered (cost cuts will have to be averaged out).

The funding structure today is neither transparent nor homogenous. Besides cost control, income generation also needs further attention. It is clear that the capabilities for obtaining additional foreign funding (among others EU Framework Programme type of funding) should be exploited. Technology transfer and valorisation of knowledge and expertise should also be strengthened in the short run.

The management contracts with the universities are in our view insufficiently standardized to be comparable and so to avoid discriminatory situations. They are flexible, and while this allows the possibility of change over time, they do not contain sufficient clarity about what should happen when agreed targets are not met. Representatives of the sector to whom we spoke feel that private universities are treated differently than public universities, and that this is inefficient.

Quality assurance, accreditation and evaluation

Concerning quality assurance and accreditation, several important steps have been taken recently and the law on tertiary education has made a clear difference here. Today, accreditation is done by ad-hoc 3 person panels (usually foreigners). The capacity of the ministry to manage education has been strengthened recently. The 2006 law has empowered the universities and has clearly spelled out what the expectations are; the Ministry intervenes only when a decisive say is needed. After two years of experience with this law, in our view improvement is needed in the use made of external evaluation and general quality assessment. The unit on evaluation and analysis, which has still not evolved sufficiently, should play a crucial role here.

We have noticed the low number of professional civil servants within the Ministries, and also the Ministry of Education and Science. This makes us wonder whether there is sufficient capacity to manage the education and research area, particularly in view of the short term corrective actions needed. For example, a strong cell dealing with general quality assessment is not present today.

Strategic focus

We have noted above that focus – both nationally and institutionally - is important when looking at the situation of Iceland today. We recognize that this is a sensitive and controversial issue – few universities find it easy to identify and to prioritize some areas when this may be perceived to be at the expense of others. The initiative of the University of Iceland with the help of international panels to identify three priority areas (from among 40 initial propositions) where they see possibilities to excel nationally and internationally, deserves commendation and could be set as an example to others. The process of making a final choice should be transparent and we are optimistic that for some of the selected areas, intensive collaboration with Iceland's public research institutes will be sought.

The point that is being made here is that critical mass is becoming increasingly important, especially for newly emerging fields (e.g. in silico biology) and fields that are strongly science based (e.g. biotechnology), and where thus substantial means (human capital, infrastructure and financial capital) are needed in order to excel. Iceland can simply not afford to spread its efforts too much if it wants to make a 'real difference'.

Human resources planning

Which skills are important for the future? How many new students are needed to fulfil the needs of certain sectors? Planning of human resources of the future is a notoriously difficult task and is not systematically addressed by the Ministry and/or the universities. The universities are steering to some extent the inflow of students in some disciplines stipulating in their contracts the number of students per sector/discipline (e.g. there are quotas in medicine and dentists). The rather open approach today leads to maximization of number of students, also in areas where they are less 'needed', in order to maximize government funding.

One consequence of lack of planning in this respect is that short term demand in the labour market is not easily addressed and vocational training has not been directed towards the need for skills. Although comprehensive planning may not be possible, some planning is needed. There is some evidence that the advanced vocational and technical skills required in the economy are not well-provided.

In times of economic crisis, the education system plays an important role in keeping young people from unemployment by offering them the possibility to continue studying. And those adults who have lost their job can retrain or upgrade their skills to be better prepared for the future. However, the demand for undergraduate student's places is putting strain on the system and restricting its capacity to react in other areas. The University of Iceland alone accepted 1.400 new students this in January of this year (300 are normally expected), most of them unemployed. The lack of additional funding in this respect caused difficulties. It is expected that the number will further rise in September (new enrolment).

3.3 System and governance

The Science and Technology Policy Council

The innovation system of Iceland is diverse and fragmented. Several bottom-up initiatives in combination with the autonomy of the ministries in dealing with education and research issues, have led to this situation. The creation of the Council, made possible by the 2003 law, was a good initiative. It brought the various stakeholders together and offered a platform for discussion and exchange of information. This has been an important step forward, a step that paved the way for further coordination and orchestration. In this respect the Council has certainly fulfilled expectations. However, more is needed. The Council needs the autonomy and the power to lead and to take decisions. The Council appears so far not to have been able to fulfil the role of policy maker, perhaps due to the lack of commitment of its members, the lack of recognition by the system, the lack of adequate support in the sense of 'intelligence' provision (cf. the role of Rannís), and the existence of parallel decision mechanisms mainly located inside the ministries.

Based on our discussions we formed the impression that the Council is the 'front office' which is visible to the outside world and the community, but that the business of the Council appears to be too heavily influenced by decisions taken by what we refer to as the 'back office' (the coordination group), the representatives of the ministries. The Council should have thus an independent voice in the system and should be in a position to 'take the lead'.

The frequency of meetings of the Council (twice a year) seems too low to us to be able to play an active role in the policy discussions, especially in these times of economic crisis. A frequency of 4 times a year seems more adequate. The overall setup of the Council (including its subcommittees) is also too complex, with too many entities involved and thus too many parallel channels of communication. A simplification is needed. There is no need for two subcommittees, one for science and one for technology, as this creates an artificial distinction between the science community and the technology community, as if they did exist separately, and an unnecessary complication in coordination. In our opinion, this should be changed in the near future.

Of course, a Council can also not operate efficiently when professional policy preparation support is lacking. Whereas today the secretariat of the Council lies within the Ministry of Education, Science and Culture, which strongly associates the Council with this Ministry and as such creates a legitimacy problem towards the other Ministries, this secretariat should be more centrally positioned, for example within a new Rannís (see below). Rannís should also be well equipped to be able to actively support the Council through the provision of real policy intelligence (based on internal and/or external data collection and analysis).

The role of Rannís

Rannís officially resides under the ministry of Education, Science and Culture. As such there is no official relationship to the other Ministries, and as a consequence also a potential lack of legitimacy towards the other Ministries. This, in combination with the weak current internal policy preparation capabilities of Rannís, makes it almost impossible to fulfil the role of a strong policy preparation agency.

Despite a clear regulatory framework and clear responsibilities and mandate, Rannís is insufficiently recognised today as a key player in policy preparation for the reasons mentioned above. The organisation's capabilities are moreover not strong enough (lack of adequate staff, financial arms-length, expertise and knowledge for example in areas like evaluation and impact assessment) to fulfil this role. Rannís is run today by one single director who reports solely to the Minister of Education, Science and Culture but has no formal link to the funding bodies that Rannís serves or to the Council. There is no board of directors or steering or advisory board that could assist the director in managing the agency. This is no longer in line with good governance principles.

Evaluation and impact assessment expertise

A well developed policy cycle contains the phases of policy design, implementation, monitoring, evaluation (and impact assessment) and redesign. In Iceland there is insufficient attention to monitoring and particularly to evaluation, especially *ex post* evaluation. The decision making bodies lack important and essential information based upon which they could take well-informed decisions. *Ex post* evaluation is not systematically practiced (regardless of the level: programme or institute), and if there are evaluations, the diffusion and take up of the findings by the policy makers are not optimal.

Rannís must play an important role in this respect and should be further professionalised as soon as possible. In order to adequately fulfil their role in policy preparation, both towards the Council and the other Ministries, Rannís should be mandated to launch/carry out evaluation and impact assessment studies on various topics. Also the diffusion of the findings should be systematically addressed.

3.4 Science and research

The need for intelligent prioritization

In view of the limited available funds for research, and current economic pressures, choices clearly have to be made about what can and cannot – and should and should not – be supported. Already, as a consequence of the falling funding flow to the University of Iceland, an internal prioritization process has been started, where capacity to attract competitive funding grants has become a criterion.

Currently, however, the majority of research funding is so-called block funding, not competitive, which makes it difficult to steer, and Iceland today does not appear to have sufficient instruments to make effective prioritisation happen. This state of affairs negatively influences both the effectiveness and the efficiency of research in general.

Some noteworthy attempts to prioritise have nevertheless been made. In 2007, a first significant foresight exercise was carried out in order to choose promising areas for the future. This seems to have been quite successful although the translation into real prioritization only is becoming reality at the beginning of 2009. Prior to this foresight exercise, a programme on Nanosciences and nano–technology and Post-genomic biomedicine was developed after consultation with the researchers' community. But as of today there is no systematic insight into the value added of this programme.

For example, even in 2009 with the creation of the new Centres of Excellence programme the challenge of choice could be avoided, as the new initiatives have been funded through new, additional funds. Of course, prioritization is easier if it does not

entail budget shifts and even discontinuation of existing programmes and initiatives. Choices are moreover difficult to be made because of the autonomy of individual Ministries over their own priorities (structural fragmentation).

In the context of this discussion, one also has to touch upon the role of the Council which so far is a coordinating one instead of a guiding one (see also section on governance). If we look at where the strengths of Icelandic research are today, we see that health-sciences (with strong players and unique databases) in particular stand out. It is interesting to note that no Centre of Excellence (or competitiveness pole) is being developed in this area, despite the comparative advantages and the large potential of the country.

It is clear that the economic crisis will further speed-up the pace of change in the Icelandic research system. The issue of prioritization, focus on strategic research areas based on strengths and opportunities should be a priority in this respect.

What certainly is important when making choices is to create as much as possible support among the various stakeholders for the choices made. Fragmentation in prioritization should be avoided at all costs.

Levels of competitive funding

In our view, the level of competitive funding is too low (14%) to allow for management of research and science in a dynamic and cost-efficient way. The 86% of block funding needs to be redistributed by e.g. carefully analysing the type of research and its value added carried out in the research institutes. It has been argued before that competition in funding most often benefits the quality of research carried out as it keeps all actors 'sharp'. We are also of the opinion that the size of competitive grants is in general too small to provide the support required for cutting edge new ideas.

Increasing the levels of competitive funding is one way to increase the efficiency and effectiveness of public funding, whereas performance criteria and contracts are other approaches. Performance criteria are/should not only be applicable to competitive funding schemes. Also non-competitive funding schemes should incorporate competitive/performance driven elements. For example, also inside the universities there should be competition among research groups in obtaining (additional) funding for research.

This would mean that a part of the 'block' funding would be distributed internally through competitive ways, as happens already today in some universities. In view of the tough budget cuts that may need to be made in the coming months, competition needs to be introduced, as only the best proposals should be funded in current circumstances.

Collaboration and mobility

Despite the fact that Iceland is a country where the key actors (companies, research performers and policy makers) are closely located to each other (mainly in Reykjavik), it seems that collaboration among them is not easier or more natural than in other countries. Collaborations are usually personal initiatives.

Where the universities and public research institutes are concerned, we see that there is are specific contract-based collaborations, such as that between Matís and the University of Iceland, but these appear to be few and ad hoc. However, there is a public interest in increasing collaboration between universities and the public research institutes; and also between the public sector and the private sector. What seems to stands in the way of this today is a lack of insight into each other's capabilities and a lack of capabilities and incentives (staff, funds) to really engage in collaboration. Moreover, the fragmentation in the system we believe is also negatively affecting collaboration intentions.

International collaboration, as shown by the number of international agreements, has grown strongly in the last few years, including for the smaller universities and colleges.

Companies also collaborate strongly in research and development with institutions abroad. International collaboration is a necessity for Iceland, as it is for many other countries, as it has a limited internal research market, limited research and development funds, and limitations as far as available expertise and knowledge is concerned.

International collaboration also allows Icelandic students and researchers to go abroad. Some programmes even require students to go abroad for a certain period of time, certainly at the post-graduate level. Mobility schemes like Erasmus are used extensively. The Icelandic government also provides loans to students wanting to go abroad. However, with the decline of the value of the ISK, the costs of living abroad have doubled and/or tripled. It is expected that without some balancing this will affect the mobility of students and researchers in the coming years.

Attracting foreign researchers to Iceland is sometimes challenging because of the specific environment, some aspects of it being inherent to the nature of the country. Iceland could do more to reach out to their diaspora and to "friends" of Iceland to act as informal 'ambassadors' that can fulfil an important role in promoting Iceland and in attracting overseas investment and talent. .

3.5 Research, development and innovation

Perception of government by some of Iceland's 'star' companies

Various studies point towards the excellent general framework conditions for innovation in Iceland. However, it seems that the perception in the 'field' is different. As a result of our company visits, we conclude that there is a widespread perception that the government does little to facilitate industrial development and competitiveness. The innovative and competitive companies visited, pointed out that they expected, and still expect, the government to be more active in approaching these companies to see what support can be provided (direct or indirect) to better deal with the effects of the economic crisis. They have indicated to us that they perceive a lack of real interest from government authorities.

It is clearly important for a government to have a good relationship with the private sector, and particularly 'star' companies, during difficult economic times. It is essential to maintain a strong private sector in Iceland and to ensure local employment. Companies expect good and stable framework conditions that involve good logistical/ICT infrastructure, availability of well-educated human resources, and a good and taxation friendly investment climate.

Iceland may wish to consider following the example of other small countries that effectively have designated "account managers" in government for key established firms and gazelles who take responsibility for day to day contact with particular firms and act as the interface with government.

Research and development in industry

Despite high relative levels of research being carried out in the public sector in Iceland, the system of policy support measures in Iceland is lacking direct support schemes that specifically address the needs of companies.

Overall, we see that the share of government funded research and development in Iceland is much higher than in other OECD countries, which can be explained by the fact that the government sector also performs more research and development than governments in other OECD countries. Less research and development intensive, both in terms of funding and performance, is the industry sector. There are only a few companies (in life sciences, machinery and equipment for food and the medical industry) that account for a large share of industry related research and development. This makes the entire industrial research and development landscape vulnerable and the population of research and development active/intensive companies needs to be broadened.

To achieve this, in our view there needs to be some change of approach. Research and development stimulation measures today seem insufficient or ineffective. The needs of the companies are not sufficiently taken into account, in particular related to their status of development and their way of innovation. A more tailored approach seems essential, in given the pressures from the economic crisis on prioritisation for the recovery.

Challenges are situated around broadening the share of research and development active companies, particularly high-tech companies, with a focus on intensifying science – industry collaboration. Tax incentive schemes to stimulate companies to perform research and development and to hire new researchers, might play a role here as well: several countries have employed such measures extremely effectively. If Iceland wishes to play a role in research and development internationally and generate value and social welfare, it has to increase the number of companies that perform research and development and the links between the knowledge base and enterprise.

The importance of the deCODE knowledge base

Business research and development performance in Iceland is dominated today by one firm: deCODE genetics. This company has been very successful in obtaining international funding (mainly FP-type of funding) and is one of the key assets that Iceland has in the high potential 'health sector'. This company is in difficulties today because of the economic crisis, and the specifically difficult situation in the worldwide biotechnology sector. We were happy to hear that the university sector is looking into various options in order to help secure the knowledge base of this company for future research to the benefit of Icelandic society.

It would be a great loss if the knowledge base and expertise built up in deCODE would disappear together with the loss of the company, especially because of the importance and the potential of the health sector for Iceland. It is clear that the Icelandic government has a responsibility in preserving the knowledge base of deCODE genetics as it is based on large public investments made by the Iceland society and its citizens and offers substantial potential future health and economic benefits.

Public – private collaboration

Science and technology policy in Iceland does not place a major focus on promoting public-private collaboration in contrast to the situation in many EU and OECD countries. This is perhaps partly because this type of co-operation is often considered to be easier in a small country where public and private R&D performers are not so numerous and where short channels for communication exist between the two worlds. However, we are of the view that this is a misperception and that cultural and structural barriers still remain to private-public collaboration despite recent positive developments in this regard.

The policy mix on research and innovation has been segmented around two clear domains: the domain of industry, and the domain of academia. Both fall under the responsibilities of two different ministries that could do more to coordinate . We have the impression that there is a 'grey zone' when it concerns bridging academic research with industrial application. Both ministries have their funds and their territory is well defined. Moreover, the Council is also organised in this way: a working group on science, a working group on technology. The distinction between science and technology is in our view obsolete as they both, to various degrees, feed into the complex process of innovation. Furthermore, coordination with other crucial policy areas like economic policy, employment policy, environmental policy and regional development policy, seems suboptimal.

Framework conditions for innovation

The framework conditions for innovations in Iceland seem generally favourable by international comparison, but this belies some specific barriers which can have much more highly leveraged impact in a small country. There appears to be a gap in policy and practice in terms of public sector measures to create the necessary public private

links and encourage potential innovative spinoffs. Specifically in the health sector, the National Hospital and the University of Iceland play a key role in developing the knowledge base, and links with the private sector seems to be improving. But the regulatory framework needs better to support the delivery of innovation. Controls relating to access to patients' health records and use of human-derived materials are unusually strict in Iceland and could be streamlined without sacrificing privacy and security or ethical norms and values. During our discussions, we were told that the early advantage Iceland had in this field has been lost and that Iceland is now lagging competitor countries.

However, the upside is that the technology is now in place and well-tried to protect individual privacy. In view of the strengths of Iceland in this sector, a more concise strategy is needed.

Availability of venture / investment capital

In the wake of the financial crisis, private investors have not yet identified research and development and innovation as potential investment objects. Furthermore, it is believed that there might not be enough knowledge with the private investors on the specificities of investing in innovative companies. For example, tax incentives for private investors to invest in young companies could be introduced (like the case in Flanders, the so-called 'win-win loans', where loans for young companies have been made taxation friendly). Incentives to invest need to be put in place so that risk is shared and a proactive programme to publicise and encourage investment – perhaps involving high profile media personalities– put in place.

4 RECOMMENDATIONS OF THE PANEL

During our various discussions in Iceland, we were consistently impressed by the awareness of our Icelandic interlocutors of the measures and actions that would be necessary to respond to the difficult situation and their willingness to move forward. Icelandic policy makers individually seem to be well aware of what needs to be done in the near future, and the work of the national expert group is very important in translating this awareness into concerted action.

It is clear that political leadership will be necessary to unite the community around a common vision and a package of measures that together address the short and medium term challenges to transform the innovation landscape in Iceland. The same leadership of course will be essential to translate the recommendations of the Icelandic national expert group – as well as of this panel - into reality as soon as possible. Education, science, research and innovation touch on all socio-economic policy areas in Iceland and are as such pivotal in the future economic recovery and social prosperity of Iceland.

Below we present our five key messages to Icelandic policy makers:

- ✓ *"Maintain investments in education at all levels"*
- ✓ *"Reshape the education and research landscape"*
- ✓ *"Focus on innovation"*
- ✓ *"Reform and strengthen governance structures and systems"*
- ✓ *"Unite support for short-term change and implement it quickly"*

4.1 *Maintain investments in education*

1. Education and training should remain high on the political agenda and not be handled only by civil servants. Action needs to match the political rhetoric. This is a plea for recognition of the importance of this area for the future of Iceland, and as such the recognition that budget cuts in this area could seriously affect that future. Education and training need to be high on the policy agendas of all ministries and all political parties.
2. We recommend to the government of Iceland to keep investing in primary and secondary education and, while seeking efficiency gains, not to reduce core budgets. Continuous investments in quality improvement are needed.
3. Education has also to play an important role in helping to keep bright young well-educated people in Iceland by offering them specialised follow-up courses and making it possible to combine learning with working. Vocational training is of particular interest in this respect. This all has to ensure the availability of good educated people once the economy revives.

4.2 Reshape the education and research landscape

4. The university system should be restructured as soon as possible based on a new vision on how potential synergies and efficiency gains can be optimized. Although the precise number of universities is not our ultimate goal, it is clear that in the near future there has to be a concentration of effort. We are in favour of maintaining diversity and some competition (though this mainly should be seen as coming from outside Iceland), but cooperation and integration are equally important. Nevertheless, we propose that moving towards a system of two universities provides the most likely route to long term success: one university clustered around the University of Reykjavik and integrating this university with the Academy of the Arts and Bifröst University, and one clustered around the University of Iceland including all current public universities. In the short term, this means one private and one public university but in the longer term (see recommendation 9) we suggest that this difference should be eroded. The two universities should continue to maintain regional campuses as necessary.
5. Geographical location of departments within the universities should where possible be such that cross-fertilization between departments and faculties is facilitated. For example, it seems sensible to co-locate the design departments of the Academy of the Arts and relevant departments of Reykjavik University to enhance opportunities in the creative industries.
6. In the scenario of two universities, a professionally run and developed administrative support centre should be setup. This centre should serve both universities administratively in a cost-efficient way. It is our expectation that this will lead to a significant cost-reduction that can be re-invested in education and research, preferably through competitive channels. A specific initiative should be put in place to support the universities secure large international grants from, for example, EC and US programmes.
7. At the post-graduate training level, Iceland should establish one single graduate school, similar to the 'academy' thinking that currently exists in Finland and other countries. This would help to bridge the gap between the two universities and make it easier for the public research organisations and industry to develop joined training programmes and teaching and/or research positions.
8. The public research organisations should be more closely integrated with universities building on successful experience with – for example – the agricultural university. Focus should be on more effective knowledge production and utilisation within the Icelandic research system.
9. Access to competitive research funding should be simplified. The mean size of individual grants needs to increase to allow meaningful project delivery and external international peer review needs to become the norm in most areas. In the longer term, we recommend that the proportion of research funding open to competition should increase.
10. More generally, we recommend that there is a move towards a more transparent common system for funding of the universities. In particular, when looking at the various funding channels, research funding and the use of tuition fees need to be harmonized across the system. Concerning tuition fees in particular, they need to be broadly considered and perhaps introduced on a larger scale.

11. In this respect, the differences in the overall governance arrangements for the various institutions should be removed. This applies mainly to the general management of the institutions and the underlying contractual arrangements that need to be implemented in a harmonized manner.
12. The system of quality assurance and more in general the system of monitoring should be improved. As already pointed out in the OECD review of tertiary education (2008), a new priority should be to set up a comprehensive system of quality assurance to give coherence to future improvement and more general accountability. Regardless of the position of such a unit (in the ministry, independent organisation or within Rannís – see below) that deals with accreditation and quality control, it is clear that it should be a professionally run unit of high expertise, capability and capacity.
13. A key message given by this panel is that focus and prioritisation are needed. Also in the new institutional setup, with a limited number of universities, focus on strategic areas is desirable if not necessary. The focus of the University of Iceland on 3 strategic areas where the university wants to excel, a realistic target according to us, is positive and should be set as an example.

4.3 Focus on innovation

14. We recommend that the new Icelandic government makes innovation a key strategic priority. Good science does not automatically generate returns. Strong framework conditions and pro-active direct business support need to be put in place to allow the translation of good ideas into competitive advantage, and into economic and non-economic benefits for Icelandic society at large.
15. Iceland clearly is too small an economy to be internationally competitive in all areas of science, technology and innovation. We therefore recommend clear targeting of specific sectors with growth potential. Three sectors that seem to us to provide a lot of potential to Iceland are: geothermal sciences, life sciences, creative industries/ICT.
16. Similarly, we recommend that the government seeks to clarify which firms established or establishing in Iceland have the greatest potential to contribute to the vision for innovation. A stable environment needs to be established and we recommend that the government seeks to demonstrate at any early stage that companies' needs are understood and where possible acted upon. "Round table" discussions with industry in different key sectors, where all actors could be brought around the table, including the new ministers for industry and research, could be a useful first step. The start of a new legislation period is an excellent moment to organise this.
17. The capacity of the universities and public research institutes for technology transfer (either through licensing and/or creation of new firms) needs to be strengthened. One option could be to establish an Icelandic Technology Transfer office within the existing Innovation Centre. We believe that there is the capacity and the will amongst practitioners to develop effective mentoring and business development partnership programmes to assist small firm development and growth. But leadership is required.
18. Indirect support for research and development and business development should complement direct support. In particular, we consider that tax incentives should be introduced as a means to increase the research and development activities and performance of Icelandic companies. The precise form of such incentives requires some further analysis to ensure the maximum impact, but in our view incentives would be particularly valuable

for individuals investing in angel funds and for small and medium size firms on research and development expenditure.

19. The current structure of Icelandic venture capital funds carries with it considerable risk of "lock-in" for firms and concomitant steadily increasing entry barriers. We recommend the development of a more structured portfolio of funds with clearer entry and exit points.
20. Regulation needs where possible to support the delivery of innovation. In most cases, this principal issue is that there is predictability of regulatory frameworks though in some cases smarter regulation seems necessary. For example, regulations relating to access to patients' health records and use of human-derived materials could be streamlined without sacrificing privacy and security or ethical norms and values. In this respect, the proposed new bill on the use of patient information should be passed as soon as possible.
21. The strategy that Iceland chooses for its future innovations should build on the successes of the past, whether in the public or the private sector. In particular, we recommend that the Icelandic government takes clear and transparent steps to preserve the knowledge base built up in deCODE genetics for the future benefit of Icelandic innovation and society more generally. The question of intervention to secure deCODE as a going concern is a political one but in our view at least deserves consideration given the contribution to knowledge that the company continues to make.
22. Utilize the worldwide network of expatriates and 'friends'. Iceland has many such potential supporters around the world. The network should be mobilized by creating a community that actively promotes Icelandic business. The network would provide its members with an official membership and representation tasks (a good example is the Scottish initiative Global Scot – see: http://www.globalscot.com).

4.4 Reform and strengthen governance structure and systems

23. Over the past years, the Science and Technology Policy Council has made a great difference in bringing together various education, research and innovation stakeholders to exchange views and information. However, this is not enough for dealing with the challenges lying ahead. The Council should have an independent and strong voice in the system and should be in a position to 'take the lead'. Decisions should be taken in the Council and the responsibilities and authority of the Council should be clearly defined.
24. The Council should always be chaired by the Prime Minister. There should be a balanced representation on the new Council between academia, industry and policy makers. The number of members should be limited in order to ensure effectiveness. Universities should be represented by the two rectors of the new universities that we have recommended.
25. The Council should be supported, and its meetings prepared, by an integrated expert committee which should combine the functions of the existing Science and Technology Committees and the Co-ordinating Committee. In addition the Council may need to set up ad-hoc committees to deal with specific tasks.
26. The periodicity of the Council's meetings should increase. Two meetings a year is not sufficient to deal with the challenges faced. A frequency of four times a year seems more adequate to us, especially during the coming challenging years.

27. The support system around the Council should be further developed and professionalised. Rannís should take up this responsibility to serve the needs of the Council, and be resourced to do so. We propose to embed the secretariat to the Council within Rannís. This would create a close connection between the Council and the policy preparatory role and other responsibilities of Rannís.
28. Rannís should be placed under the PMs Office or should become an independent organisation whose relation with the government is arranged through a contract. This is important in order to give this organisation a central and legitimate role in the system. If Rannís becomes an external agency, it should have its own board of Directors (or at least an advisory board). The capabilities of Rannís should be further strengthened and professionalised in line with its new role and mandate.
29. A new unit should be developed that closely monitors the quality of the education and research system. This unit also should be embedded in Rannís, if Rannis becomes more independent in the system (both formally but also in terms of capabilities). A unit like this should openly report about its evaluation findings.

4.5 Unite support for short-term change and implement it quickly

30. Iceland's current priorities and options need to be carefully considered. While in the longer run, a future vision needs to be put in place, in the short run, investment needs to be made in areas where Iceland has clear strengths and opportunities. Health technology/science is a promising area that remains underutilized. We recommend looking into the potential of this sector (as indicated above) and develop a shared vision. Other promising areas for Iceland are geothermal science and technology, and the creative sectors.
31. Equally important is to succeed in uniting the forces behind these choices. Instruments to realise this vary from "round table" discussions, as mentioned above, to specific communication campaigns. The example nevertheless has to be given by the Icelandic politicians.
32. Although we are confident that the recommendations provided by this panel will reach the right audience and will get the necessary attention, we would also like to emphasize the need to start implementing as soon as possible.
33. For the implementation of these recommendations we suggest to set up a specific inter-ministerial task group (implementation group) that reports to the Council. As such, a road map to implementation needs to be setup by this group as soon as possible.
34. The success of these changes should be evaluated after 18 months, after which the necessary fine tuning can take place.

ANNEX 1 – Programme 1st visit expert panel

Time	Location	Meeting with
Monday 23 February		
9:00- 10:30	The Culture House	Key officials
11:00- 12:00	The Culture House	The University Rectors Coordinating Council
12:00- 13:30	The Culture House Lunch	Berglind Ásgeirsdóttir, Permanent Secretary of the Ministry of Health
13:30-14:30	Borgartún 35	The Confederation of Icelandic Employers
14:30-15:30	Borgartún 35	The Federation of Icelandic Industries including representatives of key companies
15:00-16:30	Sætún 1	The Icelandic Confederation of Labour (ASÍ)
16:30-18:00	Hotel	Internal discussions by Expert Panel members
Tuesday 24 February		
09:00-10:30	Ministry of Education	National Task Force Group
10:30–12:00	Ministry of Education	The Coordinating Committee of the Science and Technology Policy Council
12:00-13:30	Ministry of Education Lunch	Minister of Education, Science and Culture, Katrin Jakobsdottir and Permanent Secretary Halldór Árnason
13:30-15:00	Rannís	Chairpersons of the Research Fund and of the Technology Development Fund
15:00-16:00	Ministry of Education	Members of the Science Committee and the Technology Committee
15:00-16:30	Visit to the National Hospital University Hospital	Directors and Members of Faculty of Medicine and Health of the University of Iceland
16:30-18:00	Hotel	Internal discussions by Expert Panel members
20:00-22:00	Hosted by the Ministry	Dinner with the Permanent Secretary of the Ministry of Education, Science and Culture
Wednesday 25 February		
		Schedule open for planning Visits to key companies and institutes (see list) Internal discussions within Expert Panel
16:00-17:00	Hotel	Internal discussions by Expert Panel members

ANNEX 2 – Programme 2nd visit expert panel

Time	Location	Meeting with
Monday 6 April		
08:00-12:00	Grand Hotel	Participation in Conference on Innovation Related to Health Services
13:00-18:00	Skúlagata 4 and Keldnaholt	The Marine Research Institute (Jóhann Sigurjónsson) Matis ohf (Sjöfn Sigurgísladóttir) The Icelandic Innovation Centre (Thorsteinn Sigfússon) CCP Computer Games, Hilmar Veigar Petursson
Tuesday 7 April		
09:00- 10:30	The Culture House	Meeting with key officials of the Ministry of Education for consultation G.Árnason, H. Árnason, H. Gunnarsdóttir, A. Guðmundsson and V. Lúðvíksson
10:30- 11:30	The Culture House	Meeting with the Rector of the University of Iceland, Kristín Ingólfsdóttir by the rector's request
12:00- 13:30	The Culture House	Lunch hosted by the Ministry of Education
13:30-16:00 15:00-16:00 13:30-17:00	Ministry of Education	Markku Linna and Richard Yelland to discuss with officials of the MinEd secondary, higher and tertiary education The Educational Testing Institute Iain Gillespie and Arnold Verbeek to visit Össur (Hilmar Janusson), Decode (Ingileif Jónsdóttir) Marel Food Systems
17:00 – 18:00	Hotel	Internal discussions by Expert Panel members
Wednesday 8 April		
08:30-10:00	Hotel	Internal discussions by Expert Panel members (updating Christoffer Taxell)
10:00-11:00	The Culture House	The University Rectors Coordinating Council
11:00-12:00	The Culture House	Members of the Science Committee and the Technology Committee
12:00-13:30	The Culture House	Lunch hosted by the Minister of Education, Science and Culture
13:30 – 16:00	Kríunes conference rooms	Mutual presentation of the Expert Panel opinion and the preliminary outcome of the Task Force Group Discussion of the outcomes
16:00-18:00	Hotel	Finalisation of the Expert Panel opinion and Planning for the final report
19:30-22:00	Dinner	Dinner hosted by the Ministry of Education, Science and Culture
Thursday 9 April		
Morning	Hotel	Internal discussions by Expert Panel members (towards finalization of report)